FUNDAÇÃO GETÚLIO VARGAS
ESCOLA DE ECONOMIA DE EMPRESAS DE SÃO PAULO

PHILIPP MICHAEL DAMBACH

APPLYING PIOTROSKI'S F_SCORE TO THE GERMAN STOCK MARKET. EVIDENCE FROM 2002-2016.

SÃO PAULO
2016

FUNDAÇÃO GETÚLIO VARGAS
ESCOLA DE ECONOMIA DE EMPRESAS DE SÃO PAULO

PHILIPP MICHAEL DAMBACH

APPLYING PIOTROSKI'S F_SCORE TO THE GERMAN STOCK MARKET. EVIDENCE FROM 2002-2016.

Dissertação apresentada à Escola de Economia de Empresas de São Paulo da Fundação Getúlio Vargas, como requisito para obtenção do título de Mestre Profissional em Economia.

Campo do Conhecimento:
International Master in Finance

Orientadores Prof. Dr. Ricardo R. Rochman e Pedro Lameira

SÃO PAULO
2016

Dambach, Philipp Michael.
Applying Piotroski's F_Score to the German stock market: evidence from 2002-2016 / Philipp Michael Dambach. - 2016.
47 f.

Orientadores: Ricardo Ratner Rochman, Pedro Lameira
Dissertação (MPFE) - Escola de Economia de São Paulo.

1. Mercado de capitais - Alemanha. 2. Ações (Finanças). 3. Investimento em valor. 4. Empresas - Avaliação. I. Rochman, Ricardo Ratner. II. Lameira, Pedro. III. Dissertação (MPFE) - Escola de Economia de São Paulo. IV. Título.

CDU 336.763.2(43)

PHILIPP MICHAEL DAMBACH

APPLYING PIOTROSKI'S F_SCORE TO THE GERMAN STOCK MARKET. EVIDENCE FROM 2002-2016.

Dissertação apresentada à Escola de Economia de Empresas de São Paulo da Fundação Getúlio Vargas, como requisito para obtenção do título de Mestre Profissional em Economia.

Campo do Conhecimento:
International Master in Finance

Data de Aprovação:
___/___/____.

Banca Examinadora:

____

Prof. Dr. Ricardo R. Rochman
FGV-EESP

____

Prof. Dr. Pedro Lameira
NOVA SBE

____

Prof. Dr. Maria João Major
NOVA SBE

ACKNOWLEDGEMENTS

I would like to thank Professor Dr. Ricardo Rochman for being one of my supervisors and having done an excellent work in his function. I also thank Pedro Lameira for his supportive and valuable comments on this project and for teaching a very insightful course of "Hedge Funds". Further thanks are dedicated to all those who in some form or another sparked my interest in the field of investment strategies. Finally, I want to express deep gratitude to my family for providing me with unfailing support and continuous encouragement throughout my years of study. This accomplishment would not have been possible without them. Thank you.

ABSTRACT

This work project applies Joseph Piotroski's F_SCORE to the German stock market between 2002 and 2016. Considering the smaller size of the German stock market, a F_SCORE_ADD was created to differentiate between companies with the same score. Portfolios that went long in expected winners and shorted expected losers generated strong results within the small cap sample. For large caps, the abnormality of returns was not significant after controlling for common risk factors and quality. This relates to the results of other researchers and questions the practicality of the investment strategy for institutional investors with a large capital base to employ.

KEY WORDS: Value Investing, Fundamentals, F_SCORE, CDAX

RESUMO

Esta dissertação aplica o F_SCORE de Joseph Piotroski ao mercado de ações alemão entre 2002 e 2016. Por causa do tamanho menor do mercado de ações alemão, um F_SCORE_ADD foi criado para diferenciar entre as empresas com a mesma pontuação. Carteiras que foram "long" em vencedores esperados e "short" em perdedores esperados renderam bons resultados dentro da amostra com empresas de baixo valor de mercado. Para as empresas de alta capitalização, a anormalidade de retornos não foi estatisticamente significante após o controle de fatores de risco comuns e qualidade. Isto relaciona-se com os resultados de outros investigadores e questiona a praticidade desta estratégia de investimento para os investidores institucionais com uma grande base de capital para empregar.

PALAVRAS CHAVE: Investimento em valor, Fundamentos, *F_SCORE*, *CDAX*

TABLE OF CONTENTS

1. INTRODUCTION

The value anomaly is one of the best known persisting anomalies in the market. It generated significant abnormal returns for decades and built the foundation for many successful investors. Value investing is based on the idea of buying stocks for less than their intrinsic value. Stocks can trade below their intrinsic value if human judgement, when aggregated in the market, is errant in the short-term. The value investor hopes to exploit this by profiting from a mean-reversion process in the long-term. Different strategies exist when it comes to judge whether a stock is an appropriate investment for a value investor. With the emerging interest in the field of behavioral finance in the recent years, many researchers and practitioners looked for ways to limit the exposure of their investment strategies to the biases that impact human thinking when acting as an investor in the stock market. Not only during crises it becomes evident that investors tend to exaggerate in both directions – optimism and pessimism – and do not make investment decisions on a rational basis. This is why systematic investment strategies gained popularity. The idea behind these strategies is to filter companies based on a quantitative basis and form portfolios with the companies that the mechanism has chosen, regardless of any personal preference or disfavor of the investor towards these companies. These strategies do not aim at identifying the single future best performing stocks within a whole index but at buying a portfolio that was selected by a purely quantitative mechanism and on average delivers returns that outstrip the market. They thereby minimize the risk of falling victim to biases. The popularity of these strategies is due to the fact that they offer a simple set of behavioral rules that, when followed properly, lead to adequate returns. Because of the omission of a qualitative stock picking component, for example talking to the management of a given company in order to gain further insights, quantitative strategies practice common diversification principles. Different strategies were presented by practitioners and academic research and tested for different markets.

Joseph Piotroski (2000) proposed such a systematic quantitative strategy that contains both a value measurement and a quality measurement. This work tries to contribute to the discussion of practicality of such strategies by applying Piotroski's method to the German stock market, analyzing the performance and discussing practical concerns when applying this method. It also extends the current state of research upon this method by adding a strength component named F_SCORE_ADD to the ranking system of the F_SCORE to make it applicable for smaller stock markets. Furthermore, apart from other research on this method, also quality factors are used when analyzing whether the method generates positive alpha after controlling for common risk factors.

2. LITERATURE REVIEW

Piotroski's strategy relies upon a value and a quality component. The subsequent literature review will present the academic foundation for these strategy determinants before presenting Piotroski's paper and the research related to it.

Systematic investing strategies try to profit from common market anomalies, of which one of the most prominent is the value anomaly. The first authors to postulate an investment strategy on a value basis are Graham/Dodd (1934). Since the publication of their book "Security Analysis", value investing evolved in many ways and nowadays subsumes a whole pool of different strategies and approaches.

Before the mid-1970s, some researchers suggested for the first time that, in contrast to the efficient market hypothesis, stocks with a low price-earnings ratio seem to have higher returns in the future than stocks with a high price-earnings ratio. Most of this early research contained inconsistencies such as the look-ahead bias or not adjusting the results for risk. Basu (1977) therefore tested this hypothesis himself and published the results in The Journal of Finance. His conclusion was that even after controlling for all biases, transaction costs and taxes, the effect persisted, providing evidence that stock prices do not fully reflect all available information. However, Basu (1983) found a significant size effect because the effect is stronger for stocks of smaller companies than for large corporations. Jaffe/Keim/Westerfield (1989) untangled the earnings yield effect from the size effect. Their results were that the earnings yield effect is present in every month of the year, while the size effect is negative only in January. Moreover, they found a positive effect on future returns for companies with negative earnings. Stattman (1980) as well as Rosenberg/Reid/Lanstein (1985) were the first to demonstrate that low price-to-book firms have higher average returns in the future. Fama/French (1993) summarized that, different from prior academic theory, the average returns on stocks cannot only be explained by the market factor by Sharpe (1964) but also by size and book-to-market ratio which they considered in their three-factor model for asset pricing.

Many explanations for the persistence of the value anomaly were suggested in the literature. As a possible explanation De Bondt/Thaler (1985) presented in The Journal of Finance that market overreaction leads to exceptionally large future returns of former underperformers in terms of price-earnings ratios. They viewed this also as a proof for substantial inefficiencies in the market. Research for the Japanese stock market by Chan/Hamao/Lakonishkok (1991) proved that fundamental variables such as size, cash flow, book-to-market ratio and price-to-book ratio have a significant impact on a firm's future earnings.

Additional proof to the difference in returns between value and glamour stocks is brought by La Porta et al. (1997) who attributed these differences and their persistence to behavioral factors such as expectational errors. Unsophisticated investors may perceive glamour stocks as less risky and even for professionals such stocks may be easier to justify to clients and managers. According to the authors a risk premium explanation for the differences between glamour and value stock returns is not consistent due to the fact that earnings announcement returns are substantially higher for value stocks. Further support for this argumentation is brought by Stickel (1998) who revealed the tendency of analysts to prefer low over high book-to-market stocks, even though the evidence in the literature would lead to a contrary strategy. This affirms the hypothesis that picking such stocks seems easier explicable to a manager or client.

The other position is taken by Chen/Zhang (1998) who argued that value stocks are riskier as they tend to be under distress, highly leveraged and have high uncertainty concerning future earnings. The higher returns could be explained by these risk attributes. The authors moreover found evidence that value stocks had higher returns in many markets, but in high growth markets the spread tended to be smaller.

The second pillar for Piotroski's strategy is the quality component. The important theoretical discussion is hereby, whether fundamentals can provide meaningful insights about future stock returns and quality measurements can enhance the performance of the value anomaly.

Ou/Penman (1989) delivered evidence that financial statements contain valuable information about future earnings. They showed that with a contingent of financial ratios from historic financial statement data, future changes in earnings can be predicted. Engagement in stocks with a positive expected earnings change resulted in abnormal returns that cannot be explained by firm risk characteristics or size. Holthausen/Larcker (1992) also created a model based on fundamentals with which they managed to predict future excess returns.

Research mentioned in the value anomaly section stated that high book-to-market stocks tend to be neglected by analysts. Using fundamental analysis could therefore be especially profitable in an environment with a low analyst-following as Piotroski (2000) suggested.

Greenblatt (2006) presented a strategy that relies upon the earnings yield effect. He adds a quality measurement, which he defines as return on capital. During the sample period his strategy outperformed the market by a large extent. A proof for the efficacy of this strategy for the Shanghai Stock Exchange was delivered by Yangxiu (2013). However, Wesley Gray and Tobias Carlisle (2013) argued that only the earnings yield is an important factor and the inclusion of the return on capital factor actually lowers the returns. This relates to similar arguments by Hsu and Kalesnik (2013) who concluded in their research that quality measurements like gross profitability, return on equity or gross margins are not robust and do not evidently carry a premium, whereas typical value measurements like book-to-price, earnings-to-price or cashflow-to-price persistently do.

On the other hand Asness et al. (2015) argued that controlling for quality helps for example increasing the significance and performance of the size effect. Earlier, Asness/Frazzini/Pedersen (2013) demonstrated that a quality factor that enables to discriminate between "quality" and "junk" companies yields a positive premium and can enhance the performance of value strategies. This revives the findings of Lev/Thiagarajan (1993) and Abarbanell/Bushee (1998) who built an investment strategy based on multiple fundamental signals that generated significant abnormal returns. Fama/French (2014) updated their earlier three-factor model with two new variables; they are considering profitability and investment patterns of companies as important new factors for asset pricing.

The main difference between the contrary findings and arguments seems to depend on whether single measurements or multiple aggregate fundamental signals are used. As will be discussed in the following section, Piotroski delivered evidence that using multiple fundamental signals provides better results than only a few.

Following up the mentioned research, Joseph Piotroski published his paper "Value Investing: The Use of Historical Financial Statements to Separate Winners from Losers" in 2000, introducing his fundamentally based quantitative strategy. Piotroski states that even though low price-to-book stocks outperform on average, this is due only to a few extremely well performing stocks while about 57% of these stocks in the sample actually underperformed. He therefore introduces a F_SCORE, a signaling score based on historical financial statement data that is meant to exclude those underperforming stocks in order to shift the returns distribution of the portfolio rightwards. Piotroski based himself on earlier research when selecting his screening variables. For example Sloan (1996) suggested that investors tend to focus on earnings while neglecting the information found in accruals and cash flow. This was incorporated in the ACCRUAL variable. Loughran/Ritter (1995) found that companies that issue new shares underperformed such ones that did not rely on this type of funding. This lead to the EQ_OFFER variable. All determinants of the signals will be discussed further in the methodology section. The fact that historical financial information can be used to distinguish future winners and future losers is seen by Piotroski as a proof for stocks prices not fully containing all historic signals.

Piotroski remarks that his signals should not be seen as the only ones that can be used when trying to determine financially strong companies from financial statement data. However, several researchers proof the robustness of the F_SCORE, for instance Scatizzi (2011) showed that using trailing twelve-month data instead of fiscal year data has no significant impact and Gray/Carlisle (2013) constructed an improved F_SCORE, with only slight performance enhancements. Piotroski himself tested, whether the Z-Score by Altman (1968) together with Δ ROA could discriminate successfully between strong and weak firms. The answer was yes, but the F_SCORE offered further explanatory power. Other authors mentioned in the previous section provided similar approaches based on aggregate fundamental data. This examination will follow the original definitions of the F_SCORE in the further procedure.

Krüger/Beerstecher (2015) revisited Piotroski's F_SCORE strategy for the U.S market for the recent period of time. They confirmed the high abnormal returns and proved that those can only partially be explained by common risk factors. Nevertheless, they considered the strategy to be unprofitable from a practical point of view as liquidity constraints and trading costs inhibit investors from exploiting this anomaly. For individual investors with limited capital the strategy might be sufficient but for institutional investors it is not possible when one considers the amount of money they have to invest.

Kim/Lee (2014) stressed that the results of Piotroski are likely to be overstated because the accounting information of all firms would not be actually available for the given point of time used in the study.

For the Mexican stock market, Dosamantes (2013) researched whether fundamental strategies lead to positive excess market returns. He used signals based on accounting fundamentals and then built portfolios with stocks that yield high scores. The research specifically tested F_SCORE and the similar L_SCORE by Lev/Thiagarajan (1993). The market excess annual returns were positive and significant even after controlling for the FF3M factors, however, tended to decrease in the recent period of time.

Woodley/Jones/Reburn (2011) also replicated the original findings of Piotroski over the original sample period with the same U.S. stock market and then analyzed the performance for the subsequent years. They confirmed Piotroski's results for the original sample period but stated that the following 12 years after the publication of the paper showed reverse results, meaning that firms with a low F_SCORE outperformed high F_SCORE stocks in the value stock segment and that stocks with a high F_SCORE effectively underperformed the value segment as a whole. The robustness of these results is still given after controlling for the size effect.

For the European stock market Amor-Tapia/Tascón (2016) tested different fundamentally based composite indicators, namely F_SCORE2, PEIS, F_SCORE and G_SCORE. Their findings are that only F_SCORE and G_SCORE, which is a fundamental score developed for growth stocks, deliver abnormal returns. Most of the returns are contributed by the short leg. However, they find evidence for limits of these strategies in idiosyncratic risk, transaction costs and noise trader momentum risk.

Hyde (2014) analyzed the deployment of the F_SCORE strategy in emerging markets. He demonstrated that high F_SCORE stocks indeed seem to offer a premium which cannot be explained by value, size or momentum. He argues that the common explanation that stocks with such a premium are neglected by analysts does not hold, as high F_SCORE stocks are usually heavily followed and analyzed.

Singh and Kaur (2015) tested the Piotroski F_SCORE in the Indian stock market. Their findings are that high F_SCORE stocks performed better than the sample of all value stocks and delivered abnormal returns even after controlling for size, momentum, value, recent equity offerings and accrual effects.

