Charles University in Prague

Faculty of Social Sciences
Institute of Economic Studies

MASTER'S THESIS

Quality Investing: Combining the Gross Profitability with the Free Cash Flow Yield

Author: **Bc. Jiří Dopita**

Supervisor: **Mgr. Iuliia Brushko, M.A.**

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Declaration of Authorship

The author hereby declares that he compiled this thesis independently; using only the listed resources and literature, and the thesis has not been used to obtain a different or the same degree.

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Prague, May 13, 2016

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Signature

Acknowledgments

Abstract

This thesis examined the predictive power of different strategies for future stock returns. The analysis was conducted using a data sample of 3976 firms traded on the New York Stock Exchange (NYSE) and NASDAQ during a 29 year time horizon, from July 1986 to June 2015. Predictive powers of different strategies were also tested during three sub-periods and during bull and bear markets using both long-only and long/short portfolios to check whether the predictive power is robust. It was found that the FCF yield is a better indicator of future stock returns than the gross profitability. The difference between average monthly returns was significant during all tested time periods and market situations using both long-only and long/short portfolios. The newly introduced FCF profitable value strategy proved to be a better predictor of future stock returns than the profitable value strategy. The FCF profitable value strategy presents also an improvement over the FCF yield strategy. It was found that the FCF profitable value has a better predictive power for future stock returns than the FCF yield at least during some time periods or market situations.

Abstrakt

Tato práce se zabývá zkoumáním prediktivních schopností rozdílných strategií ve spojitosti s budoucími výnosy akcií. Analýza byla provedena na vzorku 3976 firem obchodovaných na burzách NYSE a NASDAQ během časového horizontu 29 let, od července 1986 do června 2015. Prediktivní schopnosti rozdílných strategií byly testovány také v průběhu tří dílčích období a také během období býčích a medvědích trhů s použitím jak portfolií, které drží jen dlouhé pozice, tak také portfolií, které drží dlouhé i krátké pozice zároveň. Tyto scénáře byly použity pro ověření robustnosti testovaných strategií. Bylo zjištěno, že ukazatel FCF yield dokáže predikovat budoucí výnosy akcií lépe než ukazatel gross profitability. Rozdíl mezi průměrnými měsíčními výnosy byl signifikantní během všech testovaných časových období, býčích trhů a medvědích trhů s použitím jak portfolií, které drží pouze dlouhé pozice, tak portfolií, které drží dlouhé i krátké pozice. Dále bylo dokázáno, že nově představený ukazatel FCF profitable value dokáže predikovat budoucí výnosy akcií lépe než ukazatel profitable value. Ukazatel FCF profitable value představuje rovněž určité zlepšení oproti ukazateli FCF yield. Bylo zjištěno, že ukazatel FCF profitable value má lepší prediktivní schopnosti než ukazatel FCF yield v některých časových obdobích a tržních situacích.

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Acronyms

B/P   Book-to-Price

B/M   Book-to-Market

DCF   Discounted Cash Flow

EBIT   Earnings Before Interest and Taxes

EMH   Efficient Market Hypothesis

EPS   Earnings Per Share

EPV   Earnings Power Value

FCF   Free Cash Flow

HEX   Helsinki Stock Exchange

P/CF   Price-to-Cash Flow

P/E   Price-to-Earnings

P/S   Price-to-Sales

NYSE   New York Stock Exchange

ROA   Return on Assets

ROIC   Return on Invested Capital

Master's Thesis Proposal

Author:	Bc. Jiří Dopita
Supervisor:	Mgr. Iuliia Brushko, M.A.
Defense Planned:	June 2016

Proposed Topic:

Quality Investing: Combining the Gross Profitability with the Free Cash Flow Yield

Motivation:

The performance of every investor is usually compared to a selected benchmark. For a stock investor, a stock market index is commonly the most appropriate benchmark. According to the strong form of the efficient market hypothesis even the insider's information is of no value. However, there were investors who had consistently better performance than the selected benchmark. These were mostly investors following principles of a value investing set by Graham and Dodd (1934). The basic definition of the value investing is buying undervalued firms. Firms with high book-to-market ratio are usually used for empirical testing. Many studies proved that portfolios made of firms with high book-to-market ratios outperform firms with low book-to-market ratios and also selected benchmarks (e.g. Fama and French 1992; Lakonishok, Shleifer and Vishny 1994).

Different quality measures were incorporated into value strategies with positive results (e.g. Sloan 1996; Greenblatt 2006; Piotroski and So 2012; Novy-Marx 2013). Novy-Marx (2014) compared the performance of the mostly known quality strategies and concluded that the strategy based on the gross profitability introduced by Novy-Marx (2013) performs the best among all tested quality strategies. Moreover, when the gross profitability was combined with high book-to-market ratio, results were even better than the original value investing strategy with only high book-to-market ratio firms.

Connecting this strategy to a modern valuation method may yield interesting results. The most common method for valuing firms is the discounted cash flow (DCF) method. This method uses the free cash flow predictions and discounts them back to the present time. However, strict value investors usually do not want to pay much or even pay at all for the future growth. This is why the current free cash flow generation should be the most important for a value investor. Hackel, Livnat and Rai (2000) showed that a portfolio consisting of firms that are strong free cash flow generators, have low financial leverage and trade at low price-to-free cash flow multiples outperforms the market. Jokipii and Vähämma (2006) showed that the same result holds also for Finnish companies. The free cash flow yield, defined as the free cash flow divided by the enterprise value, captures the effect of the current free cash flow generation together with low financial leverage and low price-to-free cash flow multiple. Adding the free cash flow yield to the gross profitability used by Novy-Marx (2013) is expected to contribute to the existing knowledge in the field of the quality investing.

Hypotheses:

1. Hypothesis #1: The free cash flow yield together with the gross profitability gives better results than gross profitability alone.
2. Hypothesis #2: Combining the free cash flow yield with the gross profitability and the book-to-market ratio gives better results than the book-to-market ratio alone.
3. Hypothesis #3: The long/short strategy performs better than the long-only strategy.

Methodology:

The first step will be the collection of the data needed to perform this study for which I will use a FactSet database. I will study only NYSE and NASDAQ listed companies for the longest period possible. The period will be dependent on the amount of historical data provided by the FactSet database. In case of some missing data, I will try to use also other reliable sources such as Bloomberg Terminal to complement the FactSet database.

The analysis will be conducted in a similar way as the analysis done by Novy-Marx (2014). Stocks will be ranked according to each strategy using chosen metrics which are the book-to-price ratio, the gross profitability and the free cash flow yield. After the ranking is done, two portfolios will be formed. Long/short portfolio that holds stocks in the top 30% according to the rank and short stocks located in the bottom 30% and long-only portfolio that holds only stocks ranked in the top 30% according to the ranking. Performance will be tested by Fama and French (1993) three-factor model.

I will also test the performance using subsamples and try find out, whether previous results hold also within these subsamples. I will test these hypotheses using only small cap companies, then mid cap companies and then large cap companies. I will also test these hypotheses in different time periods.

Expected Contribution:

I will broaden the current research in the area of quality investing. Novy-Marx (2014) showed that a strategy combining gross profitability which is a quality variable with the traditional value strategy based on high book-to-price ratio stocks performs better than the value strategy alone. I will try to improve the performance even further by adding another quality variable called free cash flow yield.

Outline:

1. Introduction
2. Literature review and motivation
3. Data and methodology
4. Results
5. Comparing results with other studies
6. Conclusion

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Author

Supervisor

</div>

1   Introduction

Stock investors usually compare their performance to a specific index or a group of indices. According to the strong form of the efficient market hypothesis (EMH) defined by Fama (1970) even the insider's information is of no value to the investor. However, there were investors who had consistently outperformed the selected benchmark in the long run. A large part of these investors were following principles of value investing introduced by Graham and Dodd (1934) in a book called Security Analysis. These principles were further discussed in well-known book called The Intelligent Investor written by Graham (1949) that is "By far the best book on investing ever written" according to Warren Buffett, one of the best living investors who was also a Graham's student at Columbia Business School.

Making the investment decision, the investors can choose to invest either into value stocks and/or glamour stocks. Value stocks are characterized by low valuation ratios where the single most frequently used ratio associated with value investing is the price-to-book (P/B) ratio. Glamour stocks, also called growth stocks, are the opposite of value stocks. Glamour stocks are characterized by high valuation ratios. Many studies have been performed based only on these valuation ratios (Gregory et al., 2003; Bird and Casavecchia, 2007; Penman and Reggiani, 2012). These studies intended to answer whether stocks with low valuation ratios such as price-to-earnings (P/E), price-to-sales (P/S) and price-to-book (P/B) outperform in general stocks with high valuation ratios.

Another stream of literature tried to find quality measures and characteristics (Piotroski, 2000; Kozlov and Petajisto, 2012; Novy-Marx, 2013), usually based on accounting ratios or key accounting numbers, which could be used to form portfolios consisting of high quality stocks that would outperform the selected benchmark or portfolios created by the low quality stocks (stocks that were not selected to be in the high quality portfolios). They usually tried to prove that stocks of financially and operationally strong firms (e.g. low debt, high margins, etc.) perform better in the long run than stocks of firms that do not possess these qualities.

There were also the attempts in the literature to combine these value strategies with some quality characteristics in order to achieve even better results (Piotroski and So, 2012; Frazzini et al., 2013; Novy-Marx, 2014). They wanted to test for example

whether stocks of high quality firms that trade in a value range outperform stocks of low quality firms that also trade in the value range.

This thesis compares the gross profitability strategy discovered by Novy-Marx (2013) with B/P ratio and FCF yield strategies. The comparison of the gross profitability and B/P ratio strategies was already done by Novy-Marx in his study. However, as was documented before by Hackel et al. (1994), the FCF yield can be a better predictor of future stock returns than the B/P ratio. Therefore this thesis will broaden the current research in the area of value and quality investing by comparing strategies that have not been compared before. This thesis also uses a larger data set when compared to previous studies. Novy-Marx (2014) found out that the profitable value, created by combining the gross profitability with the B/P ratio, is a better predictor of stock market returns than other strategies used in his research paper. This thesis compares the profitable value strategy to the FCF yield strategy. A new strategy called the FCF profitable value, created by combining the gross profitability and the FCF yield strategies, is also compared with the FCF yield strategy and the profitable value strategy.

The thesis is structured as follows: Chapter 2 describes existing literature on value and quality investing and also focuses on papers where these two elements are combined. The last part of Chapter 2 describes the motivation of picking the FCF yield variable for a comparison with the gross profitability variable. The first part of Chapter 3 provides the reader with a detailed description of the methodology used in this thesis with special focus on the construction of variables and the ranking process. The second part of Chapter 3 is focused on data sources, sample selection used in the analysis and descriptive statistics of the data sample. Chapter 4 and Chapter 5 present the results obtained from the analysis. Chapter 4 is focused on strategies formed by individual indicators and Chapter 5 on strategies formed by using joint ranks. Results are shown for the whole testing period as well as for three tested time sub-periods and bull and bear markets. Chapter 6 then concludes the findings of the thesis.

2 Literature review and motivation

This chapter presents an overview of existing literature and a motivation of the author for his research. The chapter is organized into four subchapters. First two subchapters are focused on the development of value and quality strategies. The third subchapter is focused on literature covering the combination of value and quality strategies and the last subchapter presents to the reader the motivation of the author to perform the research which can found in the empirical part of this thesis.

2.1 Value strategies

After the EMHs were formulated by Fama in 1970, many academicians were interested whether the EMH theory holds in the real investment environment. One of the first studies made in this field was performed by Basu (1977). Basu used data of firms traded on NYSE between September 1956 and August 1971 to test whether the performance of portfolios based on different P/E ratios differs. He found out that low P/E portfolios outperformed the rest on a risk-adjusted basis. This was later confirmed by DeBondt and Thaler (1985) and they argued that this effect was caused mainly by behavioral nature. Jaffe et al. (1989) confirmed that firms with high E/P ratio (earnings yield) outperform firms with low E/P ratio using substantially longer sample period of 1951-1986. They also tested the effect of the earnings yield in each of the twelve months and concluded that the effect is present and significant in each month.

Rosenberg et al. (1985) showed that firms with high book-to-market (B/M) ratios outperform firms with low B/M ratios. The value premium or the outperformance of value stocks was also supported by the findings of Fama and French (1992) or Lakonishok et al. (1994) who argued that the outperformance did not result solely due to the additional risk but rather due to the suboptimal behavior of investors. Fama and French (1995) found that the size of the firm together with the B/M ratio is also important in explaining stock returns. Penman and Reggiani (2012) confirmed results of earlier studies showing that earnings yield (E/P ratio) is a good measure to predict future development of stock prices. Moreover, they showed that combining earnings yield and high B/M ratios results in even better expected stock returns. They argue that this can be explained by an additional risk in the future growth. However, Gregory et al. (2003) showed in their research on NYSE dataset

from 1980 to 1998 that value portfolios, formed according to their P/E and P/CF ratios, outperform growth portfolios without being exposed to an additional risk. Also Truong (2009) confirmed the value premium exists in the New Zealand market using the P/E ratio and concluded that these excess returns were not compensated by an extra risk.

Value strategies were also tested on different data samples to confirm that the outperformance previously documented was not a result of the data mining bias. Dhatt et al. (1999) investigated Russell 2000, the U.S. small-cap index. They took data from 1979 to 1997 and formed portfolios based on P/E, P/S and market-to-book (M/B) ratios. Portfolios made of value stocks outperformed portfolios made of glamour stocks. Moreover, value portfolios had lower standard deviations and coefficients of variation. Portfolios constructed using the P/S ratio performed the best among these three ratios when used individually. However, the overall best results were achieved when portfolios were formed using all of these three ratios together. Bird and Casavecchia (2007) studied 15 European markets over the period of 1989-2004 and identified portfolios formed according to the sales-to-price (S/P) ratio to be the performing the best which confirmed findings of Dhatt et al. (1999).

The international evidence was tested by Chan et al. (1991). They tested the performance of Japanese stocks based on four underlying variables: book-to-market ratio, cash flow yield, earnings yield and size of the firm. They found significant relationships among stock returns and these variables. The B/M ratio and cash flow yield had the most significant impact on expected stock returns. Fama and French (1998) further researched different stock markets from 1975 to 1995. They found out that portfolios of high book-to-market (B/M) stocks outperformed low B/M portfolios by 7.68% per year on average and that in twelve out of thirteen major markets portfolios made of value stocks outperformed those made of glamour stocks. The reason they provided is that stocks of distressed firms are usually undervalued because of market overreaction, they fall in the high B/M territory and when the market corrects these pricing errors value stocks provide higher returns.

