An Empirical Investigation of the Effectiveness of Different Asset Choice Methodologies under different Market Conditions

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Abstract (English)

The project "An Empirical Investigation of the Effectiveness of Different Asset Choice Methodologies under different Market Conditions" by Johannes Schriefers extends research on the profitability and implied riskiness of different investment strategies. While existing research mainly investigates the performance of portfolio formation strategies on a stand-alone basis, this study compares the performance of various portfolio formation methodologies under different market conditions and across different industries. More specifically, I study and compare returns, risk and abnormal returns of portfolios based on the Fama & French 5 Factor and the 3 Factor models, based on the changes as well as the level of financial ratios, and finally based on analyst forecasts and trade recommendations. The sample analyzed is the whole NYSE between 2005 and 2018. By investigating this comparably long period, I am able to examine the portfolio performances across different market conditions. Here, the period of the financial crisis beginning in 2007 is investigated, next to the market recovery in the years after the crisis and stable market conditions in the recent years. After carefully comparing the corresponding portfolio performances, the portfolios based on the delta of ratios, the level of ratios and the portfolio based on the 5FF methodology appear to provide the best results. While the portfolios based on the financial analysis are most profitable over the crisis and market recovery period, the 5FF portfolio performs superior under stable market conditions. Surprisingly, analyst forecasts and trade recommendations are not as effective. These conclusions have been confirmed across different industries.

Abstrato (Português)

Este projeto é uma extensão da investigação já existente relativa à rentabilidade e risco inerente a diversas estratégias de investimento. Enquanto que a pesquisa anterior examina a performance isolada de portefólios formados seguindo múltiplas metodologias, este estudo estabelece uma comparação entre a performance desses mesmos portefólios. Estes são comparados sob diversas condições de mercado e avaliados em diferentes setores de atividade. Especificamente, estudo e comparo o retorno, risco e retornos anormais dos vários portefólios baseados nos modelos Fama & French 5 Factors e 3 Factors, na variação e nível de rácios financeiros e, finalmente, nas previsões e recomendações dos analistas financeiros. Para investigar estas metodologias adotei como amostra a NYSE entre 2005 e 2018. A investigação de um período de tempo longo permite estabelecer comparações entre a performance dos portefólios sob diferentes condições de mercado. Neste caso, o período de crise financeira que se iniciou em 2007 é analisado, bem

como o período de recuperação que se sucedeu, e os mais recentes anos de estabilidade. Depois de uma análise cuidadosa da performance dos vários portefólios conclui-se que os portefólios baseados no delta dos rácios, no nível dos rácios e no modelo 5FF parecem produzir os melhores resultados. Embora os portefólios baseados na análise financeira sejam mais rentáveis no período de crise e de recuperação, o portefólio 5FF demonstra ter uma performance superior num mercado estável. Surpreendentemente, a metodologia baseada nas previsões e recomendações dos analistas não é tão eficaz. Estes resultados são verdadeiros para as várias indústrias analisadas.

Keywords: Asset Choice Methodologies, Abnormal returns, Ratios, Financial analysis, Portfolio performance, Performance comparison, market conditions

Palavras-Chave: Metodologias de Seleção de Ativos, Retornos Anormais, Rácios, Análise Financeira, Performance de Portfólio, Comparação de Performances, Condições de Mercado.

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1 Introduction

Nowadays, detailed stock information is publicly available via many different sources. Expert opinions regarding the investment attractiveness of a stock are easy to obtain, together with forecasts for publicly traded companies' future by analysts or managers. Nonetheless, research still confirms a significant number of market inefficiencies. One the one hand, the data available need to be scanned to identify the most relevant and accurate. One the other hand, the usefulness of specific data can differ among investment approaches, market conditions and industries. As a result, the variables and data based on which investment decisions are made, cannot generally be standardized.

Even after recognizing this, it is difficult to determine what factors/models result in the most successful investment as each has its costs and benefits.

First, investors can perform their own financial analysis of a company and calculate the corresponding ratios. The advantage here is that individual company factors are considered. However, even though ratios indicate a company's performance generally very well, only a limited amount of information is taken into consideration when basing the investment decision on them. Besides, the development of the overall market is not taken into consideration. This might result in a situation in which the investor overlooks important market data that indicate the overall course a company.

Secondly, the investors can base their decision on the input of asset pricing models. The best-recognized models here are the 3 Factor model and the 5 Factor model introduced by Fama & French. Next to other crucial stock information these models provide information about the degree to which an asset (stock) provides abnormal returns (returns that increase the corresponding market development in this point in time). In theory, since these models are based on the stock return, they consider all information available on the market, because all available information should be reflected in the stock price and consequently its return. However, even well-developed markets are not perfectly efficient, meaning that information is often overlooked. In addition, information is analyzed by regressing the returns to benchmark market/portfolio returns. As a result, individual company characteristics that might contain important information about the future performance of the corresponding stock might be overlooked here.

Third, investors can rely on expert opinions and forecasts. These forecasts are usually published by well-reputed analysts or investment banks. Especially referring to forecasted data seems to indicate the future performance of a stock even more representatively. As a result, basing the

investment decision on a forecasted ratio that is strongly correlated with the stock return seems reasonable. However, forecasts often contain error. This error might result from unforeseeable company (or also market) developments, or from a misassumption of the future development of particular company financials due to other reasons. As a result, due to the implied forecast error, forecasted company financials might have limited reliability.

Finally, investors can directly trade based on trade recommendations, experts make public. These trade recommendations often ease the situation for the trader, since they are very easy to interpret and consider, in theory, all relevant information. However, prior literature shows here as well that trade recommendations are unable to indeed provide a decision base to investors that enables them to earn abnormal returns. In addition, the forecast errors are present here as well.

Much research has been performed in order investigate the profitability of all of these strategies. Namely, the best ratios to predict stock returns have been identified (Zaremba & Szyska, 2016), the possibility to profit from abnormal stock returns over the market based on the asset pricing models has been proved (Fama & French, 1992), the profitability of trade recommendations is well investigated (Morgan & Stocken, 2003) and the general reliability of forecasted ratios has been determined (Dorestani & Razaee, 2011).

However, only a very limited amount of research has yet investigated the comparison of the profitability of all of these strategies, especially under different market conditions. By investigating the performance of portfolios that are established based on different methodologies and comparing them, this project is among the first that directly compares the profitability of the different methodologies over different time periods.

In this context, this project compares the profitability of portfolios based on ratios (Level ratios portfolio), on the delta of ratios (Δ Ratios portfolio), the abnormal stock return based on Fama & French 5 Factor model (5FF portfolio) as well as based on the Fama & French 3 Factor model (3FF), established from forecasted ratios (F ratios portfolio) and finally established based on trade recommendations (TR portfolio).

This project is based on panel data that include all companies traded at the NYSE beginning from 2005 until the end of 2018. By investigating the NYSE over this period of time, the sample includes the financial crisis beginning in year 2007, the following market recovery afterwards and stable market conditions after the recovery stage. Findings regarding the profitability of each methodology are provided under the consideration of various market conditions. As a result, the project at hand provides valuable insights as well as statistical evidence to any

investor about the profitability of each methodology in different market conditions in a developed market.

To evaluate the portfolio performance, the generated excess returns over the risk-free rate are brought into comparison with the level of risk the portfolio is exposed to via the Sharpe Ratio. Therefore, the research provides a comparable measure of the generated returns, adjusted for the risk, which is a crucial measure for any kind of investor. In addition, the abnormal returns over the market returns are determined via the alpha factor based on the Fama & French 5 Factor model.

As a result from these analyses, the portfolios realizing the highest Sharpe Factor and alpha returns are the 5FF portfolio, the portfolio based on Level Ratios and the portfolio based on the Delta of ratios. Especially over the crisis period, the portfolios based on financial analyses (Level ratios & Delta ratios portfolios) performed best, while the 5FF portfolio provided superior returns under stable market conditions. By taking less factors compared to the 5FF portfolio into account, the 3FF portfolio performed positively under all market conditions as well, while the portfolios based on trade recommendations and forecasted ratios constantly performed lowest. This might result from the impact of previously discussed forecast errors.

In addition to the general analysis based on the NYSE, an industry specific investigation is performed. In the scope of this project, the NYSE is divided in three industries, namely Consumer Services/ Other, Consumer Products & Production/Heavy Industry. Based on this industry classification, the portfolio formation methodologies are investigated under the different market conditions as well to identify possible differences in the effectivity of the methodologies among the different industry. As a result from this analysis, it is confirmed that the previously established conclusions hold true among the three industry groups.

To conclude, this project is among to compare the portfolio performance of different portfolios established based on the different portfolio formation periods. This statistical comparison is established on different market conditions as well as among different industries. As result, this project provides each investor with worthwhile information about how to make investment decisions in varying investment situations.

In chapter 2, the Literature review is given. This is followed by the detailed discussion of the applied methodology in chapter 3. Moreover, chapter 4 states out all results and considers the statistical significance of them. Then, in chapter 5 are all conclusions established. Finally, the limitations of this project and the opportunity of further research is critically evaluated in chapter 6.

2 Literature Review

In the following chapter, the existing and prior literature is carefully analyzed and set into relation to the topic of this project. In the context of this, the status quo of the existing research regarding the topic of this project is investigated. Here, the added value of this project to the prior research is pointed out. Furthermore, the literature regarding the models analyzed in this project is evaluated. Moreover, prior research regarding portfolio formation strategies is taken into account. As a final step, the investigated hypothesis is established.

2.1 Introduction & Status Quo of existing research

In the past decades, a considerable amount of discoveries regarding stock returns and anomalies were observed and established. In the scope of various strategies, academics and practitioners have tried to translate findings into efficient trading strategies. These strategies generally aim to predict and earn excess returns over the market. Thus, the underlying concept here is to identify and detect signals that help to forecast future equity performance. In this context, successfully observing the corresponding market and company specific signals provide investors with a considerable advantage over the market.

Applying the right strategy at the right time and under favorable market conditions provides the investor with a considerable advantage, although the underlying strategy might generally be known. However, as Marsh & Dimson (1999) state in the scope of the determination of Murphy's law, a successful investment strategy immediately loses its competitive advantage in the moment of its application since it becomes known to the market and other investors can copy the strategy. In addition, due to the fact that markets get more and more efficient in incorporating available public information, it is increasingly difficult to find strategies to profit from stock return anomalies.

Various strategies to identify attractive stocks have been developed in previous research. This project focuses on strategies that base the investment decision on company specific data and fundamental financial analysis and compare these to asset pricing strategies based exclusively on capital market data. Financial analysis strategies are based on very different input factors, i.e. aspects like financial ratios, various market benchmark factors and the attempt to establish a forecast of firm's fundamental performance. The scope of these strategies is to identify overvalued or undervalued firms (stocks) and provide investors with abnormal returns, i.e. returns that are in excess of the observed market return (Grinblatt, Tittmann & Wermers, 1995).

In the field of Financial Analysis, Zaremba & Szyszka (2016) have found significant empirical evidence of the possibility to earn abnormal returns based on financial analysis. In their study, 100 financial ratios are analyzed regarding their ability to identify favorable stocks by observing correlation factors and the corresponding statistical significance. This investigation is accomplished by Arkan (2016), who provides evidence about the efficiency of this strategy in emerging markets as well. Besides this, Lewellen (2002) proves the efficiency of financial ratios to forecast stock returns based on the stocks traded at the NYSE.

In line with the fact that markets develop towards increasing efficiency, expert recommendations to buy, hold or sell are publicly available. Here, one of the leading sources for expert recommendations is the I/B/E/S database, held and maintained by Thomson Reuters. I/B/E/S comprises more than 18,000 international companies and provides summarized and individual analyst's recommendations to buy, hold or sell particular stocks. By considering a wide range of financial data like cash-flows, earnings and other crucial data, the database developed to the fundamental source for this kind of information (Thomson Reuters, 2019).

Moreover, stock trade decisions can be based on the forecast of financial data. In this field, professionals publish the forecast of financial data and/or ratios per company to illustrate the financial development of the potential target and its resulting stock returns (Dorestani & Rezaee, 2011). In line with the previously discussed market efficiency, corresponding recommendations are publicly available. Here, Thomson Reuters provides via I/B/E/S Global Aggregates earnings forecasts including related ratios as well. This includes company data from companies that are included in all major indices over 87 countries (Thomson Reuters, 2019).

In the field of capital asset pricing arguably the most important contribution is by Fama & French (1992) with the introduction of their three factor model and the introduction of the five factor model in year 2014. In their study they discover that companies with specific characteristics tend to outperform companies without these characteristics. Thus, they developed models that take these characteristics into account by regressing benchmark market returns on firm returns in order to determine the corresponding beta factors and the abnormal returns of the portfolio (or stock).

All these various strategies to identify stocks that provide attractive returns for investors are frequently tested in regard to their effectivity and statistical significance. However, these strategies are, in the underlying literature, always tested separately.

Only rarely research compares the effectiveness and statistical significance under different market conditions. By aiming to fill the described gap that exists in research so far, this thesis is among the first research projects that investigate this. As a result, added value will be provided to all investors on the capital market by determining the effectiveness of different strategies to identify attractive stocks on the one hand, and taking different aspects like market conditions into consideration on the other hand.

2.2 Underlying Literature of models used

In the following, the underlying literature of the strategies investigated in the scope of this project is analyzed. This section is structured in paragraphs per model to provide a structured overview to the reader.

2.2.1 Financial Analysis & Ratios

In the scope of the strategy of financial analysis, investment decisions are based on financial ratios calculated from historical financial data. The overall basic assumption here is that companies that performed in a certain way in the past period are likely to perform accordingly in the future period. Important here is of course which ratios to be taken into account in order to determine future returns as reliable as possible.

In previous research, various ratios have been identified as most effective and statistically significant in identifying stocks that provide abnormal returns to the investor.

2.2.1.1 Identification of stocks with high returns based on ratios

To start, Zaremba & Szyszka (2016) tested the abnormal returns of portfolios formed based on one ratio each. The research was conducted on an European market. They identified ROA with an abnormal return of 1.15% (significantly different from 0 on a 5% level) and ROE with an abnormal return of 1.20% (significantly different from 0 on a 1% level) as the most effective ratios (among 100 ratios tested) (Zaremba & Szyszka, 2016). Furthermore, the ROIC is identified as suitable as well, with an observed abnormal return of 0.61% (significantly different from 0 on a 10% level). This observation confirms Brown & Rowe (2007), who previously identified ROIC as to be strongly correlated with stock returns. In additon, Brown and Rowe (2007) find the EPS ratio provides the investor with a considerable abnormal return of 1.45%

(statistically significant on a 5% level). The determination of the ratios ROA, ROE and EPS are underlined by research conducted by Arkan (2016). However, it has to be mentioned that Arkan focuses on an emerging market. Thus, the extension of his findings to companies traded at the NYSE might be limited.

Based on the aforementioned literature, the level ratios ROA, ROE, EPS & ROIC have been identified to be most relevant in identifying stocks with expected high abnormal returns. For further details, please refer to appendix 1.

2.2.1.2 Identification of stocks with high returns based on changes in ratios

Next to the previously stated analyses of level ratios, the development (i.e. change in ratios over a short period of time) needs to be considered here as well. It is assumed that the positive change of a crucial financial ratio indicates a positive development for the company and its corresponding stock and consequently produces a positive stock return. Due to the strong influence on the previously determined ratios, especially a positive increase in measures regarding profitability play an important role (Witkowska, 2006). An increase in profitability consequently has a positive impact on return based ratios (e.g. ROA, ROE & ROIC) and as well on earnings-based ratios (e.g. EPS). In line with this, Witkowska (2006) identifies the change in Gross Margin (GM) as to be representative for this effect. However, since the Gross Margin might determine an increase in profitability (Revenues - Cost of Goods Sold), it considers COGS as main cost (which might be true for most producing companies), but nevertheless disregards all operational costs (e.g. Personnel expenses). To address this, the change in Operating Margin (EBITDA) is considered to be relevant as well (Falope & Ajilore, 2009).

To conclude Change in GM & Change in EBITDA are best indicating stocks with a high probability of abnormal returns (for more details, please refer to appendix 1).

2.2.1.3 Identification of stocks based on forecasted ratios

Following forecasted ratios to identify attractive stocks generally follows a comparable approach like the one explained in 2.1. However, the significant difference is that these ratios are forecasted instead of historically observed.

By referring to forecasted financial measures, the investor is enabled to evaluate effectively how likely a particular business is to perform well (worse) in future medium or long terms (Thomson Reuters I/B/E/S Key Performance Indicators Database, 2019). However, underlying research shows that forecasting ratios always includes a forecast error that results from

deviations of a company's performance from the prediction of the expert who established the forecast (Dorestani & Rezaee, 2011). Here, the correctness of forecasted ratios increases with the increase in factors considered to establish the ratio (Dorestani & Razaee, 2011). The I/B/E/S database bases its forecasts on a wide range of input data in the field of earnings, cash flows etc. and other important financial items (Thomson Reuters, 2019). Therefore, the forecasted financial ratios gained from the database I/B/E/S can be considered as to be a reliable source for further research (a detailed description can be found in appendix 1). Based on the underlying research by Dorestani & Razzaee, assuming the correctness of the corresponding input factors and based on the availability of data, the forecasted ROA, ROE and EPS are considered to be most strongly correlated to the stock return.

2.2.2 Analyst Recommendations

In addition to an analysis-based strategy, it is possible to follow published buy, hold or sell recommendations from professionals. Analysis professional publish frequently recommendations on how to trade a particular stock. By considering all relevant financial factors, these recommendations are profound and well-reviewed (Thomson Reuters, 2019). As result, this strategy represents the easiest way to receive information on how to trade a particular stock. Besides, no financial knowledge is necessary to understand the signals since all information is transferred in a very clear recommendation. This of course increases market efficiency again, especially in regard to private investors who do not have a profound financial knowledge. Nevertheless, trade recommendations include forecast errors and misleading information as well (Morgan & Stocken, 2003). Thus, following these recommendations imply a risk, too. For further information, please refer to appendix 1.