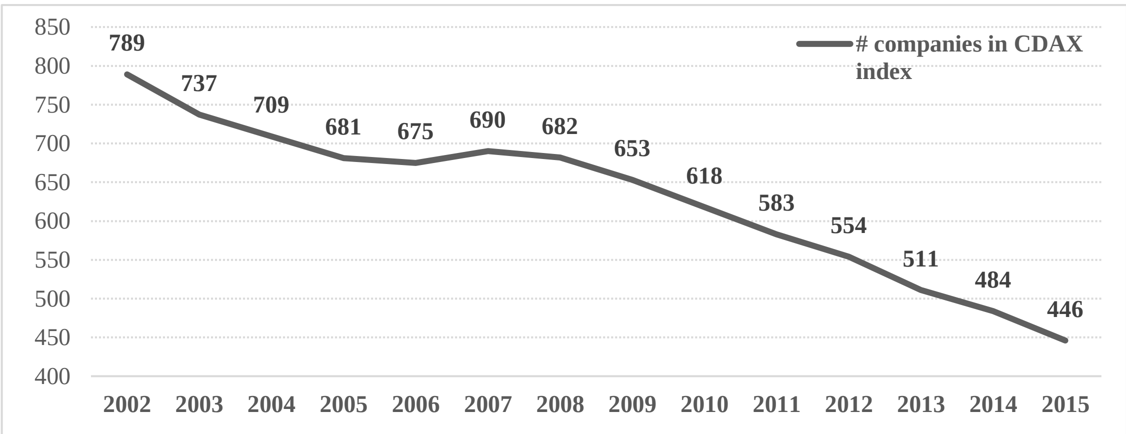
To sum up, the Piotroski method is based on a thoroughly researched theoretical framework, profiting from one of the most known persisting anomalies and extending the efficacy using fundamental signals. Evidence about practicality and persistence shows, however, mixed results. This work project tries to add to the discussion by testing and developing the approach for the German stock market for the recent period of time whilst trying to create an additional sorting signal that makes the method applicable for smaller stock markets.

When testing whether any alpha attained by this method is significant after controlling for common risk factors, the author will also control for quality on the basis of Asness/Frazzini/Pedersen (2013) and Asness et al. (2015) and the new factors by Fama/French (2014) mentioned beforehand.

3. DATA AND METHODOLOGY

This work tries to contribute to the discussion of practicality of Piotroski's investing strategy by testing it on the German stock market. Therefore, the companies for the sample are drawn from the CDAX index which contains all stock corporations in Germany. The time horizon for the examination is 2002-2016, because reliable information about the historical index constituents is only available from the beginning of 2002 onwards. In addition, the focus is designed to lie on the recent years and financial crises. The strategy requires portfolio updates every year. Therefore the first step was to retrieve the Portfolio constituents at each year. This step is important in order to ensure that the data is as much "point in time" as possible. Using the current constitution of the index would lead to a survivorship bias, because it excludes all companies that got bankrupt or acquired throughout time.

Graph 1. Change in CDAX Index Constitution 2002-2015.



Graph 1 illustrates the extent to which the index constitution changed. In 2002 there were 789 companies included in the CDAX index, whereas in 2015 only 446 companies constitute the index. On average, the number of stocks in the index declined by 4.29%

annually. This proves the importance of using the actual index constitution of each respective year.

The next step was to retrieve the financial statement data needed to build portfolios based on Joseph Piotroski's method. All of the subsequent data was taken from Bloomberg, unless marked differently. First, the companies were ranked each year based on their price-to-book ratios. The F_SCORE was then calculated for the quintile with the lowest price-to-book ratios. It represents an aggregate score that assesses companies based on three key areas, namely profitability, financial performance and operating efficiency. Table 1 specifies the determinants of the F_SCORE within the three key areas.

Table 1. Determinants of the F_SCORE.

PROFITABILITY	
ROA	= Net income before extraordinary items divided by Total assets
CFO	= Cash flow from operations divided by Total assets
Δ ROA	= Current return on assets – ROA of previous year
ACCRUAL	= CFO – ROA
FINANCIAL PERFORMANCE	
Δ LEVER	= Long-term debt of this year – Long-term debt of previous year
Δ LIQUID	= Current ratio of this year – Current ratio of previous year
EQ_OFFER	= New shares issued
OPERATING EFFICIENCY	
Δ MARGIN	= Profit margin of this year – Profit margin of previous year
Δ TURN	= Asset turnover of this year – Asset turnover of previous year

The first area in which the companies are assessed is the area of profitability. Positive ROA and CFO can be seen as a positive sign when considering the poor earnings history of most value firms. Also any improvement in ROA is considered as a positive signal. The ACCRUAL variable reflects positive accrual adjustments, which Sloan (1996) showed to have a significant negative impact on future returns. Piotroski defines it as profits being greater than cash flow from operations. Whenever the opposite is the case it should be seen as a positive signal.

The next area is financial performance, which focuses on assessing changes in the capital structure. The first variable subsumes the change in long-term debt levels. Piotroski states that when distressed firms raise capital externally, this should be seen as a proof that they cannot generate enough funding internally. Moreover it makes the firms less financially flexible. The positive change in current ratio adresses the liquidity and should be seen as a positive signal when it is achieved. Following Loughran/Ritter (1995), who found that new-share-issuers tend to underperform, results in a disapproval for new shares in the EQ_OFFER variable. This also addresses the earlier point of external financing representing a lack of internal financing possibilities.

The last section deals with the operating efficiency of the respective companies. The two variables used are changes in gross margin and asset turnover. An improved gross margin ratio indicates cost reduction or a higher price for the products sold. A higher asset turnover is a sign for productivity improvements such as higher sales or an increase in the efficiency of a firm’s operations.

Piotroski stresses that it is important to note that his variables are tailored for the distressed low price-to-book segment. He mentions that for other companies for instance, additional leverage would not necessarily result in a negative signal. Table 2 explains all of the nine resulting binary signals that follow these determinants.

Table 2. Binary Signals from the Determinants of the F_SCORE.

$\boldsymbol{If\ ROA > 0, F_{ROA} = \begin{cases} 1, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ CFO > 0, F_{CFO} = \begin{cases} 1, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ \Delta ROA > 0, F_{\Delta ROA} = \begin{cases} 1, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ ACCRUAL > 0, F_{ACCRUAL} = \begin{cases} 1, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ \Delta \mathrm{LEVER} < 0, F_{\Delta \mathrm{LEVER}} = \begin{cases} 1, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ \Delta \mathrm{LIQUID} > 0, F_{ROA} = \begin{cases} 1, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ EQ_{OFFER} \leq 0, EQ\_OFFER = \begin{cases} 1, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ \Delta \mathrm{MARGIN} > 0, F_{\Delta \mathrm{MARGIN}} = \begin{cases} 1, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ \Delta TURN > 0, F_{\Delta \mathrm{TURN}} = \begin{cases} 1, \\ 0\ otherwise \end{cases}}$

With the F_SCORE being the sum of the individual binary signals it can be described with the following equation. The highest possible score is accordingly 9 for a company with very strong prospects and 0 for a company of extremely low quality.

Equation 1. Composition of the F_SCORE.

$$\boldsymbol{F\_SCORE} = \boldsymbol{F_{ROA}} + \boldsymbol{F_{CFO}} + \boldsymbol{F_{\Delta ROA}} + \boldsymbol{F_{ACCRUAL}} + \boldsymbol{F_{\Delta LEVER}} + \boldsymbol{F_{\Delta LIQUID}} + \boldsymbol{EQ_{OFFER}} + \boldsymbol{F_{\Delta MARGIN}} + \boldsymbol{F_{\Delta TURN}}$$

Piotroski acknowledges that using simple binary signals could lead to an elimination of useful information. Furthermore, in some years many companies may have the same score, whereas other scores are relatively underrepresented. Because the German stock index is considerably smaller than the U.S. company horizon, this imposes restrictions on the original way Piotroski formed his portfolios. Instead of bundling companies with the same score into portfolios, this paper will work with deciles and quintiles. The reason is to ensure enough diversification as high and low F_SCORE ranks tend to be rarer than mediocre F_SCOREs.

In order to differentiate between companies with the same F_SCORE, as a second step a F_SCORE_ADD was created. Hence, for the portfolio construction, also the strength of the positive moves of the signal determinants scaled by total assets was considered. Table 3 shows the strength determinants for the F_SCORE_ADD which do not require additional information but use information that would otherwise be neglected when using only binary signals.

Table 3. Strength Determinants for F_SCORE_ADD.

$\boldsymbol{If\ ROA > 0, Add_{ROA} = \begin{cases} ROA, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ CFO > 0, Add_{CFO} = \begin{cases} CFO, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ \Delta ROA > 0, Add_{\Delta \mathrm{ROA}} = \begin{cases} \Delta ROA, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ ACCRUAL > 0, Add_{ACCRUAL} = \begin{cases} CFO - ROA, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ \Delta \mathrm{LEVER} < 0, Add_{\Delta \mathrm{LEVER}} = \begin{cases} -\Delta \mathrm{LEVER}, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ \Delta \mathrm{LIQUID} > 0, Add_{ROA} = \begin{cases} \Delta \mathrm{LIQUID}, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ EQ_{OFFER} \leq 0, Add_{EQOFFER} = \begin{cases} 1, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ \Delta \mathrm{MARGIN} > 0, Add_{\Delta \mathrm{MARGIN}} = \begin{cases} \Delta \mathrm{MARGIN}, \\ 0\ otherwise \end{cases}}$
$\boldsymbol{If\ \Delta TURN > 0, Add_{\Delta \mathrm{TURN}} = \begin{cases} \Delta TURN, \\ 0\ otherwise \end{cases}}$

Whenever a condition is fulfilled that would lead to a positive F_SCORE signal, the amount of positiveness is considered, for example how much the return on assets improved compared to the previous year.

Equation 2 illustrates, how the F_SCORE_ADD is calculated. All numbers from the F_SCORE_ADD determinants are added up and then divided by total assets. Within each F_SCORE, companies were then ranked based on their F_SCORE_ADD from highest to lowest values.

Equation 2. Composition of the F_SCORE_ADD.

$$\begin{aligned} \boldsymbol{F\_SCORE\_ADD} \\ &= \left(\frac{\mathbf{1}}{\boldsymbol{Total\ Assets}}\right) * (\boldsymbol{Add_{ROA}} + \boldsymbol{Add_{CFO}} + \boldsymbol{Add_{\Delta ROA}} + \boldsymbol{Add_{ACCRUAL}} \\ &+ \boldsymbol{Add_{\Delta LEVER}} + \boldsymbol{Add_{\Delta LIQUID}} + \boldsymbol{Add_{EQOFFER}}) + \boldsymbol{Add_{\Delta MARGIN}} \\ &+ \boldsymbol{Add_{\Delta TURN}} \end{aligned}$$

After ranking all companies in the low price-to-book ratio quintile based on first F_SCORE and then F_SCORE_ADD, portfolios were created based on deciles and quintiles. For instance, the highest ranked decile in each year would stand for a portfolio. Within each portfolio, all assets are assumed to be equally weighted.

In order to examine, whether the results are different for large and small corporations, the sample was also split between companies of less than 100 million € market capitalization and such that have a higher market capitalization. The same procedure mentioned above was then performed analogously for these two sample splits.

After determining the portfolios, the logged total return of each portfolio, which is defined in equation 3, was calculated on a monthly basis.

Equation 3. Calculation of Returns.

$$\boldsymbol{R_t} = \boldsymbol{ln}\left(\frac{\boldsymbol{P_t} + \boldsymbol{dividend}}{\boldsymbol{P_{t-1}}}\right)$$

Because it takes some time for companies to publish the results for their financial years and in order to avoid the look-ahead bias, the returns were calculated starting from the middle of the year. This 6 months lag has the purpose of diminishing biased errors due to the use of forward-looking information. The return of delisted companies was calculated using the price to which they got delisted, the return of acquired companies was calculated using the price for which they got acquired.

After calculating the decile returns, the CAPM, Fama-French three- and five-factor models (FF3M and FF5M), the Carhart four-factor model (C4FM), the FF3M plus the QMJ factor (Q4FM) and the C4FM plus the QMJ factor, which will be defined as Q5FM further in the text, were used in order to see if the strategy generates significant alpha after controlling for common risk factors and quality. The models were defined as follows, with r_{it} resembling the excess portfolio return after adjusting for the risk-free rate, which is proxied by the average one month money market rates ("Monatsgeld") for the beginning of the sample period and the one-month EURIBOR after June 2012. CDAXRF is the excess return on the CDAX; SMB, HML, WML, RMW, CMA and QMJ are returns on zero-investment, factor-mimicking portfolios for size, book-to-market, momentum, profitability, investment patterns and quality.

CAPM: $r_{it} = \alpha_{iT} + b_{iT}CDAXRF_t + e_{it}$

FF3M: $r_{it} = \alpha_{iT} + b_{iT}CDAXRF_t + s_{iT}SMB_t + h_{iT}HML_t + e_{it}$

C4FM: $r_{it} = \alpha_{iT} + b_{iT}CDAXRF_t + s_{iT}SMB_t + h_{iT}HML_t + w_{iT}WML_t + e_{it}$

Q4FM: $r_{it} = \alpha_{iT} + b_{iT}CDAXRF_t + s_{iT}SMB_t + h_{iT}HML_t + q_{iT}QMJ_t + e_{it}$

Q5FM: $r_{it} = \alpha_{iT} + b_{iT}CDAXRF_t + s_{iT}SMB_t + h_{iT}HML_t + w_{iT}WML_t + q_{iT}QMJ_t + e_{it}$

FF5M: $r_{it} = \alpha_{iT} + b_{iT}CDAXRF_t + s_{iT}SMB_t + h_{iT}HML_t + r_{iT}RMW_t + c_{iT}CMA_t + e_{it}$

The factors for the German market used for the CAPM, FF3M and C4FM regressions are provided by Humboldt University Berlin. More information about the construction of this multi-factor data set is delivered by Brückner et al. (2015).[1] Because the German factor data set only reaches until June 2015, the missing year's factors are proxied with the Fama/French European data set provided by Kenneth French.[2] This also applies for the two additional factors used for the Fama-French five-factor Model. The German QMJ factors were retrieved from the data set provided by AQR which is related to the paper by Asness/Frazzini/Pedersen (2013).[3]

[1] Source: https://www.wiwi.hu-berlin.de/de/professuren/bwl/bb/data/fama-french-factors-germany/fama-french-factors-for-germany
[2] Source: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#International
[3] Source: https://www.aqr.com/library/data-sets/quality-minus-junk-factors-monthly

4. RESULTS

The following section will present the results of the examination. First, tables with the raw returns will show the performance of each decile and quintile of the sample, both for the whole sample size as well as for large caps and small caps respectively. Thereafter, the results of benchmarking the excess returns over the risk free rate of the three samples with common risk factors and quality will be summarized and discussed.

Table 3. Descriptive Statistics of Returns – Whole Sample Size.