Bauman et al. (1998) tested international markets in 21 countries over a 10 year period and were searching for further evidence of the value premium. They found that value stocks outperformed growth stocks both on a total-return basis and risk-adjusted basis. Individually these results held in a majority of markets and in single 1-year periods. Trying to relate the performance to the firm size, authors found that the only category where value stocks did not outperform growth stocks was the small-cap stocks. Chan and Lakonishok (2004) provided another evidence of the

value premium when testing portfolios formed based on B/M ratio, cash flow yield, earnings yield and S/P ratio. They tested U.S. small-cap stocks and largest stocks in the MSCI indices for Europe, Australasia and Far East and found the existence of the value premium in all mentioned markets. The other international evidence of the value premium was found for Eurozone (Chanine, 2008), for Thailand (Sareewiwatthana, 2011, 2012) and Australia (Gharghoria et al., 2013)

As discussed above, there is strong evidence that value stocks tend to outperform glamour stocks in the long run. Some argue that the value premium is a consequence of data mining (e.g. Black, 1993) or is caused by the data selection bias (e.g. Kothari et al., 1995). Haugen and Baker (1996) tested stock returns depending on different ratios which are the cash flow yield, earnings yield and B/M ratio. They minimized various sources of bias, including data mining bias, and the value factors were one of the most successful regarding expected stock returns. Based on their results they argued that the value premium is not a consequence of data mining. Moreover, Davis (1994) analyzed stock returns using the B/M ratio, earnings yield and cash flow yield using U.S. data from 1940 to 1963 adjusted for the survivorship bias, the oldest dataset used compared to all previous studies. He found out that all of the used value indicators have significant explanatory power with respect to the stock returns.

Another important question many researchers ask is: Why does the value premium exist? One possible explanation could be taken from a research performed by Stickel (2007) where he found out that analysts do not usually recommend buying stocks of firms with high B/M ratio because these stocks usually underperform the market on an individual stock basis. This implies that an investor has to purchase a largely diversified portfolio of value stocks in order to beat the market which was confirmed by Rousseau and van Rensburg (2004) who found that returns are not distributed evenly across stocks in time and that a minority of stocks actually constitutes the majority of the value premium. Porta et al. (1997) argue that the value premium is caused by earnings surprises which are in general more positive for value stocks. Penman and Reggiani (2014) argue using accounting analysis that high B/M and E/P ratios typical for value stocks signal higher expected earnings growth that is more risky when compared to glamour stocks.

2.2 Quality strategies

As was mentioned earlier in this chapter, quality strategies try to find some quality characteristics of firms which are correlated with greater than normal stock returns.

Quality strategies are usually compared more to growth strategies than to value strategies because they do not primarily focus on buying undervalued stocks. Quality strategies rather promote buying stocks of firms with specific characteristics that are believed to ensure future stock outperformance. This outperformance is not dependable on the valuation stocks but is primarily focused on the outperformance of the firm compared to its competitors measured by earnings, revenues or any other relevant accounting measure.

One of the pioneers of quality investing was Benjamin Graham (1949), who introduced in his famous book the Intelligent Investor the following quality criteria:

1. Adequate size of the enterprise (basically excluding small-cap firms)

2. A sufficiently strong financial condition (current ratio of more than 2, long term debt less than net current assets)

3. Earnings stability (positive EPS in each of the past ten years)

4. Dividend record (payment of dividend in each of the past twenty years)

5. Earnings growth

6. Moderate P/E ratio (price less than 15 times 3-year average EPS)

7. Moderate ratio of price to assets (P/B ratio of no more than 1.5)

Among these seven criteria there are five quality criteria and only two value criteria which point at the greater importance of quality criteria compared to the value criteria even for Graham, the father of value investing.

Richard Sloan (1996) was among the first to perform an academic research in the field of quality investing. He developed earnings quality measure based on accrual and cash flow components of current earnings. This earnings quality measure can be summarized in a short equation:

$$earnings\ quality = \frac{cash\ earnings - accounting\ earnings}{firm\ assets}\ .$$

Sloan showed that the earnings quality can be used to predict future returns of stocks using data from the U.S. stock market because he found that stock prices do not fully reflect the accrual and cash flow components of current earnings. These findings were confirmed by LaFond (2005) or by Pincus et al. (2007) using data from international markets. Kozlov and Petajisto (2012) further confirmed the return

premium on stocks with high quality earnings using data covering all developed markets between 1988 and 2012. They also found that a strategy of shorting stocks with low earnings quality and buying stocks with high earnings quality produces a higher Sharpe ratio than value strategies. They also argue that earnings quality strategies are good complements to value strategies because of their negative correlation which produces diversification benefits.

Piotroski (2000) developed an important quality measure called the F-score which is also frequently used by investment professionals. Piotroski analyzed firms with high B/M ratio and tried to find out how the stock returns can be improved by using a simple accounting-based fundamental analysis strategy. The F-Score can have values from 0 to 9. The F-score rises in value by 1 point for each of the following criteria it meets:

1. Positive net income before extraordinary items (measures ROA)

2. Positive cash flow from operations

3. Positive year-to-year change in ROA (ΔROA is positive)

4. Cash flow from operations exceeds net income before extraordinary items

5. Long term debt to total assets fell in the year preceding portfolio formation

6. Current ratio increased compared to the previous year

7. The firm did not issue common equity in the preceding year

8. Gross margin increased compared to the previous year

9. Positive year-to-year change in the asset turnover

Using this indicator, the author shows that market-adjusted returns are the worst for firms with F-Score equal to 0 and that they are improving consistently when the F-score rises. Stocks of firms with F-Score equal to 9 have the best market-adjusted returns. Piotroski showed that the mean return earned by an investor who is investing in stocks with high B/M ratios can be increased by at least 7.5% annually through the selection of financially strong (high F-Score) firms while the entire distribution of realized returns is shifted to the right. In addition, an investment strategy that buys expected winners and shorts expected losers generates a 23% annual return between 1976 and 1996, and the strategy appears to be robust across time while also controlling for alternative investment strategies.

Another quality measures used in studies of quality investing are the ROIC which was popularized by Greenblatt and Tobias (2010) or the gross profitability used by Novy-Marx (2013), defined as ratio of gross profits to total assets. Novy-Marx (2013) found that stocks of profitable firms earn higher returns despite having, on average, low B/M ratios. The gross profitability measure was also included as one of the factors used in the new five-factor asset pricing model presented by Fama and French (2015).

Novy-Marx (2014) compared the performance of several quality strategies to each other and also to traditional value strategy of buying firms with high B/M ratio. He tested seven different quality strategies using data from NYSE between 1963 and 2013. These strategies were following:

1. *Graham quality* based on criteria set by Graham (1949) called the G-score with the score of 0 to 7 according to how many criteria the firm passes

2. *Grantham quality* based on a white paper called "The Case for Quality-The Danger of Junk" written in 2004 by Grantham's firm GMO

3. *Return on invested capital* based on the Joel Greenblatt's Magic formula

4. *Earnings quality* developed by Sloan (1996)

5. *Financial strength* based on Piotroski's F-score

6. *Defensive equity* based on well-known defensive indices (e.g. Dow Jones' Neutral Anti-Beta)

7. *Gross profitability* developed by Novy-Marx (2013)

The inference drawn from the strategy of going long in the top 30% and shorting the bottom 30% is that the gross profitability performed the best (excess return of 2.70%) followed by the F-score (2.24%) and ROIC (2.17%). However, the traditional value strategy based on B/M ratio still performed better (3.49%) than quality strategies. When the author divided the sample into subsamples depending on the market capitalization, he obtained a bit different results. The three most profitable strategies among large caps were the gross profitability (1.95%), the F-score (1.36%) and the earnings quality (1.27%) while the B/M value strategy again performed better (2.06%) than quality strategies. At the same time he presented results that were different among small caps when employing quality strategies, where the top three strategies were the gross profitability (3.32%), the G-score (2.75%) and the F-score

(2.11%) while the value strategy performed again even better (4.56%). For long-only investors, the gross profitability was clearly the best strategy with a mean return of 7.10% while other strategies had similar results with the mean returns in the range of 5.21% to 6.22%. However, none of these quality strategies alone outperformed the traditional value strategy of buying firms with high B/M ratios with a mean return of 8.70%. These findings also motivate an ongoing research in the area of combining value and quality strategies in order to achieve higher returns.

2.3 Combination of value and quality strategies

Many studies showed that stocks that are traded for low valuation multiples (value stocks) outperform the rest of the stocks (e.g. Penman and Reggiani, 2012). Many studies also showed that stocks of financially and operationally strong firms outperform stocks of firms that are not financially and operationally strong (e.g. Novy-Marx, 2013). This implies that buying stocks of high quality firms trading at low valuation multiples should lead to superior results. This is why researchers used value and quality measures previously proven to signal excess returns together to figure out whether their combinations would yield even better results.

Haugen and Baker (1996) tested both value strategies and their combinations with quality strategies. They ranked stocks based on various factors related to risk, liquidity, price-level, growth potential and the technical history of stock returns. Then they divided them into deciles to find out that the spread between the tenth decile and the first decile is approximately 35%. They called the stocks of the tenth decile Growth at Inexpensive Price (GAIP). Greenblatt and Tobias (2010) also combined ROIC with their version of the earnings yield defined as EBIT-to-enterprise value. They called this combination the Magic formula. They ranked stocks individually based on these two measures and tested the results of ten portfolios formed according to the combined ranks. It should be noted that the first six portfolios outperformed the S&P 500 index and that the 1st portfolio outperformed the 10th portfolio by more than 15% annually. Moreover, Ng (2009) found that selecting portfolios based on a combination of the Magic formula with the F-score brings higher returns than are the returns of the two strategies used separately.

Based on Piotroski's F-score, Piotroski and So (2012) showed that strategies following a combination of value strategies and quality strategy employing the F-score significantly outperform both value and quality strategy alone. Investing in quality stocks that are also cheap and safe are the reasons why Warren Buffet's Berkshire Hathaway outperformed the U.S stock market for many years according to

Frazzini et al. (2013). Similar conclusion was found by Asness et al. (2013) using their Quality Minus Junk (QMJ) factor that shorts low-quality stocks and buys high-quality stocks. The QMJ factor shows that significant risk-adjusted returns can be achieved using this strategy both in the U.S. stock market and in 24 other countries. In addition to that, they argue that the price of quality varies over time and that a low current price of quality stocks predicts high future returns of the QMJ factor.

Gross profitability, the best single quality criteria according to Novy-Marx (2013), was also combined with value criteria, the B/M ratio, and excess returns of 7.4% were significantly bigger than 3.2% for the gross profitability alone or 3.5% for the B/M ratio alone. Different quality strategies were combined with a simple value strategy based on B/M ratio by Novy-Marx (2014) using the long-only strategy. First, he tested strategies where 50% of the portfolio is invested according to B/M ratio and the other 50% of the portfolio is invested according to a selected quality strategy. Only two quality strategies, the earnings quality and defensive equity strategies did not benefit from the combination with value strategy. Other combinations of the value strategy and quality strategies achieved a better risk/reward trade-off than the one achieved by quality strategies alone. However, the average annual return and the Sharpe ratio were still the greatest for the value strategy alone (see Table 1).

Table 1: Equal combination of value and quality strategies

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Portfolio weights (%)								
Book-to-price	100	50	50	50	50	50	50	50
Graham's G-score		50						
Grantham's quality			50					
ROIC				50				
Earnings quality					50			
Piotroski's F-score						50		
Defensive							50	
Gross profitability								50
Panel B: Portfolio performance								
Average annual return	8.70	7.18	7.22	7.40	7.41	7.46	6.95	7.90
Volatility	16.2	15.2	15.0	15.4	15.7	15.0	13.9	15.2
Sharpe ratio	0.54	0.47	0.48	0.48	0.47	0.50	0.50	0.52
Panel C: Benchmarked performance								
CAPM alpha	3.36	1.69	1.80	1.81	1.79	2.06	2.18	2.40
Tracking error	7.46	3.63	3.22	3.31	4.25	3.77	5.13	3.52
Information ratio	0.45	0.47	0.56	0.55	0.42	0.55	0.42	0.68

Source: Novy-Marx (2014, p. 20)

Strategies that form portfolios jointly based on value and quality strategies were tested on two different sub-samples of data (the summary of these results is provided in Table 2). The first sub-sample consisted of large cap stocks and three combinations of value and quality strategies provided greater excess returns than the value strategy alone. These were the Magic formula, the F-score combined with value and the Profitable value based on the gross profitability. The second sub-sample consisted of small cap stocks and only Profitable value and Graham value, combination of Graham quality criteria and value, had greater excess returns than the value strategy alone.

Table 2: Long-only joint value and quality strategies

Sort variable	$E[r^e]$	α_{CAPM}	Three-factor model regression results			
			α	β_{MKT}	β_{SMB}	β_{HML}
			Panel A: Large cap results (Russell 1000)			
Traditional value	7.49	2.38	-0.78	0.99	-0.01	0.59
	[3.47]	[2.60]	[-1.76]	[114.1]	[-1.01]	[44.1]
Graham value	6.99	1.89	-0.01	0.96	-0.04	0.36
	[3.34]	[2.54]	[-0.03]	[89.3]	[-2.78]	[22.3]
Grantham value	6.90	2.20	1.01	0.89	-0.13	0.27
	[3.57]	[3.13]	[1.79]	[80.8]	[-8.35]	[16.0]
Magic formula	8.15	2.75	0.94	1.00	-0.01	0.33
	[3.71]	[3.72]	[1.61]	[86.7]	[-0.65]	[19.1]
Sloan value	6.76	1.77	0.09	0.94	-0.07	0.33
	[3.26]	[2.18]	[0.13]	[72.8]	[-3.93]	[17.0]
Piotroski and So	7.83	2.94	1.29	0.92	-0.08	0.33
	[3.80]	[3.41]	[1.79]	[65.1]	[-4.00]	[15.3]
Cheap defensive	6.42	2.35	0.11	0.83	-0.17	0.48
	[3.51]	[2.43]	[0.17]	[65.4]	[-9.44]	[24.6]
Profitable value	9.20	3.68	1.70	1.00	0.08	0.33
	[4.10]	[4.86]	[2.75]	[82.4]	[4.92]	[18.0]
			Panel B: Small cap results (Russell 2000)			
Traditional value	11.7	5.31	-0.74	1.07	0.87	0.79
	[3.96]	[3.19]	[-1.18]	[87.1]	[49.9]	[42.1]
Graham value	11.8	5.81	0.67	0.98	0.78	0.65
	[4.32]	[3.88]	[1.00]	[75.4]	[42.1]	[32.9]
Grantham value	11.4	5.56	1.36	0.95	0.70	0.51
	[4.40]	[4.21]	[2.09]	[74.2]	[38.6]	[26.3]
Magic formula	11.2	4.68	0.05	1.05	0.80	0.55
	[3.83]	[3.07]	[0.06]	[67.0]	[36.2]	[23.0]
Sloan value	11.4	4.76	-0.59	1.09	0.85	0.67
	[3.78]	[2.93]	[-0.76]	[71.6]	[39.7]	[28.8]
Piotroski and So	11.7	5.64	0.75	1.00	0.76	0.62
	[4.22]	[3.70]	[0.91]	[62.5]	[33.3]	[25.2]
Cheap defensive	10.0	5.15	0.63	0.83	0.58	0.61
	[4.43]	[3.99]	[0.92]	[62.2]	[30.6]	[30.2]
Profitable value	12.3	5.73	1.19	1.03	0.89	0.50
	[4.16]	[3.67]	[1.62]	[71.8]	[43.7]	[23.0]

Source: Novy-Marx (2014, p.24)

2.4 Motivation

As was showed by Novy-Marx (2013, 2014), portfolios based on the gross profitability had the best excess returns when compared to other quality strategies. Moreover, the gross profitability combined with B/M ratio yielded the best results among all value and quality and their combinations. Novy-Marx (2013) showed that the gross profitability strategy performed better than strategies formed according to the FCF yield and the earnings yield, where the free cash flows and earnings were scaled also by the book value of equity. He did not want to use any market-based measures because he did not want to conflate these productivity proxies with book-to-market ratio. As was mentioned above, Novy-Marx (2014) compared the gross profitability strategy with B/P ratio strategy and other quality strategies. He found that portfolios formed according to the B/P ratio strategy outperformed portfolios based on the gross profitability strategy. However, there is no mention of how the gross profitability strategy would perform against the FCF yield strategy using the traditional definition (free cash flow per share divided by the market value of equity per share) even though it was previously documented (Hackel et al., 1994) that the FCF yield can be a better indicator of future returns than the B/P ratio. Therefore, the goal of this thesis is to test on a larger data set whether the returns of portfolios based on the gross profitability are lower than the returns of portfolios constructed using the traditional FCF yield which is something that was not tested before, compare the performance of FCF yield and B/P ratio strategies and test if the returns of joint strategies, particularly the profitable value, can be further improved by adding the FCF yield variable. Tests will be performed on portfolios based on the gross profitability and FCF yield alone and also in combination with the B/P ratio. Both long-short and long-only strategies will be tested and compared together. The following parts serve as a motivation why the FCF yield was selected as the additional sorting parameter when constructing portfolios.