2.2.3 Asset Pricing Models

For the purpose of this project, research is focused on the Fama French 3 Factor (3FF) and the Fama French 5 Factor model.

2.2.2.1 Fama & French 3 Factor Model

The 3FF model introduced by Fama & French (1992) accounts for the observation that small-cap stocks tend to outperform the market on a regular basis (Fama & French, 1992). This is known as the size risk of stocks (portfolios) and is expressed in the Small-minus-Big (SMB) factor of the model. Besides this, the model further considers the value risk from stocks. Here, Fama & French observed that value stocks outperform growth stocks on a regular basis as well.

As result, and additional factor, High-minus-Low (HML) was added to the model to consider this observation (Fama & French, 1992). In line with the model developed, Kenneth French provide input data for their developed factors. These data represent the benchmark return of the overall market (Kenneth R. French Data Library, 2019). By regressing these factors to the excess return of a stock (or portfolio) (excess return over risk-free rate), the beta factor is observed that indicates the degree of movement of the analyzed stock (or portfolio) to the overall market (Fama & French, 1992). In addition, also the abnormal return (Alpha / Intercept) of the particular stock (or portfolio) is determined, representing the amount of return the stock has that cannot be explained by overall market developments. As result, the 3FF model enables a researcher to more precisely evaluate a stock or portfolio performance. Due to the fact of the ability to determine abnormal returns of stocks and portfolios, factor models can also be used to identify attractive stocks to invest in based on the determined abnormal returns (Fama & French, 1992).

2.2.2.2 Fama & French 5 Factor Model

Another well recognized asset pricing model is the 5FF model. In the scope of this, Fama & French introduced an expansion of the 3FF model. Due to the fact that the 3FF model does not account for variances in average returns of the security related to profitability and of the nature of investments made (Novy Marx, 2012; Titman, Wei & Xie, 2004). As a consequence, Fama & French expanded the 3FF model by two additional factors. The first factor included is the Robust-minus-Weak (RMW) factor. Here, the difference of returns of stocks from companies with robust profitability versus the return of companies with weak profitability is considered (Fama & French, 2014). In addition, the nature of investments undertaken by a company is investigated with introducing the Conservative-minus-Aggressive factor (CMA). Following the same logic as above, the difference of stock returns from conservatively investing companies versus the stock return from aggressively investing companies is considered (aggressively here means investments that include a considerable degree of risk) (Fama & French, 2014).

In line with the logic of the introduced 3FF model, French provides the corresponding benchmark returns on his website (Kenneth R. French Data Library, 2019). By regressing these factors, the beta factor of a stock (or portfolio) can be observed together with its corresponding abnormal return. By addressing the evidence of Novy-Marx (2012), Titman, Wei & Wie (2004) and even others that the 3FF model only provides an incomplete approach for expected returns, Fama & French introduced the more advanced 5FF model. As stated out above, the identified abnormal returns can be used by investors to identify attractive stocks to invest in (Back, 2017).

To conclude, the asset pricing models introduced by Fama & French in 1992 and 2014 provide an investor with a strategy to identify attractive stocks based on their abnormal / excess returns over the market portfolio (Fama & French, 2014). Thus, this represents a strategy to identify stocks with favorable returns without any ratios or other financial measures that are taken into account and therefore differ significantly from ratio-based strategies.

2.3 Hypothesis

In a well-developed market that is efficient, none of the strategies should be profitable and effective, since all information are available to investors and thus should already be incorporated into stock prices. Nevertheless, prior literature have found them to be effective under varying market conditions.

I expect that in situations in which the market is really stressed, a strategy based on fundamentals and financial analysis that considers company specific characteristics might be more successful. This is due to the fact that observations of the input factors obtained from the market prices might not be representative in this period of time. On the other hand, forecasts of particular ratios and future cash flows might get even more difficult due to the unpredictability of the market itself. This might result in an even higher predictability error and, therefore, in a recognizable less effectiveness of this strategy. In this case, the asset pricing models might lead to more profitable investment strategies.

Things are expected to differ during a market recovery. After observing companies in the context of a market recovery, the error in forecasted ratios might significantly be reduced. So, companies (or industries) that recover more quickly might tend to proceed this way in a recovery phase since the market responds to their products or services positively (probably due to the fact that those companies provide crucial products or services the market cannot renounce). This will consequently have a positive impact on the reliability of the ratio based strategy as well as on the forecast based strategy.

These developments, in theory, should all be reflected in the trade recommendation provided by experts. However, as previously described, statistical evidence shows that there is often still a significant standard error involved.

Finally, since the asset pricing models analyzed refer to stock returns compared to market benchmark returns, these models are based on observed stock developments. According to the theory of market efficiency, the observation of stock returns should include all information available to the market regarding each company. As result, these models in perfect theory are expected to provide the highest possible portfolio return. Nevertheless, markets first are not perfectly efficient, but in addition to this, also the 3ff and 5ff both models strongly generalize stock information. Thus, under stressed or unsecure market conditions, these models might not be effective in identifying stocks based on favorable individual characteristics.

To conclude, determining under which conditions and based on which input factors each of the previously described strategies provide higher investment returns is a crucial and interesting empirical question.

2.4 Portfolio Formation

Based on each of the introduced strategies, one portfolios is formed in order to enable a statistical comparison of each of the strategies.

To do so, two basic strategies exist. The first strategy is to identify the companies with the characteristics that perform, corresponding to the particular strategy, best and to invest long in them. However, a more advanced but also promising approach here is to apply a momentum approach to establish the portfolios. Originally, investing according to a momentum strategy means to identify stocks with the highest returns and stocks with the lowest (most likely underperforming the market) and to go long with the stocks with the highest returns while shorting the stocks that report the lowest return in a particular period of time (Faias, 2019). Here, a momentum portfolio strategy is always based on returns from the stocks observed.

However, the logic behind the determined momentum portfolio strategy can be adapted to factors other than returns itself. Thus, an adapted momentum strategy means to go long (short) with the stocks that report the best (worst) characteristics that are taken into consideration in the particular portfolio choice strategy (Zaremba & Szyszka, 2016).
Consequently, portfolios are formed based on each strategy according to the momentum approach (Zaremba & Szyszka, 2016). In a next step, the effectiveness of each approach is compared by statistically assessing the statistical performance and relevance of each portfolio. Under the consideration of different market conditions from year 2005 until today, this thesis

can conclude about the effectivity of the different portfolio establishment strategies in various market situations.

3 Methodology

This project investigates and compares the suitability of different methodologies to identify attractive stocks for investment purposes. In the scope of this, six different methodologies are investigated under varying market conditions and among different industries. To start, asset pricing models are tested. Here, the most common models (i.e. the 3 FF and the 5FF models) are evaluated. In addition to this, the approach of financial analysis is examined. Here, ratios that are, based on prior literature, strongly correlated with stock returns become the basis for portfolio choice decisions. Furthermore, the delta of ratios is taken into consideration. In the scope of this, company specific value drivers are identified based on underlying literature that have a strong influence in a company's profitability and, consequently, on its stock returns. Lately, expert forecasts are taken into consideration. Thus, ratio forecasts published by financial experts build the base for the analysis in the scope of this project. Finally, trade recommendations published by investment banks are tests in regard to their effectivity to profit from equity anomalies.

All these methodologies are tested under varying market conditions beginning from year 2005 onwards to year 2018. To provide a representative database that is statistically relevant, all companies traded at the NYSE over this period are included in the analysis. The panel data investigated in this project enable a profound investigation in market conditions that include a recession (financial crisis), a recovering market (after the crisis) as well as a well-established market (beginning form year 2012).

To test these six methodologies, one portfolio is established based on each methodology and its performance is observed and compared to the other portfolios over time. Each portfolio is established based on the adapted momentum approach (Zaremba & Zyska, 2016). Here, stocks to invest in (or short) are identified based on the percentiles of the referring variable like in the classic momentum approach. However, the referring variable in the scope of the adapted momentum approach is, instead of the return, another company specific variable (e.g. a ratio, abnormal return, etc.).

Detailed information regarding the preparation of the various data sets and the portfolio establishment are given in the following.

3.1 Data samples

In the following, the data samples per portfolio choice methodology are described. Due to the need of diverse information per methodology, different data samples have been established. To do so, diverse information from various databases have been extracted and combined to

establish data samples per methodologies based on which the investigations can be performed. More concrete, data from CRSP, Compustat, French Data Library and I/B/E/S has been incorporated.

To start, stock returns of all companies traded at the NYSE are downloaded on daily basis. Furthermore, data required to calculate the ratios that are previously identified to be strongly correlated to stock returns are obtained via Compustat. These accounting data are only available on quarterly base. The Fama & French factors needed to determine the abnormal returns per stock are gained from the French Data Library. Finally, all forecast related data (forecasted ratios) and the trade recommendations per stock are received from the I/B/E/S database. One dataset per portfolio establishment methodology has been established that entails all revelant information. The establishment of each data set is individually described in appendix 1.

Ensuring comparable structure of datasets

To ensure the comparability of all datasets, all companies are excluded that do not have all data available that are required to perform all analyses. Consequently, all datasets include the same companies. In total, this amounts to 4,557 companies that have been traded at the NYSE from year 2005 to the end of year 2018 and are therefore taken into consideration in the analyses of this project.

However, especially in the scope of the calculation of the ratios, errors have been observed. These errors are mainly due to missing data and therefore cannot be solved in this project. In order to further ensure the comparability, all companies that have an error in one of the established datasets at one point of time are excluded from the analysis. This guarantees that all data required in the scope of this project are available for each individual at any point of time. In this final step, 1,184 companies are excluded from the dataset. Hence, a total of 3,373 companies are taken into consideration over the whole time series. As result, by any point in time the minimum amount of companies taken into account is above 2,300. Consequently, the sample is large enough to provide statistically relevant evidence.

3.2 Portfolio Formation

To statistically compare the six methodologies investigated in the scope of this project, one portfolio per methodology is established. This ensures the comparability of the methodologies over the investigated timeframe. The portfolios are established following the momentum logic. While momentum is usually based on returns, the classic momentum strategy is adapted following Zaremba & Szyszka (please refer to the literature review). In the context of the

adapted momentum approach, the assets to be invested in (or shorted) are identified based on an individual referring variable, comparable to the classic momentum strategy. However, in difference to this, the referring variable is not the stock return, but a ratio, a change of a ratio over time or another individual value that makes the company performance somehow comparable. After allocating each stock based on the corresponding percentile of the referring variable, it is invested long in all stocks that are allocated above the 90th percentile, while all stocks are shorted that are allocated in the 10th percentile. The resulting portfolio provides the return based on the adapted momentum approach. For further details, please refer to appendix 2.

3.3 Portfolio Performance Analysis

The statistical evaluation of the portfolio performance is crucial. Additionally, it is essential to test the statistical significance (significantly different from zero) of the data obtained. To do so, the portfolio performances are evaluated based on the following measures.

Table 1: Statistical Portfolio Performance Evaluation Measures

Performance Evaluation	
Statistical Measure	Significance test
Mean Excess return over risk-free rate	T-Test, P-Value
Volatility	Not Applicable
Sharpe Ratio	T-Test, P-Value
Abnormal Returns (Alpha) – Fama & French 5 Factor Model	Not Applicable

Source: Faias 2019, own illustration

By setting the gained excess average return of the portfolio in relation to the implied volatility, the Sharpe Factor indicates the return realized under the acceptance of the risk implied in the portfolio (Investopedia, 2019). As result, the Sharpe Factor provides a risk adjusted (and thus much more valuable) insight in the portfolio performance compared to the excess return only. As the Sharpe Ratio is very and widely used, the performance evaluations in this project is mainly based on the Sharpe Factor as well.

To accomplish this, it is determined how much abnormal return has been generated from a portfolio over the time series. This is done based on the Fama & French 5 Factor model. Here, the Fama & French Factors are regressed with the portfolio returns that are to be investigated.

In the scope of this, the abnormal return is defined as alpha (intercept) of the regression. By accomplishing the analysis of the portfolio performance with the observation of the alpha returns, it is determined to what extend a portfolio has generated its result due to underlying (favorable) market conditions, and how much of the realized return is exceeding the market benchmark return and is therefore resulting from smart investment decisions. Additional statistical measures are observed as well to make additional information available if the received results require further details. These measures are stated in Appendix 3.

3.4 Portfolio tests under different market conditions

Under different market conditions, the applicability of referring variable to identify the most attractive stocks to invest in (short) might vary.

Therefore, all portfolios are tested under different sub time series, in which different market situations have been observed in the North American Market. In the scope of this, the following sub time series with different market conditions are considered:

Table 2: Time Series with different market conditions

Market Condition	Duration
Full time series	1Q2005 – 4Q2018
Crisis	1Q2007 – 4Q2008
Recovery	1Q2009 – 4Q2011
Stable	1Q2012 – 4Q2018

Source: Bordo & Landon-Lane, 2010, Own Illustration

By testing all portfolios under these market conditions separately and over the whole time series as well, all characteristics of different market conditions that have been taken place since 1Q2005 can be extrapolated and analyzed separately. Thus, this project provides insights about the profitability and usability of the six portfolio establishment methodologies under varying market conditions.

3.5 Long – Short Analysis

In addition, it is investigated to what extent the realized returns per portfolio are gained via the long or the short position under the different market conditions. By determining the proportion of the revenue of the long versus the short position, several conclusions can be drawn.

First, it investigates the added value of a momentum approach compared to a simple investment approach (e.g. only investing long). By investigating the proportion over different market

conditions, it can be identified how combining both investment approaches increase the portfolio performance. For example, over the period of crisis, it can be assumed that the proportion of the short positions strongly dominates while it might be vice versa over the stage in market recovery when companies generally gain value.

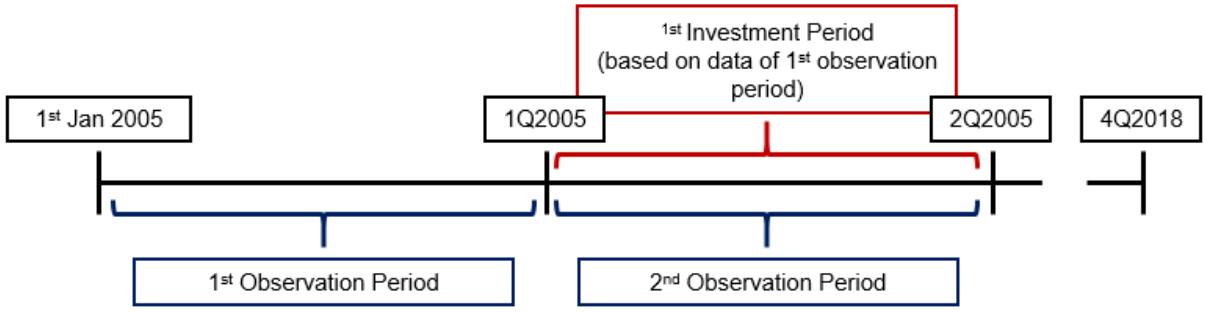
Next, by comparing the long and short return proportions, it can be concluded to what extend a particular portfolio formation methodology is effective in identifying attractive investment opportunities. If the proportion of long and short positions in a particular portfolio formation methodology does not change over different market conditions, this methodology can be considered as to be less effective in identifying individual attractive investment opportunities. As result, this conclusion could for example indicate a reason behind a lower portfolio performance.

3.6 Qn+1 versus Qn

In practice, the timing of the publication of information needs to be considered. This means, the investor can only start investing from the moment on, she has the information available she aims to base her investment decision on. As a result, in practice, the data of the referring variable is made available at the end of each quarter. Then, after identifying the attractive stocks based on the method previously described, the investment can be made in the identified stocks. Consequently, the investment decision is based on the data gained at the end of a quarter (e.g. quarter 1). When investing then, the returns generated from the portfolio is the sum of the returns of the assets invested in the following quarter (e.g. quarter 2).

The graph 1 at hand illustrated this as well. Here, the publishing date is always at the end of each quarter (at point 1Q2005 for the first time). Consequently, the portfolio returns are generated from the first day in quarter 2 of year 2005 until point 2Q2005 (last day in quarter 2 of year 2005). This logic is then proceeded over the whole time series.

Graph 1: Qn+1 investment approach

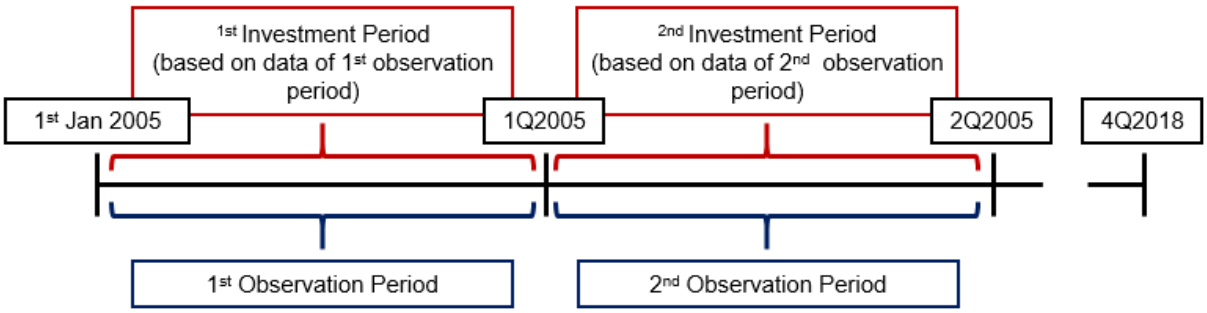


Source: Own Illustration

As the investment has to be made like this due to the reason of the publication date of the information needed, it represents the practical approach of investing. In order to provide an answer to the question which portfolio formation methodology provides best returns in practice, this approach is mainly analyzed in the scope of this project. Here, it is referred as the Qn+1 approach.

Further, it is investigated if, and if yes to what extent the drawn conclusion of the main analysis might change when applying a different investment period. When assuming that all stock information required are fully available already at the first day of the quarter (which in practice is not the case), the investor could invest directly in the period, the data are actually gained. This approach is illustrated in the graph at hand.