DECILES	*Market*	*Deciles - Long only*									
Risk & Return:	CDAX	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Arithmetic Return	6.77%	8.11%	3.67%	-2.76%	1.50%	-4.66%	-11.33%	-2.43%	-13.67%	-11.29%	-19.04%
Geometric Return	4.54%	6.13%	1.62%	-5.07%	-0.78%	-7.57%	-14.41%	-5.47%	-20.40%	-14.90%	-22.70%
Standard Dev.	21.13%	19.90%	20.23%	21.51%	21.37%	24.14%	24.80%	24.66%	36.67%	26.87%	27.07%
Info Sharpe	0.32	0.41	0.18	-0.13	0.07	-0.19	-0.46	-0.10	-0.37	-0.42	-0.70
Distribution:	CDAX	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Monthly Max	18.24%	16.90%	16.04%	17.17%	18.10%	20.11%	16.71%	17.74%	61.59%	14.86%	17.30%
Q3	4.07%	3.95%	3.70%	3.45%	3.89%	3.70%	3.06%	3.62%	3.69%	4.02%	2.96%
Med	1.38%	0.87%	0.70%	0.14%	0.28%	-0.20%	-0.26%	0.08%	-0.83%	0.09%	-1.23%
Q1	-2.54%	-2.60%	-2.51%	-2.73%	-2.85%	-3.83%	-4.47%	-3.95%	-5.03%	-4.55%	-6.18%
Monthly Min	-27.24%	-16.20%	-21.02%	-24.98%	-19.14%	-21.65%	-25.82%	-24.91%	-76.26%	-36.53%	-31.38%
Higher Moments:	CDAX	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Skewness	-1.04	-0.10	-0.51	-1.01	-0.39	-0.28	-0.63	-0.42	-1.20	-1.25	-0.65
Kurtosis	3.39	0.53	1.68	3.43	1.39	0.85	1.47	0.78	22.02	3.12	1.90
Positive Periods:	CDAX	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Positive Months	58.93%	55.95%	58.33%	51.79%	51.79%	47.02%	48.81%	50.00%	44.05%	50.60%	40.48%
Positive Years	64.29%	71.43%	64.29%	57.14%	57.14%	57.14%	42.86%	50.00%	35.71%	42.86%	21.43%

QUINTILES	*Market*	*Quintiles - Long only*					*Quintiles - Long Short*				
Risk & Return:	CDAX	1st	2nd	3rd	4th	5th	(1)–(10)	(1-2)–(9-10)	(1-3)–(8-10)	(1-4)–(7-10)	(1-5)–(6-10)
Arithmetic Return	6.77%	5.89%	-0.63%	-8.00%	-8.05%	-15.16%	27.14%	21.05%	17.67%	14.24%	12.73%
Geometric Return	4.54%	4.45%	-2.42%	-10.24%	-11.09%	-17.86%	24.17%	19.32%	16.19%	13.29%	11.97%
Standard Dev.	21.13%	16.98%	18.95%	21.17%	24.64%	23.21%	24.40%	18.64%	17.22%	13.79%	12.29%
Info Sharpe	0.32	0.35	-0.03	-0.38	-0.33	-0.65	1.11	1.13	1.03	1.03	1.04
Distribution:	CDAX	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
Monthly Max	18.24%	15.59%	14.07%	15.01%	24.22%	16.08%	30.67%	17.36%	26.60%	21.10%	15.57%
Q3	4.07%	3.55%	3.29%	3.57%	3.16%	2.96%	6.37%	4.49%	3.92%	3.29%	3.17%
Med	1.38%	0.51%	0.24%	-0.07%	-0.19%	-0.36%	2.14%	1.84%	1.72%	1.43%	1.11%
Q1	-2.54%	-2.11%	-2.86%	-3.82%	-4.19%	-4.75%	-2.07%	-1.67%	-0.93%	-1.19%	-1.07%
Monthly Min	-27.24%	-16.70%	-20.79%	-18.34%	-41.52%	-27.87%	-16.92%	-14.09%	-23.06%	-15.02%	-11.66%
Higher Moments:	CDAX	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
Skewness	-1.04	-0.31	-0.79	-0.46	-1.46	-0.73	0.33	0.19	-0.14	0.23	0.03
Kurtosis	3.39	1.15	2.24	0.38	8.01	1.41	1.36	1.03	6.88	4.46	2.15
Positive Periods:	CDAX	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
Positive Months	58.93%	56.55%	53.57%	49.40%	48.81%	47.62%	65.48%	65.48%	68.45%	66.07%	63.69%
Positive Years	64.29%	57.14%	50.00%	57.14%	50.00%	42.86%	100.00%	85.71%	100.00%	85.71%	92.86%

Table 3 summarizes the results for the different deciles and quintiles of companies ranked according to F_SCORE and F_SCORE_ADD for the whole sample size. Long only returns are presented in the upper section and lower left hand side, whereas the results for the long-short portfolios can be found in the lower right hand part of the table. When looking at the deciles it becomes clear, that from the highest to the lowest decile, the performance deteriorates almost gradually. The relationship is not perfect, but the arithmetic return correlates with the number of decile with a percentage of -90.95%. This means that the F_SCORE and F_SCORE_ADD ranking method performs quite well when discriminating between companies with different future prospects. The highest quintiles consist of companies with strong prospects and as observable, they performed well, whereas the bottom deciles consist of the companies with the worst prospects which noticeably perform very poorly. However, only the first decile manages to offer a better performance than the market and only three deciles yield positive returns on average. For the results in quintiles, the relationship between F_SCORE and F_SCORE_ADD rank and performance becomes even more stringent. The next step is to look at the long-short portfolios that go long in expected winners and short expected losers. Five long-short portfolios were formed, the first going long in the top decile and shorting the bottom decile, which is presented as (1)–(10), the second one longing the first two deciles while shorting the bottom two deciles and so on. The majority of returns is contributed by the short leg. Four of these portfolios offer a lower standard deviation than the market while at the same time offering a multiple of the market's returns. Accordingly, all of them offer attractive risk-return figures of above one. In the distribution of returns the median is always high and positive and in contrast to the market and the long only portfolios, the monthly maximum always exceeds the monthly minimum. Most of the long-short portfolios have a positive skewness, which means that the distribution is asymmetric with a bias towards more positive values. The number of positive months and years is largely increased.

The next paragraphs will discuss the difference of performance in large and small caps. For this examination the sample was split in half between companies that exceed a market capitalization of 100 million € and such that do not. Splitting the sample leads to a smaller sample base, because Piotroski's method works with the bottom quintile of price-to-book companies. Therefore the resulting portfolios contain less companies, which impacts diversification effects. This should be kept in mind when comparing the following results to the results for the whole sample size.

Table 4. Descriptive Statistics of Returns – Large Caps.

DECILES	*Market*	*Deciles - Long only*									
Risk & Return:	CDAX	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Arithmetic Return	6.77%	10.19%	9.82%	10.58%	-0.40%	2.17%	-3.75%	10.36%	-2.28%	-1.49%	-11.12%
Geometric Return	4.54%	8.33%	7.86%	7.97%	-3.40%	-1.26%	-7.79%	8.85%	-5.90%	-5.61%	-16.29%
Standard Dev.	21.13%	19.27%	19.82%	22.85%	24.51%	26.19%	28.39%	17.34%	26.89%	28.70%	32.14%
Info Sharpe	0.32	0.53	0.50	0.46	-0.02	0.08	-0.13	0.60	-0.08	-0.05	-0.35
Distribution:	CDAX	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Monthly Max	18.24%	17.61%	13.21%	16.68%	24.38%	22.68%	25.35%	13.04%	29.77%	24.06%	34.08%
Q3	4.07%	4.73%	4.35%	5.13%	4.59%	4.00%	3.59%	3.95%	4.33%	4.85%	4.31%
Med	1.38%	1.10%	1.35%	1.36%	0.07%	1.00%	0.79%	1.26%	-0.10%	0.24%	-0.48%
Q1	-2.54%	-1.92%	-2.39%	-2.74%	-3.87%	-3.27%	-2.49%	-1.77%	-4.94%	-3.92%	-4.66%
Monthly Min	-27.24%	-21.66%	-24.19%	-21.72%	-24.80%	-30.90%	-46.43%	-19.92%	-19.89%	-40.98%	-36.86%
Higher Moments:	CDAX	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Skewness	-1.04	-0.89	-0.89	-0.52	-0.52	-1.02	-1.73	-0.70	0.33	-1.01	-0.85
Kurtosis	3.39	2.44	2.20	1.12	1.53	3.93	8.35	1.84	1.41	4.05	3.42
Positive Periods:	CDAX	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Positive Months	58.93%	60.12%	60.71%	58.33%	51.19%	55.36%	54.76%	60.12%	49.40%	51.79%	45.83%
Positive Years	64.29%	78.57%	71.43%	57.14%	57.14%	57.14%	50.00%	78.57%	42.86%	57.14%	50.00%

QUINTILES	*Market*	*Quintiles - Long only*					*Quintiles - Long Short*				
Risk & Return:	CDAX	1st	2nd	3rd	4th	5th	(1)–(10)	(1-2)–(9-10)	(1-3)–(8-10)	(1-4)–(7-10)	(1-5)–(6-10)
Arithmetic Return	6.77%	10.01%	5.09%	-0.79%	4.04%	-6.31%	21.31%	16.31%	15.16%	8.68%	8.13%
Geometric Return	4.54%	8.42%	2.89%	-3.46%	2.19%	-10.03%	17.19%	14.21%	13.74%	7.76%	7.39%
Standard Dev.	21.13%	17.81%	20.98%	23.11%	19.22%	27.31%	28.71%	20.48%	16.87%	13.58%	12.17%
Info Sharpe	0.32	0.56	0.24	-0.03	0.21	-0.23	0.74	0.80	0.90	0.64	0.67
Distribution:	CDAX	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
Monthly Max	18.24%	10.01%	18.55%	21.71%	16.15%	25.46%	38.01%	24.12%	15.93%	11.02%	10.21%
Q3	4.07%	4.68%	4.71%	3.87%	4.32%	4.06%	5.66%	4.80%	4.27%	3.24%	2.98%
Med	1.38%	1.67%	0.48%	0.50%	0.31%	-0.28%	1.31%	1.45%	0.88%	0.47%	0.68%
Q1	-2.54%	-1.92%	-2.75%	-2.64%	-3.00%	-4.08%	-2.53%	-1.81%	-1.57%	-1.38%	-1.37%
Monthly Min	-27.24%	-22.92%	-19.27%	-26.18%	-16.86%	-31.20%	-27.79%	-22.56%	-15.75%	-12.98%	-10.75%
Higher Moments:	CDAX	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
Skewness	-1.04	-1.17	-0.41	-0.89	-0.13	-0.78	0.97	0.20	-0.01	-0.05	-0.18
Kurtosis	3.39	2.80	0.76	3.13	0.60	2.86	4.50	3.06	1.60	0.83	0.87
Positive Periods:	CDAX	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
Positive Months	58.93%	59.52%	54.76%	55.36%	53.57%	47.62%	61.31%	58.93%	61.31%	55.95%	60.71%
Positive Years	64.29%	71.43%	50.00%	50.00%	50.00%	50.00%	78.57%	71.43%	78.57%	78.57%	85.71%

The first thing to notice when looking at the results for the large cap sample is that the top three deciles present better information Sharpe ratios compared to the market.

However, the relationship between number of decile and returns are less perfect, even when looking at quintiles. This is mainly due to the fact that the 7th decile is the best performing one, which proves that the Piotroski F_SCORE has a more limited application among large corporations with a probably high analyst following. As a result, the long-short portfolios have lower information Sharpe ratios compared to the whole sample size portfolios, the average being 0.75. Distribution of returns and higher moments do not show the same characteristics as in the whole sample size. More portfolios exhibit negative skewness and for some the monthly maximum does not outstrip the monthly minimum. Also, the percentage of positive years is lower.

Table 5. Descriptive Statistics of Returns – Small Caps.

DECILES	***Market***	***Deciles - Long only***									
Risk & Return:	CDAX	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Arithmetic Return	6.77%	9.79%	6.76%	0.77%	-9.05%	-9.25%	-9.85%	-15.39%	-32.68%	-15.31%	-22.60%
Geometric Return	4.54%	7.09%	3.75%	-3.20%	-14.01%	-13.22%	-13.73%	-20.64%	-48.58%	-19.79%	-30.10%
Standard Dev.	21.13%	23.25%	24.54%	28.18%	31.49%	28.18%	27.85%	32.41%	56.40%	29.94%	38.72%
Info Sharpe	0.32	0.42	0.28	0.03	-0.29	-0.33	-0.35	-0.47	-0.58	-0.51	-0.58
Distribution:	CDAX	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Monthly Max	18.24%	21.88%	23.65%	21.22%	35.95%	27.37%	19.71%	19.26%	95.13%	15.65%	26.09%
Q3	4.07%	4.78%	3.41%	4.50%	4.12%	3.68%	3.91%	4.53%	3.77%	3.70%	3.98%
Med	1.38%	0.79%	0.26%	-0.42%	0.29%	-0.17%	-0.64%	-0.43%	-1.04%	-0.37%	-1.22%
Q1	-2.54%	-2.95%	-3.25%	-4.34%	-4.16%	-4.78%	-4.78%	-6.64%	-7.62%	-5.67%	-6.62%
Monthly Min	-27.24%	-24.70%	-18.63%	-30.96%	-42.87%	-49.83%	-37.47%	-33.66%	-138.93%	-35.26%	-51.28%
Higher Moments:	CDAX	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Skewness	-1.04	-0.24	0.14	-0.19	-0.74	-1.04	-0.41	-0.59	-2.34	-0.95	-1.33
Kurtosis	3.39	1.54	1.01	1.03	4.51	7.80	2.21	1.20	35.92	2.08	4.84
Positive Periods:	CDAX	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Positive Months	58.93%	54.76%	52.98%	48.21%	51.79%	48.21%	45.24%	47.02%	41.67%	48.21%	45.24%
Positive Years	64.29%	57.14%	64.29%	42.86%	57.14%	42.86%	35.71%	42.86%	21.43%	35.71%	42.86%

QUINTILES	***Market***	***Quintiles - Long only***					***Quintiles - Long Short***				
Risk & Return:	CDAX	1st	2nd	3rd	4th	5th	(1)–(10)	(1-2)–(9-10)	(1-3)–(8-10)	(1-4)–(7-10)	(1-5)–(6-10)
Arithmetic Return	6.77%	8.28%	-4.14%	-9.55%	-24.04%	-18.95%	32.39%	27.23%	29.30%	23.56%	18.97%
Geometric Return	4.54%	6.35%	-7.19%	-12.13%	-30.13%	-22.63%	24.91%	23.99%	25.62%	21.00%	17.03%
Standard Dev.	21.13%	19.63%	24.69%	22.73%	34.92%	27.12%	38.69%	25.47%	27.13%	22.64%	19.67%
Info Sharpe	0.32	0.42	-0.17	-0.42	-0.69	-0.70	0.84	1.07	1.08	1.04	0.96
Distribution:	CDAX	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
Monthly Max	18.24%	16.37%	24.19%	15.55%	43.37%	14.11%	55.91%	31.42%	47.43%	36.37%	28.96%
Q3	4.07%	4.05%	3.52%	3.41%	3.30%	3.48%	8.18%	6.18%	5.72%	4.81%	4.66%
Med	1.38%	0.74%	-0.62%	-0.33%	-1.31%	-0.96%	2.37%	2.72%	2.16%	2.17%	1.44%
Q1	-2.54%	-2.41%	-3.90%	-4.42%	-6.83%	-4.89%	-3.22%	-2.00%	-1.51%	-1.13%	-1.64%
Monthly Min	-27.24%	-18.50%	-25.35%	-30.13%	-72.24%	-35.55%	-39.50%	-18.92%	-29.04%	-22.06%	-19.45%
Higher Moments:	CDAX	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
Skewness	-1.04	-0.30	-0.43	-0.58	-1.71	-1.16	0.53	0.43	1.14	0.57	0.32
Kurtosis	3.39	1.00	2.28	2.32	15.31	2.74	3.97	2.10	8.09	5.09	3.39
Positive Periods:	CDAX	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
Positive Months	58.93%	55.95%	47.02%	45.24%	44.05%	45.83%	61.90%	63.69%	66.67%	67.86%	65.48%
Positive Years	64.29%	64.29%	64.29%	35.71%	35.71%	42.86%	78.57%	92.86%	92.86%	85.71%	78.57%

Table 5 summarizes the statistics for the small cap sample. Of all three samples, it offers the highest return for the top decile and quintile. The relationship between F_SCORE and F_SCORE_ADD rank and returns is more stringent than for the large cap sample. In the quintiles however, the relationship appears not perfect due to the large negative performance of the 8^{th} decile. The distribution of returns seems more extreme in the small cap sample with some deciles having high monthly maxima and minima and extreme kurtosis figures. Also, the numbers of positive years and months are the lowest for this sample. The long-short porfolios offer higher information Sharpe ratios of around one compared to the large cap sample. Also the spread between high F_SCORE and low F_SCORE companies is the highest in this sample, resulting in an average return of 32.39% for the portfolio that goes long in the top decile and short in the bottom decile. The long-short portfolios exhibit monthly maxima that largely exceed the monthly minima. Also, the skewness for all portfolios is positive and almost all portfolios have a leptokurtic distribution. The number of positive months is high and the portfolios offered positive results in almost all years of the period studied.

To conclude, the F_SCORE and F_SCORE_ADD ranking system is able to discriminate between companies with strong prospects and such that will perform poorly in a fairly gradual manner. Portfolios that go long expected winners and short expected losers would have generated attractive risk-return figures for the period studied. Splitting the sample between large and small caps reveals differences in performance. For the large cap sample size the F_SCORE did not work as perfect as in the small cap sample. A reason may be that the companies with a large market capitalization have a higher analyst following, which may lead to a faster incorporation of fundamentals in prices. This would affect the practicality of the Piotroski F_SCORE for this sample, especially when one considers the half-year lag between the end of a financial year and the actual investment period. Small caps showed a more stringent relationship between F_SCORE rank and performance. Therefore the risk-return metrics are more attractive. On the other hand, the small cap sample exhibits more extreme statistics, with high kurtosis figures and mostly negative deciles for the long only portfolios. Also, the majority of returns is yielded by the short leg. It seems that these companies are more distressed and in a worse state compared to the large cap companies. Also, these companies appear less investible due to the fact that they are of a low market capitalization. This may impose liquidity constraints and high transaction costs, which may make investing in these companies with the Piotroski method unfeasible. On the other hand, this may be also the reason for the profitability of investing in this segment with the F_SCORE method, as fundamental data does not get incorporated as fast.