2.4.1   Valuation techniques

The free cash flow is the most important input when valuing firms using the discounted cash flow (DCF) method. The DCF method is a core valuation method presented in almost every modern valuation textbook, e.g. Copeland et al. (2005), Damodaran (2011, 2012) or Rosenbaum and Pearl (2013). This method is based on free cash flows in future years which are discounted back to get the present value. An investor using the DCF method has to predict the operating cash flow, capital expenditures and many other accounting measures of a firm many years into the future and also set a proper discount rate and growth rate (see Figure 1 for a brief

overview). Therefore, the DCF valuation is very dependent on assumptions and free cash flow projections.

Figure 1: Discounted Cash Flow Valuation Method
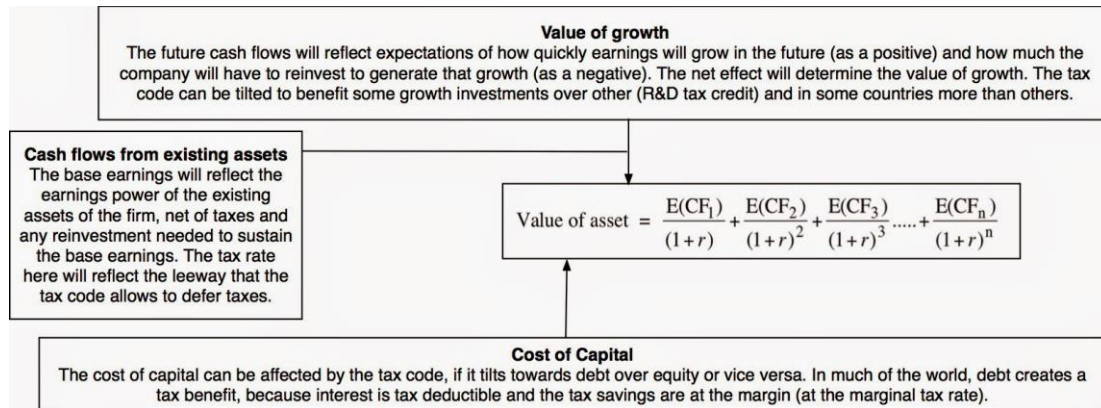
Source: Aswath Damodaran's blog (aswathdamodaran.blogspot.com)

However, strict value investors usually do not want to pay much or even pay at all for the future growth. They want to buy assets at a reasonable price with respect to current earnings and get any future growth for free. According to Greenwald (2001) the value of a firm consists of three elements: assets, earnings power and profitable growth (see Figure 2).

Figure 2: Three Slices of Value
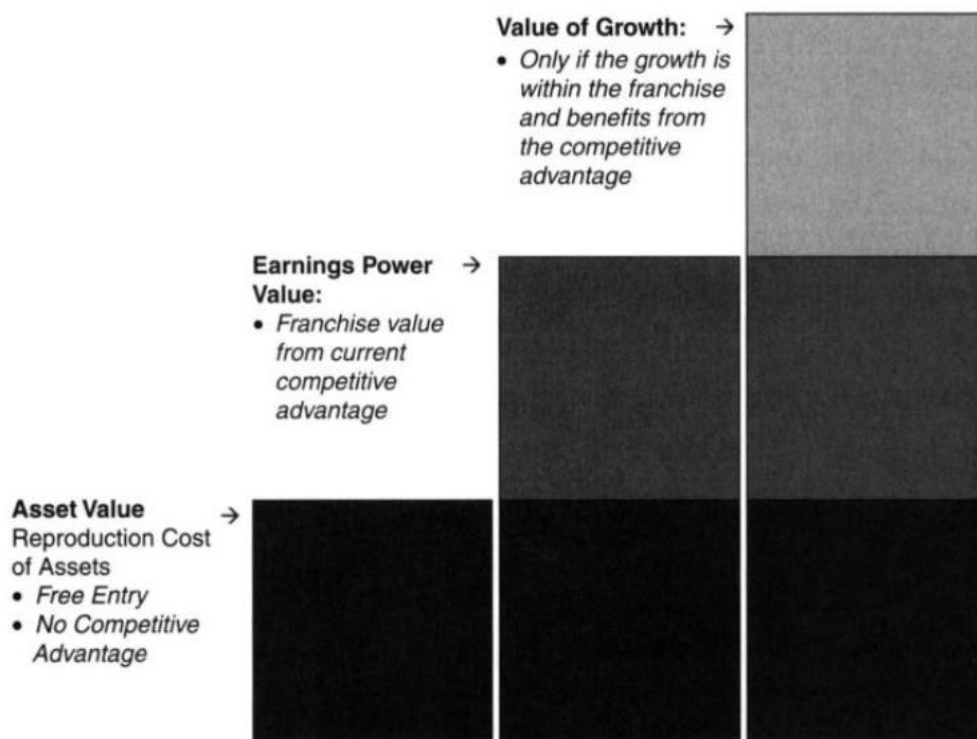
Source: Greenwald (2001)

The earnings power value (EPV) is a valuation technique based on current earnings. The two main assumptions are that current earnings are in line with sustainable levels of free cash flow and that the level of current earnings will remain constant for the indefinite future. Applying these assumptions, the earnings power value is then calculated as current adjusted earnings divided by the current cost of capital. Because the growth is valuable only when it is happening within a franchise when the return on invested capital is higher than the costs of new investments, the EPV is the core valuation technique used by strict value investors for the majority of firms to get the first idea of their values. In reality the majority investors perform other more sophisticated analyzes to value the firm but the EPV might serve as a good starting point.

To sum it up, the DCF valuation method is a mainstream valuation technique that discounts future cash flows to get the present value of the assets. In order to perform such a valuation, the investor needs to predict all the future cash flows. On the other hand, valuation methods used by value investors, as described above, focus on the current situation of valued firms. Therefore, the current cash flow generation should be the most important metric for a value investor if he would like to evaluate whether the firm is expensive or cheap when compared to other firms. The single metric that connects the current free cash flow generation and the current value of the firm is the free cash flow yield. The higher the free cash flow yield the less the investor pays for each unit of free cash flow.

2.4.2   The free cash flow anomaly

Hackel et al. (1994) documented another investment anomaly which is connected to the free cash flow. They found that long-only portfolios based on small-cap firms which are consistent free cash flow generators with low financial leverage that sell for low P/FCF multiple generate superior returns compared to similar B/M portfolios, similar size portfolios and similar beta portfolios using data for NYSE, AMEX and NASDAQ firms. Hackel and Livnat (1995) further documented this anomaly using data from international markets. Hackel et al. (2000) used the same strategy as Hackel et al. (1994) but they did not limit their analysis only on small-cap stocks. They analyzed the whole range of stocks, excluding only stocks with market cap below $100 million, using data for the years 1979-1996. They found out that portfolios based on free cash flow have abnormal returns of 3.1% for beta adjusted portfolios, 4.7% for size adjusted portfolios, 6.4% for B/M adjusted portfolios and that the returns are also superior to the returns of the S&P 500 Index. They also

argued that there is no association between these excess returns and other reported anomalies based on E/P or B/M ratios.

The free cash flow anomaly was also confirmed by Jokipii and Vähämaa (2006) using data from Helsinki Stock Exchange for the years 1990-2000. However, they had to simplify some of the rules used by Hackel et al. (2000) because of the limitations of the Helsinki Stock Exchange. The mean return for the portfolios based on free cash flow criteria had a mean 12-month return of 23.3% which was significantly more on both economical and statistical basis compared to the HEX Portfolio index with a mean 12-month return of 11.5% (for cumulative returns see Figure 3). They further documented that the portfolio based on free cash flow criteria was more profitable especially during market downturns.

Figure 3: Cumulative Returns on the FCF and the HEX Portfolios

Source: Jokipii and Vähämaa (2006, p. 971)

Arslan and Karan (2007) tested the free cash flow anomaly on data from the Istanbul Stock Exchange for the period of 1999-2005. They found that the portfolio based on the free cash flow did not outperform the ISE 100 index during bull markets. However, the free cash flow portfolio significantly outperformed the index during bear markets (mean 12-month return of 0.1% against -10.7%). The free cash flow anomaly was further discussed by Chughtai et al. (2011) using data from Pakistan. They confirm that excess returns can be achieved following the free cash flow strategy.

Finally Mizerka et al. (2015) studied the free cash flow anomaly on data listed on the Warsaw Stock Exchange in Poland. They concluded that the returns of

portfolios based on the free cash flow were higher than the returns of other firms. However, these results were not robust and significant enough to conclude that the free cash flow anomaly exists also in Poland. They argue that this might be caused by the sample period of 2001-2011 which was not long enough to conclude whether the free cash flow anomaly exists in Poland or not. As was documented by Hudson et al. (2002) or Marquering et al. (2006), market anomalies tend to weaken or may disappear and then reappear again as the time flows. This suggests that anomalies should be tested on a data sample covering longer periods.

The cash generating ability of firms is very important in the long run. Frazzini et al. (2013) show how Buffett achieved such an extraordinary performance and one of the reasons is that he buys companies that are safe which also means that they are generating sufficient amount of cash flow to survive bad times. Simutin (2010) studies excess cash holdings and he documents that the return of the portfolio of firms with high excess cash exceeds the return of the portfolio of firms with low excess cash by 5% annually. Palazzo (2010) found that firms with a high cash–to–assets ratio outperform firms with a low cash–to–assets ratio. He argues this is because the cash holdings serve as a hedge against future shortfalls. This is in-line with the free cash flow anomaly where most of the researchers note exceptional performance of the free cash flow portfolio especially in downward markets. This fact can be seen also in Figure 3 where the HEX index collapsed after the burst of the dot-com bubble. Internet firms were highly valued and very popular but a lot of them were not generating cash which proved to be unsustainable in the long-term horizon. On the other hand firms that were generating a lot of free cash flow were able to invest (e.g. in R&D) and were able to generate excess returns for their shareholders.

3   Data and methodology

This chapter is divided into two parts. The first part describes the methodology used in the empirical part of this thesis, including the ranking process, portfolio construction and subsequent analyzes of portfolios. The second part describes the data collection process, sample selection and also shows descriptive statistics of the sample.

3.1   Methodology

Each year the firms are ranked according to key variables: the book-to-price ratio, gross profitability and free cash flow yield. Variables are constructed in a following way:

- $B/P\ ratio = Book\ value\ of\ equity/Market\ value\ of\ equity$

- $Gross\ profitability = Gross\ income/Total\ Assets$

- $FCF\ yield = Free\ cash\ flow/Market\ value\ of\ equity$

Then, the firms are ranked again based on the sum of the individual ranks obtained in the first step. Table 3 provides the illustration of the ranking process.

Table 3: Ranking process

Company Name	B/P ratio rank	FCF Yield rank	Sum of ranks	Joint rank
Company 1	1	1	2	1
Company 2	3	6	9	4
Company 3	6	2	8	3
Company 4	5	8	13	8
Company 5	4	7	11	6
Company 6	7	3	10	5
Company 7	8	4	12	7
Company 8	2	5	7	2

Source: Author

In order to compare the performance of different strategies such as buying stocks with high book-to-market ratio, both long-only and long/short portfolios are formed. Long-only portfolios hold the stocks ranked in the top 30% according to a selected strategy while long/short portfolios hold stocks ranked in the top 30% and short stocks of firms ranked in the bottom 30% according to the selected strategy. The construction of portfolios and measuring of the performance starts on the 1st July 1986. The holding period is one year. Portfolios are rebalanced each year according to new ranks to capture changes in fundamental indicators and also the change in the market value of equity.

For the robustness check, performance of the middle 40% portfolio is also computed in order to analyze whether strategies based on different measures have significant sorting power, i.e. whether the bottom 30% portfolio performs the worst and the top 30% portfolio the best.

The average monthly return of stocks in the sample used for this analysis is 1.66%. Therefore it would make no sense to compare long-only portfolios and long/short portfolios on an absolute performance basis because there is a positive performance bias in the sample. However, short positions in long/short portfolios should limit losses of these portfolios or even make portfolios profitable during bad times such as recessions and bear markets in general and therefore these long/short portfolios should deliver a higher performance during bad times than long-only portfolios. Therefore long/short portfolios should also have lower volatility. In order to account for the potential decrease in portfolio volatility the Sharpe ratio is used to compare the performance of these portfolios. Another indicator used to analyze different strategies is the value of a $1 investment at the end of the analyzed period assuming that the investment was made at the beginning of the analyzed period. Maximum drawdowns which are showing the percentage peak-to-through decline in portfolio values are also used to analyze portfolios. Furthermore, the one-month and one-year outperformance frequencies are displayed for different strategies. The outperformance is measured against the sample average. These outperformance measures are important for investors because they show them the probability with which the selected portfolio outperforms the benchmark on a one-month or one-year basis regardless of the time they invest in the selected portfolio.

Transaction costs and taxes are omitted in this thesis. These two elements would decrease returns showed for different strategies. However, it does not mean that findings in this thesis are irrelevant because transaction costs are only a fraction of total investments and taxes are the same for every investor. On the other hand, the

difference in returns between strategies might actually be different in the real investment environment because some strategies might have lower turnover of stocks than other strategies and hence lower transaction costs.