Graph 2: Qn investment approach



Source: Own illustration

Here, by assuming the immediate availability of the required stock information, the investment based on the first observation period can directly be made in the first period. As result, the first observation period equals the first investment period. This investment approach is considered in the scope of this project as Qn approach. Due to the fact that this approach is investigated in underlying literature as well, this project compares the portfolio performance of each portfolio under different market conditions to determine if the drawn conclusions can be confirmed under the Qn approach, even though being aware of the fact that this approach is often only theoretically possible.

3.7 Industry Specific Analysis

In the scope of this project, an industry specific analysis is performed as well. Based on the fact that the importance or degree of correlation of a particular ratio to the stock returns differ among industries, a specification between different industries is established in this project, too. Thus,

the profitability, risk and general performance of each of the six portfolios is tested for each industry under the different market conditions described above. To do this, all companies traded at the NYSE over the period under review are classified in three different industries: Consumer Services/Other, Consumer Goods & Production/Heavy Industry. The classification has been done based on the SIC Industry Classification code received from Compustat per company. For a more detailed explanation regarding the industry classifications, please refer to Appendix 17.

4 Results

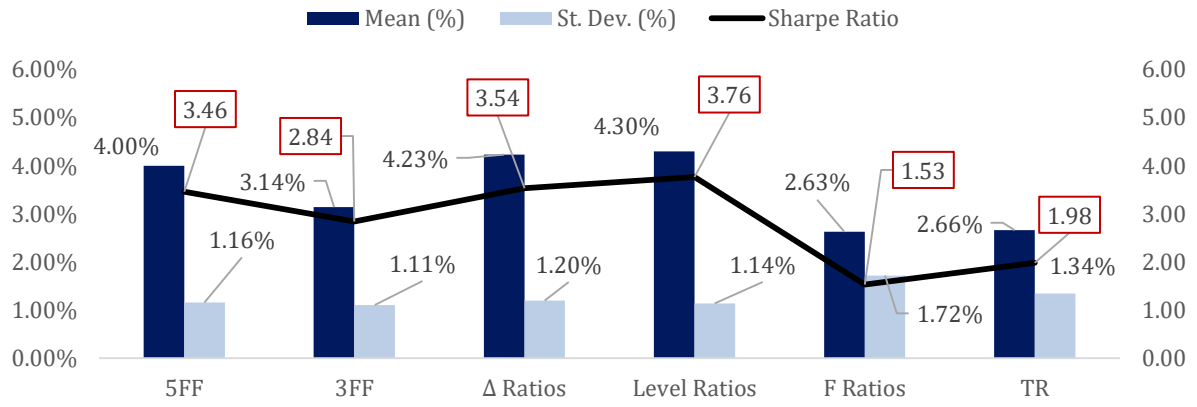
4.1 General Analysis Results

The gained results of each of the six portfolios are examined here. In the scope of this, the performance of each of the portfolios is compared under consideration of each market condition. To do so, the Sharpe ratio is used as main factor of comparison, as it provides a measure that compares each portfolio's excess return to its risk (volatility). In addition, the abnormal (alpha) returns per portfolio are determined based on the Fama & French 5 Factor model.

4.1.1 Complete Time Series (1Q2005 – 4Q2018)

To start, the performance of the portfolios for the complete time series is analyzed.

Graph 3: Portfolios performance, complete time series



Source: Internal analysis, own illustration

Table 3: Statistical significance of Analysis factors, full time series (T-Test values)

T-Test values	5FF	3FF	Δ Ratios	Level Ratios	F Ratios	TR
Ex. Mean	25.89***	21.25***	26.46***	28.17***	11.45***	14.85***
Sharpe	9.80***	9.47***	9.83***	9.91***	7.77***	8.62***

Note: The table states the t-test values. "*" significance on 10% level; "**" significance on a 5% level; "***" significance on a 1% level indicate the statistical significance of the corresponding analysis value.
Source: Internal analysis, own illustration

Based on the t – test results, the statistical significance on a 1% level is confirmed for all values of the excess mean return as well as the Sharpe Factor. This is undermined based on the p-value as well (please refer to Appendix 5). As a result, the data gained provide statistically relevant information to draw conclusions.

First, it is observed that all portfolios provide a positive excess mean return over the full time series, while being exposed to a considerable degree of risk in terms of volatility. Over the full time series, all different market conditions are considered (lower excess mean return during crisis, volatile excess men return over the recovery and comparably high excess mean return under stable market conditions). As result, volatility is comparably high over the full time series.

As graph 3 illustrates, the Level Ratios portfolio provides the highest mean excess return (4.30%), followed by the Δ Ratios portfolio (4.23%) and the 5FF portfolio (4.00%). Besides the observed mean excess return per portfolio, all three portfolios show a comparable level of risk in terms of volatility. Among the three highest performing portfolios, the Level Ratios portfolio is exposed to the lowest degree of risk with a volatility of 1.14%. Even though the 5FF portfolio shows with 1.16% a lower degree of volatility compared to the Δ Ratios portfolio (1.20%),

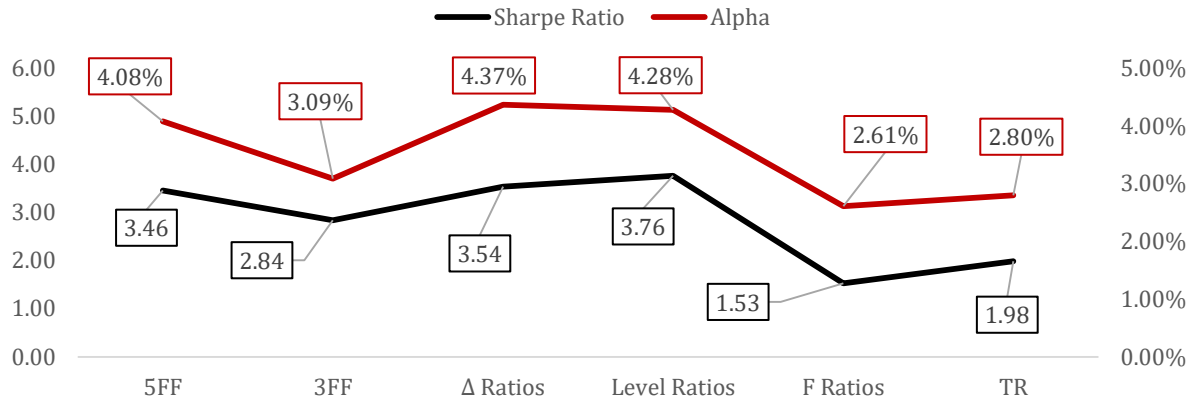
Consequently, the Level Ratios portfolio provides over the full time series the highest Sharpe Factor (3.76), but is closely followed by the Δ Ratios portfolio (3.54) and the 5FF portfolio (3.46).

By considering less factors compared to the 5FF model, the portfolio based on the 3FF model provides a considerably lower excess mean return of 3.14%, but is also less volatile with 1.11%. As result, the 3FF portfolio still promises a significant excess return for its risk.

The portfolio based on the Trade Recommendations and the Forecasted Ratios realized the lowest Sharpe Factors with 1.98 and 1.53 respectively. Both portfolios produced comparably low excess mean returns while being faced with comparably high degrees of volatility.

After determining the abnormal excess returns of each portfolio over the market development by regressing the returns of each portfolio to the Fama & French 5 Factor Model, the gradation among the different portfolio performances can generally be confirmed.

Graph 4 – Abnormal returns per portfolio, complete time series



Source: Internal analysis, own illustration

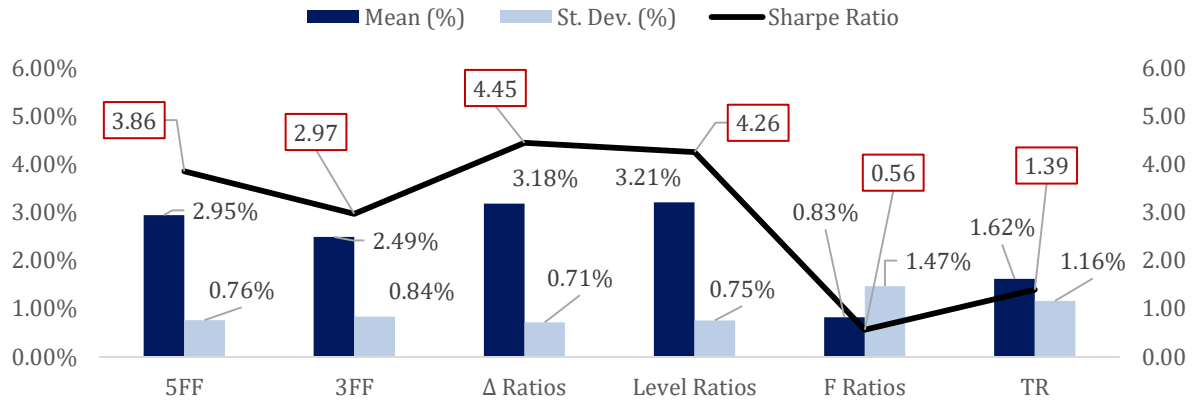
While providing a Sharpe Factor lower than the Level Ratios portfolio, the Δ Ratios portfolio generates with 4.37% the highest abnormal return among all portfolios over the period under review. Nevertheless, the Level Ratios portfolio provides with an alpha of 4.28% a comparable degree of abnormal return. In line with the determined Sharpe Factor, the 5FF portfolio as well generates with 4.08% a recognizable excess return. By considering less factors compared to the 5FF portfolio, the 3FF portfolio underperforms here as well with an observed alpha of 3.08%. The lowest alphas are generated again at the F Ratios Portfolio (2.57%9 and the TR portfolio (2.83%).

Consequently, the comparison of the abnormal returns of each portfolio underlines the previously identified performances of each portfolio

4.1.2 Crisis Period (1Q2007 – 4Q2008)

In this sub-section, the profitability of the portfolios over the period of the crisis is investigated. The crisis period is defined as the period from 1Q2007 to 4Q2008 (Bordo & Landon-Lane, 2010). Over this period, the following results have been observed.

Graph 5: Portfolios performance, crisis period



Source: Internal analysis, own illustration

Table 4: - Statistical significance of Analysis factors, crisis period (T-Test Values)

T-Test values	5FF	3FF	Δ Ratios	Level Ratios	F Ratios	TR
Ex. Mean	10.92***	8.40***	12.59***	12.04***	1.59*	3.94***
Sharpe	3.76***	3.61***	3.81***	3.80***	1.48*	2.81**

Note: The table states the t-test values. "*" significance on 10% level; "**" significance on a 5% level; "***" significance on a 1% level indicate the statistical significance of the corresponding analysis value.
Source: Internal analysis, own illustration

The statistical significance can be confirmed here on a 1% level for all values except for the observed values gained from the F Ratios portfolio. Here, the significance can only be confirmed on a 10% level. Besides, the Obtained Sharpe Factor obtained on the TR portfolio is statistically significant on a 5% level. For an additional test of the statistical significance, please refer to Appendix 5. As result, the values obtained provide statistically significant insights and findings (with a limitation for the F Ratios data). As result, due to the statistical significance of the obtained values, relevant conclusions can be drawn.

All portfolios generate a lower excess mean return compared to the full time series, but however, are also exposed to a lower volatility. This is due to the fact that over the crisis period, excess mean returns are constantly lower and therefore also less volatile.

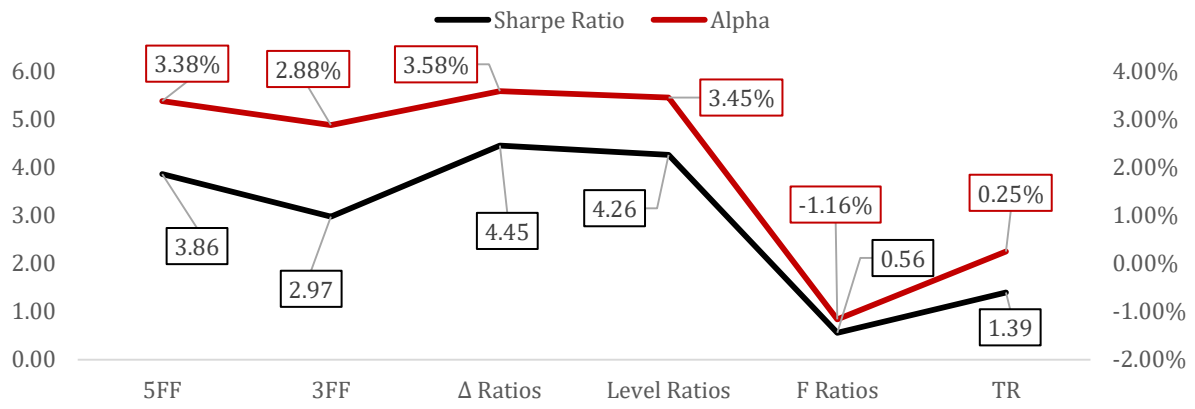
Over this period, a strong discrepancy between the portfolios has been observed. The clearly best performance among the analyzed portfolios has been realized by the portfolio based on the Delta of Ratios (Sharpe Factor 4.44) and based on the Level Rations (Sharpe Factor 4.26). Due to the fact that the criteria applied to establish these portfolios are solely based on company specific measures, it seems to be possible to identify the most attractive investments even (or especially) in the period of a market crisis.

However, the 5FF portfolio as well provided an attractive performance with a slightly smaller Sharpe Factors of 3.83. Here, the portfolio is exposed to a comparably low degree of risk like

the Level Ratios Portfolio (0.76% vs. 0.75%), but however realized a lower excess average return. In line with this, the 3FF portfolio performs comparable but lower, but still provides an attractive investment with a recognizable Sharpe Factor of 2.97.

Besides, the TR portfolio performs significantly worse with less than half of the realized excess average return that goes in hand with almost double of the degree of volatility compared to the previously described portfolios. Next to this, the F Ratios portfolio provides clearly the lowest Sharpe Factor while being exposed to the highest degree of volatility and the lowest excess average return among all portfolios.

Graph 6: Abnormal returns per portfolio, crisis period



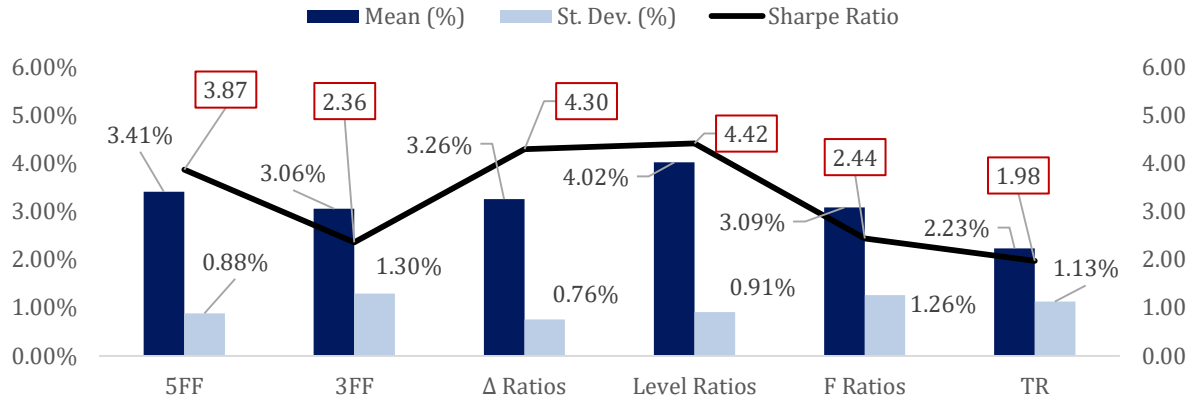
Source: Internal analysis, own illustration

Turning now to the analysis of the abnormal returns per portfolio over the period under review, the superior performance of the Δ Ratios portfolio (3.58%) and the Level Ratios Portfolio (3.45%) can be confirmed. Besides this, the 5FF portfolio provides with an alpha of 3.38% a considerable abnormal return as well. In line with its comparably lower excess mean returns over the crisis period, the 3FF portfolio here provides a lower abnormal return of 2.88%, but still provides an attractive abnormal return to the investor. The TR portfolio generates with 0.2%% almost no abnormal return and therefore seems to be generally unattractive over the crisis period. However, the F Ratios portfolio offers a negative abnormal return of -1.16% and therefore provides a lower return as the general market over the crisis period. To conclude, the previously identified ranking of the performance of the portfolios can be confirmed based on the abnormal returns each portfolio generates over the period under review.

4.1.3 Recovering Market (1Q2009 – 4Q2011)

Next, this project examines the phase of the market recovery directly after the crisis. This is done to provide a holistic approach since market conditions in a market recovery can of course also been considered to be unique. According to this, this project considers the period of market recovery from 1Q2009 until 4Q2011. The following data have been gained:

Graph 7: Portfolio performance, recovery period



Source: Internal analysis, own illustration

Table 5: Statistical significance of Analysis factors, recovery period (T-Test values)

T-Test values	5FF	3FF	Δ Ratios	Level Ratios	F Ratios	TR
Ex. Mean	13.41***	8.17***	14.89***	15.30***	8.46***	6.85***
Sharpe	4.60***	4.20***	4.65***	4.67***	4.24***	3.98***

Note: The table states the t-test values. "*" significance on 10% level; "**" significance on a 5% level; "***" significance on a 1% level indicate the statistical significance of the corresponding analysis value.
Source: Internal analysis, own illustration

The t – test confirms the statistical significance on a 1% level for all values. This is underlined with a p value of 0.00 for all values (please refer to Appendix 5). Therefore, the conclusions drawn are statistically relevant.