The next step was to benchmark the returns with common factor models. Six different regressions were performed. The first one is the Capital Asset Pricing Model by Sharpe (1964), the second one is the Fama-French three-factor model by Fama/French (1996), the third one their extended five-factor model (2014), the fourth one is the four-factor model by Carhart (1997), the fifth one is the Q4FM, which resembles the FF3M extended with a quality-minus-junk factor (QMJ) introduced by Asness/Frazzini/Pedersen (2013), and the sixth one is the Q5FM, which will resemble the C4FM extended with the QMJ factor. Three summary tables for each sample will be presented and discussed, the regression output can be found in the the appendix.[4]

[4] All regressions were performed using EViews. The appendix (pages 37 – 42) exhibits all outputs.

Table 6. Regression Summary for Long-Short Portfolios – Whole Sample Size.[5]

Model:	*Whole Sample Size*	(1)–(10)	(1-2)–(9-10)	(1-3)–(8-10)	(1-4)–(7-10)	(1-5)–(6-10)
CAPM:	α	*	*	*	*	*
	CDAX-Rf	X	*	*	*	*
FF3M:	α	*	*	*	*	*
	CDAX-Rf	X	*	*	*	**
	SMB	X	X	X	X	X
	HML	X	X	X	X	X
C4FM:	α	*	*	*	*	*
	CDAX-Rf	X	***	X	X	X
	SMB	X	X	X	X	X
	HML	X	X	X	X	X
	WML	X	***	**	**	**
Q4FM:	α	*	*	**	*	*
	CDAX-Rf	X	X	X	X	X
	SMB	X	X	X	X	X
	HML	X	X	X	X	X
	QMJ	X	X	***	X	X
Q5FM:	α	*	*	**	**	**
	CDAX-Rf	X	X	X	X	X
	SMB	X	X	X	X	X
	HML	X	X	X	X	X
	WML	X	***	***	***	***
	QMJ	X	X	X	X	X
FF5M:	α	*	*	**	**	**
	CDAX-Rf	X	X	X	X	X
	SMB	X	X	X	X	X
	HML	X	X	X	X	X
	RMW	X	**	*	*	**
	CMA	X	X	X	X	X

Table 6 summarizes the regression outputs for the portfolios drawn from the complete sample size. Controlling the excess returns of the five long-short portfolios over the risk-free rate for the risk-adjusted market return, size, value, momentum, quality, profitability and investment patterns results in a positive and significant alpha at the 5%

[5] For all three regression summary tables the following symbols mark the significance of the variables.

*	Significant at the 1% level	**	Significant at the 5% level
***	Significant at the 10% level	X	Not significant

level for all portfolios in all models. Adding quality factors or controlling for the profitability and the investment patterns of the companies does not manage to eliminate the alpha achieved by Piotroski's method. Interestingly, the RMW factor by Fama/French (2014) performed better as a variable than the QMJ factor by Asness/Frazzini/Pedersen (2013).

Table 7. Regression Summary for Long-Short Portfolios – Large Caps.

Model:	*Large Cap Sample*	(1)–(10)	(1-2)–(9-10)	(1-3)–(8-10)	(1-4)–(7-10)	(1-5)–(6-10)
CAPM:	α	*	*	*	**	**
	CDAX-Rf	*	*	*	**	***
FF3M:	α	*	*	*	**	**
	CDAX-Rf	*	*	*	*	***
	SMB	**	*	**	X	X
	HML	X	**	X	X	X
C4FM:	α	**	**	*	X	X
	CDAX-Rf	**	*	**	X	X
	SMB	**	**	X	X	X
	HML	X	**	***	X	X
	WML	X	*	*	*	**
Q4FM:	α	***	***	*	X	X
	CDAX-Rf	X	**	**	X	X
	SMB	**	**	*	X	X
	HML	X	***	*	X	X
	QMJ	***	*	***	X	X
Q5FM:	α	***	X	**	X	X
	CDAX-Rf	X	X	X	X	X
	SMB	***	***	X	X	X
	HML	X	***	***	X	X
	WML	X	*	*	**	***
	QMJ	X	*	X	X	X
FF5M:	α	**	*	*	***	***
	CDAX-Rf	*	*	*	***	X
	SMB	**	**	***	X	X
	HML	X	***	X	X	X
	RMW	X	***	X	X	X
	CMA	X	X	X	***	***

For the large cap sample controlling for common risk factors and quality diminishes the alpha obtained by Piotroski's F_SCORE strategy. In contrast to the whole sample size, the QMJ factor hereby explains the returns better than the RMW factor. A possible explanation could be that the QMJ factor by Asness/Frazzini/Pedersen (2013) is derived from the Gordon growth model, which may be more suitable for large corporations. The Q5FM model seems to capture the returns the best.

Table 8. Regression Summary for Long-Short Portfolios – Small Caps.

Model:	*Small Cap Sample*	(1)–(10)	(1-2)–(9-10)	(1-3)–(8-10)	(1-4)–(7-10)	(1-5)–(6-10)
CAPM:	α	*	*	*	*	*
	CDAX-Rf	**	*	*	**	**
FF3M:	α	*	*	*	*	*
	CDAX-Rf	**	*	*	*	*
	SMB	X	X	X	X	X
	HML	X	***	X	X	***
C4FM:	α	*	*	*	*	*
	CDAX-Rf	**	**	*	**	**
	SMB	X	X	X	X	X
	HML	X	***	X	X	***
	WML	X	X	X	X	X
Q4FM:	α	*	*	*	*	*
	CDAX-Rf	**	X	***	X	X
	SMB	X	X	X	X	X
	HML	X	***	X	X	X
	QMJ	X	X	X	X	X
Q5FM:	α	*	*	*	*	*
	CDAX-Rf	**	X	***	X	X
	SMB	X	X	X	X	X
	HML	X	***	X	X	X
	WML	X	X	X	X	X
	QMJ	X	X	X	X	X
FF5M:	α	*	*	*	*	*
	CDAX-Rf	**	***	X	X	X
	SMB	X	X	X	X	X
	HML	X	***	X	X	X
	RMW	X	X	X	***	***
	CMA	X	X	X	X	X

In the small cap sample the alpha for all portfolios is significant above the 1% level. The only significant variable above the 10% level is the excess return of the CDAX over the risk-free rate. Controlling for common risk factors, quality, profitability and investment patterns does not affect the abnormality of returns in this sample.

All long-short portfolios show a small and negative beta towards the market excess return. This means that the returns of these portfolios are not very and negatively correlated with market movements, which could provide attractive characteristics, when added to a portfolio that has considerable market risk. Splitting the sample revealed that the long cap sample with corporations of a market capitalization above 100 million € did not perform as well and stringent as would be desirable. Furthermore, the returns achieved in this sample can be mimicked by portfolios that load upon common risk factors and quality. The small cap on the other hand presented attractive, stable alpha that persists after controlling for common risk factors, quality, profitability and investment patterns. Other authors however suggested, that this alpha is not harvestable in practice due to liquidity and size constraints associated with small companies. This may be an explanation for the persistence of this anomaly.

5. SUMMARY AND CONCLUSION

The systematic quantitative investment method based on Piotroski's F_SCORE yielded positive and stable results in the German stock market for the sample period of 2002-2016. Using a F_SCORE_ADD appeared a viable way to expand the application of the Piotroski F_SCORE to smaller stock markets. Further research can contribute to the discussion of this extension of the F_SCORE.

A portfolio that goes long in expected winners and shorts expected losers based on fundamental signals for stocks within the highest book-to-market quintile of the CDAX index generated high abnormal returns even after controlling for common risk factors and quality. In fact, the portfolio returns had very little and negative correlation with the market and the strategy appeared stable throughout the sample period.

However, when splitting the sample between small and large corporations it becomes clear that the strategy delivers abnormal returns only for the small cap sample consisting of companies with a market capitalization lower than 100 million €. This may make the strategy unfeasible for institutional investors due to liquidity and trading constraints, considering the amount of capital that usually needs to be employed by such players. These results relate to the findings of other authors and may be one reason for the persistence of the anomaly.

6. BIBLIOGRAPHY

Abarbanell, Jeffrey, and Brian Bushee. 1997. "Fundamental Analysis, Future Earnings, and Stock Prices." *Journal of Accounting Research*, 35: 1-24.

Abarbanell, Jeffrey, and Brian Bushee. 1998. "Abnormal Returns to a Fundamental Analysis Strategy". *Accounting Review*, 73: 19-45.

Altman, Edward. 1968. "Financial Ratios, Discriminant analysis and the Prediction of Corporate Bankruptcy." *The Journal of Finance,* 23(4): 589-609.

Amor-Tapia, Borja, and María Tascón. 2016. "Separating Winners from Losers: Composite Indicators Based on Fundamentals in the European Context." *Journal of Economics and Finance*, 66(1): 70-94.

Asness, Clifford, Andrea Frazzini, and Lasse Pedersen. 2013. "Quality Minus Junk." *Working Paper*.

Asness, Clifford, Andrea Frazzini, Ronen Israel, Tobias Moskowitz, and Lasse Pedersen. 2015. "Size Matters, If You Control Your Junk." *Working Paper*.

Basu, Sanjoy. 1977. "Investment Performance of Common Stocks in Relation to their Price-Earnings Ratios: A Test of the Efficient Market Hypothesis." *The Journal of Finance,* 32(3): 663-682.

Basu, Sanjoy. 1983. "The relationship between earnings' yield, market value and return for NYSE common stocks: Further evidence." *Journal of Financial Economics*, 12(1): 129-156.

Brückner, Roman, Patrick Lehmann, Martin Schmidt, and Richard Stehle. 2015. "Another German Fama/French Factor Data Set." http://ssrn.com/abstract=2682617.

Campbell, John, and Robert Shiller. 1988. "Stock Prices, Earnings, and Expected Dividends." *The Journal of Finance,* 43(3): 661-676.

Carhart, Mark. 1997. "On Persistence in Mutual Fund Performance." *The Journal of Finance,* 52(1): 57-82.

Chan, Louis, Yasushi Hamao, and Josef Lakonishok. 1991. "Fundamentals and Stock Returns in Japan." *The Journal of Finance* 46(5): 1739-1789.

Chen, Nai-fu, and Feng Zhang. 1998. "Risk and Return of Value Stocks." *Journal of Business*, 71(4): 501-535.

De Bondt, Werner, and Richard Thaler. 1985. "Does the Stock Market Overreact?" *The Journal of Finance*, 40(3): 793-805.

Dosamantes, Carlos. 2013. "The Relevance of Using Accounting Fundamentals in the Mexican Stock Market." *Journal of Economics, Finance and Administrative Science,* 18: 2-10.

Fama, Eugene, and Kenneth French. 1992. “The Cross-Section of Expected Stock Returns.” *The Journal of Finance*, 47(2): 427-465.

Fama, Eugene, and Kenneth French. 1996. “Multifactor Explanations of Asset Pricing Anomalies.” *The Journal of Finance*, 51(1): 55-84.

French, Eugene, and Kenneth French. 2014. “A Five-Factor Asset Pricing Model.” *Fama-Miller Working Paper*.

Fama, Eugene, and Marshall Blume. 1966. “Filter Rules and Stock-Market Trading.” *The Journal of Business*, 39(1): 226-241.

Graham, Benjamin, and David Dodd. 1934. *Security Analysis*. New York: McGraw-Hill.

Gray, Wesley, and Tobias Carlisle. 2013. *Quantitative Value: A Practitioner's Guide to Automating Intelligent Investment and Eliminating Behavioral Errors*. Hoboken, New Jersey: John Wiley & Sons.

Greenblatt, Joel. 2006. *The Little Book That Beats the Market*. Hoboken, New Jersey: John Wiley & Sons.

Haugen, Robert, and Nardin Baker. 1996. “Commonality in the Determinants of Expected Stock Returns.” *Journal of Financial Economics*, 41: 401.

Holthausen, Robert, and David Larcker. 1996. “The Prediction of Stock Returns Using Financial Statement Information.” *Journal of Accounting and Economics* 15(3): 373-411.

Hsu, Jason, and Vitali Kalesnik. 2014. *Finding Smart Beta in the Factor Zoo.* Newport Beach, California: Research Affiliates.

Hyde, Charles. 2014. “An Emerging Markets Analysis of the Piotroski F-score.” *The Finsia Journal of Applied Finance*, 2: 23-28.

Jaffe, Jeffrey, Donald Keim, and Randolph Westerfield. 1989. “Earnings Yields, Market Values, and Stock Returns.” *The Journal of Finance*, 44(1): 135-148.

Kim, Sohyung, and Cheol Lee. 2014. “Implementability of Trading Strategies Based on Accounting Information: Piotroski (2000) Revisited.” *European Accounting Review*, 23(4): 553-558.

Kothari, Suthawan. 2001. “Capital markets research in accounting.” *Journal of Accounting and Economics*, 31(1-3): 105-231.

Krauss, Christopher, Tom Krüger, and Daniel Beerstecher. 2015. “The Piotroski F-Score: A fundamental value strategy revisited from an investor's perspective.” *IWQW Discussion Paper Series*, 13: 1-27.

La Porta, Rafael, Josef Lakonishok, Andrei Shleifer, and Robert Vishny. 1997. “Good News for Value Stocks: Further Evidence on Market Efficiency.” *The Journal of Finance*, 52(2): 859-874.

Lev, Baruch, and S. Ramu Thiagarajan. 1993. “Fundamental Information Analysis.” *Journal of Accounting Research*, 31(2): 190-215.

Loughran, Tim, Jay Ritter. 1995. “The New Issues Puzzle.” *The Journal of Finance,* 50(1): 23-51.

Ou, Jane, and Stephen H. Penman. 1989. “Accounting Measurement, Price-Earnings Ratio, and the Information Content of Security Prices.” *Journal of Accounting Research*, 27: 111-144.

Ou, Jane, and Stephen H. Penman. 1989. “Financial Statement Analysis and the Prediction of Stock Returns.” *Journal of Accounting and Economics*, 11: 295-329.

Piotroski, Joseph. 2000. “Value Investing: The Use of Historical Financial Statements to Separate Winners from Losers.” *Journal of Accounting Research*, 38.

Piotroski, Joseph, and Eric So. 2011. “Identifying Expectation Errors in Value/Glamour Strategies: A Fundamental Analysis Approach.” *Review of Financial Studies*, 25(9): 2841-2875.

Rosenberg, Barr, Kenneth Reid, and Ronald Lanstein. 1985. “Persuasive Evidence of Market Inefficiency.” *Journal of Portfolio Management*, 11: 9-17.

Scatizzi, Cara. 2010. “Adjusting for the real world: Testing variations of Piotroski's Screen.” *AAII Journal*, 32(4): 21-26.

Sharpe, William. 1964. “Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk.” *The Journal of Finance,* 19(3): 425-442.

Singh, Jaspal, and Kiranpreet Kaur. 2015. “Adding value to value stocks in Indian stock market: an empirical analysis.” *International Journal of Law and Management*, 57(6): 621-636.

Sloan, Richard. 1996. “Do Stock Prices Fully Reflect Information in Accruals and Cash Flows about Future Earnings?” *The Accounting Review*, 71(3): 289-315.

Stattman, Dennis. 1980. “Book Values and Stock Returns.” *The Chicago MBA: A Journal of Selected Papers*, 4: 25-45.

Stickel, Scott. 1998. “Analyst Incentives and the Financial Characteristics of Wall Street Darlings and Dogs.” *The Journal of Investing*, 16(3): 23-32.

Woodley, Melissa, Steven Jones, and James Reburn. 2011. “Value Stocks and Accounting Screens: Has a Good Rule Gone Bad?” *Journal of Accounting and Finance*, 11(4): 87-104.

Yangxiu, Ye. 2013. “Application of the Stock Selection Criteria of Three Value Investors, Benjamin Graham, Peter Lynch, and Joel Greenblatt: A Case of Shanghai Stock Exchange from 2006 to 2011.” *International Journal of Scientific and Research Publications*, 3(8): 1-7.

7. APPENDICES

Table 9. Long-Short Portfolio Regressions – Output for Whole Sample Size.