3.2 Data

3.2.1   Data Sources

The data for this thesis were collected from the Thomson Reuters DataStream platform. The analysis is focused on companies which are traded in the United States of America, particularly on the New York Stock Exchange (NYSE) and NASDAQ. There were two restrictions applied such that secondary listings were excluded from the stock selection and the same was applied for non-equity securities.

For the analysis the key financial data and stock market data were gathered. The key financial ratios include the book value of equity (the Price-to-book value used in the analysis was downloaded directly from the Worldscope database), total assets, gross income, free cash flow per share and common shares outstanding at the yearly frequency. The time period for the financial data is 1985 to 2013 and covers year-end data. The financial data were obtained from the Worldscope fundamentals database (part of Thomson Reuters) which includes also stocks that are not listed anymore. It is desirable to include the data of stocks that are not listed anymore to mitigate the survivorship bias. Stock prices were downloaded using a monthly frequency and they cover the period between years 1986 and 2015. The time periods of these two data sets do not exactly match which is caused by the methodology explained in previous subchapter.

3.2.2   Sample Selection

Following the methodology of Fama and French (1992) and Jokipii and Vähämaa (2006), only positive numbers were kept for the analysis for price-to-book values, total assets, gross income and free cash flow per share value.

Because portfolios used in the analysis are formed on the 1st July, the value of the book-to-price ratio is always as of the 1st July. The same holds for the free cash flow yield. Only gross profitability is formed solely using the end of year numbers. As an example, the free cash flow yield used to analyze stock returns in a twelve-month period starting in July 1990 would be formed by dividing the free cash flow generated in 1989 by the market value of equity as of the beginning of the 1st July.

Based on the methodology described later, it is important to have all the fundamental data for a given year together with stock prices covering twelve months starting in July the year later. Because of this methodology, only firms with all the fundamental data and stock prices are left for the analysis in order to have a complete set of data. If there is any element missing in a given year, the data for that year is excluded from the analysis. Given a large team and a huge amount of time, it might be possible to manually find the missing data using various databases. However, the chosen approach should yield unbiased results, because none of the data is excluded randomly or on purpose to achieve better results.

3.2.3   Descriptive statistics

The number of firms used in the analysis differs in every year. It is caused by the availability of historical data in Thomson Reuters DataStream and by the data adjustment process. The number of firms ranges from 292 in the year 1985 up to 1849 in the year 2013. The development can be seen in Figure 4.

Figure 4: Number of firms used in the analysis each year
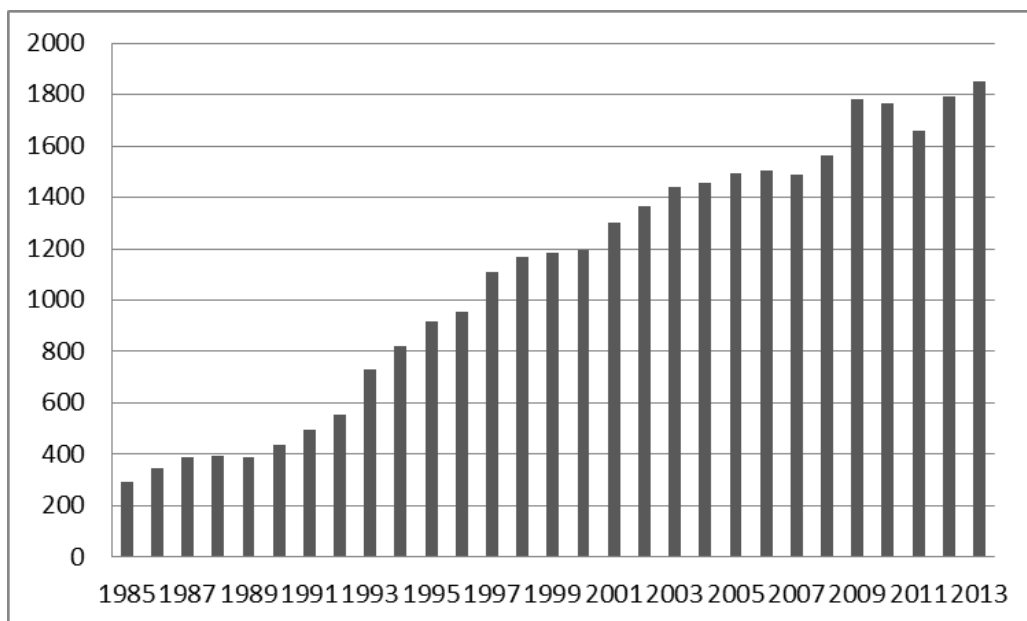
Source: Author' computations

To get a better understanding of the three key variables used in the analysis, it is useful to see what the average value of each variable is and how these values evolve in time. Averages for top 30% and bottom 30% were also included since long-only portfolios are created by selecting stocks that are positioned in the top 30% range with respect to the selected variable and long/short portfolios are long the stocks located within top 30% and short stocks within the bottom 30%.

Figure 5: Book-to-Price ratio averages
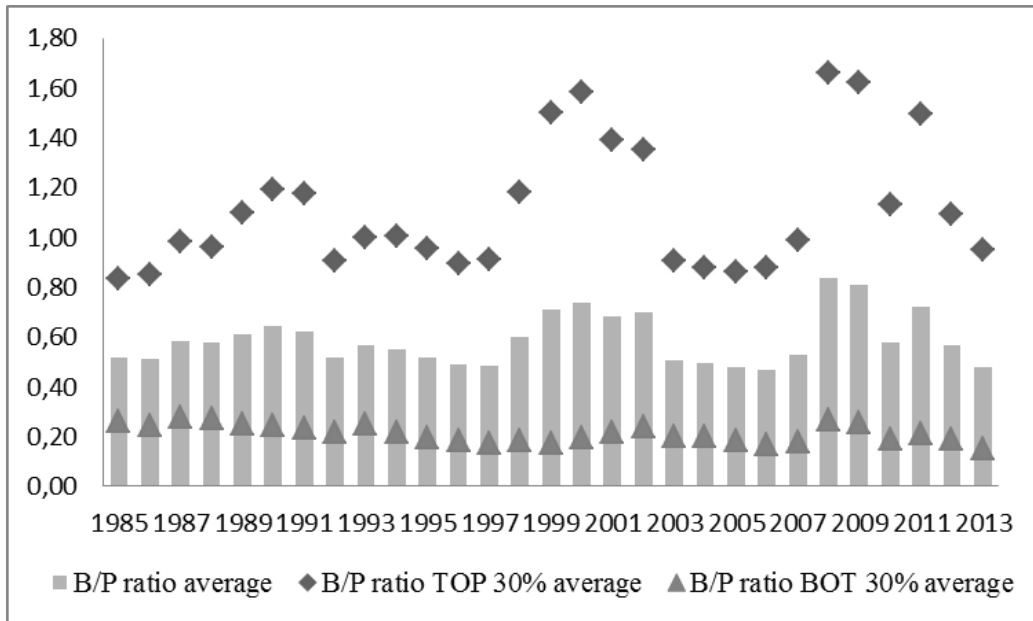
Source: Author' computations

Figure 6: Gross Profitability averages
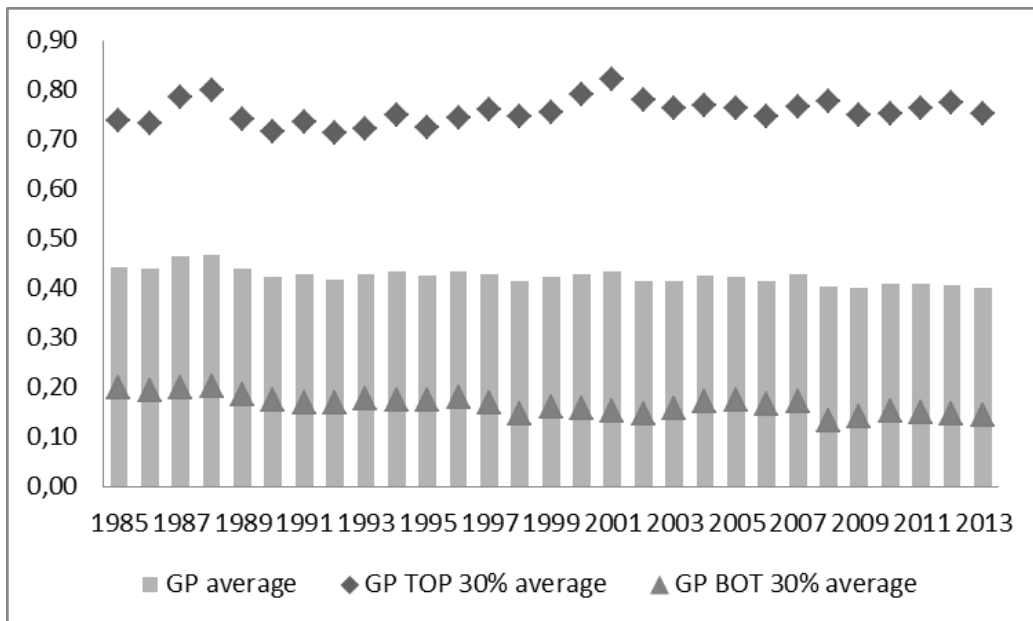
Source: Author' computations

Figure 7: Free Cash Flow Yield averages
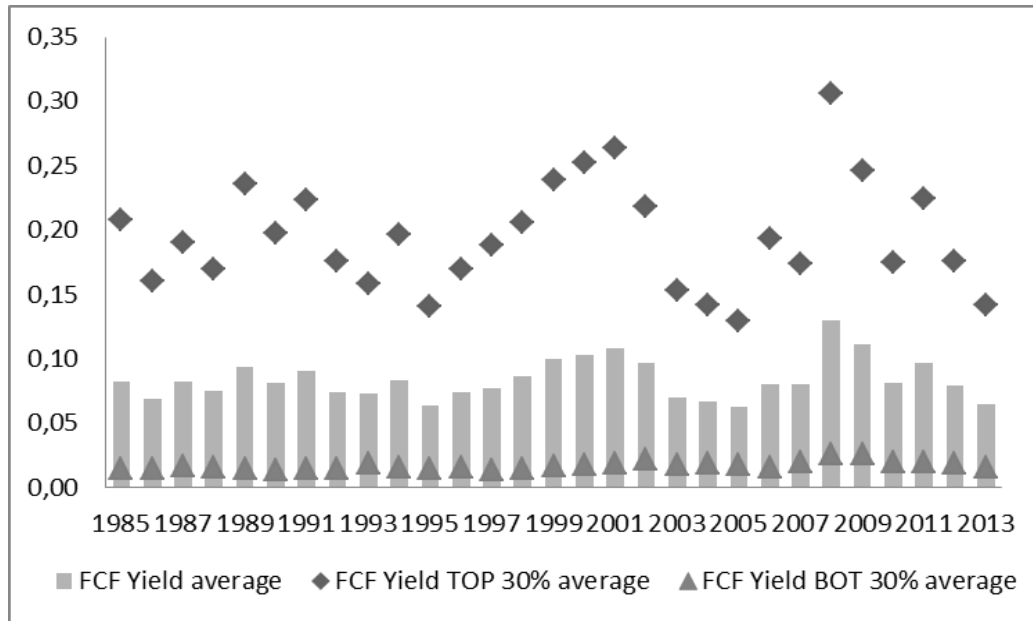
Source: Author' computations

One can see in the Figure 5, Figure 6 and Figure 7 that the distance between the sample average of individual variables and the average of variables ranked in the top 30% is larger than the distance between the sample average of individual variables and the average of variables ranked in the bottom 30% in the majority of years. This is caused by the sample selection (exclusion of negative numbers) and also by couple of outliers with really high values. However, these outliers were not excluded from the dataset because they provide as valuable information as the rest of the dataset. This can also be partly seen when comparing the average and median values. For B/P ratio and FCF Yield variables, the median values are more stable and less volatile throughout the period used in the analysis than average values. Table 4 shows the minimum, average and maximum values taken from average and median values of selected variables during the testing period.

Table 4: Comparison of average and median values

		Minimum	Average	Maximum	Variance
B/P ratio	**Average**	0.47	0.59	0.84	0.0105
	Median	0.36	0.47	0.63	0.0037
Gross profitability	**Average**	0.40	0.43	0.47	0.0003
	Median	0.32	0.37	0.41	0.0009
FCF Yield	**Average**	0.04	0.06	0.11	0.0004
	Median	0.03	0.04	0.07	0.0001

Source: Author' computations

4   Performance of portfolios formed by individual indicators

This chapter shows the results of portfolios formed by individual indicators. Results throughout the whole testing period are presented at the beginning of this chapter and are more detailed. Results during different time periods and market situations are presented in following subchapters.

4.1   Results throughout the whole testing period

Table 5 shows the results of portfolios formed according to different strategies: B/P ratio, gross profitability and FCF yield. All of these strategies have the ability to rank the stocks and create Top 30% portfolios which performance is better than the average performance of the sample mean of which is 1.66%.

Table 5: Monthly returns (07/1986 - 06/2015) using individual indicators

		Sharpe ratio	St. Dev	Average Return
B/P Ratio	**Bottom 30%**	0.1762	0.0592	1.32%
	Mid 40%	0.2120	0.0557	1.46%
	Top 30%	0.3560	0.0553	2.25%
Gross Profitability	**Bottom 30%**	0.1995	0.0561	1.40%
	Mid 40%	0.2277	0.0569	1.58%
	Top 30%	0.3136	0.0553	2.02%
FCF Yield	**Bottom 30%**	0.1284	0.0562	1.00%
	Mid 40%	0.2095	0.0545	1.42%
	Top 30%	0.4015	0.0583	2.62%

Source: Author's computations

If we look at the B/P ratio, gross profitability and FCF yield individually the performance of portfolios sorted from the worst to the best is looking similar. The bottom 30% portfolio performs the worst and has also the lowest Sharpe ratio followed by the mid 40% portfolio which has slightly better results with performance

still below the average of the sample. The top 30% portfolio achieves the highest monthly return that is significantly greater (with gross profitability having the lowest t-stat among indicators in excess of 5.6, B/P ratio and FCF yield even higher) than the bottom 30% return and also the average return of the sample. This suggests that all of these three indicators were good predictors of future returns and an investor could have achieved excess returns following these strategies.

Table 6 shows results of long-only and long/short portfolios formed according to different strategies. Long-only portfolios significantly outperform long/short portfolios on the average performance basis. This is mainly caused by the fact that the average performance of the sample is 1.66% and as a result even the bottom 30% portfolios have positive average returns. This is why the Sharpe ratio is computed to capture the possible decrease in volatility for the long/short portfolios.

Table 6: Monthly returns (07/1986 – 06/2015) of long-only and long/short portfolios using individual indicators

		Sharpe ratio	St. Dev	Average Return
B/P Ratio	**Long/short**	0.2227	0.0289	0.93%
	Long only	0.3560	0.0553	2.25%
Gross Profitability	**Long/short**	0.1341	0.0249	0.62%
	Long only	0.3136	0.0553	2.02%
FCF Yield	**Long/short**	0.5928	0.0226	1.62%
	Long only	0.4015	0.0583	2.62%

Source: Author's computations

As was suggested by Novy-Marx (2014) the B/P ratio performs significantly better than the gross profitability for the long-only portfolio. The B/P ratio outperforms the gross profitability also using the long/short portfolios. However the outperformance is not statistically significant on a 5% level of significance. The FCF yield portfolios deliver the best results. Returns for both long-only and long/short portfolios are significantly higher than return of portfolios based on B/P ratio and gross profitability. Moreover, the long/short portfolio formed according to the FCF yield strategy has the highest Sharpe ratio among all other strategies, suggesting that this strategy acted very well during bear markets and other market downturns.