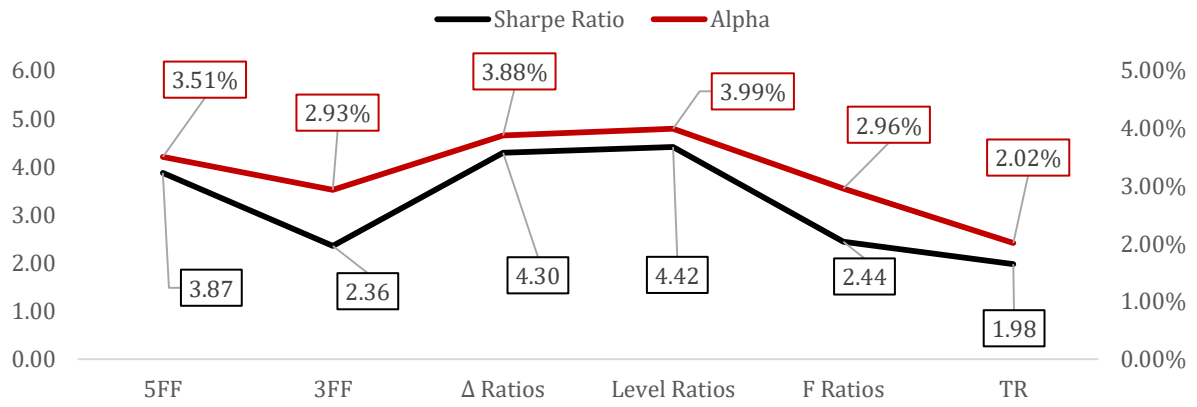
Here, the excess mean returns generally increase again, which is combined with an increasing volatility for the portfolios (compared to the crisis period). In this period, the market and the companies start to recover and gain back value, which leads to an increase in excess mean returns, but however, also to an increase in volatility.

The Level Ratios and the Δ Ratios portfolio realized the highest Sharpe Factors. The significantly high excess average return of the Level Ratios portfolio of 4.02% comes in hand with a comparably high volatility among the three best performing portfolios. However, the Sharpe Factor realized here is high due to the high average return. Next to this, the Δ Ratios portfolio provides a lower excess return but as well as lower degree of risk, resulting in a slightly

lower Sharpe Factor. This is followed by the 5FF portfolio with a Sharpe Factor of 3.87. The F Ratios portfolio performs only slightly better than the 3FF portfolio, by realizing a slightly higher excess return and a bit lower risk exposure. Next to this, the F Ratios portfolio performance is comparably low while generating the lowest excess mean return among the other portfolios in the period under review. However, the TR portfolio is exposed to a risk of 1.13% volatility, which is lower than the degree of risk of the F Ratios and the 3FF portfolios (1.26% and 1.30% respectively. Nevertheless, the TR portfolio clearly realizes the lowest Sharpe Factor over this period.

In a next step, the generated abnormal returns per portfolio under stable market conditions are investigated.

Graph 8: Abnormal returns per portfolio, recovery period



Source: Internal analysis, own illustration

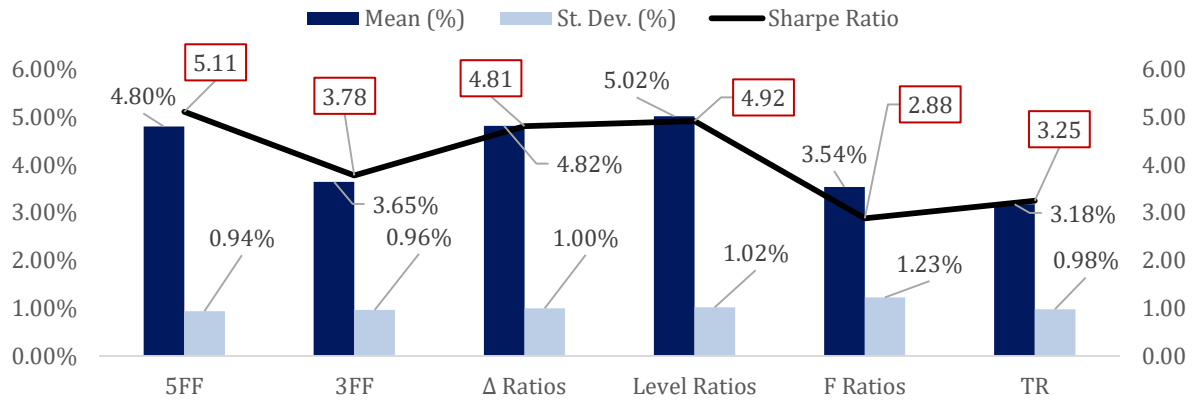
Based on the alpha generated, the Level Ratios Portfolio generates the highest abnormal return to the investor, closely followed by the Δ Ratios portfolio (3.99% & 3.88% respectively). In line with the observed Sharpe Factor, the 5FF portfolio performs closely as well by generating 3.51% excess return over the market. The F Ratios portfolio again realizes an insignificantly higher alpha of 2.96% compared to the 3FF portfolio with 2.93%. Here, the slightly superior performance of the F Ratios portfolio is reflected again. With the smallest abnormal return among the tested portfolios over the recovery market period, the TR portfolio provides with 2.02% still a recognizable alpha return as well.

To conclude, the observed Sharpe Factor together with the generated alpha return consistently indicate the difference in the performance of the portfolios

4.1.4 Stable Market (1Q2012 – 4Q2018)

To investigate the performance of the portfolios under the stable market conditions, the data from 1Q2012 until 4Q2018 are investigated. This project considers the NYSE to be recovered from the beginning of 2012 up until now and being in a stable condition. The following observations have been made:

Graph 9: Portfolios performance, stable market conditions



Source: Internal analysis, own illustration

Table 6: Statistical significance of Analysis factors, stable period (T-Test values)

T-Test values	5FF	3FF	Δ Ratios	Level Ratios	F Ratios	TR
Ex. Mean	27.06***	19.99***	25.47***	26.03***	15.24***	17.19***
Sharpe	7.21***	7.01***	7.18***	7.19***	6.72***	6.86***

Note: The table states the t-test values. "*" significance on 10% level; "**" significance on a 5% level; "***" significance on a 1% level indicate the statistical significance of the corresponding analysis value.
Source: Internal analysis, own illustration

The statistical significance on a 1% level is verified for all values. This is confirmed by a constant p value equal to 0.00 for all values (please refer to Appendix 5). Consequently, the gained results are sufficient to formulate statistically relevant conclusions.

Under the conditions of a stable market, the highest excess mean returns are generated since market (and company) developments are easier to predict. Consequently, also the degree of risk is minimized, which results in a lower volatility for all portfolios.

Under the conditions of a stable market, the 5FF portfolio performs strongest with a realized Sharpe Factor of 5.11. Even though the portfolio provides a lower average excess return (4.80%) compared to the Level Ratios portfolio (5.02%) and the Δ Ratios portfolio (4.82%), it is exposed to the lowest risk of 0.94% volatility among all portfolios. Next to this, the Level Ratios portfolio provides the second highest Sharpe Factor of 4.92, which is due to the comparably high realized average excess return of 5.02%. While providing a lower excess

return of 4.82%, the Δ Ratios portfolio is exposed to an almost comparable degree of risk of 1.00%. Thus, the Sharpe Factor is slightly reduced here to 4.81.

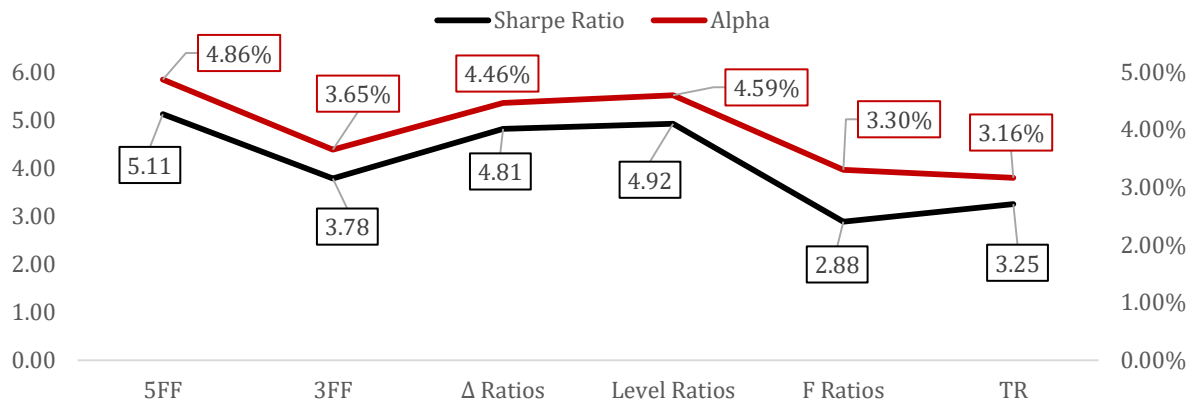
In stable market conditions, the TR portfolio provides a recognizable Sharpe Factor of 3.25 by being exposed to the very low degree of risk of only 0.98% volatility. As result, the Sharpe Factor indicates the portfolio's attractiveness here as well.

Next to this, the 3FF portfolio is exposed to a low degree of volatility as well and, therefore, generates a recognizable Sharpe Factor of 3.78.

Finally, the F Ratios portfolio clearly provides the lowest Sharpe Factor (2.88) which is due to the highest degree of volatility among all portfolios (1.23%), even though it generates with 3.54% a higher excess average return than the TR portfolio.

In a final step, the generation of abnormal returns per portfolio under stable market conditions is investigated.

Graph 10: Abnormal returns per portfolio, stable market conditions



Source: Internal analysis, own illustration

Under stable market conditions, the 5FF portfolio generates the highest abnormal returns among the investigated portfolios. Besides, in line with the previously determined portfolio performance, the Level Ratios portfolio and the Δ Ratios Portfolio both generate a recognizable alpha of 4.59% and 4.46% respectively. Furthermore, the abnormal returns observed based on the 3FF portfolio is recognizably lower compared to the best three portfolios, but however still provides an attractive gain for the investor. Finally, is has to be concluded that the TR portfolio and the F Ratios portfolio as well perform strongly under stable market conditions but realizing attractive abnormal returns as well.

4.1.5 Interim Conclusion

To start, over the crisis period, excess mean returns for all portfolios are comparably low, which also goes in hand with a lower degree of volatility. This is due to the fact that returns are constantly low and, as a result, less volatile. Over the recovery period, the market (and the companies) gain back value, which leads to an increase in returns, but also to an increase in volatility. Over stable market conditions, the stock developments are easier to predict. As result, the returns generated by each portfolio is the highest over this period, while the degree of risk is minimized. When bringing this together and measuring returns and volatility over the complete time series, the portfolio generate a moderate Sharpe Factor. Since the portfolios performance is influenced by the changing performances of all market situations, the degree of volatility is modest together with the returns generated.

Overall, it can be deduced that the 5FF, the Δ Ratios and the Level Ratio portfolios have been provided the highest returns in comparison to the risk they are exposed to (represented by the Sharpe Ratio). In addition to this, these three portfolios as well have generated the highest abnormal returns under all market conditions among the investigated portfolios as well.

The Level Ratios portfolio is based on four ratios that are highly correlated to the corresponding stock returns (for more information please refer to Methodology). By individually observing these ratios and bringing these observations together, attractive stocks can reliably be identified and risk can be reduced. In line with that, the Δ Ratios portfolio is profitable as well. However, due to the fact that the delta per ratio is the referring variable here, the development of a company is taken into account. Even though this is a reliable indicator, these data can sometimes be misleading due to reporting issues, delays or other factors.

However, both portfolios proved their superior profitability in times of a crisis. Here, focusing investment decision on real observed individual company data instead of forecasts of market data provides, in this project, the most reliable way to identify profitable investments. Especially during this period, forecast errors can be very significant (please refer to the Literature Review) and also market data are frequently volatile and hard to predict. As result and in line with the Hypothesis, ratio based portfolios provide the highest returns and lowest risk.

Besides this, while both portfolios based on ratios of course only take a limited amount of data (the particular ratios) into account, the 5FF portfolio bases the investment decision in theory on all data available in the market (for more information, please refer to Methodology). However, here information are of course strongly generalized, which as well can imply errors or misinterpretation of data. Nevertheless, by applying this holistic approach here, a comparably

profitable portfolio has been established. This portfolio always provides a significant and attractive excess return compared with a low degree of volatility. As result, it constantly produced a Sharpe factor among the highest.

The 3FF portfolio is comparable to the 5FF portfolio, but however, takes less factors into account (please refer to Literature Review). Due to this fact, because of which it also has been criticized in underlying literature, several characteristics have not been taken into consideration. As result, average excess returns develop comparable to the 5FF portfolio but lower, while the degree of volatility of often slightly higher. As result, even though the 3FF model finds much application in practice, the superior usability of the 5FF model has been proved.

By critically examining the TR portfolio, the effect of a forecast error can be observed (please refer to Literature Review). Especially over the period of the crisis, the performance of this portfolio was observed to be comparably low. Due to the fact that predictions over the period of the crisis of course have been very difficult, it can be assumed that the forecast error here plays a significant role. Besides, under stable market conditions, the TR portfolio provides favorable results. Thus, in line with the Hypothesis, predicting company performances under stable conditions is of course easier versus in volatile conditions. As result, forecast errors here can be reduced and a favorable and profitable performance is realized.

This goes in hand with the performance of the F Ratios portfolio. In the scope of this, the forecast error of course as well has come into account. The F Ratios portfolio can overall be considered to be the lowest performing portfolio. In the one hand, the forecast error problem here comes into place. On the other hand, this portfolio is based on a limited amount of ratios that take into account a limited amount of factors. Thus, there are of course always factors or financial data that are not considered in the scope of the establishment of this project. By comparing this to the holistic approach of a trade recommendation, this factor is reduced. Consequently, the TR portfolio often performs better that the F Ratios portfolio.

In addition, abnormal returns, determined as alpha in the Fama & French 5 Factor model, have been considered as well to investigate, to what extent each portfolios returns are due to market developments, and how much abnormal return has been generated. Finally, when considering the obtained abnormal returns per portfolio and period, it is concluded that the established conclusions can be confirmed under consideration of the abnormal returns.

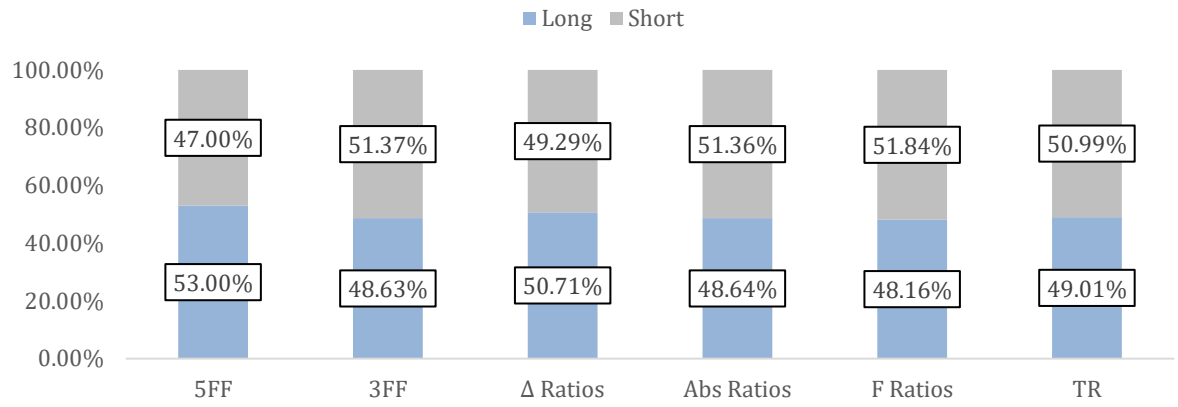
4.2 Long versus Short return

In the scope of this analysis, the proportion of the return of the assets that have been shorted is compared to the proportion of the return gained by investing long in assets. This is done for each portfolio separately and per market condition.

4.2.1 Complete Time Series (1Q2005 – 4Q2018)

To start, the long versus short returns per portfolio are compared for the time series as a whole. The observed proportions are given in the graph below:

Graph 11: Long vs. Short returns per portfolio, complete time series



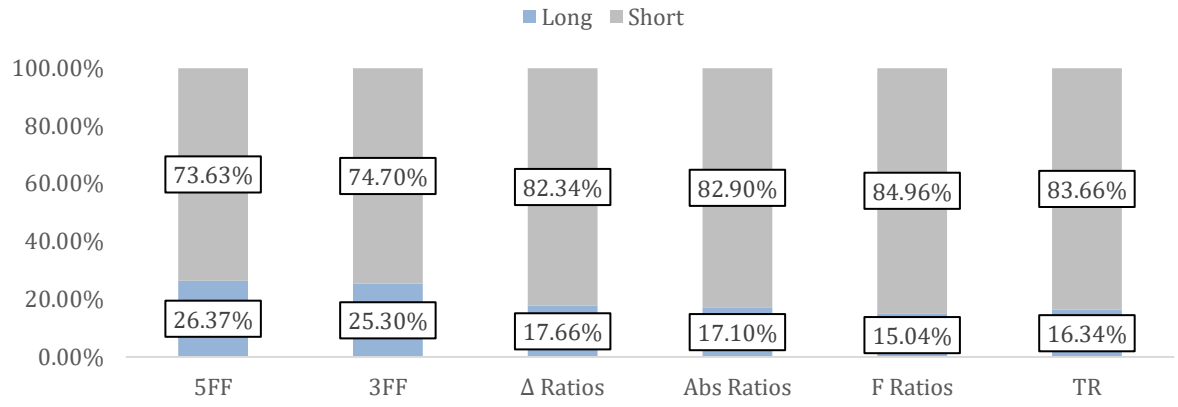
Source: Internal analysis, own illustration

In general, it can be concluded that, over the whole time series, equal proportions of long and short returns are realized per portfolio. Here, the proportion of long positions prevails slightly in the 5FF and the Δ Ratios portfolio, while the returns gained from the short positions in total overweight insignificantly in the other portfolios.