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 20:13
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.021675	0.005438	3.985769	0.0001
CDAX RF	-0.097067	0.089209	-1.088088	0.2781

R-squared	0.007082	Mean dependent var	0.021296
Adjusted R-squared	0.001100	S.D. dependent var	0.070379
S.E. of regression	0.070340	Akaike info criterion	-2.459113
Sum squared resid	0.821326	Schwarz criterion	-2.421923
Log likelihood	208.5655	Hannan-Quinn criter.	-2.444019
F-statistic	1.183935	Durbin-Watson stat	2.133867
Prob(F-statistic)	0.278134		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 20:14
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.017103	0.004028	4.245558	0.0000
CDAX RF	-0.226440	0.066085	-3.426505	0.0008

R-squared	0.066056	Mean dependent var	0.016220
Adjusted R-squared	0.060430	S.D. dependent var	0.053757
S.E. of regression	0.052107	Akaike info criterion	-3.059195
Sum squared resid	0.450716	Schwarz criterion	-3.022005
Log likelihood	258.9724	Hannan-Quinn criter.	-3.044101
F-statistic	11.74093	Durbin-Watson stat	1.997018
Prob(F-statistic)	0.000771		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 20:16
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.014078	0.003760	3.743827	0.0002
CDAX RF	-0.172723	0.061688	-2.799971	0.0057

R-squared	0.045098	Mean dependent var	0.013405
Adjusted R-squared	0.039346	S.D. dependent var	0.049626
S.E. of regression	0.048640	Akaike info criterion	-3.196907
Sum squared resid	0.392731	Schwarz criterion	-3.159717
Log likelihood	270.5402	Hannan-Quinn criter.	-3.181813
F-statistic	7.839836	Durbin-Watson stat	2.278595
Prob(F-statistic)	0.005717		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 20:18
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.011118	0.003004	3.701318	0.0003
CDAX RF	-0.148008	0.049276	-3.003631	0.0031

R-squared	0.051547	Mean dependent var	0.010541
Adjusted R-squared	0.045833	S.D. dependent var	0.039776
S.E. of regression	0.038854	Akaike info criterion	-3.646188
Sum squared resid	0.250597	Schwarz criterion	-3.608998
Log likelihood	308.2798	Hannan-Quinn criter.	-3.631094
F-statistic	9.021799	Durbin-Watson stat	2.237707
Prob(F-statistic)	0.003081		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 20:18
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009770	0.002686	3.638085	0.0004
CDAX RF	-0.125699	0.044056	-2.853181	0.0049

R-squared	0.046748	Mean dependent var	0.009280
Adjusted R-squared	0.041005	S.D. dependent var	0.035472
S.E. of regression	0.034738	Akaike info criterion	-3.870157
Sum squared resid	0.200312	Schwarz criterion	-3.832967
Log likelihood	327.0932	Hannan-Quinn criter.	-3.855063
F-statistic	8.140641	Durbin-Watson stat	2.188017
Prob(F-statistic)	0.004880		

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 20:19
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.020777	0.005551	3.743193	0.0003
CDAX RF	-0.116353	0.098582	-1.180271	0.2396
SMB	-0.072528	0.188271	-0.385233	0.7006
HML	0.160767	0.210653	0.763182	0.4465

R-squared	0.012351	Mean dependent var	0.021296
Adjusted R-squared	-0.005715	S.D. dependent var	0.070379
S.E. of regression	0.070580	Akaike info criterion	-2.440625
Sum squared resid	0.816967	Schwarz criterion	-2.366245
Log likelihood	209.0125	Hannan-Quinn criter.	-2.410438
F-statistic	0.683655	Durbin-Watson stat	2.121551
Prob(F-statistic)	0.563235		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 20:20
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.016968	0.004119	4.119211	0.0001
CDAX RF	-0.242847	0.073157	-3.319512	0.0011
SMB	-0.073278	0.139715	-0.524481	0.6007
HML	0.005229	0.156325	0.033453	0.9734

R-squared	0.067725	Mean dependent var	0.016220
Adjusted R-squared	0.050672	S.D. dependent var	0.053757
S.E. of regression	0.052377	Akaike info criterion	-3.037174
Sum squared resid	0.449911	Schwarz criterion	-2.962794
Log likelihood	259.1226	Hannan-Quinn criter.	-3.006987
F-statistic	3.971284	Durbin-Watson stat	1.987613
Prob(F-statistic)	0.009155		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 20:21
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013503	0.003833	3.522881	0.0006
CDAX RF	-0.199794	0.068074	-2.934939	0.0038
SMB	-0.114415	0.130008	-0.880062	0.3801
HML	0.082357	0.145463	0.566168	0.5721

R-squared	0.052803	Mean dependent var	0.013405
Adjusted R-squared	0.035476	S.D. dependent var	0.049626
S.E. of regression	0.048738	Akaike info criterion	-3.181199
Sum squared resid	0.389563	Schwarz criterion	-3.106819
Log likelihood	271.2207	Hannan-Quinn criter.	-3.151012
F-statistic	3.047463	Durbin-Watson stat	2.258419
Prob(F-statistic)	0.030324		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 20:22
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010956	0.003070	3.568395	0.0005
CDAX RF	-0.162087	0.054530	-2.972422	0.0034
SMB	-0.062038	0.104141	-0.595714	0.5522
HML	0.014072	0.116522	0.120771	0.9040

R-squared	0.053923	Mean dependent var	0.010541
Adjusted R-squared	0.036617	S.D. dependent var	0.039776
S.E. of regression	0.039041	Akaike info criterion	-3.624887
Sum squared resid	0.249969	Schwarz criterion	-3.550507
Log likelihood	308.4905	Hannan-Quinn criter.	-3.594700
F-statistic	3.115818	Durbin-Watson stat	2.229989
Prob(F-statistic)	0.027759		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 20:22
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009572	0.002746	3.485752	0.0006
CDAX RF	-0.119960	0.048773	-2.459582	0.0149
SMB	0.030149	0.093145	0.323681	0.7466
HML	0.049498	0.104219	0.474942	0.6355

R-squared	0.048383	Mean dependent var	0.009280
Adjusted R-squared	0.030976	S.D. dependent var	0.035472
S.E. of regression	0.034919	Akaike info criterion	-3.848065
Sum squared resid	0.199968	Schwarz criterion	-3.773685
Log likelihood	327.2374	Hannan-Quinn criter.	-3.817878
F-statistic	2.779431	Durbin-Watson stat	2.180752
Prob(F-statistic)	0.042859		

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 20:23
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.018745	0.005720	3.277243	0.0013
CDAX RF	-0.029499	0.116072	-0.254142	0.7997
SMB	-0.009270	0.193022	-0.048025	0.9618
HML	0.168883	0.210106	0.803798	0.4227
WML	0.170998	0.121556	1.406747	0.1614

R-squared	0.024198	Mean dependent var	0.021296
Adjusted R-squared	0.000252	S.D. dependent var	0.070379
S.E. of regression	0.070370	Akaike info criterion	-2.440787
Sum squared resid	0.807167	Schwarz criterion	-2.347812
Log likelihood	210.0261	Hannan-Quinn criter.	-2.403054
F-statistic	1.010536	Durbin-Watson stat	2.095851
Prob(F-statistic)	0.403682		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 20:24
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.014936	0.004224	3.536374	0.0005
CDAX RF	-0.156027	0.085710	-1.820410	0.0705
SMB	-0.010045	0.142531	-0.070478	0.9439
HML	0.013343	0.155147	0.086000	0.9316
WML	0.170930	0.089759	1.904312	0.0586

R-squared	0.088015	Mean dependent var	0.016220
Adjusted R-squared	0.065635	S.D. dependent var	0.053757
S.E. of regression	0.051963	Akaike info criterion	-3.047273
Sum squared resid	0.440119	Schwarz criterion	-2.954298
Log likelihood	260.9709	Hannan-Quinn criter.	-3.009539
F-statistic	3.932764	Durbin-Watson stat	1.965896
Prob(F-statistic)	0.004481		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 20:25
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.011210	0.003909	2.867353	0.0047
CDAX RF	-0.101791	0.079335	-1.283043	0.2013
SMB	-0.043036	0.131931	-0.326206	0.7447
HML	0.091515	0.143608	0.637257	0.5249
WML	0.192948	0.083083	2.322348	0.0215

R-squared	0.083140	Mean dependent var	0.013405
Adjusted R-squared	0.060640	S.D. dependent var	0.049626
S.E. of regression	0.048098	Akaike info criterion	-3.201846
Sum squared resid	0.377086	Schwarz criterion	-3.108871
Log likelihood	273.9551	Hannan-Quinn criter.	-3.164112
F-statistic	3.695150	Durbin-Watson stat	2.261174
Prob(F-statistic)	0.006584		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 20:26
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009283	0.003140	2.955953	0.0036
CDAX RF	-0.090580	0.063730	-1.421325	0.1571
SMB	-0.009959	0.105979	-0.093967	0.9253
HML	0.020755	0.115359	0.179912	0.8574
WML	0.140781	0.066740	2.109390	0.0364

R-squared	0.079063	Mean dependent var	0.010541
Adjusted R-squared	0.056463	S.D. dependent var	0.039776
S.E. of regression	0.038637	Akaike info criterion	-3.639914
Sum squared resid	0.243327	Schwarz criterion	-3.546939
Log likelihood	310.7528	Hannan-Quinn criter.	-3.602180
F-statistic	3.498398	Durbin-Watson stat	2.233682
Prob(F-statistic)	0.009048		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 20:27
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.008169	0.002813	2.903658	0.0042
CDAX RF	-0.060001	0.057095	-1.050898	0.2949
SMB	0.073819	0.094945	0.777491	0.4380
HML	0.055101	0.103349	0.533154	0.5947
WML	0.118048	0.059792	1.974306	0.0500

R-squared	0.070608	Mean dependent var	0.009280
Adjusted R-squared	0.047801	S.D. dependent var	0.035472
S.E. of regression	0.034614	Akaike info criterion	-3.859792
Sum squared resid	0.195298	Schwarz criterion	-3.766817
Log likelihood	329.2225	Hannan-Quinn criter.	-3.822058
F-statistic	3.095878	Durbin-Watson stat	2.180753
Prob(F-statistic)	0.017290		

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 20:28
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.018585	0.006075	3.059283	0.0026
CDAX RF	-0.034042	0.135152	-0.251877	0.8015
SMB	-0.029090	0.194596	-0.149489	0.8814
HML	0.173965	0.211305	0.823285	0.4115
QMJ	0.245752	0.275832	0.890947	0.3743

R-squared	0.017138	Mean dependent var	0.021296
Adjusted R-squared	-0.006982	S.D. dependent var	0.070379
S.E. of regression	0.070624	Akaike info criterion	-2.433578
Sum squared resid	0.813008	Schwarz criterion	-2.340603
Log likelihood	209.4205	Hannan-Quinn criter.	-2.395844
F-statistic	0.710543	Durbin-Watson stat	2.083258
Prob(F-statistic)	0.585826		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 20:29
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.014871	0.004501	3.303905	0.0012
CDAX RF	-0.164115	0.100134	-1.638953	0.1032
SMB	-0.031729	0.144176	-0.220072	0.8261
HML	0.017854	0.156557	0.114039	0.9093
QMJ	0.235063	0.204364	1.150219	0.2517

R-squared	0.075231	Mean dependent var	0.016220
Adjusted R-squared	0.052538	S.D. dependent var	0.053757
S.E. of regression	0.052326	Akaike info criterion	-3.033353
Sum squared resid	0.446288	Schwarz criterion	-2.940378
Log likelihood	259.8016	Hannan-Quinn criter.	-2.995619
F-statistic	3.315080	Durbin-Watson stat	1.948921
Prob(F-statistic)	0.012158		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 20:30
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010590	0.004167	2.541253	0.0120
CDAX RF	-0.090430	0.092711	-0.975399	0.3308
SMB	-0.056701	0.133488	-0.424760	0.6716
HML	0.099892	0.144951	0.689147	0.4917
QMJ	0.326519	0.189214	1.725656	0.0863

R-squared	0.069797	Mean dependent var	0.013405
Adjusted R-squared	0.046970	S.D. dependent var	0.049626
S.E. of regression	0.048447	Akaike info criterion	-3.187398
Sum squared resid	0.382573	Schwarz criterion	-3.094423
Log likelihood	272.7415	Hannan-Quinn criter.	-3.149664
F-statistic	3.057634	Durbin-Watson stat	2.228635
Prob(F-statistic)	0.018383		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 20:31
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009391	0.003355	2.799137	0.0057
CDAX RF	-0.103313	0.074637	-1.384197	0.1682
SMB	-0.031022	0.107465	-0.288667	0.7732
HML	0.023496	0.116693	0.201352	0.8407
QMJ	0.175478	0.152328	1.151974	0.2510

R-squared	0.061563	Mean dependent var	0.010541
Adjusted R-squared	0.038534	S.D. dependent var	0.039776
S.E. of regression	0.039002	Akaike info criterion	-3.621091
Sum squared resid	0.247950	Schwarz criterion	-3.528116
Log likelihood	309.1716	Hannan-Quinn criter.	-3.583357
F-statistic	2.673284	Durbin-Watson stat	2.226701
Prob(F-statistic)	0.033917		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 20:32
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.007930	0.002996	2.646968	0.0089
CDAX RF	-0.058314	0.066654	-0.874870	0.3829
SMB	0.062682	0.095971	0.653129	0.5146
HML	0.059382	0.104212	0.569821	0.5696
QMJ	0.184052	0.136036	1.352967	0.1779

R-squared	0.058951	Mean dependent var	0.009280
Adjusted R-squared	0.035858	S.D. dependent var	0.035472
S.E. of regression	0.034831	Akaike info criterion	-3.847328
Sum squared resid	0.197747	Schwarz criterion	-3.754353
Log likelihood	328.1755	Hannan-Quinn criter.	-3.809594
F-statistic	2.552760	Durbin-Watson stat	2.170884
Prob(F-statistic)	0.041034		

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 20:33
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.017537	0.006126	2.862439	0.0048
CDAX RF	0.014772	0.140765	0.104939	0.9166
SMB	0.012299	0.197250	0.062355	0.9504
HML	0.176579	0.211002	0.836862	0.4039
WML	0.153397	0.125825	1.219125	0.2246
QMJ	0.158867	0.284492	0.558424	0.5773

R-squared	0.026073	Mean dependent var	0.021296
Adjusted R-squared	-0.003986	S.D. dependent var	0.070379
S.E. of regression	0.070519	Akaike info criterion	-2.430806
Sum squared resid	0.805616	Schwarz criterion	-2.319236
Log likelihood	210.1877	Hannan-Quinn criter.	-2.385525
F-statistic	0.867383	Durbin-Watson stat	2.073539
Prob(F-statistic)	0.504421		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 20:35
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013814	0.004521	3.055317	0.0026
CDAX RF	-0.114923	0.103886	-1.106245	0.2703
SMB	0.009981	0.145572	0.068567	0.9454
HML	0.020489	0.155721	0.131573	0.8955
WML	0.154587	0.092860	1.664732	0.0979
QMJ	0.147505	0.209957	0.702549	0.4833

R-squared	0.090785	Mean dependent var	0.016220
Adjusted R-squared	0.062723	S.D. dependent var	0.053757
S.E. of regression	0.052044	Akaike info criterion	-3.038410
Sum squared resid	0.438782	Schwarz criterion	-2.926840
Log likelihood	261.2265	Hannan-Quinn criter.	-2.993130
F-statistic	3.235151	Durbin-Watson stat	1.943336
Prob(F-statistic)	0.008222		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 20:36
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009447	0.004173	2.263809	0.0249
CDAX RF	-0.037203	0.095883	-0.387999	0.6985
SMB	-0.011568	0.134358	-0.086100	0.9315
HML	0.102744	0.143725	0.714861	0.4757
WML	0.167269	0.085707	1.951643	0.0527
QMJ	0.231778	0.193784	1.196064	0.2334

R-squared	0.091165	Mean dependent var	0.013405
Adjusted R-squared	0.063115	S.D. dependent var	0.049626
S.E. of regression	0.048035	Akaike info criterion	-3.198733
Sum squared resid	0.373785	Schwarz criterion	-3.087163
Log likelihood	274.6936	Hannan-Quinn criter.	-3.153453
F-statistic	3.250042	Durbin-Watson stat	2.239425
Prob(F-statistic)	0.007992		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 20:37
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.008506	0.003363	2.529651	0.0124
CDAX RF	-0.062115	0.077260	-0.803980	0.4226
SMB	0.003910	0.108261	0.036118	0.9712
HML	0.025703	0.115809	0.221944	0.8246
WML	0.129464	0.069060	1.874664	0.0626
QMJ	0.102149	0.156145	0.654193	0.5139

R-squared	0.081489	Mean dependent var	0.010541
Adjusted R-squared	0.053140	S.D. dependent var	0.039776
S.E. of regression	0.038705	Akaike info criterion	-3.630648
Sum squared resid	0.242685	Schwarz criterion	-3.519078
Log likelihood	310.9744	Hannan-Quinn criter.	-3.585367
F-statistic	2.874490	Durbin-Watson stat	2.231563
Prob(F-statistic)	0.016281		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 20:38
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.007218	0.003009	2.398940	0.0176
CDAX RF	-0.025158	0.069137	-0.363883	0.7164
SMB	0.090795	0.096879	0.937201	0.3501
HML	0.061158	0.103634	0.590141	0.5559
WML	0.104194	0.061799	1.686019	0.0937
QMJ	0.125036	0.139728	0.894849	0.3722