The growth of 1 dollar investment for different strategies in forming long-only portfolios and long/short portfolios is shown in Figure 8 and Figure 9 respectively.

These figures show the outperformance of the FCF yield strategy, especially among long/short portfolios.

Figure 8: Performance of $1 invested in long-only portfolios (log scale, individual ranks)
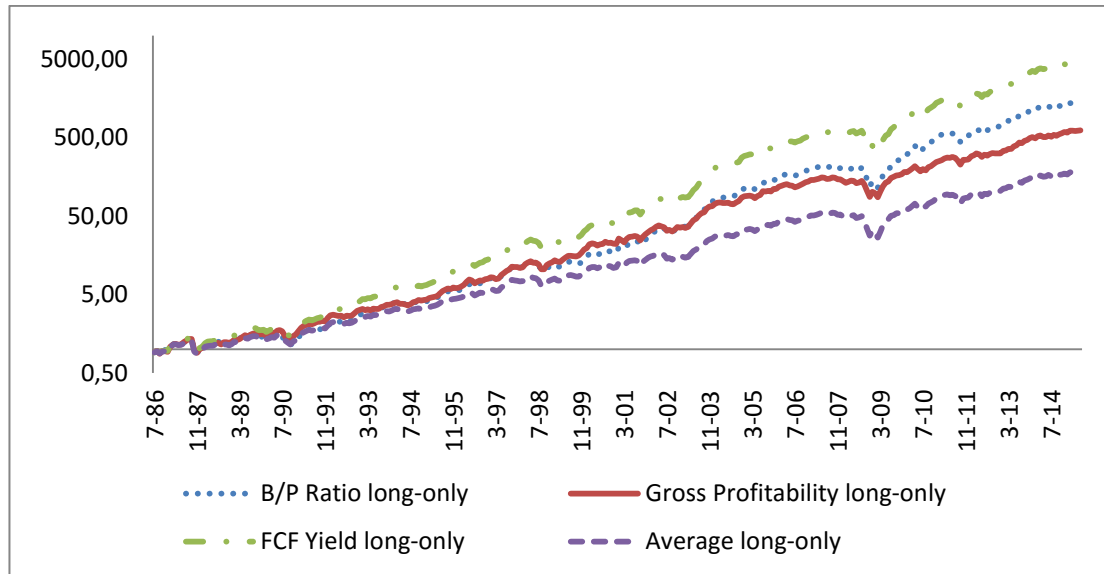
Source: Author's computations

Figure 9: Performance of $1 invested in long/short portfolios (log scale, individual ranks)
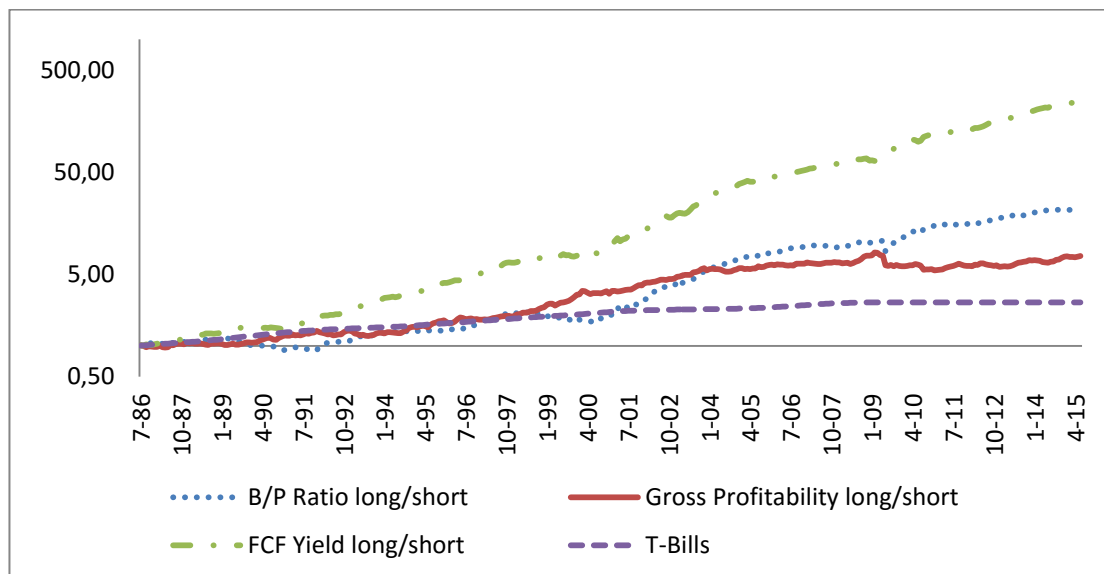
Source: Author's computations

Table 7 presents the value of one invested dollar at the end of sample period, maximum drawdowns experienced by different strategies during the testing period and one-month and one-year outperformance frequencies of different strategies. Outperformance frequencies are frequencies with which strategies outperformed the

sample average. The FCF yield long/short strategy would provide investors with a very low maximum drawdown compared to the sample average while delivering higher value of an invested dollar. The FCF long-only portfolio would be a bit riskier than other long-only portfolios constructed with respect to different strategies. However, this risk would be compensated with superior returns on investment. There was only 1 one-year period out 337 one-year periods during which the long-only FCF yield strategy would not outperform the sample average.

Table 7: Growth of $1 invested, drawdowns, outperformance frequencies (i.r.)

Strategies	Value of a $1 investment at the end of sample	Max drawdown	One-month outperformance frequency	One-year outperformance frequency
Long/short				
B/P ratio	21.31	-23.93%	43.39%	28.78%
Gross profitability	7.58	-32.91%	38.22%	26.41%
FCF Yield	246.47	-7.38%	47.13%	46.59%
T-Bills	2.66	0.00%	36.21%	16.32%
Long-only				
B/P ratio	1360.97	-47.32%	67.82%	84.27%
Gross profitability	614.85	-44.12%	63.79%	83.68%
FCF Yield	4583.54	-48.41%	79.60%	99.70%
Sample average	179.88	-51.83%	0.00%	0.00%

Source: Author's computations

4.2 Results throughout different time periods

The previous sub-chapter suggests that the FCF yield is a better indicator of future returns than the B/P ratio and the gross profitability. However, it is good to test the behavior of these different strategies during different time periods and also specifically during bull and bear markets to check whether the predictive power is robust. Time periods during which portfolio returns were analyzed are following: July 1986 to June 1996, July 1996 to June 2006, July 2006 to June 2015. Time periods during which the S&P 500 index was in a bear market period were used for analysis of a behavior of selected strategies during a bear market. The following periods were identified as bear markets: August 1987 to December 1987, March 2000 to October 2002 and October 2007 to March 2009. Other time periods were considered to be a bull market and were used for the analysis of strategies during bull markets.

4.2.1   July 1986 to June 1996

The first period during which the performances of portfolios were tested is July 1986 to June 1996. In this period all of these strategies have the ability to rank the stocks when the top 30% portfolios significantly outperform bottom 30% portfolios (B/P ratio on a 10% level of significance, gross profitability and FCF yield even on a 5% level of significance). The FCF yield strategy again has the best sorting power. However, the gross profitability performs better than the B/P ratio in this time period (this can be seen in Table 8).

The results are similar to long/short and long-only portfolios. Long-only portfolios significantly outperform the average performance of all companies in the data set (B/P ratio again on a 10% level of significance and gross profitability and FCF on a 5% level of significance). The average monthly return based on gross profitability is higher than the return of B/P ratio strategy but the difference is not statistically significant. These strategies have also almost the same Sharpe ratio. The FCF yield long-only strategy performs better than both gross profitability and B/P ratio strategies with significantly higher returns than both of these strategies and a higher Sharpe ratio. Results are the same with long/short portfolios. The gross profitability strategy delivers better returns than the gross profitability strategy but the difference is not significant again. However, the strategy based on the B/P ratio has a negative Sharpe ratio compared to a positive Sharpe ratio of the gross profitability strategy. The FCF yield long/short portfolio performs the best during this time period. It has the highest Sharpe ratio which is even higher than the Sharpe ratio of long-only

portfolio with a significantly higher return. The FCF yield long/short portfolio also delivers an average monthly return that is significantly higher than returns of other two strategies (see Table 9 for detailed results). The FCF yield is a better indicator of future returns during this period than other two tested indicators based on both long-only and long/short portfolios.

Table 8: Monthly returns (07/1986 - 06/1996) using individual indicators

		Sharpe ratio	St. Dev	Average Return
B/P Ratio	**Bottom 30%**	0.1758	0.0529	1.37%
	Mid 40%	0.2006	0.0507	1.46%
	Top 30%	0.2600	0.0491	1.72%
Gross Profitability	**Bottom 30%**	0.1788	0.0481	1.31%
	Mid 40%	0.1928	0.0505	1.42%
	Top 30%	0.2616	0.0537	1.85%
FCF Yield	**Bottom 30%**	0.1153	0.0481	1.00%
	Mid 40%	0.1830	0.0493	1.35%
	Top 30%	0.3354	0.0541	2.26%

Source: Author's computations

Table 9: Monthly returns (07/1986 – 06/1996) of long-only and long/short portfolios using individual indicators

		Sharpe ratio	St. Dev	Average Return
B/P Ratio	**Long/short**	-0.0447	0.0221	0.93%
	Long only	0.2600	0.0491	2.25%
Gross Profitability	**Long/short**	0.0439	0.0222	0.62%
	Long only	0.2616	0.0537	2.02%
FCF Yield	**Long/short**	0.4632	0.0176	1.62%
	Long only	0.3354	0.0541	2.62%

Source: Author's computations

4.2.2   July 1996 to June 2006

The second time period used for testing the performance of individual strategies is July 1996 to June 2006. All of tested strategies maintained the ranking power during this time period. For all tested strategies portfolios consisting of stocks ranked in the top 30% significantly outperformed portfolios of stocks ranked in the bottom 30% with t-stats equal to 5.27 for the B/P ratio, 4.79 for the gross profitability and 7.98 for the FCF yield. The FCF yield has again the best sorting power in this period. However, the B/P ratio ranks stock in a more profitable way than the gross profitability during this time period which is in line with overall results but opposite to results obtained from the July 1986 – June 1996 period. Further results are provided by the Table 10.

Table 10: Monthly returns (07/1996 - 06/2006) using individual indicators

		Sharpe ratio	**St. Dev**	**Average Return**
B/P Ratio	**Bottom 30%**	0.1731	0.0579	1.30%
	Mid 40%	0.2804	0.0494	1.68%
	Top 30%	0.5080	0.0502	2.84%
Gross Profitability	**Bottom 30%**	0.2478	0.0468	1.45%
	Mid 40%	0.2905	0.0533	1.84%
	Top 30%	0.4097	0.0532	2.48%
FCF Yield	**Bottom 30%**	0.1477	0.0571	1.14%
	Mid 40%	0.2650	0.0476	1.56%
	Top 30%	0.5515	0.0522	3.17%

Source: Author's computations

Long-only portfolios of every tested individual strategy again significantly outperform the average performance of all companies in the data set with t-stats of 6.04 for the B/P ratio, 5.29 for the gross profitability and 9.33 for the FCF yield. When looking at the performance of long-only portfolios, the FCF yield strategy is significantly outperforming strategies based on the B/P ratio and the gross profitability. The B/P ratio delivers significantly better results than the gross profitability strategy. These results hold both for the average monthly returns and Sharpe ratios. Results are similar when we look at how long/short portfolios performed. The long/short portfolio based on the FCF yield strategy has the highest

Sharpe ratio among all long-only and long/short portfolios and outperforms long/short portfolios constructed according to B/P ratio and gross profitability strategies. However, the outperformance over the B/P ratio strategy is not statistically significant. The B/P ratio outperforms the gross profitability strategy both in terms of the average monthly return and the Sharpe ratio but the difference is not significant even at a 10% level of significance. Results are summarized in Table 11.

Table 11: Monthly returns (07/1996 – 06/2006) of long-only and long/short portfolios using individual indicators

		Sharpe ratio	St. Dev	Average Return
B/P Ratio	**Long/short**	0.3885	0.0322	1.55%
	Long only	0.5080	0.0502	2.84%
Gross Profitability	**Long/short**	0.3101	0.0233	1.02%
	Long only	0.4097	0.0532	2.48%
FCF Yield	**Long/short**	0.6222	0.0279	2.03%
	Long only	0.5515	0.0522	3.17%

Source: Author's computations

4.2.3   July 2006 to June 2015

The last time period during which the testing of strategies formed on individual factors was performed is July 2006 to June 2015. The ranking power during this time period did not work that well as it did during previous time periods. Only the FCF yield maintained all of the previous properties. That is that the top 30% portfolio significantly outperforms the bottom 30% portfolio and that the return of the top 30% portfolio is higher than the return of the mid 40% portfolio which is higher than the return of the bottom 30% portfolio. If we look at portfolios formed according to the B/P ratio strategy, the average monthly return of the top 30% portfolio is higher than the return of the bottom 30% portfolio and the outperformance is statistically significant. However, the bottom 30% portfolio has higher return than the mid 40% portfolio. The gross profitability results are even worse. The top 30% does outperform the bottom 30% portfolio but their returns are not statistically different and the returns of bottom 30% portfolio and mid 40% portfolio are almost the same with the mid 40% portfolio performing insignificantly better. Summary of results is provided by Table 12.

Table 12: Monthly returns (07/2006 - 06/2015) using individual indicators

		Sharpe ratio	St. Dev	Average Return
B/P Ratio	**Bottom 30%**	0.1806	0.0672	1.30%
	Mid 40%	0.1698	0.0670	1.22%
	Top 30%	0.3168	0.0660	2.17%
Gross Profitability	**Bottom 30%**	0.1892	0.0721	1.45%
	Mid 40%	0.2050	0.0672	1.46%
	Top 30%	0.2705	0.0595	1.69%
FCF Yield	**Bottom 30%**	0.1216	0.0637	0.86%
	Mid 40%	0.1921	0.0665	1.36%
	Top 30%	0.3404	0.0686	2.42%

Source: Author's computations

Returns of long-only portfolios based on FCF yield and B/P ratio strategies significantly outperform the average return of the whole data set with t-stat of 6.51 for the FCF yield and 4.59 for the B/P ratio. The long-only portfolio of the gross profitability strategy would not provide investors with significantly higher returns than was the return of the average (the t-stat is equal to 1.34). The long-only FCF yield portfolio significantly outperforms the long-only portfolio based on the B/P ratio with the t-stat equal to 2.71 while having also higher Sharpe ratio. The FCF yield long/short portfolio had again the highest Sharpe ratio which is also the highest Sharpe ratio across all tested time periods and market situations. The FCF yield long/short portfolio delivers significantly higher returns than long/short portfolios based on the B/P ratio and the gross profitability which can be seen in Table 13. The long/short portfolio formed according to the B/P ratio outperforms the one formed according to the gross profitability. However, the difference is not statistically significant.