4.2.2 Crisis period (1Q2007 – 4Q2008)

The short and long returns over the period of the crisis are investigated next. The graph below illustrates the results:

Graph 12: Long vs. Short returns per portfolio, crisis period



Source: Internal analysis, own illustration

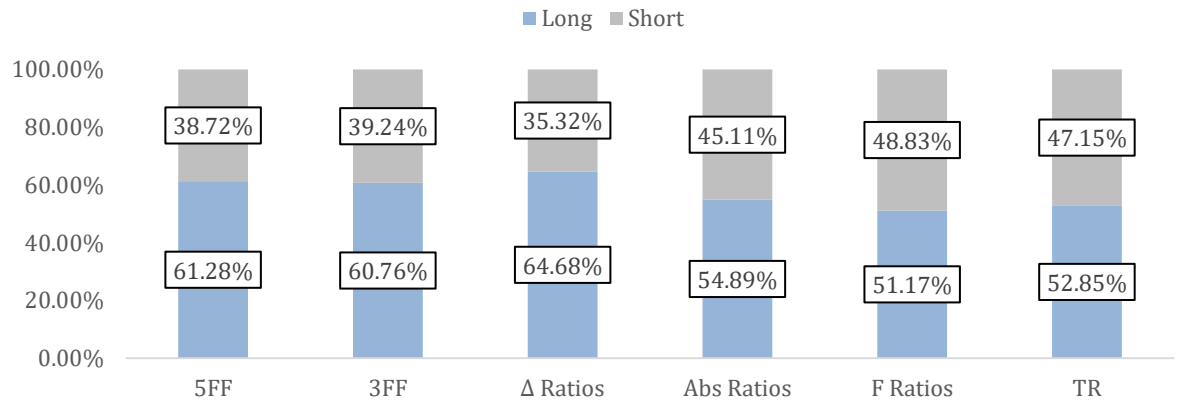
Over the period of the crisis, the proportion of short returns is clearly dominant among all portfolios. Especially strong are the proportions in the portfolios that are ratio and/or based on individual financial analysis. This observation indicates the effectiveness of financial analysis measures to identify short investment opportunities based on company specific data.

Nevertheless, the high proportion of more than 70% of the 5FF and the 3FF portfolio indicate that also the market based portfolios receive a notable amount of their returns from shorting assets in times of a crisis.

4.2.3 Recovering Market (1Q2009 – 4Q2011)

In a next step, the long and short returns in the market recovery period are examined. The gained data are illustrated in the same graph:

Graph 13: Long vs. Short returns per portfolio, market recovery period



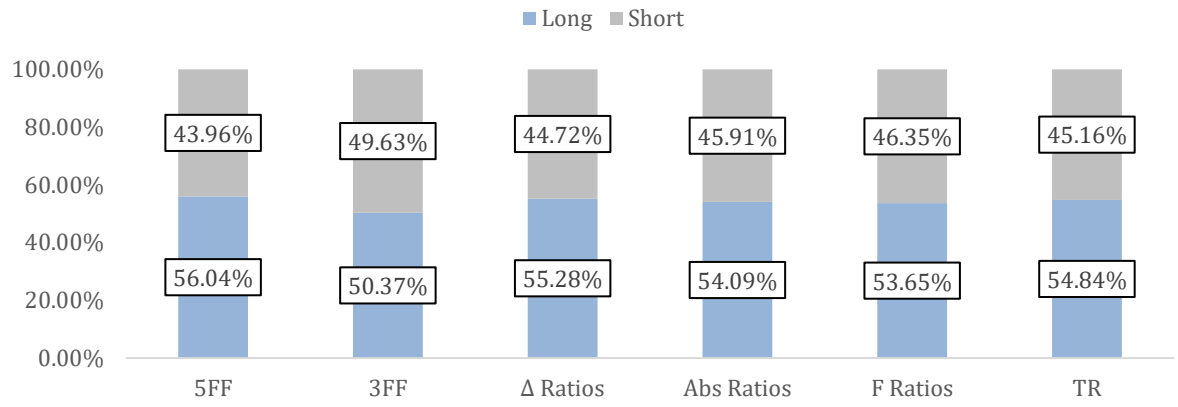
Source: Internal analysis, own illustration

Under this market condition, the contrary effect to the crisis period is observed. In a recovering market, the companies (and consequently the market) gain value back. Resulting from this, going long with assets often provides profitable returns. Thus, the proportional share of returns gained from long positions overweight in all portfolios under review. Nevertheless, the short return still amounts to a significant proportion of the return as well. Under market conditions that can be considered to be normal, portfolios more or less often have slightly higher share of long returns compared to short returns (please refer to 2.3.4 Stable Market). So, the tendency of the market to normalize can be observed, even though the companies are still in recovery, because of which the long return proportion predominate more significantly.

4.2.4 Stable Market (1Q2012 – 4Q2018)

Finally, the proportion of long and short returns in a stable market period are investigated. Thus, the data are given in the graph at hand:

Graph 14: Long vs. Short returns per portfolio, stable market period



Source: Internal analysis, own illustration

Evidence here shows that in stable market conditions the share of long and short returns more or less equal each other with a small tendency to long positions. As financially healthy companies generally have the tendency to grow, a slight tendency to long returns can be explained. Nevertheless, also the returns gained by shorting assets plays a significant role in all portfolios.

4.3.5 Interim Conclusion

It can be concluded that under stable market conditions, the proportional share of short and long returns more or less equal each other with a slight tendency to the long positions. This is due to

the fact that it can be assumed that all financially healthy companies have a tendency to grow without extraordinary individual characteristics or competitive advantages. As result, a slight tendency to long positions in the portfolio is reasonable. However, the short positions provide a very significant proportion of the return as well. As result, it is concluded that applying a momentum approach to establish the portfolios will, under stable market conditions, statistically provide a higher return than portfolios in which it is invested long only.

Furthermore, it is figured out that in a crisis period, the short returns clearly provide the highest share of returns in a portfolio. In these periods, stock values decrease, which results in a negative return. When shorting these stocks, the portfolio gains in value. Consequently, this measure is crucial in crisis periods.

Conversely, in a period of market recovery, the long positions become more dominant in realizing returns. Here, companies (and with them the market) gain value. Thus, investing long often makes sense. However, since the market is normalizing again, the short positions here (around 35% on average) play a more important role than the long positions in the period of crisis (around 15% on average).

4.3 Qn versus Qn+1

As an additional analysis, the Qn+1 is statistically compared with the Qn approach. Due to delays in the publishing of data, the Qn+1 approach is the investment approach that is applied in practice. The Qn+1 approach enables the investor with an opportunity to deal with delays in the publication or other problems (For more information, please refer to Methodology). As result, the Qn+1 approach is the investment approach that is considered to be generally applied in practice and is therefore the approach that is investigated in detail in the scope of this project. However, the Qn approach is, at least in theory, applicable as well. Therefore, to additionally test how the portfolio performances develop if it is invested directly in the observation quarter according to the Qn approach, the performance of each portfolio is compared according to both investment approaches under all market conditions. This analysis provides further information in regard to determine if the previously identified results can be confirmed under the Qn approach. In addition, it is investigated if the theoretically possible Qn approach provides more or less attractive returns to the investor compared to the practically applied Qn+1 approach (for more details, please refer to the chapter Methodology).

In general, the Qn+1 strategy provides a way to deal better with market fluctuations and developments, which is mainly due to its nature of investing in period that follows directly to

the date, the company and market data are published. Therefore, indications of future company and market developments can better be reflected. As a result, in almost all methodologies (5FF, 3FF, Δ Ratios, Level Ratios & F Ratios), the Qn+1 strategy provided an added value in the crisis period and as well in the period of the emerging market.

Nevertheless, even though the Qn+1 strategy has a positive impact on almost all portfolios, the TR portfolio has clearly been negatively influenced here. As previously explained, the Qn+1 strategy here gives misleading indications when to invest in which asset by generally misinterpreting the Trade Recommendations. Consequently, the Qn+1 strategy here has a clear negative impact of the portfolio performance.

However, even though the Qn+1 strategy has a recognizable impact on the performance of all portfolios, it can be concluded that the established results and conclusions in Chapter 4.1 regarding the profitability and suitability of each portfolio establishment strategy under each market condition holds true under the Qn+1 strategy as well with the exception of the TR portfolio due to stated reasons. For a detailed evaluation of all data gained in this analysis, please refer to Appendix 4.

4.4 Industry Specific Analysis

By performing the analysis of the Sharpe Factors and abnormal returns per industry group over the different time series with the corresponding market situations, it is summarized that all conclusions established in the main analysis hold true across the three industry groups. Even though this conclusion is established based on the gained results, it still needs to be considered that this fact might result from a diluting effect. All companies traded at the NYSE are categorized in 128 industries based on Thomson Reuters (please refer to Appendix 17). In the scope of this project, these 128 industries are brought together in three industry groups, which then are investigated separately. As a result of this, the fact that all conclusions established in the main analysis hold true across all industry groups might result from the fact that the categorization of the industries in three industry groups is not detailed enough to provide profound results. For detailed information and data regarding the industry specific analysis, please refer to Appendix 11 –Appendix 16.

5 Conclusion

The analysis above indicates that the 5FF portfolio, the Δ ratios portfolio and the Level ratios portfolio performed best over the full time series. In general, these portfolios provide the highest excess mean return while being exposed to the lowest degree of risk in terms of volatility. More precisely, the Δ Ratios portfolio and the Level ratios portfolio always slightly outperform the 5FF portfolio in unsecure market conditions (i.e. the crisis and the recovery period). Due to the fact that both ratio based portfolios identify attractive stocks based on company individual data instead of using market data as benchmark, both methodologies provide superior results in times with insecure or changing market conditions. Besides, the 5FF portfolio provides superior results under stable market conditions. Then, the market is much better predictable and identifying stocks based on the abnormal return over the market benchmark return delivers superior excess returns including a comparably lower risk. This finding is confirmed when investigating the generated abnormal returns of these three portfolios. Here, as ratio based portfolios as well provided the higher abnormal return over the crisis and recovery period, while the 5FF portfolio is most successful under stable conditions. When bringing these findings together, these three portfolios provide the most attractive investment situation to any kind of investor.

The 3FF portfolio performs constantly attractive as well, but however due to the fact that is considers less factors that the 5FF model, it is constantly outperformed by the three dominating portfolios.

Further, the TR portfolio provides positive results too, which are nevertheless comparably unattractive to investors. Here, the forecast/interpretation error that has already been identified in prior literature shows its influence together with the empirical proof from prior literature that trade recommendations cannot provide an investor with the best possible base for investment decisions.

Finally, the F Ratios portfolio was the lowest performing portfolio in almost all situations (except for the market recovery period). Here, the forecast error clearly negatively influences the portfolio performance together with the fact that, by nature, only a limited amount of information is taken into consideration. Therefore, this portfolio is almost constantly outperformed from the TR portfolio. However, the portfolio provided attractive results under the market recovery period. Due to the fact that under these market conditions almost all companies gain value, the forecast error might be minimized due to a comparably easier analysis situation for the forecaster (all companies gain value). Thus, the performance of the F Ratios portfolio and the TR portfolio has been best under stable market conditions.

The long versus the short proportion per portfolio strongly depend on the market situation. In general, an almost equal distribution among long and short proportions is observed under stable market conditions, with a slight tendency to the long position. This can be explained with the assumption that companies in general grow over time.
Over the period of the crisis, the proportion is strongly shifted towards the short returns. In this period, companies generally lose value so that shorting them seems to be reasonable to create positive returns. This shift has especially be observed in the ratio based portfolios. This observation again underlines the conclusion that basing investment decisions on financial analysis (ratios) in times of a crisis leads to superior portfolio performance, since attractive investments (mainly shorting opportunities) are identified more reliable. In recovering market conditions, the long versus short proportion shifts towards the opposite. Here, the main proportion of returns is mainly generated with long positions, which is according to the fact that companies mainly gain back value. In line with the previously determined conclusion regarding the superior effectivity of ratio based portfolios in periods with changing market conditions, the superior performance has been observed here as well.

In the scope of comparing the Qn+1 versus the Qn approach, it is concluded that the Qn+1 approach generally generates a better portfolio performance over all market conditions. This is due to the fact that the Qn+1 approach is more future oriented. Hence, it reflects better the financial developments per company (stock). However, the only assumption observed is the TR portfolio. Here, the Qn approach generates clearly better results than the Qn+1 approach. This is due to the fact that within the Qn+1 approach, trade recommendations are observed over a quarter, and then, the investment is made in the following quarter. This leads to the fact that the investments are made after the trade recommendations might already be expired or at least less applicable. In the Qn approach, it is directly invested in the period in time when the trade recommendation is published. However, to make the portfolio comparable, the Qn+1 approach is applied to the TR portfolio as well. As a result of this finding it can be concluded that investing according to trade recommendations provide of course a better result when investing directly after publication. However, in regard to practice, forming a portfolio based on trade recommendations will confront the investor with practical difficulties.

Finally, it is deduced that all previously established conclusions hold true among different industries. However, formulating this conclusion might be misleading. In the scope of this project, the NYSE has been classified in three different industries. As a result, a strong diluting

effect has been occurred. Consequently, after confirming that all conclusions hold true across industries, it has to be critically considered that this might only be due to the less precise classification of different industries in the scope of this project. However, due to the fact that the investigation across industries does not represent the main research focus of this project, this diluting effect had to be accepted. Nevertheless, investigating the performance across industries in more detail might be an attractive further extension of this research.

6 Limitations

Within its conduction, this project has been facing several limitations as well. Next to this, additional opportunities for further research arise as well.
To start, ratio based portfolios of course only consider a limited amount of data (the data that are included in the ratios. Therefore, more ratios can be included in order to minimize this. However, it is (most likely) not possible to consider literally all information in the scope of a financial analysis. Thus, this limitation always exist in this context.

Furthermore, the industry analysis can be enhanced with more industry classifications. The more different industry classifications are taken into account, the more precisely the analysis will deliver results. As this project's main purpose is not to determine the effectiveness of the methodologies across industries, the diluting effect is accepted. (main focus: analysis across different market conditions).

Moreover, a further extension of the research would be to test if the conclusion also hold true in emerging markets. Due to the nature of the markets, the factors based on which profitable stocks are identified might differ. As a result, further researching the performances under these circumstances would provide added value.

In addition, the general the fact that accounting data are available only on quarterly basis represent a limitation as well. If the portfolios could be reestablished based on shorter time frames, the degree of detail of the findings could of course be increased.

Finally, other portfolio formation strategies as well as other asset classes can be considered and the corresponding portfolio performances can be statistically investigated. Investigating this further represents an attractive opportunity for further research.

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List of Appendices

Appendix 1: Data Sample Preparation

Asset pricing – 5FF

To establish the data sample based on which the asset pricing models are examined, the daily Holding Period Returns of each public company in North America is obtained via the CRSP database. These data are derived from year 2005 onwards. In a next step, the database is filtered for stocks that are traded at the NYSE based on the Exchange code (Code 1) provided by CRSP. Due to the fact that over the period from year 2005 onwards companies have been closed, merged and newly founded, the companies included in the sample vary per year. However, the sample includes around 2,800 companies yearly, which matches data published from the NYSE about how many companies are traded at this stock exchange.

Next, the data set has been cleaned and an index-match formula with multiple criteria has been applied to process the dataset to a table in which one company ticker per column is linked to one trading day per row.

Asset Pricing – 3FF

Since the 3FF model, alike the 5FF model refers to stock returns as well, the same dataset established based on the output of CRSP is used. The data necessary for the 3FF model are derived from the Kenneth French data library as well.

Level Ratios

To establish a data sample that includes all information required in the scope of the Level of Ratios methodology, the information of CRSP and Compustat has been combined.

To start, the data required to establish the ratios that have been previously identified to be highly correlated with stock returns have been obtained via Compustat. Here, the data of all North American companies are derived beginning from year 2005 as well. In a first step, this large data set is filtered by the Stock exchange Code (Code 11) provided by Compustat. Then, because Compustat does not provide calculated ratios, the input factors per ratio are downloaded and each ratio is calculated. Here, the most granular data available are quarterly. Hence, the ratios are also calculated on a quarterly basis.

The information gained and processed to establish the ratios are given in the table below:

Table 7: Level Ratios

ROA	ROE	ROIC	EPS
$\frac{Net\ Income}{Total\ Assets}$	$\frac{Net\ Income}{Total\ Equity}$	$\frac{EBIT * (1 - Tc)}{Total\ Debt + Equity}$	$\frac{Net\ Income - Pref.Divindes}{Common\ shares\ outstanding}$

Source: Investopedia 2019, own illustration

In a next step, the data are proceeded again to a set that includes one ticker per column and one quarter per line via an index match formula with multiple criteria. This is done per ratio, so that four data sets are established (one per ratio).

In order to establish a portfolio, the data gained from Compustat need to be linked to their corresponding stock returns, derived from CRSP. Due to the fact that both databases use different tickers (and both not the official ones), the Permno code provided by CRSP is used. This code identifies a company over the whole period of its existence and is never given to two companies, even if one company goes bankrupt, merges of closes for other reasons. Consequently, using the Permno code as identifier guarantees a combination of both databases without the risk of confusion. The Permno code can is linked to the individual tickers of Compustat, so that the return of each company`s stock is unequivocally linked to its corresponding ratio per particular point in time.

As result, around 2,800 companies are taken into consideration at any point in time here as well.

Delta of Ratios

In additional analysis, stocks are identified based on the development of their ratios from one observation period to the other. As determined in the Literature review, the delta of the Gross margin and the delta of the EBITDA margin are, based on prior literature, identified to be strongly correlated with stock returns. The accounting data required to calculate the margins are again collected from Compustat. Following the same approach that described above, the data from all companies traded in North America are downloaded beginning from year 2005 onwards and filtered based on the Stock Exchange Code (Code 11) for the stocks traded at the NYSE. In line with the described nature of Compustat, these data are available on a quarterly base as well.

The information used to determine both margins are stated below:

Table 8: Δ Ratios

Gross Margin	EBITDA Margin
$\frac{Gross\ Profit}{Total\ Revenues}$	$\frac{EBITDA}{Total\ Revenues}$

Source: Investopedia 2019, own illustration

According to the previously described approach, the resulting margins are proceeded to a set in which one ticker per column brings the margin together with the corresponding quarter of each year.

Then, the delta per margin from one quarter to the following is calculated by dividing the margin of quarter Qn+1 over the margin of quarter Qn. To provide the pure proportional change, 1 is then subtracted from the result. As an example, to determine the change of a ratio in 4Q2018, the observed value if this quarter is divided by the value in 3Q2018 and 1 is subtracted. Consequently, the proportional change per quarter is observed per company for each margin.
In a last step, the resulting two sets of data are linked to the corresponding Holding Period Returns from CRSP based on the Permno code as described above.