R-squared	0.075180	Mean dependent var	0.009280
Adjusted R-squared	0.046636	S.D. dependent var	0.035472
S.E. of regression	0.034635	Akaike info criterion	-3.852818
Sum squared resid	0.194337	Schwarz criterion	-3.741248
Log likelihood	329.6367	Hannan-Quinn criter.	-3.807537
F-statistic	2.633826	Durbin-Watson stat	2.174084
Prob(F-statistic)	0.025558		

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 20:48
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.020339	0.005884	3.456567	0.0007
CDAX RF	-0.108002	0.123310	-0.875855	0.3824
SMB	-0.050500	0.196739	-0.256687	0.7977
HML	0.214531	0.216210	0.992235	0.3226
RMW	0.196743	0.449368	0.437822	0.6621
CMA	-0.378295	0.460343	-0.821769	0.4124

R-squared	0.020456	Mean dependent var	0.021296
Adjusted R-squared	-0.009776	S.D. dependent var	0.070379
S.E. of regression	0.070722	Akaike info criterion	-2.425055
Sum squared resid	0.810263	Schwarz criterion	-2.313485
Log likelihood	209.7046	Hannan-Quinn criter.	-2.379775
F-statistic	0.676629	Durbin-Watson stat	2.087279
Prob(F-statistic)	0.641749		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 20:48
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.014178	0.004308	3.291202	0.0012
CDAX RF	-0.143636	0.090275	-1.591106	0.1135
SMB	0.015308	0.144031	0.106285	0.9155
HML	0.057072	0.158285	0.360565	0.7189
RMW	0.726466	0.328979	2.208248	0.0286
CMA	-0.019329	0.337013	-0.057353	0.9543

R-squared	0.100143	Mean dependent var	0.016220
Adjusted R-squared	0.072369	S.D. dependent var	0.053757
S.E. of regression	0.051775	Akaike info criterion	-3.048755
Sum squared resid	0.434266	Schwarz criterion	-2.937185
Log likelihood	262.0955	Hannan-Quinn criter.	-3.003475
F-statistic	3.605708	Durbin-Watson stat	1.961493
Prob(F-statistic)	0.004049		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 20:49
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010346	0.003985	2.596359	0.0103
CDAX RF	-0.086069	0.083505	-1.030701	0.3042
SMB	-0.015797	0.133230	-0.118568	0.9058
HML	0.131853	0.146415	0.900543	0.3692
RMW	0.805495	0.304309	2.646968	0.0089
CMA	0.053565	0.311740	0.171826	0.8638

R-squared	0.096534	Mean dependent var	0.013405
Adjusted R-squared	0.068649	S.D. dependent var	0.049626
S.E. of regression	0.047892	Akaike info criterion	-3.204658
Sum squared resid	0.371577	Schwarz criterion	-3.093087
Log likelihood	275.1912	Hannan-Quinn criter.	-3.159377
F-statistic	3.461875	Durbin-Watson stat	2.267010
Prob(F-statistic)	0.005333		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 20:51
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.008182	0.003175	2.577036	0.0109
CDAX RF	-0.062316	0.066539	-0.936535	0.3504
SMB	0.024756	0.106162	0.233191	0.8159
HML	0.058437	0.116668	0.500880	0.6171
RMW	0.709239	0.242483	2.924908	0.0039
CMA	0.039814	0.248404	0.160278	0.8729

R-squared	0.107060	Mean dependent var	0.010541
Adjusted R-squared	0.079500	S.D. dependent var	0.039776
S.E. of regression	0.038162	Akaike info criterion	-3.658882
Sum squared resid	0.235929	Schwarz criterion	-3.547312
Log likelihood	313.3461	Hannan-Quinn criter.	-3.613602
F-statistic	3.884639	Durbin-Watson stat	2.227003
Prob(F-statistic)	0.002369		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 20:53
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.007433	0.002857	2.601812	0.0101
CDAX RF	-0.043659	0.059870	-0.729223	0.4669
SMB	0.097817	0.095521	1.024036	0.3073
HML	0.087801	0.104975	0.836406	0.4042
RMW	0.554412	0.218179	2.541093	0.0120
CMA	-0.002911	0.223507	-0.013025	0.9896

R-squared	0.091037	Mean dependent var	0.009280
Adjusted R-squared	0.062982	S.D. dependent var	0.035472
S.E. of regression	0.034337	Akaike info criterion	-3.870113
Sum squared resid	0.191005	Schwarz criterion	-3.758543
Log likelihood	331.0895	Hannan-Quinn criter.	-3.824832
F-statistic	3.244996	Durbin-Watson stat	2.179652
Prob(F-statistic)	0.008069		

Table 10. Long-Short Portfolio Regressions – Output for Large Caps.

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 21:01
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.017647	0.006248	2.824290	0.0053
CDAX RF	-0.311535	0.102502	-3.039310	0.0028

R-squared	0.052714	Mean dependent var	0.016433
Adjusted R-squared	0.047007	S.D. dependent var	0.082791
S.E. of regression	0.080822	Akaike info criterion	-2.181307
Sum squared resid	1.084339	Schwarz criterion	-2.144117
Log likelihood	185.2298	Hannan-Quinn criter.	-2.166213
F-statistic	9.237405	Durbin-Watson stat	1.824656
Prob(F-statistic)	0.002756		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 21:02
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013574	0.004291	3.163283	0.0019
CDAX RF	-0.334882	0.070393	-4.757324	0.0000

R-squared	0.119980	Mean dependent var	0.012268
Adjusted R-squared	0.114679	S.D. dependent var	0.058990
S.E. of regression	0.055504	Akaike info criterion	-2.932884
Sum squared resid	0.511398	Schwarz criterion	-2.895694
Log likelihood	248.3623	Hannan-Quinn criter.	-2.917791
F-statistic	22.63214	Durbin-Watson stat	1.919224
Prob(F-statistic)	0.000004		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 21:03
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.012187	0.003621	3.365869	0.0009
CDAX RF	-0.224999	0.059395	-3.788164	0.0002

R-squared	0.079568	Mean dependent var	0.011309
Adjusted R-squared	0.074024	S.D. dependent var	0.048669
S.E. of regression	0.046833	Akaike info criterion	-3.272638
Sum squared resid	0.364088	Schwarz criterion	-3.235448
Log likelihood	276.9016	Hannan-Quinn criter.	-3.257544
F-statistic	14.35019	Durbin-Watson stat	1.777931
Prob(F-statistic)	0.000212		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 21:04
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006375	0.002986	2.134607	0.0343
CDAX RF	-0.119109	0.048992	-2.431198	0.0161

R-squared	0.034383	Mean dependent var	0.005911
Adjusted R-squared	0.028566	S.D. dependent var	0.039194
S.E. of regression	0.038630	Akaike info criterion	-3.657756
Sum squared resid	0.247714	Schwarz criterion	-3.620566
Log likelihood	309.2515	Hannan-Quinn criter.	-3.642662
F-statistic	5.910723	Durbin-Watson stat	1.730539
Prob(F-statistic)	0.016113		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 21:05
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.005790	0.002692	2.150590	0.0330
CDAX RF	-0.087169	0.044167	-1.973618	0.0501

R-squared	0.022927	Mean dependent var	0.005450
Adjusted R-squared	0.017041	S.D. dependent var	0.035126
S.E. of regression	0.034825	Akaike info criterion	-3.865102
Sum squared resid	0.201327	Schwarz criterion	-3.827912
Log likelihood	326.6685	Hannan-Quinn criter.	-3.850008
F-statistic	3.895169	Durbin-Watson stat	2.123489
Prob(F-statistic)	0.050085		

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 21:05
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.017922	0.006263	2.861655	0.0048
CDAX RF	-0.430193	0.111230	-3.867615	0.0002
SMB	-0.553030	0.212425	-2.603416	0.0101
HML	-0.224393	0.237679	-0.944100	0.3465

R-squared	0.091412	Mean dependent var	0.016433
Adjusted R-squared	0.074792	S.D. dependent var	0.082791
S.E. of regression	0.079635	Akaike info criterion	-2.199207
Sum squared resid	1.040042	Schwarz criterion	-2.124827
Log likelihood	188.7334	Hannan-Quinn criter.	-2.169020
F-statistic	5.499965	Durbin-Watson stat	1.902712
Prob(F-statistic)	0.001265		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 21:07
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.014517	0.004235	3.427984	0.0008
CDAX RF	-0.430363	0.075210	-5.722133	0.0000
SMB	-0.458306	0.143635	-3.190757	0.0017
HML	-0.331666	0.160711	-2.063733	0.0406

R-squared	0.181731	Mean dependent var	0.012268
Adjusted R-squared	0.166763	S.D. dependent var	0.058990
S.E. of regression	0.053847	Akaike info criterion	-2.981828
Sum squared resid	0.475513	Schwarz criterion	-2.907448
Log likelihood	254.4736	Hannan-Quinn criter.	-2.951641
F-statistic	12.14104	Durbin-Watson stat	2.044612
Prob(F-statistic)	0.000000		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 21:06
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013072	0.003620	3.611198	0.0004
CDAX RF	-0.283881	0.064289	-4.415704	0.0000
SMB	-0.288229	0.122778	-2.347558	0.0201
HML	-0.268149	0.137374	-1.951954	0.0526

R-squared	0.121652	Mean dependent var	0.011309
Adjusted R-squared	0.105585	S.D. dependent var	0.048669
S.E. of regression	0.046028	Akaike info criterion	-3.295628
Sum squared resid	0.347441	Schwarz criterion	-3.221248
Log likelihood	280.8327	Hannan-Quinn criter.	-3.265441
F-statistic	7.571373	Durbin-Watson stat	1.880483
Prob(F-statistic)	0.000090		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 21:08
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006988	0.003026	2.309365	0.0222
CDAX RF	-0.146744	0.053742	-2.730506	0.0070
SMB	-0.138918	0.102637	-1.353494	0.1778
HML	-0.167247	0.114839	-1.456364	0.1472

R-squared	0.053549	Mean dependent var	0.005911
Adjusted R-squared	0.036236	S.D. dependent var	0.039194
S.E. of regression	0.038477	Akaike info criterion	-3.653995
Sum squared resid	0.242798	Schwarz criterion	-3.579615
Log likelihood	310.9356	Hannan-Quinn criter.	-3.623808
F-statistic	3.092989	Durbin-Watson stat	1.787942
Prob(F-statistic)	0.028591		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 21:09
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006143	0.002750	2.233683	0.0269
CDAX RF	-0.092326	0.048843	-1.890256	0.0605
SMB	-0.030317	0.093280	-0.325010	0.7456
HML	-0.081122	0.104370	-0.777255	0.4381

R-squared	0.026704	Mean dependent var	0.005450
Adjusted R-squared	0.008900	S.D. dependent var	0.035126
S.E. of regression	0.034969	Akaike info criterion	-3.845166
Sum squared resid	0.200549	Schwarz criterion	-3.770785
Log likelihood	326.9939	Hannan-Quinn criter.	-3.814979
F-statistic	1.499887	Durbin-Watson stat	2.139880
Prob(F-statistic)	0.216566		

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 21:10
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.015688	0.006456	2.430232	0.0162
CDAX RF	-0.334743	0.131005	-2.555201	0.0115
SMB	-0.483512	0.217854	-2.219430	0.0278
HML	-0.215473	0.237136	-0.908648	0.3649
WML	0.187922	0.137194	1.369756	0.1726

R-squared	0.101752	Mean dependent var	0.016433
Adjusted R-squared	0.079709	S.D. dependent var	0.082791
S.E. of regression	0.079423	Akaike info criterion	-2.198747
Sum squared resid	1.028206	Schwarz criterion	-2.105772
Log likelihood	189.6948	Hannan-Quinn criter.	-2.161013
F-statistic	4.616071	Durbin-Watson stat	1.901260
Prob(F-statistic)	0.001479		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 21:11
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010845	0.004240	2.557774	0.0114
CDAX RF	-0.273446	0.086041	-3.178082	0.0018
SMB	-0.344020	0.143082	-2.404352	0.0173
HML	-0.317002	0.155746	-2.035376	0.0434
WML	0.308935	0.090106	3.428574	0.0008

R-squared	0.236773	Mean dependent var	0.012268
Adjusted R-squared	0.218043	S.D. dependent var	0.058990
S.E. of regression	0.052163	Akaike info criterion	-3.039559
Sum squared resid	0.443527	Schwarz criterion	-2.946584
Log likelihood	260.3229	Hannan-Quinn criter.	-3.001825
F-statistic	12.64171	Durbin-Watson stat	2.075701
Prob(F-statistic)	0.000000		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 21:12
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010228	0.003648	2.804171	0.0057
CDAX RF	-0.162368	0.074021	-2.193541	0.0297
SMB	-0.199729	0.123093	-1.622577	0.1066
HML	-0.256794	0.133988	-1.916539	0.0570
WML	0.239232	0.077518	3.086141	0.0024

R-squared	0.170141	Mean dependent var	0.011309
Adjusted R-squared	0.149777	S.D. dependent var	0.048669
S.E. of regression	0.044876	Akaike info criterion	-3.340511
Sum squared resid	0.328261	Schwarz criterion	-3.247536
Log likelihood	285.6029	Hannan-Quinn criter.	-3.302777
F-statistic	8.354752	Durbin-Watson stat	1.896474
Prob(F-statistic)	0.000004		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 21:12
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004817	0.003064	1.572055	0.1179
CDAX RF	-0.053948	0.062176	-0.867655	0.3869
SMB	-0.071332	0.103396	-0.689894	0.4912
HML	-0.158575	0.112548	-1.408957	0.1608
WML	0.182696	0.065114	2.805793	0.0056

R-squared	0.097154	Mean dependent var	0.005911
Adjusted R-squared	0.074999	S.D. dependent var	0.039194
S.E. of regression	0.037695	Akaike info criterion	-3.689258
Sum squared resid	0.231611	Schwarz criterion	-3.596283
Log likelihood	314.8977	Hannan-Quinn criter.	-3.651524
F-statistic	4.385069	Durbin-Watson stat	1.793862
Prob(F-statistic)	0.002152		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 21:14
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004573	0.002809	1.627923	0.1055
CDAX RF	-0.025242	0.057008	-0.442785	0.6585
SMB	0.018542	0.094801	0.195589	0.8452
HML	-0.074853	0.103191	-0.725383	0.4693
WML	0.132075	0.059701	2.212278	0.0283

R-squared	0.055076	Mean dependent var	0.005450
Adjusted R-squared	0.031888	S.D. dependent var	0.035126
S.E. of regression	0.034561	Akaike info criterion	-3.862845
Sum squared resid	0.194703	Schwarz criterion	-3.769869
Log likelihood	329.4789	Hannan-Quinn criter.	-3.825111
F-statistic	2.375170	Durbin-Watson stat	2.153839
Prob(F-statistic)	0.054239		

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 21:15
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013036	0.006806	1.915508	0.0572
CDAX RF	-0.246770	0.151410	-1.629808	0.1051
SMB	-0.456233	0.218005	-2.092761	0.0379
HML	-0.194982	0.236725	-0.823664	0.4113
QMJ	0.547633	0.309014	1.772197	0.0782

R-squared	0.108588	Mean dependent var	0.016433
Adjusted R-squared	0.086713	S.D. dependent var	0.082791
S.E. of regression	0.079120	Akaike info criterion	-2.206387
Sum squared resid	1.020381	Schwarz criterion	-2.113412
Log likelihood	190.3365	Hannan-Quinn criter.	-2.168653
F-statistic	4.963987	Durbin-Watson stat	1.922164
Prob(F-statistic)	0.000841		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 21:16
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.008355	0.004491	1.860465	0.0646
CDAX RF	-0.199017	0.099904	-1.992087	0.0480
SMB	-0.336219	0.143845	-2.337375	0.0206
HML	-0.294571	0.156196	-1.885902	0.0611
QMJ	0.690710	0.203894	3.387592	0.0009

R-squared	0.235551	Mean dependent var	0.012268
Adjusted R-squared	0.216792	S.D. dependent var	0.058990
S.E. of regression	0.052205	Akaike info criterion	-3.037959
Sum squared resid	0.444237	Schwarz criterion	-2.944984
Log likelihood	260.1886	Hannan-Quinn criter.	-3.000225
F-statistic	12.55637	Durbin-Watson stat	2.031594
Prob(F-statistic)	0.000000		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 21:17
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010293	0.003935	2.615788	0.0097
CDAX RF	-0.179536	0.087539	-2.050925	0.0419
SMB	-0.233163	0.126041	-1.849894	0.0661
HML	-0.251418	0.136864	-1.836984	0.0680
QMJ	0.311534	0.178659	1.743737	0.0831