Table 13: Monthly returns (07/2006 – 06/2015) of long-only and long/short portfolios using individual indicators

		Sharpe ratio	St. Dev	Average Return
B/P Ratio	**Long/short**	0.2602	0.0306	0.88%
	Long only	0.3168	0.0660	2.17%
Gross Profitability	**Long/short**	0.0568	0.0287	0.25%
	Long only	0.2705	0.0595	1.69%
FCF Yield	**Long/short**	0.7308	0.0202	1.56%
	Long only	0.3404	0.0686	2.42%

Source: Author's computations

4.2.4   Bull markets

Some strategies might work especially well during the bear market or during the bull market. This is why it might be good to analyze the behavior of these strategies under market situations mentioned above. The first situation analyzed was the behavior during bull markets. The ranking power of all strategies is present under bull markets. Top 30% portfolios significantly outperform bottom 30% portfolios with t-stat of 5.06 for the B/P ratio, 3.68 for the gross profitability and 12.99 for the FCF yield. The FCF yield strategy once again delivers the best results (see Table 14).

Table 14: Monthly returns during bull markets using individual indicators

		Sharpe ratio	St. Dev	Average Return
B/P Ratio	**Bottom 30%**	0.3138	0.0490	1.82%
	Mid 40%	0.3370	0.0471	1.87%
	Top 30%	0.4950	0.0473	2.63%
Gross Profitability	**Bottom 30%**	0.3355	0.0471	1.86%
	Mid 40%	0.3589	0.0479	2.00%
	Top 30%	0.4496	0.0472	2.40%
FCF Yield	**Bottom 30%**	0.2662	0.0450	1.48%
	Mid 40%	0.3308	0.0464	1.82%
	Top 30%	0.5456	0.0504	3.03%

Source: Author's computations

All of three tested long-only portfolios outperformed the average return. The difference is significant with t-stat equal to 6.53 for the B/P ratio, 4.64 for the gross profitability and 12.43 for the FCF yield. The long-only portfolio created according to the B/P ratio strategy provided significantly higher returns than the one created according to the gross profitability. The best performing long-only portfolio was the one using the FCF yield strategy. It has significantly outperformed portfolios based on the B/P ratio and the gross profitability both in terms of average monthly return and the Sharpe ratio. The FCF yield long/short portfolio delivered the highest Sharpe ratio among all tested long-only and long/short portfolios and had also the highest monthly average return among long/short portfolios with differences between returns being statistically significant. The B/P ration long/short portfolio performed better than the long/short portfolio created by using the gross profitability strategy but the difference is not statistically significant. Results are summed up in Table 15.

Table 15: Monthly returns of long-only and long/short portfolios during bull markets using individual indicators

		Sharpe ratio	St. Dev	Average Return
B/P Ratio	**Long/short**	0.1913	0.0271	0.80%
	Long only	0.4950	0.0473	2.63%
Gross Profitability	**Long/short**	0.1022	0.0251	0.54%
	Long only	0.4496	0.0472	2.40%
FCF Yield	**Long/short**	0.6205	0.0204	1.55%
	Long only	0.5456	0.0504	3.03%

Source: Author's computations

4.2.5   Bear markets

Finally, the performance of strategies during bear markets was tested to complement the results obtained from bull markets testing. The ranking power of all strategies was present under the bear market conditions suggesting it was possible to earn excess return over the average. Top 30% portfolios once again outperform bottom 30% portfolios which can be seen in Table 16. Differences are statistically significant with t-stat of 3.2 for the B/P ratio, 3.21 for the gross profitability and 4.65 for the FCF yield strategy. The FCF yield strategy delivers the best results during bear market periods.

Table 16: Monthly returns during bear markets using individual indicators

		Sharpe ratio	St. Dev	Average Return
B/P Ratio	**Bottom 30%**	-0.1720	0.0930	-1.33%
	Mid 40%	-0.1135	0.0860	-0.71%
	Top 30%	-0.0026	0.0840	0.25%
Gross Profitability	**Bottom 30%**	-0.1530	0.0868	-1.06%
	Mid 40%	-0.1090	0.0882	-0.69%
	Top 30%	-0.0372	0.0845	-0.04%
FCF Yield	**Bottom 30%**	-0.1962	0.0926	-1.55%
	Mid 40%	-0.1145	0.0832	-0.68%
	Top 30%	0.0192	0.0869	0.44%

Source: Author's computations

Long-only portfolios based on FCF yield and B/P ratio delivered a positive average monthly return during bear markets despite the fact that the average monthly return of companies in the data sample was -0.61%. The gross profitability long-only portfolio was the only one to deliver a negative monthly average return. All of the long-only portfolios tested significantly outperformed the average (t-stats were following: 3.34 for the B/P ratio, 3.42 for the gross profitability and 5.24 for the FCF yield). Monthly average returns and Sharpe ratios can be seen in Table 17. However, differences in returns are not statistically significant using the 5% level of significance. The difference between returns of the FCF yield and gross profitability long-only portfolios is significant when the 10% level of significance is used. Long/short portfolios perform obviously better during bear markets than long-only portfolios. All of long/short portfolios had not only higher average monthly returns than their long-only counterparts but these returns were achieved with much lower volatility which has obviously resulted in a higher Sharpe ratio of long/short portfolios. The FCF yield long/short portfolio performs the best, followed by the B/P ratio portfolio and gross profitability portfolio. However, the differences are not significant again on a 5% level of significance and the only significant difference is between the FCF yield portfolio and gross profitability portfolio using the 10% level of significance with t-stat equal to 1.83.

Table 17: Monthly returns of long-only and long/short portfolios during bear markets using individual indicators

		Sharpe ratio	St. Dev	Average Return
B/P Ratio	**Long/short**	0.3578	0.0365	1.58%
	Long only	-0.0026	0.0840	0.25%
Gross Profitability	**Long/short**	0.3175	0.0234	1.01%
	Long only	-0.0372	0.0845	-0.04%
FCF Yield	**Long/short**	0.5411	0.0317	1.98%
	Long only	0.0192	0.0869	0.44%

Source: Author's computations

Results shown in these sub-chapters suggest that the FCF yield is a better indicator of future returns than the B/P ratio and the gross profitability. Both long-only and long/short portfolios based on the FCF yield delivered better results in terms of the average monthly return and Sharpe ratio than portfolios constructed according to the B/P ration and the gross profitability. The FCF yield long-only portfolio has the highest one-year outperformance frequency of 99.7%. On the other hand, the FCF yield long/short portfolio showed the lowest maximum drawdown which is something that risk-averse investors appreciate. The analysis also suggests that all of these three strategies could be used to achieve above average returns over the long-term investment horizon, even though the FCF yield strategy should provide investors with the best returns on their investments.

5   Performance of portfolios formed by using joint ranks

Novy-Marx (2013, 2014) showed that strategies based on both value and quality indicators provide investors with better results than strategies using single value or single quality indicators. According to results presented in previous sub-chapters, the best single indicator of future stocks returns is the FCF yield. Novy-Marx (2014) compared the performance of many joint quality and value strategies and found out that the best strategy is the **profitable value**, a combination of B/P ratio and gross profitability. Therefore, this sub-chapter is focused on comparing the FCF yield and profitable value strategies. Moreover, strategy formed according to joint ranking on B/P ratio, gross profitability and FCF yield is added to the comparison to test whether adding the FCF yield rank to the profitable value strategy further enhances the portfolio performance. This strategy will be further referred to as a **FCF profitable value**.

5.1   Results throughout the whole testing period

As was shown in the previous sub-chapter, the FCF yield has a significant ranking power. Table 18 shows that the profitable value and the FCF profitable value have also the ability to rank the stocks. Top 30% portfolios deliver better returns than Mid 40% portfolios and these deliver better results than Bottom 30% portfolios. The Top 30% portfolios have significantly better monthly average returns than the Bottom 30% portfolios with t-stat of 9.07 for the profitable value and 11.58 for the FCF profitable value. The FCF profitable value seems to be the best indicator followed by the FCF yield. The Profitable value ranks stocks in the least efficient way.

Table 18: Monthly returns (07/1986 - 06/2015) using joint ranks

		Sharpe ratio	St. Dev	Average Return
FCF yield	**Bottom 30%**	0.1284	0.0562	1.00%
	Mid 40%	0.2095	0.0545	1.42%
	Top 30%	0.4015	0.0583	2.62%
Profitable value	**Bottom 30%**	0.1348	0.0585	1.07%
	Mid 40%	0.2355	0.0545	1.57%
	Top 30%	0.3680	0.0567	2.37%
FCF Profitable value	**Bottom 30%**	0.1147	0.0578	0.95%
	Mid 40%	0.2113	0.0548	1.44%
	Top 30%	0.4170	0.0572	2.67%

Source: Author's computations

The long-only portfolio based on the FCF yield performed the best among individual indicators. Moreover, it has a significantly better performance than the long-only portfolio constructed according to the profitable value strategy (with t-stat equal to 3.82). The FCF profitable value long-only portfolio also significantly outperforms the gross profitability portfolio (t-stat of 6.14). The FCF profitable value long-only portfolio performs the best. This strategy has the highest monthly average return and the highest Sharpe ratio. However, the difference between the FCF yield and FCF profitable value strategies is not statistically significant (t-stat of only 0.97). All of these long-only portfolios significantly outperform the sample average (t-stat of 13.49 for the FCF yield, 9.19 for the profitable value and 12.57 for the FCF profitable value).

Results are similar if we look at long/short portfolios. The FCF yield and FCF profitable value portfolios significantly outperform the profitable value portfolio (FCF yield with t-stat equal to 2.52 and FCF profitable value with t-stat of 6.38). The FCF profitable value long/short portfolio delivers the highest average monthly return. However, the difference is not statistically significant (t-stat of 1.05) from the average monthly return of the long/short portfolio based on FCF yield strategy. The FCF yield strategy has the lowest standard deviation and delivers the highest Sharpe ratio among all long/short and long-only portfolios.

Table 19: Monthly returns (07/1986 – 06/2015) of long-only and long/short portfolios using joint ranks

		Sharpe ratio	**St. Dev**	**Average Return**
FCF yield	**Long/short**	0.5928	0.0226	1.62%
	Long only	0.4015	0.0583	2.62%
Profitable value	**Long/short**	0.3808	0.0266	1.30%
	Long only	0.3680	0.0567	2.37%
FCF Profitable value	**Long/short**	0.5191	0.0277	1.72%
	Long only	0.4170	0.0572	2.67%

Source: Author's computations

The Growth of one dollar investment at the beginning of testing period for long-only portfolios and long/short portfolios is shown in Figure 10 and Figure 11. These figures show that the FCF profitable value delivers the best results among both long/short and long-only portfolios. However, these results are very close with the results of FCF yield portfolios. This finding is in line with the t-stat indicating no statistically significant difference.

Figure 10: Performance of $1 invested in long-only portfolios (log scale, joint ranks)
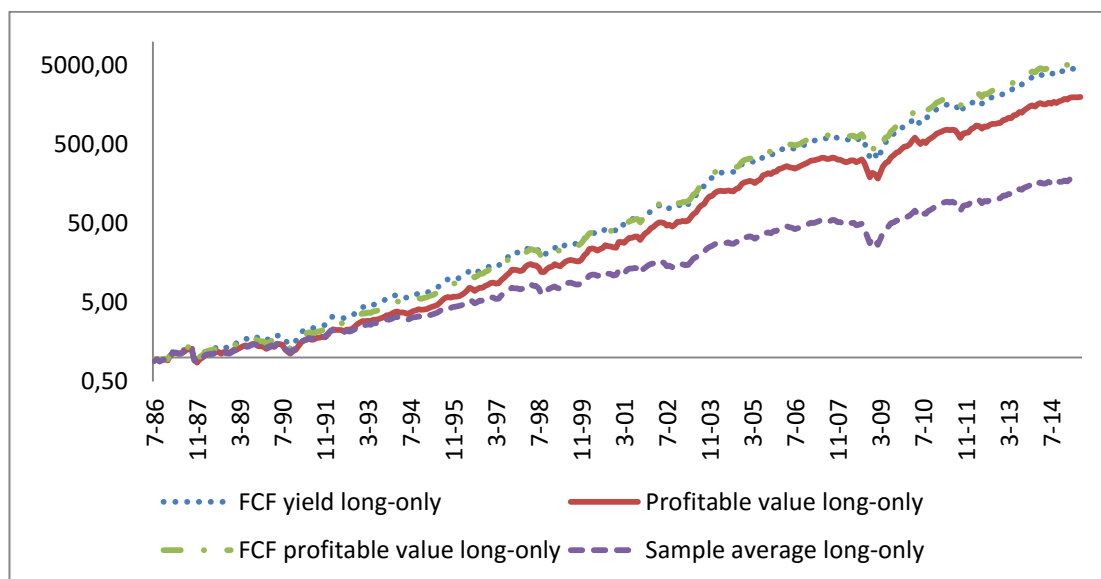
Source: Author's computations

Figure 11: Performance of $1 invested in long/short portfolios (log scale, joint ranks)
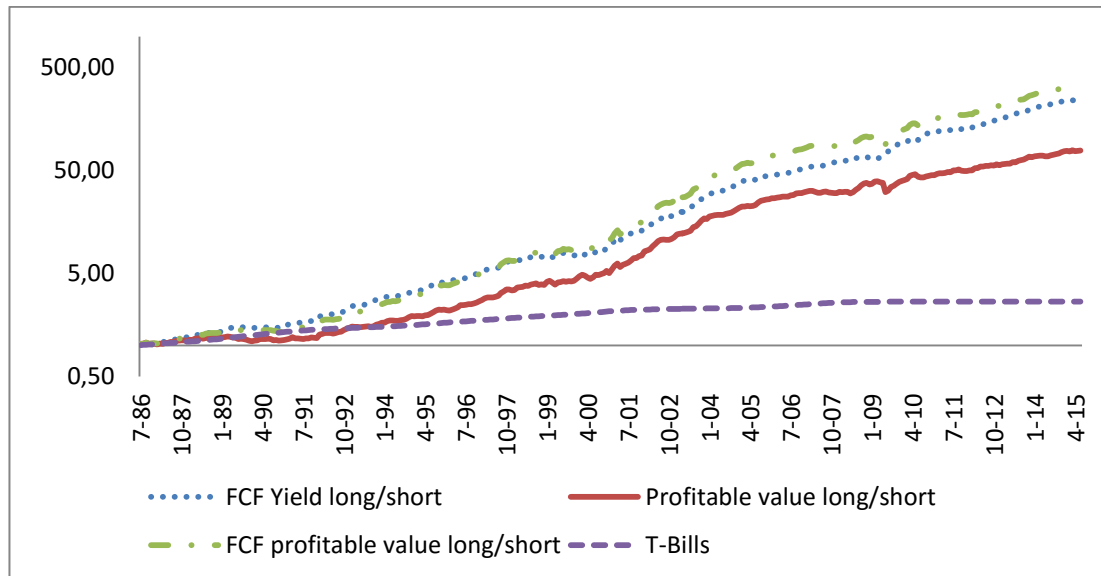
Source: Author's computations

Table 20 presents the value of one invested dollar at the end of sample period, maximum drawdowns experienced by different strategies during the testing period and one-month and one-year outperformance frequencies of different strategies. The FCF yield long/short strategy has again the lowest maximum drawdown among all strategies. However, the FCF yield no longer provides investors with the highest value of a $1 dollar investment. The FCF profitable value delivers the highest value of $1 dollar investment among long/short portfolios even though the maximum drawdown is much bigger than the drawdown for the FCF yield. This is caused especially by the outperformance frequencies. The FCF profitable value portfolio has the highest one-year outperformance frequency of 50.45% which is a very good result if we take into account that the outperformance is measured against the sample average long-only portfolio. The FCF profitable value long-only portfolio provides investors with the highest value of $1 dollar investment even though it has lower outperformance frequencies than the FCF yield long-only portfolio. This is caused mainly by lower maximum drawdowns in comparison to other long-only portfolios. Adding the FCF element to profitable value brings lower maximum drawdown on one side and increases both one-month and one-year outperformance frequencies on the other side which is a win-win situation.