Forecasted Ratios

Also investigated is the effectiveness of basing investment decision on ratios forecasted by financial experts. Therefore, ratio forecasts are downloaded from I/B/E/S and linked to the corresponding Holding Period Returns obtained from CRSP.
In line with the previously described establishment of datasets, in a first step forecast data from all companies traded at a stock exchange in North America are derived. To provide further comparability, this project bases its investigations on the same ratios taken into consideration in the scope of the analysis of Absolute Ratios.
Therefore, the data gained from I/B/E/S and the resulting ratios are:

Table 9: Forecasted Ratios

ROA	ROE	EPS
$\frac{Net\ Income}{Total\ Assets}$	$\frac{Net\ Income}{Total\ Equity}$	$\frac{Net\ Income - Pref.Divindes}{Common\ shares\ outstanding}$

Source: Investopedia 2019, own illustration

However, due to the fact that I/B/E/S does not provide a Stock Exchange code (like CRSP & Compustat), the database could not be filtered for stocks traded at the NYSE here.
After again establishing the previously described dataset with one ticker per column and one quarter per line based on an index-match application, three different data sets are established (one per ratio). In a next step, these data sets are linked to the CRSP output to identify again the corresponding Holding Period Return. However, I/B/E/S and CRSP cannot directly be linked since both databases do not have a variable in common. Nevertheless, the WRDS database provides a macro script that enables to link the output of I/B/E/S directly to CRSP. After excluding all tickers that did not match to one of the CRSP tickers, all companies are removed from the I/B/E/S dataset that are not traded at NYSE.

Trade Recommendations

Trade recommendations published by financial experts can be publicly gained from I/B/E/S as well. With a comparable approach to the previously described, the trade recommendations are downloaded from I/B/E/S for whole North American and filtered for the NYSE in the scope of linking the dataset to the CRSP output. To ease the handling in the context of a quantitative analysis, trade recommendations are not only downloaded as I/B/E/S text, but also as I/B/E/S recommendation code, which follows the following logic:

Table 10: Trade Recommendations classification

I/B/E/S Text	I/B/E/S Recommendation Code
Strong Sell	1
Sell	2
Hold	3
Buy	4
Strong Buy	5

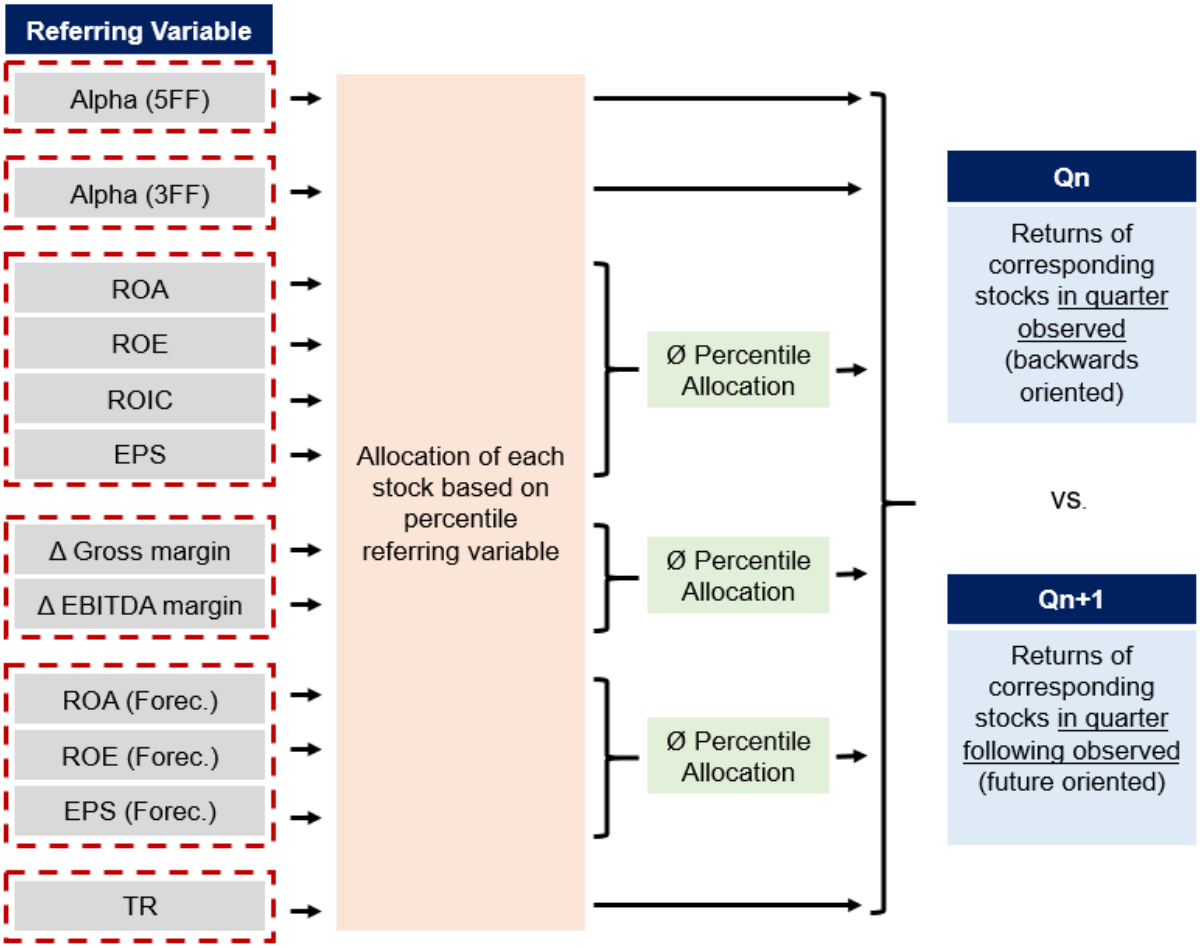
Source: I/B/E/S 2019, own illustration

Since the trade recommendations are not published periodically, the dataset is prepared following the same structure like the set with returns by determining the trade recommendations per ticker per day on a daily basis from year 2005 onwards to year 2018.

Appendix 2: Portfolio Formation Strategy

Following the adapted momentum approach (Zaremba & Szyszka, 2010), the strategy of the portfolio formation is illustrated in the graph at hand.

Graph 15: Portfolio formation strategy



Source: Own Illustration

Like introduced above, the momentum portfolio formation is based on a particular referring variable. Since a (adapted) momentum approach can only be based on one referring variable at a time, one portfolio has been formed per referring variable (in total 12).

To start, in a first step, the percentiles of each referring variable are calculated. This is done per point in time since the percentiles of course change over time. In the scope of this project, this is done quarterly since this is the most detailed time accounting information are publicly available. In the context of the calculation of the percentiles, they are determined in every 10^{th} step, beginning with the 10^{th} percentile until the 90^{th} percentile. Then, all stocks in the sample (the NYSE) are allocated to the corresponding percentile based on the stock's individual level of the referring variable. The allocation is done quarterly as well, since the value of the percentiles change and the allocation of the stocks consequently with it. In a final step, the

stocks allocated above the 90th percentile are identified in order to invest long and the stocks in the 10th percentile are shorted. This is done by establishing a long-short portfolio in which the positive return of the long investments is added to the positively expressed negative returns of the short positions. As result, a long-short portfolio for each referring variable is formed and quarterly adjusted on a rolling basis.

Like illustrated in graph 15 at hand, the 5FF portfolio, the 3FF portfolio and the TR portfolio are based on one referring variable. Thus, the long-short portfolios established are a final. However, the ratio based portfolios (Δ Ratios, Level Ratios & Forecasted Ratios) include at least two referring variables. Consequently, to establish one portfolio per investment methodology, the individual portfolios of each referring variable need to be combined. To do so, the individual asset allocation according to the corresponding percentile of each portfolio is averaged with the asset allocation based on the other referring variables. With this average allocation, the final portfolio is then established according to the approach explained.

Appendix 3: Further Statistical measures for Portfolio Performance Evaluation

Next to this, to provide a holistic view of the portfolio performance, the normal distribution of the returns is investigated.

Table 11: Normal Distribution Tests

Normal Distribution	
Statistical Measure	Significance test
Skewness	Not Applicable
Excess Kurtosis	Not Applicable
Jarque-Bera Test	P-Value

Source: Own Illustration

In general, investigating the degree of normal distribution of portfolio returns is performed to investigate the distribution of returns in terms of value and frequency. This can help to predict the extend of coming returns to the investor. In this context, skewness and kurtosis are investigated to identify to what extend the distribution differs from the normal distribution. Here, extreme values are taken into consideration instead of focusing solely on averages. However, in the context of this project, the extend to which the portfolio returns differ from a normal distribution does not provide answers to the investigated problem. However, the statistics are still calculated and tested for significance in order to make the information available and to refer to it if necessary.

Table 12: Additional Tests

Additional Tests	
Statistical Measure	Significance test
Minimum	Not Applicable
Maximum	Not Applicable
Median	Not Applicable
25th Percentile	Not Applicable
75th Percentile	Not Applicable

Source: Own Illustration

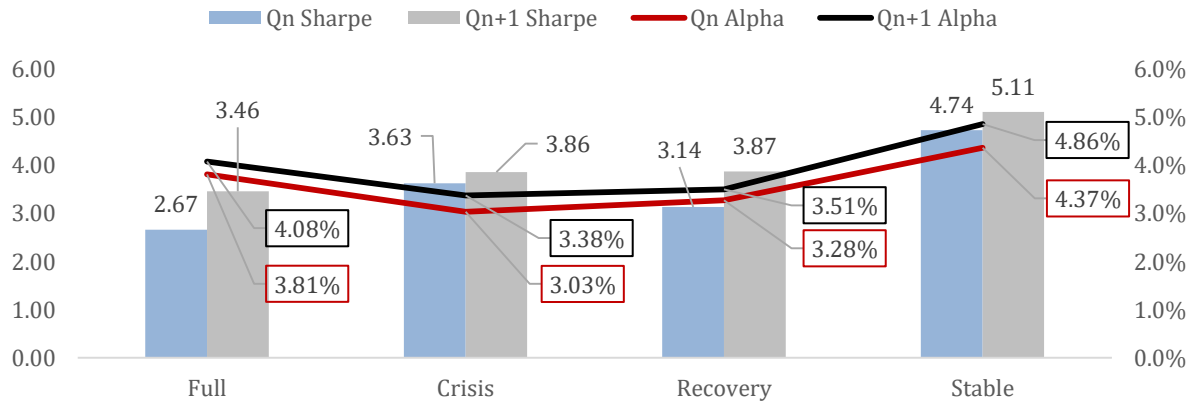
To provide a holistic set of information regarding the portfolio performances, the additional measures are provided as well. Here, a better overview about the portfolio data is given in case it is needed. Due to the high amount of data received in this project, all results are stated in detail in the appendices. Nevertheless, they are referred to in case it is necessary to further investigate results and/or to provide information that give an added value in the context of the analysis.

Appendix 4: Qn+1 vs. Qn Detailed Analysis Results

5FF Portfolio

To start, the realized returns and the implied risk of the 5FF portfolio according to Qn is compared to the gained data of Qn+1. The following data are observed:

Graph 16: Qn versus Qn+1, 5FF



Source: Internal analysis, own illustration

Table 13: Statistical Significance of Analysis factors, 5FF portfolio, Qn+1 vs. Qn

T-Test values	Full	Crisis	Recovery	Stable
Qn Sharpe	9.35***	3.73***	4.17***	6.80***
Qn+1 Sharpe	9.80***	3.76***	4.60***	7.21***

Note: The table states the t-test values. "*" significance on 10% level; "**" significance on a 5% level; "***" significance on a 1% level indicate the statistical significance of the corresponding analysis value.
Source: Internal analysis, own illustration

The t – test results confirm that the Sharpe Factors observed according to the Qn+1 and the Qn approach are both statistically significant on a 1% level over all periods investigated. The determined p – values underline this, so that conclusions can be drawn based on these values.

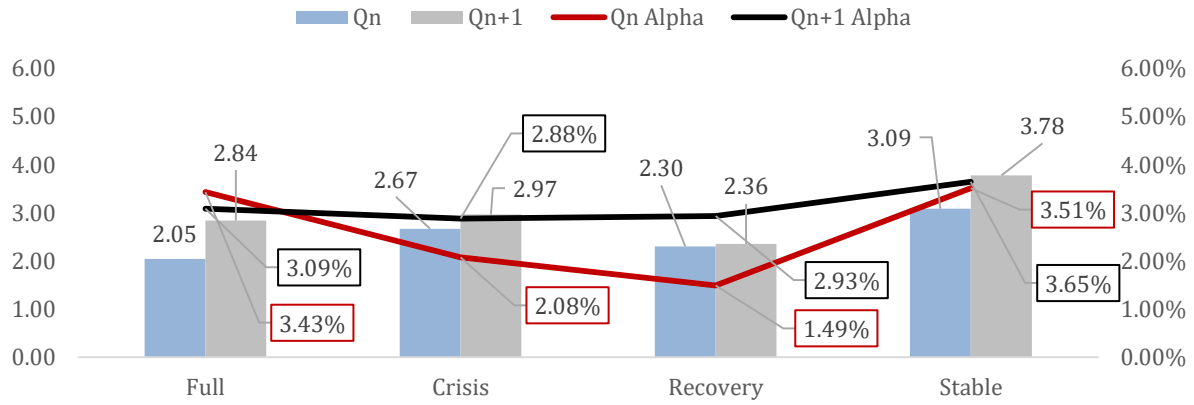
Here, the Sharpe Factor realized according to the Qn+1 approach is constantly higher. Especially, in periods with developing (changing) market conditions, the Qn+1 strategy produces a higher Sharpe Factor. In the crisis period, the Sharpe Factor can be increased by around 0.25, which indicates that the Qn+1 strategy provides a higher excess return and a lower volatility compared to Qn. This goes in hand with the Hypothesis, in which it is assumed that, as long as the referring variable is strongly correlated with the stock return, the portfolio provides higher returns due to its investment in the following quarter (not the actual) according to the Qn+1 strategy. By doing so, indications about future company performances are better reflected in the portfolio performance. This effect can also be observed during the conditions of the emerging market. Here, due to its (now positively) developing nature, the Qn+1 provides a higher Sharpe Factor as the Qn strategy (3.87 versus 3.14 respectively).

To conclude, the Qn+1 strategy provides a higher Sharpe Factor of 3.46 over the fill time series, which is mainly due to the better performance in changing market conditions. This goes in hand with the observation that according to the Qn+1 approach, constantly higher abnormal returns are generated under all market conditions.

3FF Portfolio

Furthermore, the Qn strategy and the Qn+1 strategy is compared based on the 3FF portfolio. The gained results are illustrated at hand:

Graph 17: Qn versus Qn+1, 3FF



Source: Internal analysis, own illustration

Table 14: Statistical Significance of Analysis factors, 3FF Portfolio, Qn+1 vs. Qn

T-Test values	Full	Crisis	Recovery	Stable
Qn Sharpe	8.71***	3.53***	4.17***	6.80***
Qn+1 Sharpe	9.47***	3.61***	4.20***	7.01***

Note: The table states the t-test values. "*" significance on 10% level; "**" significance on a 5% level; "***" significance on a 1% level indicate the statistical significance of the corresponding analysis value.
Source: Internal analysis, own illustration

The 3FF portfolio provides statistically significant results on a 1% level only as well. Consequently, representative conclusions can be drawn here as well.

In the scope of the analysis based on the 3FF portfolio, comparable results are identified as well. Due to the same reasons like stated above, the Qn+1 strategy better compensate market fluctuations, which is reflected in higher Sharpe Factors in the crisis and the emerging period. In line with the previously gained results, both strategies perform almost equally under stable market conditions.

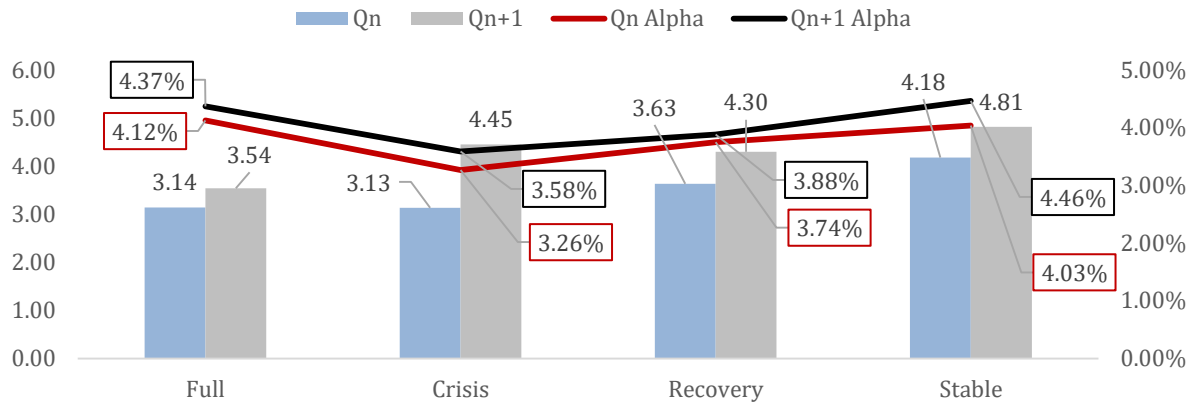
Thus, these factors as well lead to the conclusion that the Qn+1 strategy here better compensates for changing market conditions and therefore provides higher excess returns and a lower volatility over the whole time series under review.

Moreover, especially in the crisis and the recovery period, recognizably higher alpha returns are generated by the Qn+1 approach. Thus, in line with the 5FF portfolio, the better (future oriented) performance of the Qn+1 leads especially in periods of changing market conditions to a better portfolio performance.