R-squared	0.137737	Mean dependent var	0.011309
Adjusted R-squared	0.116577	S.D. dependent var	0.048669
S.E. of regression	0.045744	Akaike info criterion	-3.302205
Sum squared resid	0.341079	Schwarz criterion	-3.209230
Log likelihood	282.3852	Hannan-Quinn criter.	-3.264471
F-statistic	6.509342	Durbin-Watson stat	1.881961
Prob(F-statistic)	0.000069		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 21:18
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.005177	0.003301	1.568100	0.1188
CDAX RF	-0.078740	0.073446	-1.072084	0.2853
SMB	-0.103030	0.105749	-0.974290	0.3314
HML	-0.156343	0.114830	-1.361516	0.1752
QMJ	0.203035	0.149895	1.354507	0.1774

R-squared	0.064084	Mean dependent var	0.005911
Adjusted R-squared	0.041116	S.D. dependent var	0.039194
S.E. of regression	0.038379	Akaike info criterion	-3.653283
Sum squared resid	0.240095	Schwarz criterion	-3.560308
Log likelihood	311.8758	Hannan-Quinn criter.	-3.615550
F-statistic	2.790221	Durbin-Watson stat	1.787671
Prob(F-statistic)	0.028171		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 21:19
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004438	0.002999	1.479729	0.1409
CDAX RF	-0.028313	0.066723	-0.424333	0.6719
SMB	0.003465	0.096070	0.036063	0.9713
HML	-0.070858	0.104319	-0.679241	0.4979
QMJ	0.191120	0.136175	1.403485	0.1624

R-squared	0.038326	Mean dependent var	0.005450
Adjusted R-squared	0.014726	S.D. dependent var	0.035126
S.E. of regression	0.034866	Akaike info criterion	-3.845273
Sum squared resid	0.198154	Schwarz criterion	-3.752298
Log likelihood	328.0029	Hannan-Quinn criter.	-3.807539
F-statistic	1.624009	Durbin-Watson stat	2.152661
Prob(F-statistic)	0.170630		

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 21:21
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.012109	0.006875	1.761183	0.0801
CDAX RF	-0.203566	0.157971	-1.288633	0.1994
SMB	-0.419600	0.221359	-1.895563	0.0598
HML	-0.192668	0.236792	-0.813658	0.4170
WML	0.135767	0.141205	0.961491	0.3377
QMJ	0.470735	0.319265	1.474431	0.1423

R-squared	0.113646	Mean dependent var	0.016433
Adjusted R-squared	0.086289	S.D. dependent var	0.082791
S.E. of regression	0.079139	Akaike info criterion	-2.200173
Sum squared resid	1.014591	Schwarz criterion	-2.088602
Log likelihood	190.8145	Hannan-Quinn criter.	-2.154892
F-statistic	4.154242	Durbin-Watson stat	1.918609
Prob(F-statistic)	0.001409		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 21:22
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006660	0.004449	1.496860	0.1364
CDAX RF	-0.120109	0.102232	-1.174866	0.2418
SMB	-0.269312	0.143254	-1.879956	0.0619
HML	-0.290344	0.153242	-1.894680	0.0599
WML	0.247970	0.091382	2.713562	0.0074
QMJ	0.550259	0.206615	2.663212	0.0085

R-squared	0.268787	Mean dependent var	0.012268
Adjusted R-squared	0.246219	S.D. dependent var	0.058990
S.E. of regression	0.051215	Akaike info criterion	-3.070505
Sum squared resid	0.424923	Schwarz criterion	-2.958935
Log likelihood	263.9224	Hannan-Quinn criter.	-3.025224
F-statistic	11.90993	Durbin-Watson stat	2.060547
Prob(F-statistic)	0.000000		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 21:23
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.008800	0.003898	2.257705	0.0253
CDAX RF	-0.110030	0.089557	-1.228598	0.2210
SMB	-0.174229	0.125494	-1.388342	0.1669
HML	-0.247695	0.134243	-1.845116	0.0668
WML	0.218423	0.080052	2.728496	0.0071
QMJ	0.187819	0.180999	1.037677	0.3010

R-squared	0.175621	Mean dependent var	0.011309
Adjusted R-squared	0.150177	S.D. dependent var	0.048669
S.E. of regression	0.044866	Akaike info criterion	-3.335231
Sum squared resid	0.326093	Schwarz criterion	-3.223661
Log likelihood	286.1594	Hannan-Quinn criter.	-3.289950
F-statistic	6.902304	Durbin-Watson stat	1.896398
Prob(F-statistic)	0.000007		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 21:24
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004009	0.003280	1.222193	0.2234
CDAX RF	-0.024348	0.075363	-0.323073	0.7471
SMB	-0.056911	0.105604	-0.538908	0.5907
HML	-0.153429	0.112967	-1.358178	0.1763
WML	0.170927	0.067365	2.537344	0.0121
QMJ	0.106221	0.152312	0.697389	0.4866

R-squared	0.099857	Mean dependent var	0.005911
Adjusted R-squared	0.072075	S.D. dependent var	0.039194
S.E. of regression	0.037755	Akaike info criterion	-3.680351
Sum squared resid	0.230918	Schwarz criterion	-3.568781
Log likelihood	315.1495	Hannan-Quinn criter.	-3.635070
F-statistic	3.594271	Durbin-Watson stat	1.793529
Prob(F-statistic)	0.004138		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 21:25
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003629	0.003005	1.207971	0.2288
CDAX RF	0.009340	0.069033	0.135300	0.8925
SMB	0.035391	0.096734	0.365858	0.7149
HML	-0.068841	0.103479	-0.665269	0.5068
WML	0.118325	0.061707	1.917543	0.0569
QMJ	0.124101	0.139519	0.889486	0.3751

R-squared	0.059669	Mean dependent var	0.005450
Adjusted R-squared	0.030646	S.D. dependent var	0.035126
S.E. of regression	0.034584	Akaike info criterion	-3.855812
Sum squared resid	0.193756	Schwarz criterion	-3.744242
Log likelihood	329.8882	Hannan-Quinn criter.	-3.810531
F-statistic	2.055939	Durbin-Watson stat	2.161107
Prob(F-statistic)	0.073603		

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 21:26
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.016090	0.006623	2.429371	0.0162
CDAX RF	-0.370053	0.138794	-2.666200	0.0084
SMB	-0.489233	0.221443	-2.209296	0.0286
HML	-0.158733	0.243358	-0.652262	0.5152
RMW	0.534341	0.505793	1.056441	0.2923
CMA	-0.272739	0.518146	-0.526376	0.5993

R-squared	0.103226	Mean dependent var	0.016433
Adjusted R-squared	0.075547	S.D. dependent var	0.082791
S.E. of regression	0.079602	Akaike info criterion	-2.188485
Sum squared resid	1.026519	Schwarz criterion	-2.076915
Log likelihood	189.8327	Hannan-Quinn criter.	-2.143204
F-statistic	3.729485	Durbin-Watson stat	1.900984
Prob(F-statistic)	0.003192		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 21:28
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.012082	0.004449	2.715933	0.0073
CDAX RF	-0.344174	0.093229	-3.691724	0.0003
SMB	-0.380601	0.148744	-2.558762	0.0114
HML	-0.284098	0.163465	-1.737980	0.0841
RMW	0.638055	0.339744	1.878048	0.0622
CMA	-0.036079	0.348041	-0.103662	0.9176

R-squared	0.203003	Mean dependent var	0.012268
Adjusted R-squared	0.178404	S.D. dependent var	0.058990
S.E. of regression	0.053469	Akaike info criterion	-2.984358
Sum squared resid	0.463152	Schwarz criterion	-2.872788
Log likelihood	256.6861	Hannan-Quinn criter.	-2.939078
F-statistic	8.252589	Durbin-Watson stat	2.036302
Prob(F-statistic)	0.000001		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 21:31
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.011763	0.003810	3.087245	0.0024
CDAX RF	-0.241515	0.079846	-3.024752	0.0029
SMB	-0.241975	0.127393	-1.899438	0.0593
HML	-0.217447	0.140000	-1.553190	0.1223
RMW	0.388624	0.290975	1.335592	0.1836
CMA	-0.226047	0.298081	-0.758340	0.4493

R-squared	0.141148	Mean dependent var	0.011309
Adjusted R-squared	0.114641	S.D. dependent var	0.048669
S.E. of regression	0.045794	Akaike info criterion	-3.294265
Sum squared resid	0.339729	Schwarz criterion	-3.182695
Log likelihood	282.7183	Hannan-Quinn criter.	-3.248985
F-statistic	5.324797	Durbin-Watson stat	1.840197
Prob(F-statistic)	0.000147		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 21:31
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006166	0.003147	1.958960	0.0518
CDAX RF	-0.125802	0.065960	-1.907243	0.0583
SMB	-0.103515	0.105238	-0.983624	0.3268
HML	-0.099670	0.115653	-0.861802	0.3901
RMW	0.308792	0.240372	1.284640	0.2008
CMA	-0.435903	0.246242	-1.770217	0.0786

R-squared	0.096261	Mean dependent var	0.005911
Adjusted R-squared	0.068367	S.D. dependent var	0.039194
S.E. of regression	0.037830	Akaike info criterion	-3.676364
Sum squared resid	0.231841	Schwarz criterion	-3.564793
Log likelihood	314.8145	Hannan-Quinn criter.	-3.631083
F-statistic	3.451044	Durbin-Watson stat	1.707608
Prob(F-statistic)	0.005445		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 21:32
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.005226	0.002851	1.833248	0.0686
CDAX RF	-0.067334	0.059745	-1.127027	0.2614
SMB	0.007294	0.095322	0.076519	0.9391
HML	-0.016206	0.104755	-0.154705	0.8772
RMW	0.325338	0.217722	1.494281	0.1370
CMA	-0.400265	0.223039	-1.794593	0.0746

R-squared	0.076894	Mean dependent var	0.005450
Adjusted R-squared	0.048403	S.D. dependent var	0.035126
S.E. of regression	0.034265	Akaike info criterion	-3.874300
Sum squared resid	0.190207	Schwarz criterion	-3.762730
Log likelihood	331.4412	Hannan-Quinn criter.	-3.829019
F-statistic	2.698890	Durbin-Watson stat	2.068094
Prob(F-statistic)	0.022635		

Table 11. Long-Short Portfolio Regressions – Output for Small Caps.

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 21:42
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.026821	0.008540	3.140647	0.0020
CDAX RF	-0.295535	0.140094	-2.109554	0.0364

R-squared	0.026109	Mean dependent var	0.025669
Adjusted R-squared	0.020242	S.D. dependent var	0.111598
S.E. of regression	0.110462	Akaike info criterion	-1.556450
Sum squared resid	2.025522	Schwarz criterion	-1.519260
Log likelihood	132.7418	Hannan-Quinn criter.	-1.541356
F-statistic	4.450220	Durbin-Watson stat	2.084952
Prob(F-statistic)	0.036396		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 21:43
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.022351	0.005569	4.013779	0.0001
CDAX RF	-0.252149	0.091351	-2.760229	0.0064

R-squared	0.043883	Mean dependent var	0.021368
Adjusted R-squared	0.038123	S.D. dependent var	0.073443
S.E. of regression	0.072029	Akaike info criterion	-2.411661
Sum squared resid	0.861239	Schwarz criterion	-2.374471
Log likelihood	204.5795	Hannan-Quinn criter.	-2.396567
F-statistic	7.618864	Durbin-Watson stat	2.035398
Prob(F-statistic)	0.006426		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 21:43
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.024109	0.005941	4.057881	0.0001
CDAX RF	-0.260136	0.097463	-2.669070	0.0084

R-squared	0.041149	Mean dependent var	0.023094
Adjusted R-squared	0.035373	S.D. dependent var	0.078245
S.E. of regression	0.076849	Akaike info criterion	-2.282125
Sum squared resid	0.980348	Schwarz criterion	-2.244935
Log likelihood	193.6985	Hannan-Quinn criter.	-2.267031
F-statistic	7.123937	Durbin-Watson stat	2.280861
Prob(F-statistic)	0.008361		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 21:45
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.019115	0.004966	3.848923	0.0002
CDAX RF	-0.206346	0.081472	-2.532708	0.0122

R-squared	0.037205	Mean dependent var	0.018311
Adjusted R-squared	0.031405	S.D. dependent var	0.065273
S.E. of regression	0.064240	Akaike info criterion	-2.640545
Sum squared resid	0.685047	Schwarz criterion	-2.603355
Log likelihood	223.8058	Hannan-Quinn criter.	-2.625451
F-statistic	6.414608	Durbin-Watson stat	2.157494
Prob(F-statistic)	0.012246		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 21:46
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.015127	0.004328	3.495191	0.0006
CDAX RF	-0.164981	0.070997	-2.323771	0.0213

R-squared	0.031505	Mean dependent var	0.014484
Adjusted R-squared	0.025670	S.D. dependent var	0.056713
S.E. of regression	0.055980	Akaike info criterion	-2.915796
Sum squared resid	0.520212	Schwarz criterion	-2.878606
Log likelihood	246.9269	Hannan-Quinn criter.	-2.900703
F-statistic	5.399912	Durbin-Watson stat	2.297001
Prob(F-statistic)	0.021350		

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 21:47
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.027285	0.008718	3.129687	0.0021
CDAX RF	-0.347312	0.154834	-2.243129	0.0262
SMB	-0.247657	0.295700	-0.837529	0.4035
HML	-0.169933	0.330854	-0.513619	0.6082

R-squared	0.031020	Mean dependent var	0.025669
Adjusted R-squared	0.013295	S.D. dependent var	0.111598
S.E. of regression	0.110853	Akaike info criterion	-1.537696
Sum squared resid	2.015307	Schwarz criterion	-1.463316
Log likelihood	133.1665	Hannan-Quinn criter.	-1.507509
F-statistic	1.750055	Durbin-Watson stat	2.091795
Prob(F-statistic)	0.158839		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 21:48
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.023898	0.005617	4.254725	0.0000
CDAX RF	-0.306888	0.099758	-3.076320	0.0025
SMB	-0.281308	0.190517	-1.476550	0.1417
HML	-0.400988	0.213166	-1.881104	0.0617

R-squared	0.071259	Mean dependent var	0.021368
Adjusted R-squared	0.054270	S.D. dependent var	0.073443
S.E. of regression	0.071422	Akaike info criterion	-2.416902
Sum squared resid	0.836579	Schwarz criterion	-2.342522
Log likelihood	207.0198	Hannan-Quinn criter.	-2.386715
F-statistic	4.194384	Durbin-Watson stat	2.054185
Prob(F-statistic)	0.006853		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 21:49
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.025197	0.006011	4.192019	0.0000
CDAX RF	-0.326449	0.106753	-3.057971	0.0026
SMB	-0.326300	0.203876	-1.600480	0.1114
HML	-0.321214	0.228114	-1.408132	0.1610

R-squared	0.062992	Mean dependent var	0.023094
Adjusted R-squared	0.045852	S.D. dependent var	0.078245
S.E. of regression	0.076430	Akaike info criterion	-2.281359
Sum squared resid	0.958016	Schwarz criterion	-2.206979
Log likelihood	195.6341	Hannan-Quinn criter.	-2.251172
F-statistic	3.675068	Durbin-Watson stat	2.307068
Prob(F-statistic)	0.013447		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 21:50
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.020017	0.005030	3.979464	0.0001
CDAX RF	-0.257946	0.089337	-2.887335	0.0044
SMB	-0.254917	0.170615	-1.494106	0.1371
HML	-0.261428	0.190898	-1.369461	0.1727

R-squared	0.057054	Mean dependent var	0.018311
Adjusted R-squared	0.039805	S.D. dependent var	0.065273
S.E. of regression	0.063961	Akaike info criterion	-2.637567
Sum squared resid	0.670924	Schwarz criterion	-2.563186
Log likelihood	225.5556	Hannan-Quinn criter.	-2.607380
F-statistic	3.307638	Durbin-Watson stat	2.174589
Prob(F-statistic)	0.021655		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 21:51
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.016208	0.004375	3.704891	0.0003
CDAX RF	-0.205580	0.077698	-2.645878	0.0089
SMB	-0.207424	0.148387	-1.397853	0.1640
HML	-0.283567	0.166028	-1.707941	0.0895

R-squared	0.055178	Mean dependent var	0.014484
Adjusted R-squared	0.037894	S.D. dependent var	0.056713
S.E. of regression	0.055628	Akaike info criterion	-2.916733
Sum squared resid	0.507497	Schwarz criterion	-2.842353
Log likelihood	249.0056	Hannan-Quinn criter.	-2.886546
F-statistic	3.192526	Durbin-Watson stat	2.318399
Prob(F-statistic)	0.025136		