Table 20: Growth of $1 invested, drawdowns, outperformance frequencies (j.r.)

Strategies	Value of a $1 investment at the end of sample	Max drawdown	One-month outperformance frequency	One-year outperformance frequency
Long/short				
FCF Yield	246.47	-7.38%	47.13%	46.59%
Profitable value	78.19	-21.58%	43.97%	36.50%
FCF Profitable value	331.30	-20.45%	48.85%	50.45%
T-Bills	2.66	0.00%	36.21%	16.32%
Long-only				
FCF Yield	4583.54	-48.41%	79.60%	99.70%
Profitable value	1979.17	-46.00%	70.11%	91.10%
FCF Profitable value	5410.70	-44.61%	78.16%	95.85%
Sample average	179.88	-51.83%	0.00%	0.00%

Source: Author's computations

5.2   Results throughout different time periods

The same time periods and market situations that were used to analyze the performance of different strategies based on individual ranks are used again in this sub-chapter to analyze the performance of strategies based on joint ranks.

5.2.1   July 1986 to June 1996

The first period analyzed is July 1986 to June 1996. As was shown previously, all of the individual strategies showed that they have significant ranking power during this time period. The ranking power is also present among profitable value and FCF

profitable value strategies. Top 30% portfolio significantly outperforms the Bottom 30% portfolios (t-stat of 4.81 for profitable value and 7.05 for the FCF profitable value). The comparison is presented in Table 21. However, strategies based on joint ranks do not provide investors with any significant improvement over strategies using individual ranks. The FCF profitable value results do not differ much from results achieved using the FCF yield strategy and the profitable value strategy is not an improvement when compared to the B/P ratio and gross profitability strategies.

Table 21: Monthly returns (07/1986 - 06/1996) using joint ranks

		Sharpe ratio	St. Dev	Average Return
FCF Yield	**Bottom 30%**	0.1153	0.0481	1.00%
	Mid 40%	0.1830	0.0493	1.35%
	Top 30%	0.3354	0.0541	2.26%
Profitable value	**Bottom 30%**	0.1251	0.0495	1.07%
	Mid 40%	0.2354	0.0500	1.62%
	Top 30%	0.2653	0.0522	1.83%
FCF Profitable value	**Bottom 30%**	0.0984	0.0485	0.92%
	Mid 40%	0.2062	0.0504	1.49%
	Top 30%	0.3255	0.0528	2.16%

Source: Author's computations

Profitable value and FCF profitable value long-only portfolios significantly outperform the sample average long-only portfolio with t-stat equal to 3.22 and 6.27 respectively. If long-only portfolios of tested strategies are compared to each other, the FCF profitable value and FCF yield strategies significantly outperform the profitable value strategy (t-stat of 5.08 for FCF profitable value and 4.71 for FCF yield). The FCF yield strategy, the best strategy among individual indicators, still provides the best results even among strategies constructed using joint ranks with the highest monthly average return and the highest Sharpe ratio which can be seen in Table 22. The only strategy which it does not significantly outperform is the FCF profitable value (t-stat of 1.54). The profitable value strategy performs a bit better than the B/P ratio but difference is not statistically significant with t-stat of 0.95. The gross profitability alone performs better than the profitable value but again the outperformance is not significant. Results are similar among long/short portfolios. FCF yield and FCF profitable value strategies outperform profitable value strategy

and the difference is significant with t-stat of 3.13 and 5.01 respectively. The difference between monthly average returns of FCF yield and FCF profitable value strategies is not statistically significant (t-stat of only 0.19) and Sharpe ratios are similar with FCF yield having the ratio slightly higher.

Table 22: Monthly returns (07/1986 – 06/1996) of long-only and long/short portfolios using joint ranks

		Sharpe ratio	**St. Dev**	**Average Return**
FCF Yield	**Long/short**	0.4632	0.0176	1.26%
	Long only	0.3354	0.0541	2.26%
Profitable value	**Long/short**	0.1831	0.0174	0.76%
	Long only	0.2653	0.0522	1.83%
FCF profitable value	**Long/short**	0.4125	0.0193	1.24%
	Long only	0.3255	0.0528	2.16%

Source: Author's computations

5.2.2   July 1996 to June 2006

The second time period that was used for testing the performance of individual strategies and is used also for strategies based on joint ranks is July 1996 to June 2006. The ranking power is present for strategies using joint ranks. The Top 30% portfolios significantly outperform Bottom 30% portfolios during this time period (t-stat of 7.72 for the profitable value and 8.70 for the FCF profitable value). The profitable value ranks portfolios in a more efficient way than B/P ratio or gross profitability alone. Also the FCF profitable value presents an improvement over the FCF yield during this time period. Results are presented in Table 23.

Joint rank strategies pay off when looking at long-only portfolios. The FCF profitable value long-only portfolio performs the best among all long-only portfolios during this time period which can be seen in Table 24. This strategy significantly outperforms the profitable value strategy (t-stat equal to 3.27) and also the FCF yield strategy (t-stat equal to 2.27). The FCF yield strategy outperforms the profitable value strategy when looking at long-only portfolios but the difference is not statistically significant (t-stat of only 0.49). Moreover, the profitable value strategy delivers significantly higher monthly average return than the B/P ratio strategy (t-stat of 2.60) and also the gross profitability strategy (t-stat of 5.08). The FCF profitable

value and profitable value long-only portfolios also significantly outperform the sample average long-only portfolio with t-stats of 9.30 and 8.00 respectively.

Table 23: Monthly returns (07/1996 - 06/2006) using joint ranks

		Sharpe ratio	St. Dev	Average Return
FCF Yield	**Bottom 30%**	0.1477	0.0571	1.14%
	Mid 40%	0.2650	0.0476	1.56%
	Top 30%	0.5515	0.0522	3.17%
Profitable value	**Bottom 30%**	0.1378	0.0531	1.03%
	Mid 40%	0.2767	0.0499	1.68%
	Top 30%	0.5293	0.0533	3.12%
FCF Profitable value	**Bottom 30%**	0.1126	0.0533	0.92%
	Mid 40%	0.2631	0.0490	1.59%
	Top 30%	0.5797	0.0528	3.36%

Source: Author's computations

Results are similar when analyzing long/short portfolios. The winning strategy in this time period is the FCF profitable value strategy with the highest average monthly return among long/short strategies and the highest Sharpe ratio among all analyzed portfolios. The FCF profitable value long/short portfolio significantly outperforms the equivalent profitable value portfolio with t-stat equal to 3.10 and also the FCF yield long/short portfolio (t-stat of 3.09). The profitable value strategy again significantly outperforms the B/P ratio and gross profitability strategy. It should be also noted that the average monthly return of FCF profitable value and profitable value long/short portfolios is higher than the average monthly return of the sample average long-only portfolio but the difference is not statistically significant.

Table 24: Monthly returns (07/1996 – 06/2006) of long-only and long/short portfolios using joint ranks

		Sharpe ratio	St. Dev	Average Return
FCF Yield	**Long/short**	0.6222	0.0279	2.03%
	Long only	0.5515	0.0522	3.17%
Profitable value	**Long/short**	0.6047	0.0297	2.09%
	Long only	0.5293	0.0533	3.12%
FCF profitable value	**Long/short**	0.6976	0.0307	2.44%
	Long only	0.5797	0.0528	3.36%

Source: Author's computations

5.2.3   July 2006 to June 2015

The last time period used in this testing of strategies is July 2006 to June 2015. The ranking power is again present for strategies using joint ranks to create portfolios. The Top 30% portfolio significantly outperforms the Bottom 30% portfolio with t-stat of 3.53 for the profitable value strategy and 4.94 for the FCF profitable value strategy. More details are presented in Table 25. The profitable value strategy created by joint ranking of B/P ratio and gross profitability indicators presents an improvement over these two strategies based on individual indicators. The B/P ratio strategy struggled to rank stocks in a proper way when the Bottom 30% portfolio performed better than the Mid 40% portfolio. The gross profitability strategy did not work at all because the Top 30% portfolio did not significantly outperform the Bottom 30% portfolio and the average monthly return was way below the return of the Top 30% portfolio created according to the B/P ratio strategy. The profitable value strategy ranks the stocks in a proper way with the performance of its Top 30% portfolio being slightly lower than the B/P ratio one. However, the difference is not statistically significant. However, the FCF profitable value strategy did not deliver any significant improvement over the FCF yield strategy during this time period in terms of the ranking power.

Table 25: Monthly returns (07/2006 - 06/2015) using joint ranks

		Sharpe ratio	St. Dev	Average Return
FCF Yield	**Bottom 30%**	0.1216	0.0637	0.86%
	Mid 40%	0.1921	0.0665	1.36%
	Top 30%	0.3404	0.0686	2.42%
Profitable value	**Bottom 30%**	0.1438	0.0724	1.12%
	Mid 40%	0.2028	0.0640	1.38%
	Top 30%	0.3186	0.0642	2.13%
FCF Profitable value	**Bottom 30%**	0.1318	0.0696	1.00%
	Mid 40%	0.1755	0.0649	1.22%
	Top 30%	0.3612	0.0657	2.46%

Source: Author's computations

Long-only portfolios based on joint ranks significantly outperform the long-only sample average portfolio (t-stat of 4.44 for the profitable value and 6.40 for the FCF profitable value). Both FCF yield and FCF profitable value strategies provide investors with a higher average monthly return than the profitable value strategy and differences are statistically significant (t-stat of 2.02 for the FCF yield and 2.89 for the FCF profitable value). Strategies based on joint ranks do not add value during this time period. The FCF profitable value strategy did perform a bit better than the FCF yield strategy but the t-stat is equal only to 0.51 resulting in the difference not being significant. The profitable value strategy outperformed the gross profitability strategy (t-stat of 3.40). However, the monthly average return was lower than the return of the B/P ratio strategy but again the difference is not statistically significant.

Strategies based on joint ranks do not present again any improvement if we look at long/short portfolios. The FCF yield long/short portfolio delivers the highest Sharpe ratio and also the highest average monthly return. The FCF profitable value performs slightly worse but the difference of monthly returns between FCF yield strategy and FCF profitable value is not statistically significant (t-stat of 0.43). The profitable value strategy performs significantly worse than the FCF yield strategy (t-stat of 1.90) and also the FCF profitable value strategy (t-stat of 3.25). The profitable value strategy provides investors with higher monthly average returns than the B/P ratio strategy and the gross profitability strategy. However, the difference between

returns of the profitable value and B/P ratio long/short portfolios is not significant. Results are summarized in Table 26.

Table 26: Monthly returns (07/2006 – 06/2015) of long-only and long/short portfolios using joint ranks

		Sharpe ratio	St. Dev	Average Return
FCF Yield	**Long/short**	0.7308	0.0202	1.56%
	Long only	0.3404	0.0686	2.42%
Profitable value	**Long/short**	0.3116	0.0296	1.00%
	Long only	0.3186	0.0642	2.13%
FCF profitable value	**Long/short**	0.4481	0.0307	1.46%
	Long only	0.3612	0.0657	2.46%

Source: Author's computations

5.2.4   Bull markets

All of the individual strategies showed significant ranking power during bull markets. Strategies based on joint ranks are also able to rank stocks from the best to the worst in terms of monthly average returns. The profitable value strategy ranks stocks in a more efficient way than B/P ratio and gross profitability strategies. The Top 30% portfolio outperforms the Bottom 30% with the t-stat equal to 8.14 which is a highly significant difference. The FCF profitable value delivers even more powerful ranking power with the Top 30% having significantly higher monthly average return than the Bottom 30% portfolio (t-stat of 10.47). However, the difference in ranking powers of FCF yield and FCF profitable value strategies is not significant. Detailed results are presented in Table 27.

Long-only portfolios constructed according to strategies based on joint ranks significantly outperformed the sample average long-only portfolio (t-stat of 8.26 for the profitable value and 11.55 for the FCF profitable value). The profitable value strategy delivered higher monthly average returns than B/P ratio and gross profitability strategies but the difference is significant only for the gross profitability with the t-stat of 4.27 (t-stat for the B/P ratio is equal to 1.58). However, the profitable value strategy performed worse than the FCF yield strategy which uses just one indicator and the difference is statistically significant with the t-stat of 4.09. The FCF profitable value performed slightly better than the FCF yield but that the t-stat is

equal to 0.37 which points to the fact that the difference is minimal and not statistically significant.

Table 27: Monthly returns during bull markets using joint ranks

		Sharpe ratio	St. Dev	Average Return
FCF Yield	**Bottom 30%**	0.2662	0.0450	1.48%
	Mid 40%	0.3308	0.0464	1.82%
	Top 30%	0.5456	0.0504	3.03%
Profitable value	**Bottom 30%**	0.2680	0.0483	1.58%
	Mid 40%	0.3673	0.0458	1.97%
	Top 30%	0.5032	0.0489	2.74%
FCF Profitable value	**Bottom 30%**	0.2495	0.0471	1.46%
	Mid 40%	0.3337	0.0463	1.83%
	Top 30%	0.5584	0.0495	3.05%

Source: Author's computations

The profitable value long-short portfolio significantly outperformed both the B/P ratio long-short portfolio (t-stat of 3.02) and the gross profitability long-short portfolio (t-stat of 4.66). But once again, the profitable value strategy performs worse than strategies using free cash flows. The monthly average return of the FCF profitable value strategy is significantly greater than the return of profitable value strategy with the t-stat equal to 5.92 and also the FCF yield strategy performed significantly better (t-stat of 2.84). The FCF yield strategy performed the best among strategies based on individual indicators and it has the highest Sharpe ratio among all strategies due to very low standard deviation (see Table 28). The FCF profitable value strategy delivered the highest average monthly return but the difference from the FCF yield strategy is not statistically significant (t-stat of 0.39).