Δ Ratios Portfolio

Moreover, the performance of the portfolio according to the Qn strategy versus the performance according to the Qn+1 strategy based on the Δ Ratios portfolio is investigated and compared. The observed data are stated in the graph below:

Graph 18: Qn versus Qn+1, Δ Ratios



Source: Internal analysis, own illustration

Table 15: Statistical Significance of Analysis factors, Δ Ratios Portfolio, Qn+1 vs. Qn

T-Test values	Full	Crisis	Recovery	Stable
Qn Sharpe	9.65***	3.65***	4.57***	7.09***
Qn+1 Sharpe	9.83***	3.81***	4.65***	7.18***

Note: The table states the t-test values. "*" significance on 10% level; "**" significance on a 5% level; "***" significance on a 1% level indicate the statistical significance of the corresponding analysis value.
Source: Internal analysis, own illustration

All Sharpe Factors obtained from the Δ Ratios portfolio are statistically relevant on a 1% level as well. This is according to the observed p – values.

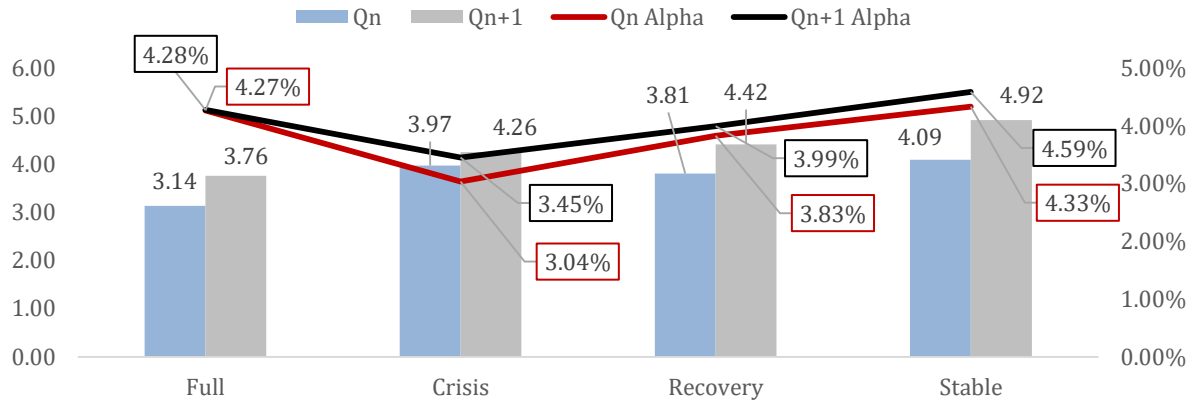
Based on the Δ Ratios portfolio, the Qn+1 strategy again produces superior results compared to the Qn strategy. Here, the positive effect of the Qn+1 strategy in changing market conditions can again be clearly observed. Due to the fact that the delta per ratio (the referring variable on which the portfolio is established) already indicates the development (change/Δ) in the performance of the company, the progressive Qn+1 approach still supports this by investing in the following period. Consequently, the effect here is even further supported.

This is further underlined by the generation of constantly higher abnormal returns in all market conditions.

Level Ratios Portfolio

Additionally, the Abs Ratios portfolio is investigated to figure out if the previously gained results can be confirmed under the Qn+1 strategy. The data are given in the following:

Graph 19: Qn versus Qn+1, Level Ratios



Source: Internal analysis, own illustration

Table 16: Statistical Significance of Analysis factors, Level Ratios Portfolio, Qn+1 vs. Qn

T-Test values	Full	Crisis	Recovery	Stable
Qn Sharpe	9.65***	3.77***	4.59***	7.07***
Qn+1 Sharpe	9.91***	3.80***	4.67***	7.19***

Note: The table states the t-test values. "*" significance on 10% level; "**" significance on a 5% level; "***" significance on a 1% level indicate the statistical significance of the corresponding analysis value.
Source: Internal analysis, own illustration

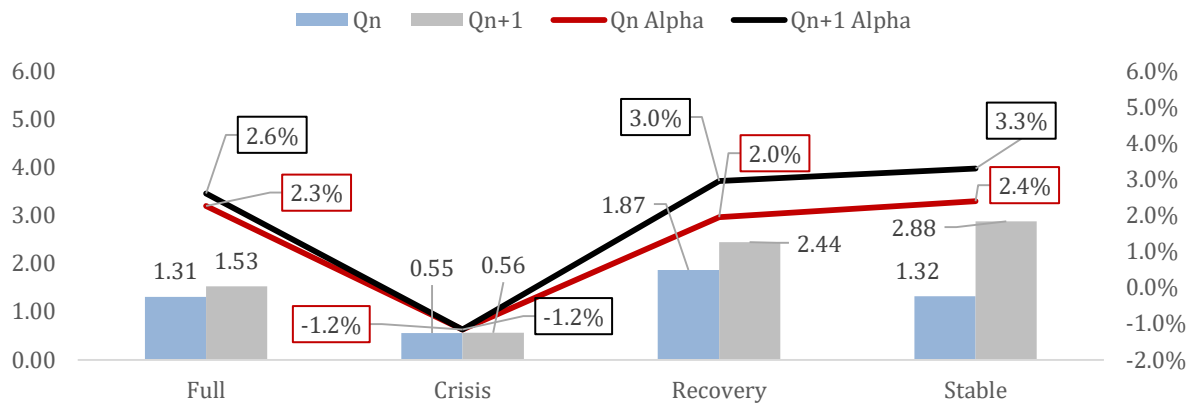
Statistical significance can be confirmed based on the t – test results on a 1% level for all data, too. Besides, the p - value provides another statistical proof for significance. By investigating the Level Ratios portfolio, the previously determined findings can be confirmed. The Qn+1 strategy also here helps to deal with changing market conditions and provide under these circumstances a higher return. Besides, also here, the results previously gained generally hold true and are supported by the Qn+1 strategy.

Besides, also here the observed abnormal returns confirm the superior performance of the Qn+1 strategy, especially under crisis market conditions. However, over the full time series, the Qn+1 strategy produces only a slightly higher abnormal return compared to the Qn strategy.

Forecast Ratios Portfolio

Then, the Forecast Ratios portfolio is analyzed under the consideration of the differences between the Qn and the Qn+1 strategy and these results are gained:

Graph 20: Qn versus Qn+1, Forecast Ratios



Source: Internal analysis, own illustration

Table 17: Statistical Significance of Analysis factors, F Ratios Portfolio, Qn+1 vs. Qn

T-Test values	Full	Crisis	Recovery	Stable
Qn Sharpe	7.19***	1.46*	3.90***	5.11***
Qn+1 Sharpe	7.77***	1.48*	4.24***	6.72***

Note: The table states the t-test values. "*" significance on 10% level; "**" significance on a 5% level; "***" significance on a 1% level indicate the statistical significance of the corresponding analysis value.
Source: Internal analysis, own illustration

The t – test results indicate statistical significance for the Sharpe Factors (according to Qn+1 & Qn) on a 1% level over the full times series, during the market recovery period and under stable market conditions. However, over the period of the crisis, the Sharpe Factors are only significant on a 10% level. Nevertheless, the data provide a statistically significant base to draw conclusions.

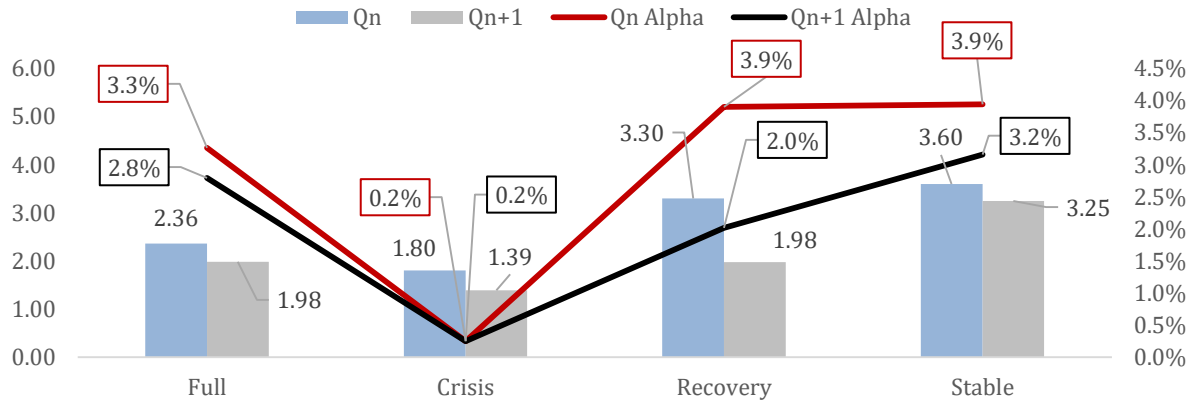
In line with the previously made observations, the Qn+1 strategy provides a good strategy to compensate market insecurities. However, the Qn+1 strategy is, in terms of the Sharpe Factor, clearly dominant over the period of the market recovery but produces a very comparable Sharpe Factor over the period of the crisis. Next to this, this portfolio provides the strongest difference in Sharpe Factor under stable market conditions with a strongly superior performance of the Qn+1 approach. As result, the Sharpe Factors over the full time series under review is higher as well, even though the Sharpe Factor over the crisis period is very comparable.

In line with this findings, the abnormal returns generated are recognizably higher under all market conditions investigated. However, in the period of crisis, both approaches generated the same negative abnormal return of -1.2%. Thus, in both approaches, the portfolio generated a lower return than the overall market and is therefore for an investor unattractive at all in crisis conditions.

Trade Recommendations Portfolio

Finally, the portfolio established based on the Trade Recommendations is examined as well. The gained results are given below:

Graph 21: Qn versus Qn+1, Trade Recommendations



Source: Internal analysis, own illustration

Table 18: Statistical Significance of Analysis factors, TR Portfolio, Qn+1 vs. Qn

T-Test values	Full	Crisis	Recovery	Stable
Qn Sharpe	9.08***	3.15***	4.50***	6.96***
Qn+1 Sharpe	8.62***	2.81**	3.98***	6.86***

Note: The table states the t-test values. "*" significance on 10% level; "**" significance on a 5% level; "***" significance on a 1% level indicate the statistical significance of the corresponding analysis value.
Source: Internal analysis, own illustration

The Sharpe Factors are statistically significant on a 1% level except for the Qn+1 Sharpe Factor over the Crisis Period, which is statistically significant on a 5% level. Besides, this is as well confirmed by p – values. As result of the observed statistical significance, the obtained values allow representative conclusions.

Here, it is observed that the Qn+1 strategy does not provide an increase in the Sharpe Factor over the crisis or the recovering period. It is concluded, that the Qn+1 strategy reduces the Sharpe Factors over all periods in the time series.

This may result from the fact that the Qn+1 strategy in the case of the TR portfolio leads to the investment in an asset at the "wrong" time. Usually, a trade recommendation gives the advice to invest (or short) a particular asset at a particular point in time. This is applied in the Qn strategy. By investing now according to the Qn+1 strategy, the portfolio invests in the asset always one period "too late", so consequently in a period in which the recommendation might not be valid anymore. Consequently, the excess returns of the portfolio are reduced and the degree of risk the portfolio is exposed to is increased. As result, the Sharpe Factor is reduced under all market circumstances due to this systematic mistake.

As result from these circumstances, the generated abnormal returns are significantly higher in the recovery and stable period. Only during the crisis, the portfolio generates a comparable alpha return, even though the Sharpe Factor here is recognizably higher with the Qn approach as well. To conclude, the Qn approach increases the performance of the TR portfolio significantly according to the Sharpe Factor and the generated abnormal returns as well. This is due to the fact that the Qn approach leads to the direct investment in the companies that are recommended to be traded, while the Qn+1 approach leads to a delay in the investment and therefore is more unprecise.

Appendix 5 - Descriptive Statistics General Analysis – Qn+1

Table 19: Descriptive Statistics, General Analysis, Qn+1

	Recovery						Stable Market					
	5FF	3FF	Δ Ratios	Lev. Ratios	F Ratios	TR	5FF	3FF	Δ Ratios	Lev. Ratios	F Ratios	TR
Mean (%)	3.41%	3.06%	3.26%	4.02%	3.09%	2.23%	4.80%	3.65%	4.82%	5.02%	3.54%	3.18%
t-stat	*13.41*	*8.17*	*14.89*	*15.30*	*8.46*	*6.85*	*27.06*	*19.99*	*25.47*	*26.03*	*15.24*	*17.19*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Sharpe ratio	3.87	2.36	4.30	4.42	2.44	1.98	5.11	3.78	4.81	4.92	2.88	3.25
t-stat	*4.60*	*4.20*	*4.65*	*4.67*	*4.24*	*3.98*	*7.21*	*7.01*	*7.18*	*7.19*	*6.72*	*6.86*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Std. Dev. (%)	0.88%	1.30%	0.76%	0.91%	1.26%	1.13%	0.94%	0.96%	1.00%	1.02%	1.23%	0.98%
Skewness	-0.93	-0.16	1.01	-0.79	0.10	0.56	-0.65	-1.86	-3.11	-3.40	-0.57	-0.41
Excess kurtosis	0.82	-1.82	0.59	-0.75	-0.07	-0.78	1.11	4.47	12.24	13.89	-0.62	-0.30
JB test statistic	2.07	1.71	2.20	1.52	0.02	0.94	3.38	39.36	219.76	278.95	1.96	0.90
p-value	0.35	0.42	0.33	0.47	0.99	0.63	0.18	0.00	0.00	0.00	0.37	0.64
Minimum (%)	1.46%	1.41%	2.35%	2.46%	0.92%	0.63%	2.15%	0.40%	0.55%	0.56%	1.36%	1.33%
Median (%)	3.37%	3.40%	3.23%	4.41%	3.34%	1.91%	4.92%	3.87%	5.21%	5.26%	3.84%	3.27%
Maximum (%)	4.50%	4.72%	4.79%	4.98%	5.45%	4.27%	6.52%	4.86%	5.63%	5.85%	5.65%	4.92%
Swift	3.04%	3.31%	2.44%	2.52%	4.53%	3.64%	4.37%	4.46%	5.08%	5.29%	4.29%	3.59%
Percentile 25 (%)	3.16%	1.82%	2.75%	3.43%	2.20%	1.43%	4.19%	3.38%	4.50%	4.99%	2.80%	2.69%
Percentile 75 (%)	4.12%	4.12%	3.34%	4.71%	3.73%	3.09%	5.38%	4.20%	5.29%	5.55%	4.45%	3.75%

	Full Time Series						Crisis					
	5FF	3FF	Δ Ratios	Lev. Ratios	F Ratios	TR	5FF	3FF	Δ Ratios	Lev. Ratios	F Ratios	TR
Mean (%)	4.00%	3.14%	4.23%	4.30%	2.63%	2.66%	2.95%	2.49%	3.18%	3.21%	0.83%	1.62%
t-stat	*25.89*	*21.25*	*26.46*	*28.17*	*11.45*	*14.85*	*10.91*	*8.40*	*12.59*	*12.04*	*1.59*	*3.94*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.11*	*0.00*
Sharpe ratio	3.46	2.84	3.54	3.76	1.53	1.98	3.86	2.97	4.45	4.26	0.56	1.39
t-stat	*9.80*	*9.47*	*9.83*	*9.91*	*7.77*	*8.62*	*3.76*	*3.61*	*3.81*	*3.80*	*1.48*	*2.81*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.14*	*0.00*
Std. Dev. (%)	0.01	1.11%	1.20%	1.14%	1.72%	1.34%	0.76%	0.84%	0.71%	0.75%	1.47%	1.16%
Skewness	-0.50	-0.76	-1.09	-1.27	-0.43	-0.43	1.54	-0.71	-0.73	0.20	-0.89	1.05
Excess kurtosis	0.64	-0.10	1.15	1.88	-0.53	-0.64	2.66	-0.53	-0.50	2.60	-0.64	0.67
JB test statistic	3.33	5.41	14.18	23.27	2.40	2.65	5.50	0.76	0.80	2.31	1.20	1.61
p-value	0.19	0.07	0.00	0.00	0.30	0.27	0.06	0.68	0.67	0.32	0.55	0.45
Minimum (%)	0.00%	0.00%	0.00%	0.00%	-1.58%	-0.81%	2.22%	0.99%	1.98%	1.87%	-1.58%	0.50%
Median (%)	4.18%	3.36%	4.55%	4.58%	2.77%	2.81%	2.74%	2.63%	3.31%	3.13%	1.32%	1.36%
Maximum (%)	6.52%	4.86%	5.99%	5.85%	5.65%	4.93%	4.57%	3.34%	4.03%	4.61%	2.42%	3.88%
Swift	6.52%	4.86%	5.99%	5.85%	7.23%	5.74%	2.36%	2.34%	2.05%	2.73%	4.00%	3.38%
Percentile 25 (%)	3.24%	2.28%	3.27%	3.43%	1.41%	1.47%	2.43%	2.05%	2.88%	3.07%	0.13%	0.76%
Percentile 75 (%)	4.89%	4.00%	5.27%	5.25%	3.97%	3.74%	3.22%	3.17%	3.67%	3.29%	1.84%	2.12%