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 22:10
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.029265	0.009017	3.245615	0.0014
CDAX RF	-0.431957	0.182983	-2.360636	0.0194
SMB	-0.309306	0.304292	-1.016476	0.3109
HML	-0.177843	0.331225	-0.536924	0.5921
WML	-0.166648	0.191628	-0.869642	0.3858

R-squared	0.035495	Mean dependent var	0.025669
Adjusted R-squared	0.011826	S.D. dependent var	0.111598
S.E. of regression	0.110936	Akaike info criterion	-1.530421
Sum squared resid	2.006000	Schwarz criterion	-1.437445
Log likelihood	133.5553	Hannan-Quinn criter.	-1.492687
F-statistic	1.499660	Durbin-Watson stat	2.099899
Prob(F-statistic)	0.204681		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 22:11
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.023025	0.005817	3.958524	0.0001
CDAX RF	-0.269581	0.118040	-2.283806	0.0237
SMB	-0.254136	0.196295	-1.294664	0.1973
HML	-0.397502	0.213669	-1.860366	0.0646
WML	0.073450	0.123617	0.594175	0.5532

R-squared	0.073266	Mean dependent var	0.021368
Adjusted R-squared	0.050524	S.D. dependent var	0.073443
S.E. of regression	0.071563	Akaike info criterion	-2.407161
Sum squared resid	0.834771	Schwarz criterion	-2.314186
Log likelihood	207.2015	Hannan-Quinn criter.	-2.369427
F-statistic	3.221640	Durbin-Watson stat	2.056236
Prob(F-statistic)	0.014130		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 22:12
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.025549	0.006230	4.100693	0.0001
CDAX RF	-0.341462	0.126435	-2.700697	0.0077
SMB	-0.337234	0.210255	-1.603933	0.1107
HML	-0.322617	0.228864	-1.409647	0.1605
WML	-0.029558	0.132408	-0.223232	0.8236

R-squared	0.063278	Mean dependent var	0.023094
Adjusted R-squared	0.040291	S.D. dependent var	0.078245
S.E. of regression	0.076652	Akaike info criterion	-2.269760
Sum squared resid	0.957723	Schwarz criterion	-2.176785
Log likelihood	195.6598	Hannan-Quinn criter.	-2.232026
F-statistic	2.752790	Durbin-Watson stat	2.305190
Prob(F-statistic)	0.029898		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 22:12
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.019885	0.005215	3.813343	0.0002
CDAX RF	-0.252280	0.105820	-2.384038	0.0183
SMB	-0.250790	0.175974	-1.425152	0.1560
HML	-0.260898	0.191549	-1.362043	0.1751
WML	0.011156	0.110820	0.100665	0.9199

R-squared	0.057112	Mean dependent var	0.018311
Adjusted R-squared	0.033974	S.D. dependent var	0.065273
S.E. of regression	0.064155	Akaike info criterion	-2.625724
Sum squared resid	0.670883	Schwarz criterion	-2.532749
Log likelihood	225.5608	Hannan-Quinn criter.	-2.587990
F-statistic	2.468289	Durbin-Watson stat	2.175149
Prob(F-statistic)	0.046870		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 23:06
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.015873	0.004534	3.500804	0.0006
CDAX RF	-0.191256	0.092013	-2.078578	0.0392
SMB	-0.196991	0.153013	-1.287414	0.1998
HML	-0.282228	0.166556	-1.694495	0.0921
WML	0.028202	0.096360	0.292669	0.7701

R-squared	0.055674	Mean dependent var	0.014484
Adjusted R-squared	0.032500	S.D. dependent var	0.056713
S.E. of regression	0.055784	Akaike info criterion	-2.905354
Sum squared resid	0.507230	Schwarz criterion	-2.812379
Log likelihood	249.0497	Hannan-Quinn criter.	-2.867620
F-statistic	2.402459	Durbin-Watson stat	2.321275
Prob(F-statistic)	0.051970		

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 22:26
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.029802	0.009552	3.119983	0.0021
CDAX RF	-0.441843	0.212511	-2.079157	0.0392
SMB	-0.297544	0.305980	-0.972428	0.3323
HML	-0.185090	0.332254	-0.557074	0.5782
QMJ	-0.282234	0.433715	-0.650737	0.5161

R-squared	0.033531	Mean dependent var	0.025669
Adjusted R-squared	0.009814	S.D. dependent var	0.111598
S.E. of regression	0.111049	Akaike info criterion	-1.528386
Sum squared resid	2.010085	Schwarz criterion	-1.435411
Log likelihood	133.3844	Hannan-Quinn criter.	-1.490652
F-statistic	1.413792	Durbin-Watson stat	2.114819
Prob(F-statistic)	0.231659		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 22:27
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.021019	0.006137	3.424943	0.0008
CDAX RF	-0.198798	0.136536	-1.456005	0.1473
SMB	-0.224265	0.196589	-1.140782	0.2556
HML	-0.383657	0.213470	-1.797237	0.0741
QMJ	0.322717	0.278658	1.158115	0.2485

R-squared	0.078839	Mean dependent var	0.021368
Adjusted R-squared	0.056234	S.D. dependent var	0.073443
S.E. of regression	0.071348	Akaike info criterion	-2.413192
Sum squared resid	0.829752	Schwarz criterion	-2.320217
Log likelihood	207.7081	Hannan-Quinn criter.	-2.375458
F-statistic	3.487641	Durbin-Watson stat	2.017377
Prob(F-statistic)	0.009206		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 22:28
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.023994	0.006590	3.640726	0.0004
CDAX RF	-0.281258	0.146619	-1.918295	0.0568
SMB	-0.302452	0.211106	-1.432697	0.1539
HML	-0.313968	0.229234	-1.369642	0.1727
QMJ	0.134922	0.299235	0.450888	0.6527

R-squared	0.064159	Mean dependent var	0.023094
Adjusted R-squared	0.041194	S.D. dependent var	0.078245
S.E. of regression	0.076616	Akaike info criterion	-2.270700
Sum squared resid	0.956823	Schwarz criterion	-2.177725
Log likelihood	195.7388	Hannan-Quinn criter.	-2.232967
F-statistic	2.793736	Durbin-Watson stat	2.299523
Prob(F-statistic)	0.028014		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 22:51
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.018192	0.005507	3.303321	0.0012
CDAX RF	-0.189432	0.122524	-1.546085	0.1240
SMB	-0.218760	0.176414	-1.240040	0.2167
HML	-0.250442	0.191563	-1.307366	0.1929
QMJ	0.204556	0.250060	0.818027	0.4145

R-squared	0.060909	Mean dependent var	0.018311
Adjusted R-squared	0.037864	S.D. dependent var	0.065273
S.E. of regression	0.064026	Akaike info criterion	-2.629759
Sum squared resid	0.668181	Schwarz criterion	-2.536784
Log likelihood	225.8997	Hannan-Quinn criter.	-2.592025
F-statistic	2.643016	Durbin-Watson stat	2.169107
Prob(F-statistic)	0.035582		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 22:54
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013798	0.004777	2.888376	0.0044
CDAX RF	-0.115077	0.106275	-1.082818	0.2805
SMB	-0.159663	0.153019	-1.043419	0.2983
HML	-0.269055	0.166158	-1.619269	0.1073
QMJ	0.270208	0.216898	1.245785	0.2146

R-squared	0.064089	Mean dependent var	0.014484
Adjusted R-squared	0.041122	S.D. dependent var	0.056713
S.E. of regression	0.055535	Akaike info criterion	-2.914305
Sum squared resid	0.502710	Schwarz criterion	-2.821330
Log likelihood	249.8016	Hannan-Quinn criter.	-2.876571
F-statistic	2.790449	Durbin-Watson stat	2.323996
Prob(F-statistic)	0.028161		

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 23:00
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.030789	0.009662	3.186805	0.0017
CDAX RF	-0.487807	0.221988	-2.197453	0.0294
SMB	-0.336517	0.311064	-1.081824	0.2809
HML	-0.187552	0.332752	-0.563640	0.5738
WML	-0.144442	0.198427	-0.727936	0.4677
QMJ	-0.200422	0.448647	-0.446725	0.6557

R-squared	0.036682	Mean dependent var	0.025669
Adjusted R-squared	0.006950	S.D. dependent var	0.111598
S.E. of regression	0.111209	Akaike info criterion	-1.519747
Sum squared resid	2.003532	Schwarz criterion	-1.408177
Log likelihood	133.6587	Hannan-Quinn criter.	-1.474466
F-statistic	1.233749	Durbin-Watson stat	2.115265
Prob(F-statistic)	0.295673		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 23:01
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.020745	0.006216	3.337455	0.0010
CDAX_RF	-0.185999	0.142814	-1.302385	0.1946
SMB	-0.213414	0.200121	-1.066422	0.2878
HML	-0.382971	0.214074	-1.788970	0.0755
WML	0.040219	0.127657	0.315052	0.7531
QMJ	0.299938	0.288634	1.039162	0.3003

R-squared	0.079403	Mean dependent var	0.021368
Adjusted R-squared	0.050989	S.D. dependent var	0.073443
S.E. of regression	0.071546	Akaike info criterion	-2.401900
Sum squared resid	0.829244	Schwarz criterion	-2.290330
Log likelihood	207.7596	Hannan-Quinn criter.	-2.356619
F-statistic	2.794546	Durbin-Watson stat	2.021118
Prob(F-statistic)	0.018922		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 23:02
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.024318	0.006674	3.643570	0.0004
CDAX RF	-0.296369	0.153351	-1.932623	0.0550
SMB	-0.315264	0.214885	-1.467127	0.1443
HML	-0.314778	0.229867	-1.369390	0.1728
WML	-0.047486	0.137075	-0.346425	0.7295
QMJ	0.161818	0.309928	0.522114	0.6023

R-squared	0.064852	Mean dependent var	0.023094
Adjusted R-squared	0.035989	S.D. dependent var	0.078245
S.E. of regression	0.076824	Akaike info criterion	-2.259536
Sum squared resid	0.956114	Schwarz criterion	-2.147966
Log likelihood	195.8010	Hannan-Quinn criter.	-2.214256
F-statistic	2.246925	Durbin-Watson stat	2.294970
Prob(F-statistic)	0.052142		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 23:03
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.018276	0.005579	3.275737	0.0013
CDAX RF	-0.193340	0.128192	-1.508199	0.1335
SMB	-0.222073	0.179632	-1.236267	0.2181
HML	-0.250652	0.192156	-1.304417	0.1939
WML	-0.012279	0.114587	-0.107155	0.9148
QMJ	0.211510	0.259083	0.816382	0.4155

R-squared	0.060975	Mean dependent var	0.018311
Adjusted R-squared	0.031993	S.D. dependent var	0.065273
S.E. of regression	0.064221	Akaike info criterion	-2.617925
Sum squared resid	0.668134	Schwarz criterion	-2.506355
Log likelihood	225.9057	Hannan-Quinn criter.	-2.572644
F-statistic	2.103887	Durbin-Watson stat	2.168292
Prob(F-statistic)	0.067537		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 23:04
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013810	0.004840	2.853626	0.0049
CDAX RF	-0.115666	0.111196	-1.040203	0.2998
SMB	-0.160162	0.155815	-1.027899	0.3055
HML	-0.269087	0.166679	-1.614402	0.1084
WML	-0.001852	0.099394	-0.018636	0.9852
QMJ	0.271258	0.224732	1.207027	0.2292

R-squared	0.064091	Mean dependent var	0.014484
Adjusted R-squared	0.035205	S.D. dependent var	0.056713
S.E. of regression	0.055706	Akaike info criterion	-2.902402
Sum squared resid	0.502709	Schwarz criterion	-2.790832
Log likelihood	249.8018	Hannan-Quinn criter.	-2.857121
F-statistic	2.218738	Durbin-Watson stat	2.323825
Prob(F-statistic)	0.054882		

Dependent Variable: 1 10
Method: Least Squares
Date: 08/01/16 Time: 23:07
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.029254	0.009257	3.160326	0.0019
CDAX RF	-0.415322	0.193985	-2.141003	0.0338
SMB	-0.312435	0.309498	-1.009490	0.3142
HML	-0.219209	0.340128	-0.644490	0.5202
RMW	-0.535704	0.706919	-0.757801	0.4497
CMA	0.117999	0.724183	0.162940	0.8708

R-squared	0.035874	Mean dependent var	0.025669
Adjusted R-squared	0.006117	S.D. dependent var	0.111598
S.E. of regression	0.111256	Akaike info criterion	-1.518909
Sum squared resid	2.005211	Schwarz criterion	-1.407339
Log likelihood	133.5884	Hannan-Quinn criter.	-1.473628
F-statistic	1.205580	Durbin-Watson stat	2.102203
Prob(F-statistic)	0.308865		

Dependent Variable: 1 2 9 10
Method: Least Squares
Date: 08/01/16 Time: 23:08
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.021389	0.005948	3.595783	0.0004
CDAX RF	-0.210797	0.124656	-1.691033	0.0928
SMB	-0.209306	0.198886	-1.052394	0.2942
HML	-0.397561	0.218568	-1.818934	0.0708
RMW	0.575211	0.454271	1.266230	0.2072
CMA	0.338010	0.465364	0.726335	0.4687

R-squared	0.080742	Mean dependent var	0.021368
Adjusted R-squared	0.052370	S.D. dependent var	0.073443
S.E. of regression	0.071494	Akaike info criterion	-2.403355
Sum squared resid	0.828037	Schwarz criterion	-2.291785
Log likelihood	207.8819	Hannan-Quinn criter.	-2.358075
F-statistic	2.845817	Durbin-Watson stat	2.047473
Prob(F-statistic)	0.017184		

Dependent Variable: 1 3 8 10
Method: Least Squares
Date: 08/01/16 Time: 23:10
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.022069	0.006351	3.474866	0.0007
CDAX RF	-0.209773	0.133096	-1.576110	0.1170
SMB	-0.233070	0.212351	-1.097567	0.2740
HML	-0.297372	0.233366	-1.274273	0.2044
RMW	0.752448	0.485027	1.551353	0.1228
CMA	0.260356	0.496872	0.523990	0.6010

R-squared	0.076742	Mean dependent var	0.023094
Adjusted R-squared	0.048246	S.D. dependent var	0.078245
S.E. of regression	0.076334	Akaike info criterion	-2.272332
Sum squared resid	0.943958	Schwarz criterion	-2.160762
Log likelihood	196.8759	Hannan-Quinn criter.	-2.227052
F-statistic	2.693119	Durbin-Watson stat	2.308203
Prob(F-statistic)	0.022881		

Dependent Variable: 1 4 7 10
Method: Least Squares
Date: 08/01/16 Time: 23:12
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.017338	0.005307	3.267267	0.0013
CDAX RF	-0.160375	0.111210	-1.442095	0.1512
SMB	-0.172452	0.177433	-0.971929	0.3325
HML	-0.226234	0.194992	-1.160218	0.2477
RMW	0.671118	0.405271	1.655976	0.0997
CMA	0.101400	0.415168	0.244238	0.8074

R-squared	0.073758	Mean dependent var	0.018311
Adjusted R-squared	0.045171	S.D. dependent var	0.065273
S.E. of regression	0.063782	Akaike info criterion	-2.631631
Sum squared resid	0.659039	Schwarz criterion	-2.520061
Log likelihood	227.0570	Hannan-Quinn criter.	-2.586351
F-statistic	2.580069	Durbin-Watson stat	2.171308
Prob(F-statistic)	0.028247		

Dependent Variable: 1 5 6 10
Method: Least Squares
Date: 08/01/16 Time: 23:13
Sample: 2002M07 2016M06
Included observations: 168

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013664	0.004612	2.962496	0.0035
CDAX RF	-0.111410	0.096655	-1.152659	0.2507
SMB	-0.130756	0.154211	-0.847901	0.3977
HML	-0.259506	0.169472	-1.531261	0.1277
RMW	0.620531	0.352230	1.761721	0.0800
CMA	0.173407	0.360832	0.480576	0.6315

R-squared	0.073190	Mean dependent var	0.014484
Adjusted R-squared	0.044585	S.D. dependent var	0.056713
S.E. of regression	0.055434	Akaike info criterion	-2.912172
Sum squared resid	0.497822	Schwarz criterion	-2.800602
Log likelihood	250.6224	Hannan-Quinn criter.	-2.866891
F-statistic	2.558614	Durbin-Watson stat	2.322057
Prob(F-statistic)	0.029395		