Table 28: Monthly returns of long-only and long/short portfolios during bull markets using joint ranks

		Sharpe ratio	St. Dev	Average Return
FCF Yield	**Long/short**	0.6205	0.0204	1.55%
	Long only	0.5456	0.0504	3.03%
Profitable value	**Long/short**	0.3597	0.0245	1.17%
	Long only	0.5032	0.0489	2.74%
FCF profitable value	**Long/short**	0.5029	0.0260	1.59%
	Long only	0.5584	0.0495	3.05%

Source: Author's computations

5.2.5   Bear markets

The last scenario during which strategies constructed according to joint ranks were tested is the bear market periods. The ranking power is very strong among joint ranks strategies. The profitable value Top 30% portfolio delivered monthly average return of 0.36% while the Bottom 30% portfolio average monthly return was -1.63% and the difference is statistically significant with t-stat equal to 4.17. The FCF profitable value strategy performed even better when ranking stocks. The Top 30% portfolio outperformed the Bottom 30% and the difference is statistically significant (t-stat of 5.10). The sample average monthly return during bear markets is -0.61% and Table 29 shows that Top 30% portfolios of selected strategies were able to deliver positive returns even when bad times occurred on the stock market exchange.

Long-only portfolios based on joint ranks strategies would provide investors with positive returns even during bear markets. The profitable value strategy's average monthly return is 0.36% which is significantly greater return than the return provided by the sample average long-only portfolio (t-stat of 4.08). The profitable value strategy also presents an improvement over the B/P ratio strategy and the gross profitability strategy. However, the difference is only significant in case of the gross profitability strategy (t-stat of 2.07). In case of the B/P ratio strategy the t-stat is equal to 0.75 which points to the fact that the difference is not statistically significant. The FCF yield strategy was the best one among individual indicators strategies. The FCF profitable value long-only portfolio has even higher average monthly return but the difference is not significant (t-stat of 1.27). The FCF profitable value long-only portfolio significantly outperforms the long-only profitable value portfolio (t-stat of

2.6). The difference between returns of long-only portfolios constructed according to the profitable value strategy and the FCF yield strategy is not statistically significant (t-stat of 0.39).

Table 29: Monthly returns during bear markets using joint ranks

		Sharpe ratio	St. Dev	Average Return
FCF Yield	**Bottom 30%**	-0.1962	0.0926	-1.55%
	Mid 40%	-0.1145	0.0832	-0.68%
	Top 30%	0.0192	0.0869	0.44%
Profitable value	**Bottom 30%**	-0.2058	0.0923	-1.63%
	Mid 40%	-0.0985	0.0849	-0.57%
	Top 30%	0.0108	0.0850	0.36%
FCF Profitable value	**Bottom 30%**	-0.2215	0.0929	-1.79%
	Mid 40%	-0.1069	0.0847	-0.64%
	Top 30%	0.0406	0.0850	0.62%

Source: Author's computations

The best strategy for a long/short portfolio during bear markets is the FCF profitable value. This strategy had an average monthly return of 2.40% which is a lot higher return than the sample average return of -0.61%. The long/short portfolio based on the FCF profitable value strategy outperforms all other strategies tested with t-stats equal to 2.37 for the profitable value strategy, 1.69 for the FCF yield strategy, 3.06 for the gross profitability strategy and 3.67 for the B/P ratio strategy. The strategy with the second best performance is the profitable value strategy. The performance is summarized in Table 30. However, the difference between returns of the profitable value strategy and the FCF yield strategy is not statistically significant (t-stat of 0.02). The profitable value strategy significantly outperforms the gross profitability strategy with the t-stat equal to 2.61 and also outperforms the B/P ratio strategy but the difference is not significant (t-stat of 1.32).

Table 30: Monthly returns of long-only and long/short portfolios during bear markets using joint ranks

		Sharpe ratio	St. Dev	Average Return
FCF Yield	**Long/short**	0.5411	0.0317	1.98%
	Long only	0.0192	0.0869	0.44%
Profitable value	**Long/short**	0.4865	0.0354	1.99%
	Long only	0.0108	0.0850	0.36%
FCF profitable value	**Long/short**	0.6105	0.0349	2.40%
	Long only	0.0406	0.0850	0.62%

Source: Author's computations

5.3 Summary of results

The results confirm that the B/P ratio strategy delivered higher returns than the gross profitability strategy. Among long-only portfolios, the B/P strategy performed significantly better during the whole testing period and also during two out of three tested sub-periods and bull markets. The B/P ratio strategy outperformed the gross profitability strategy also during bear markets but the difference is not statistically significant. The gross profitability strategy delivered statistically insignificant higher returns than the B/P strategy during one sub-period. Among long/short portfolios the B/P ratio strategy outperformed the gross profitability strategy in all tested scenarios and time periods except for one time sub-period. However, differences in performances of these long/short portfolios are not statistically significant.

The FCF yield strategy performed the best among strategies using individual indicators. For long-only portfolios the FCF yield strategy delivered significantly higher returns than the gross profitability strategy during all tested scenarios. The FCF yield strategy also significantly outperformed the B/P ratio strategy during all tested scenarios except for bear markets where the outperformance was not statistically significant. The FCF yield strategy also significantly outperformed the gross profitability strategy during all tested scenarios within long/short portfolios. The FCF yield long/short portfolios also significantly outperformed the B/P ratio long/short portfolios in all scenarios except for the 07/1996-06/2006 time period and bear markets where the outperformance was not statistically significant.

The performance of strategies based on joint ranks was also tested. To compare these strategies to strategies using individual indicators, the FCF yield

strategy was added to this comparison. Among long-only portfolios the FCF profitable value strategy performed the best in five out of six tested scenarios. However, the outperformance over the FCF yield strategy was statistically significant only during one tested sub-period. The FCF profitable value strategy significantly outperformed the profitable value strategy in every tested scenario. The FCF yield strategy performed the best among all tested strategies during the 07/1986-06/1996 time period but the difference between the FCF yield strategy the FCF profitable value strategy was not statistically significant. The FCF yield strategy also significantly outperformed the gross profitability strategy except for one tested sub-period and bear markets where the difference was not significant.

The FCF profitable value strategy performed the best also within long/short portfolios. The FCF profitable value strategy significantly outperformed the profitable value strategy during every tested scenario. However, if we compare the FCF profitable value strategy to the FCF yield strategy, the outperformance is not that clear. The FCF profitable value strategy significantly outperformed the FCF yield strategy during one tested sub-period and during bear markets, then the difference was not statistically significant also twice (throughout the whole tested period and bull markets) and in two tested sub-periods the FCF yield strategy delivered higher performance but the difference was not statistically significant. Detailed table is provided in the Appendix A.

Table 31 summarizes the ranking power of different strategies during different time periods and under different market situations. The ranking power of tested strategies is present and significant at the 5% level of significance under each scenario with the exception of the gross profitability and the B/P ratio strategies during the 07/2006-07/2015 time period. Table 32 summarizes time periods and market situations during which returns of long-only portfolios of different strategies significantly outperformed at 5% level of significance the sample average. All of the tested strategies significantly outperformed the sample average during all tested scenarios using a 5% level of significance except for the gross profitability during the 07/2006-06/2015 sub-period where the strategy did not significantly outperform the sample average and the B/P ratio during the 07/1986-06/1996 sub-period where the strategy outperformed the sample average on a 10% level of significance.

Table 31: The ranking power of tested strategies

Ranking power	Overall	07/1986-06/1996	07/1996-06/2006	07/2006-06/2015	Bull markets	Bear markets
Gross Profitability	Yes	Yes	Yes	No	Yes	Yes
B/P ratio	Yes	Yes*	Yes	No	Yes	Yes
FCF Yield	Yes	Yes	Yes	Yes	Yes	Yes
Profitable value	Yes	Yes	Yes	Yes	Yes	Yes
FCF profitable value	Yes	Yes	Yes	Yes	Yes	Yes

10% level of significance

Source: Author's computations

Table 32: Outperformance of long-only portfolios versus the sample average

	Overall	07/1986-06/1996	07/1996-06/2006	07/2006-06/2015	Bull markets	Bear markets
Gross Profitability	Yes	Yes	Yes	No	Yes	Yes
B/P ratio	Yes	Yes*	Yes	Yes	Yes	Yes
FCF Yield	Yes	Yes	Yes	Yes	Yes	Yes
Profitable value	Yes	Yes	Yes	Yes	Yes	Yes
FCF profitable value	Yes	Yes	Yes	Yes	Yes	Yes

10% level of significance

Source: Author's computations

6   Conclusion

This thesis examined the predictive power of different strategies for future stock returns. The analysis was conducted using a data sample of 3976 firms traded on the New York Stock Exchange (NYSE) and NASDAQ during a 29 year time horizon, from July 1986 to June 2015. Predictive powers of different strategies were also tested during three sub-periods and during bull markets and bear markets to check whether the predictive power is robust. Strategies were tested using both long-only and long/short portfolios. The main goal of this thesis was to compare the gross profitability strategy with the free cash flow strategy which has not been done in the original paper and to test whether adding the FCF variable to the joint ranking process of profitable value strategy would deliver even better results.

The first part of the analysis was focused on strategies using individual indicators. The predictive power of the gross profitability, B/P ratio and FCF yield indicators was confirmed. The only exception was the gross profitability during one of the tested sub-periods when the long-only portfolio based on the gross profitability had lower average monthly return than was the return of the sample average. It was found out that the FCF yield is a better indicator of future stock returns than the gross profitability. The difference between average monthly returns was significant during all tested time periods and market situations using both long-only and long/short portfolios. Portfolios based on the FCF yield had the highest one-month and one-year outperformance frequencies and also the value of 1 dollar invested at the beginning of the tested period was the highest at the end of the tested period for portfolios based on the FCF yield. Moreover, the maximum drawdown for the long/short portfolio based on the FCF yield was considerably lower than maximum drawdowns of long/short portfolios constructed according to the B/P ratio and the gross profitability while delivering higher returns and outperformance frequencies. The B/P ratio was confirmed to be a predictor of future stock returns than the gross profitability when constructing long-only portfolios. The difference between average monthly returns was significant during all tested scenarios except for one time sub-period (07/1986-06/1996) and bear markets. It was not confirmed that the B/P ratio is a better predictor of future stock returns than the gross profitability when constructing long/short portfolios since differences between returns were not statistically significant.

The second part of the analysis was focused on strategies using joint ranks and their comparison with the best strategy based on an individual indicator which is the FCF yield. It was found out that the FCF yield is a better predictor of future stock returns than the profitable value except for bear market periods. Among long-only portfolios the FCF yield delivered significantly higher returns during all tested scenarios except one testing sub-period and bear markets. Results were the same for long/short portfolios where the FCF yield again significantly outperformed the profitable value during all tested scenarios with the exception of one tested sub-period and bear markets. The newly created FCF profitable value strategy performed even better. The FCF profitable value long-only portfolio significantly outperformed the profitable value long-only portfolio during all tested scenarios including all tested sub-periods and bear markets. Results were the same for long/short portfolios where the FCF profitable value delivered significantly higher results than the profitable value during all tested scenarios. The FCF profitable value long-only portfolio had the lowest maximum drawdowns and provided investors with the highest value of $1 invested at the beginning of the tested period when compared to other long-only portfolios. However, the FCF yield had the highest one-month and one-year outperformance frequencies. Among long/short portfolios the FCF profitable value had the highest one-month and one-year outperformance frequencies and delivered the highest value of $1 invested at the beginning of the tested period. The FCF yield portfolio had the lowest maximum drawdown. When the average monthly returns of the FCF profitable value strategy were compared to the returns of the FCF yield strategy it was found that the FCF profitable value delivered significantly higher returns for both long-only and long/short portfolios during one tested sub-period and also during bear markets for the long/short portfolios. The FCF yield did not deliver significantly higher returns in any period. Therefore, one could conclude that the FCF profitable value has a better predictive power for future stock returns than the FCF yield at least during some time periods or market situations and should be preferred to the FCF yield.

Even though the analysis was performed with as much data as was available at the Thomson Reuters platform, the focus was only on the NYSE and NASDAQ markets. Therefore, the analysis could be extended by including firms that are traded on other stock exchanges and on international markets. Another interesting addition to this work would be an inclusion of transaction costs to make the returns more realistic. Finally, more different variables could be included in the joint ranking process when forming portfolios which might uncover even better predictors of future stock market returns than the proposed FCF profitable value.

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Appendix A: Graphical representation of results

Long-only portfolios

Overall

| FCF profitable value | not significant | FCF Yield | significant | Profitable value | not significant | B/P ratio | significant | Gross Profitability |

07/1986-06/1996

| FCF Yield | not significant | FCF profitable value | significant | Gross Profitability | not significant | Profitable value | not significant | B/P ratio |

07/1996-06/2006

| FCF profitable value | significant | FCF Yield | not significant | Profitable value | significant | B/P ratio | significant | Gross Profitability |

07/2006-06/2015

| FCF profitable value | not significant | FCF Yield | significant | B/P ratio | not significant | Profitable value | significant | Gross Profitability |

Bull markets

| FCF profitable value | not significant | FCF Yield | significant | Profitable value | not significant | B/P ratio | significant | Gross Profitability |

Bear markets

| FCF profitable value | not significant | FCF Yield | not significant | Profitable value | not significant | B/P ratio | not significant | Gross Profitability |

During bear markets the FCF yield and profitable value strategies significantly outperform the gross profitability strategy on a 5% and 10% level of significance respectively. Also the FCF profitable value strategy significantly outperforms the profitable value strategy.

Long-short portfolios

Overall

FCF profitable value	not significant →	FCF Yield	significant →	Profitable value	significant →	B/P ratio	not significant →	Gross Profitability

07/1986-06/1996

FCF Yield	not significant →	FCF profitable value	significant →	Profitable value	not significant →	Gross Profitability	not significant →	B/P ratio

07/1996-06/2006

FCF profitable value	significant →	Profitable value	not significant →	FCF Yield	not significant →	B/P ratio	not significant →	Gross Profitability

07/2006-06/2015

FCF Yield	not significant →	FCF profitable value	significant →	Profitable value	not significant →	B/P ratio	not significant →	Gross Profitability

Bull markets

FCF profitable value	not significant →	FCF Yield	significant →	Profitable value	significant →	B/P ratio	not significant →	Gross Profitability

Bear markets

FCF profitable value	significant →	Profitable value	not significant →	FCF Yield	not significant →	B/P ratio	not significant →	Gross Profitability

During the first tested time period (07/1986-06/1996) the profitable value strategy significantly outperforms the gross profitability strategy. During the second tested time period (07/1996-06/2006) the FCF yield strategy significantly outperforms the gross profitability strategy and the profitable value strategy significantly outperforms both the B/P ratio strategy and the gross profitability strategy. During the third tested time period (07/2006-06/2015) the profitable value strategy significantly outperforms the gross profitability strategy. During bear markets the FCF yield strategy and the profitable value strategy significantly outperform the gross profitability on a 5% and 10% level of significance respectively.