Source: Own illustration

Appendix 6 - Descriptive Statistics General Analysis – Qn

Table 20: Descriptive Statistics, General Analysis, Qn

	Full Time Series						Crisis					
	5FF	3FF	Δ Ratios	Lev. Ratios	F Ratios	TR	5FF	3FF	Δ Ratios	Lev. Ratios	F Ratios	TR
Mean (%)	4.21%	3.31%	4.03%	4.33%	2.07%	3.21%	2.12%	2.21%	2.84%	2.34%	0.71%	1.54%
t-stat	*19.95*	*15.31*	*23.49*	*23.47*	*9.81*	*17.69*	*10.27*	*7.55*	*8.85*	*11.24*	*1.57*	*5.10*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.12*	*0.00*
Sharpe ratio	2.67	2.05	3.14	3.14	1.31	2.36	3.63	2.67	3.13	3.97	0.55	1.80
t-stat	*9.35*	*8.71*	*9.65*	*9.65*	*7.19*	*9.08*	*3.73*	*3.53*	*3.65*	*3.77*	*1.46*	*3.15*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.14*	*0.00*
Std. Dev. (%)	0.02	1.62%	1.28%	1.38%	1.58%	1.36%	0.58%	0.83%	0.91%	0.59%	1.28%	0.85%
Skewness	-0.13	0.40	-0.64	0.08	1.18	-0.11	-0.56	-0.71	-0.56	0.26	-0.82	-0.73
Excess kurtosis	-1.05	-0.45	0.89	-0.70	4.29	-0.83	-1.02	1.33	-0.92	-1.65	-1.31	-0.68
JB test statistic	2.75	2.01	5.68	1.19	55.92	1.72	0.77	1.25	0.70	1.00	1.47	0.86
p-value	0.25	0.37	0.06	0.55	0.00	0.42	0.68	0.53	0.71	0.61	0.48	0.65
Minimum (%)	1.16%	0.19%	0.00%	1.64%	-1.23%	0.24%	1.16%	0.62%	1.33%	1.64%	-1.23%	0.24%
Median (%)	4.55%	3.00%	4.13%	4.25%	1.79%	3.15%	2.33%	2.30%	3.13%	2.26%	1.42%	1.71%
Maximum (%)	7.19%	7.37%	6.62%	7.03%	8.59%	5.36%	2.84%	3.35%	3.97%	3.14%	1.96%	2.47%
Swift	6.02%	7.19%	6.62%	5.39%	9.81%	5.12%	1.67%	2.73%	2.64%	1.49%	3.19%	2.24%
Percentile 25 (%)	2.79%	2.05%	3.43%	3.43%	1.33%	2.28%	1.65%	1.88%	2.11%	1.86%	-0.27%	1.19%
Percentile 75 (%)	5.39%	4.52%	4.94%	5.46%	2.81%	4.32%	2.49%	2.55%	3.46%	2.80%	1.55%	2.05%

	Recovery						Stable Market					
	5FF	3FF	Δ Ratios	Lev. Ratios	F Ratios	TR	5FF	3FF	Δ Ratios	Lev. Ratios	F Ratios	TR
Mean (%)	2.80%	1.97%	3.72%	4.51%	2.25%	3.56%	5.07%	4.20%	4.48%	4.89%	2.36%	3.80%
t-stat	*10.87*	*7.97*	*12.58*	*13.19*	*6.47*	*11.43*	*25.06*	*16.34*	*22.10*	*21.67*	*7.01*	*19.04*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Sharpe ratio	3.14	2.30	3.63	3.81	1.87	3.30	4.74	3.09	4.18	4.09	1.32	3.60
t-stat	*4.47*	*4.17*	*4.57*	*4.59*	*3.90*	*4.50*	*7.17*	*6.80*	*7.09*	*7.07*	*5.11*	*6.96*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Std. Dev. (%)	0.89%	0.86%	1.02%	1.19%	1.21%	1.08%	1.07%	1.36%	1.07%	1.19%	1.78%	1.06%
Skewness	0.79	-1.22	-0.30	0.37	-0.40	-0.54	0.02	-0.50	-0.33	0.24	1.70	-0.06
Excess kurtosis	0.71	0.97	2.11	0.02	-0.75	0.69	-0.69	-0.30	0.46	-1.31	4.25	-1.36
JB test statistic	1.50	3.43	2.40	0.28	0.60	0.82	0.56	1.27	0.77	2.29	34.65	2.18
p-value	0.47	0.18	0.30	0.87	0.74	0.66	0.76	0.53	0.68	0.32	0.00	0.34
Minimum (%)	1.56%	0.19%	1.45%	2.64%	0.23%	1.29%	3.14%	1.48%	1.94%	3.17%	0.29%	2.22%
Median (%)	2.72%	2.16%	3.62%	4.54%	2.47%	3.62%	4.97%	4.35%	4.34%	4.78%	1.77%	3.98%
Maximum (%)	4.61%	2.97%	5.63%	6.73%	3.83%	5.27%	7.19%	6.52%	6.62%	7.03%	8.59%	5.36%
Swift	3.04%	2.78%	4.18%	4.10%	3.60%	3.98%	4.05%	5.04%	4.67%	3.87%	8.30%	3.14%
Percentile 25 (%)	2.38%	1.83%	3.46%	3.66%	1.40%	3.15%	4.44%	3.48%	4.13%	3.82%	1.13%	2.75%
Percentile 75 (%)	2.96%	2.44%	3.99%	4.94%	2.98%	4.24%	5.98%	5.25%	5.32%	5.98%	3.15%	4.58%

Source: Own Illustration

Appendix 7 – Descriptive Statistics Long – Short – Qn+1

Table 21: Descriptive Statistics, Long – Short, Qn+1

	Full Time Series											
	5FF		3FF		Δ Ratios		Abs Ratios		F Ratios		TR	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Mean (%)	2.07%	1.93%	1.62%	1.52%	2.20%	2.04%	2.27%	2.03%	1.42%	1.21%	1.36%	1.30%
t-stat	17.64	19.78	15.36	19.04	16.86	18.84	16.15	20.07	9.68	10.90	12.52	13.38
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sharpe ratio	2.36	2.64	2.05	2.54	2.25	2.52	2.16	2.68	1.29	1.46	1.67	1.79
t-stat	9.07	9.33	8.72	9.25	8.96	9.23	8.85	9.36	7.14	7.59	8.08	8.30
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Std. Dev. (%)	0.88%	0.73%	0.79%	0.60%	0.98%	0.81%	1.05%	0.76%	1.10%	0.83%	0.81%	0.73%
Skewness	-0.44	-0.26	-0.18	-0.46	-0.86	-0.29	-0.67	-0.55	0.18	-0.82	-0.19	0.07
Excess kurtosis	-0.62	-0.01	-0.90	-0.08	-0.21	-0.20	-0.61	0.15	-1.17	1.23	-1.17	0.31
JB test statistic	2.71	0.62	2.17	2.01	7.02	0.86	5.09	2.90	3.49	9.79	3.52	0.27
p-value	0.26	0.73	0.34	0.37	0.03	0.65	0.08	0.23	0.17	0.01	0.17	0.87
Minimum (%)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-0.23%	-1.41%	-0.22%	-0.59%
Median (%)	2.24%	1.95%	1.76%	1.59%	2.39%	2.16%	2.66%	2.20%	1.25%	1.36%	1.46%	1.35%
Maximum (%)	3.60%	3.44%	3.34%	2.71%	3.67%	3.69%	4.28%	3.63%	3.72%	2.79%	2.62%	3.33%
Swift	3.60%	3.44%	3.34%	2.71%	3.67%	3.69%	4.28%	3.63%	3.95%	4.20%	2.84%	3.92%
Percentile 25 (%)	1.45%	1.59%	0.86%	1.18%	1.99%	1.56%	1.51%	1.52%	0.40%	0.82%	0.73%	0.80%
Percentile 75 (%)	2.66%	2.45%	2.21%	1.94%	2.87%	2.51%	3.03%	2.59%	2.36%	1.70%	2.04%	1.78%

	Crisis											
	5FF		3FF		Δ Ratios		Abs Ratios		F Ratios		TR	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Mean (%)	0.74%	2.21%	0.65%	1.84%	0.47%	2.71%	0.57%	2.64%	0.13%	0.69%	0.28%	1.34%
t-stat	10.11	11.09	8.56	8.22	13.32	11.81	6.00	12.94	1.64	1.56	4.31	3.81
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.12	0.00	0.00
Sharpe ratio	3.58	3.92	3.03	2.91	4.71	4.18	2.12	4.58	0.58	0.55	1.52	1.35
t-stat	3.72	3.76	3.62	3.60	3.83	3.79	3.33	3.82	1.52	1.45	2.93	2.76
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.15	0.00	0.01
Std. Dev. (%)	0.21%	0.56%	0.21%	0.63%	0.10%	0.65%	0.27%	0.58%	0.23%	1.25%	0.18%	0.99%
Skewness	0.93	1.72	-0.71	-0.71	0.81	-0.69	0.18	0.31	-0.75	-0.87	0.18	1.19
Excess kurtosis	0.53	3.34	-0.84	-0.44	0.21	-0.13	-0.19	0.61	-0.97	-0.47	-1.72	1.25
JB test statistic	1.25	7.65	0.90	0.74	0.90	0.64	0.06	0.25	1.07	1.08	1.03	2.41
p-value	0.53	0.02	0.64	0.69	0.64	0.73	0.97	0.88	0.58	0.58	0.60	0.30
Minimum (%)	0.53%	1.69%	0.29%	0.70%	0.37%	1.60%	0.15%	1.73%	-0.23%	-1.41%	0.07%	0.42%
Median (%)	0.70%	2.05%	0.68%	1.93%	0.46%	2.83%	0.55%	2.61%	0.21%	1.07%	0.27%	1.17%
Maximum (%)	1.13%	3.44%	0.86%	2.49%	0.65%	3.58%	0.98%	3.63%	0.39%	2.13%	0.55%	3.33%
Swift	0.60%	1.76%	0.57%	1.79%	0.28%	1.98%	0.83%	1.90%	0.62%	3.54%	0.48%	2.92%
Percentile 25 (%)	0.59%	1.84%	0.55%	1.49%	0.37%	2.49%	0.42%	2.40%	-0.01%	0.15%	0.11%	0.56%
Percentile 75 (%)	0.84%	2.38%	0.84%	2.34%	0.51%	3.10%	0.68%	2.78%	0.30%	1.48%	0.44%	1.68%

	Stable Market											
	5FF		3FF		Δ Ratios		Abs Ratios		F Ratios		TR	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Mean (%)	2.59%	2.21%	1.99%	1.66%	2.74%	2.08%	2.87%	2.15%	2.06%	1.48%	1.77%	1.41%
t-stat	25.74	18.81	17.88	16.78	23.42	19.93	22.92	16.56	12.54	13.70	16.25	15.12
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sharpe ratio	4.86	3.55	3.38	3.17	4.43	3.77	4.33	3.13	2.37	2.59	3.07	2.86
t-stat	7.19	6.95	6.90	6.83	7.13	7.01	7.11	6.82	6.43	6.57	6.80	6.71
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Std. Dev. (%)	0.53%	0.62%	0.59%	0.52%	0.62%	0.55%	0.66%	0.69%	0.87%	0.57%	0.58%	0.49%
Skewness	-0.01	-0.53	-0.91	-0.78	-2.28	-1.16	-1.89	-1.28	-0.16	0.43	-0.43	0.14
Excess kurtosis	-0.39	0.61	2.86	1.80	9.18	3.34	7.79	1.57	-0.79	-0.05	-0.51	-0.34
JB test statistic	0.18	1.73	13.39	6.63	122.42	19.31	87.40	10.53	0.84	0.88	1.18	0.23
p-value	0.91	0.42	0.00	0.04	0.00	0.00	0.00	0.01	0.66	0.64	0.55	0.89
Minimum (%)	1.47%	0.68%	0.23%	0.17%	0.26%	0.29%	0.33%	0.22%	0.58%	0.57%	0.59%	0.54%
Median (%)	2.55%	2.29%	2.14%	1.72%	2.79%	2.19%	2.89%	2.26%	2.24%	1.46%	1.80%	1.38%
Maximum (%)	3.60%	3.33%	3.34%	2.71%	3.67%	3.22%	4.28%	3.14%	3.72%	2.79%	2.62%	2.42%
Swift	2.13%	2.65%	3.10%	2.55%	3.41%	2.93%	3.95%	2.92%	3.14%	2.23%	2.03%	1.88%
Percentile 25 (%)	2.25%	1.88%	1.78%	1.46%	2.49%	1.83%	2.75%	1.99%	1.25%	1.11%	1.47%	1.07%
Percentile 75 (%)	2.90%	2.55%	2.27%	1.95%	3.08%	2.39%	3.23%	2.64%	2.61%	1.74%	2.18%	1.70%

	Recovery											
	5FF		3FF		Δ Ratios		Abs Ratios		F Ratios		TR	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Mean (%)	2.11%	1.30%	1.84%	1.22%	2.09%	1.17%	2.61%	1.41%	1.63%	1.45%	1.21%	1.02%
t-stat	15.12	10.01	8.16	7.65	16.29	11.04	15.38	12.06	7.36	8.04	7.06	6.26
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sharpe ratio	4.37	2.89	2.36	2.21	4.70	3.19	4.44	3.48	2.12	2.32	2.04	1.81
t-stat	4.66	4.40	4.20	4.13	4.69	4.48	4.67	4.54	4.08	4.18	4.03	3.86
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Std. Dev. (%)	0.48%	0.45%	0.78%	0.55%	0.44%	0.37%	0.59%	0.40%	0.77%	0.63%	0.59%	0.57%
Skewness	-1.79	-0.15	-0.17	0.19	0.29	1.23	-0.80	0.08	0.41	0.18	0.56	0.54
Excess kurtosis	3.69	-1.13	-1.75	-1.48	0.20	1.23	0.06	-1.03	-0.55	-0.69	-1.00	-0.72
JB test statistic	13.21	0.69	1.58	1.17	0.19	3.78	1.28	0.54	0.48	0.30	1.13	0.83
p-value	0.00	0.71	0.45	0.56	0.91	0.15	0.53	0.76	0.79	0.86	0.57	0.66
Minimum (%)	0.85%	0.61%	0.80%	0.53%	1.35%	0.79%	1.46%	0.79%	0.48%	0.44%	0.40%	0.23%
Median (%)	2.15%	1.28%	2.10%	1.15%	2.08%	1.07%	2.66%	1.47%	1.60%	1.44%	1.06%	0.82%
Maximum (%)	2.58%	1.92%	2.95%	2.11%	2.89%	2.00%	3.35%	2.08%	3.05%	2.44%	2.28%	2.00%
Swift	1.73%	1.31%	2.15%	1.58%	1.54%	1.21%	1.89%	1.29%	2.56%	2.00%	1.87%	1.77%
Percentile 25 (%)	2.05%	1.07%	1.09%	0.75%	1.92%	0.90%	2.43%	1.01%	1.00%	1.01%	0.75%	0.71%
Percentile 75 (%)	2.44%	1.71%	2.41%	1.74%	2.22%	1.27%	3.06%	1.65%	2.02%	1.88%	1.84%	1.36%

Source: Own Illustration

Appendix 8 – Descriptive Statistics Long – Short – Qn

Table 22: Descriptive Statistics, Long – Short, Qn

	Full Time Series											
	5FF		3FF		Δ Ratios		Abs Ratios		F Ratios		TR	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Mean (%)	2.23%	1.98%	1.61%	1.70%	2.05%	1.98%	2.11%	2.23%	1.01%	1.06%	1.55%	1.66%
t-stat	14.63	21.43	12.77	15.49	15.77	20.75	16.01	20.00	8.91	9.75	13.91	16.31
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sharpe ratio	1.95	2.86	1.71	2.07	2.11	2.77	2.14	2.67	1.19	1.30	1.86	2.18
t-stat	8.57	9.49	8.15	8.74	8.79	9.43	8.83	9.35	6.82	7.17	8.42	8.88
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Std. Dev. (%)	1.14%	0.69%	0.94%	0.82%	0.97%	0.71%	0.99%	0.83%	0.85%	0.81%	0.83%	0.76%
Skewness	0.12	0.49	0.57	0.45	-0.42	-0.21	-0.42	1.07	1.51	0.63	-0.13	0.60
Excess kurtosis	-0.63	-0.24	0.00	0.19	-0.53	-0.18	-0.70	0.67	4.52	2.52	-1.06	0.49
JB test statistic	1.05	2.41	3.07	2.01	2.32	0.50	2.83	11.65	68.82	18.54	2.81	3.97
p-value	0.59	0.30	0.22	0.37	0.31	0.78	0.24	0.00	0.00	0.00	0.25	0.14
Minimum (%)	0.27%	0.77%	0.06%	0.09%	0.00%	0.00%	0.18%	1.09%	-0.37%	-0.86%	0.08%	0.16%
Median (%)	2.35%	1.86%	1.54%	1.68%	2.20%	1.87%	2.25%	2.11%	0.84%	1.01%	1.62%	1.63%
Maximum (%)	5.22%	3.61%	4.41%	3.86%	4.13%	3.52%	3.73%	4.74%	4.58%	4.01%	3.03%	3.79%
Swift	4.95%	2.84%	4.36%	3.76%	4.13%	3.52%	3.55%	3.65%	4.95%	4.87%	2.95%	3.63%
Percentile 25 (%)	1.46%	1.48%	0.84%	1.13%	1.35%	1.52%	1.48%	1.60%	0.40%	0.53%	0.91%	1.10%
Percentile 75 (%)	3.09%	2.46%	2.32%	2.24%	2.70%	2.57%	2.82%	2.45%	1.41%	1.40%	2.21%	2.06%

	Crisis											
	5FF		3FF		Δ Ratios		Abs Ratios		F Ratios		TR	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Mean (%)	0.56%	1.56%	0.56%	1.65%	0.49%	2.35%	0.40%	1.94%	0.11%	0.60%	0.28%	1.26%
t-stat	8.07	11.14	6.96	7.27	6.06	8.63	5.22	12.06	1.06	1.70	4.93	4.97
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.09	0.00	0.00
Sharpe ratio	2.85	3.94	2.46	2.57	2.14	3.05	1.84	4.26	0.37	0.60	1.74	1.76
t-stat	3.58	3.76	3.47	3.50	3.34	3.63	3.17	3.80	1.02	1.57	3.11	3.12
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.12	0.00	0.00
Std. Dev. (%)	0.20%	0.40%	0.23%	0.64%	0.23%	0.77%	0.22%	0.45%	0.28%	1.00%	0.16%	0.72%
Skewness	-0.37	-0.58	-0.53	-0.54	0.35	-0.75	0.61	0.04	-0.92	-0.74	-0.03	-0.74
Excess kurtosis	-1.78	-0.73	1.65	0.30	-0.97	-0.74	-1.64	-2.57	-0.75	-1.40	-1.39	-0.74
JB test statistic	1.23	0.63	1.28	0.42	0.48	0.93	1.39	2.21	1.32	1.40	0.64	0.92
p-value	0.54	0.73	0.53	0.81	0.79	0.63	0.50	0.33	0.52	0.50	0.72	0.63
Minimum (%)	0.27%	0.89%	0.13%	0.49%	0.19%	1.01%	0.18%	1.46%	-0.37%	-0.86%	0.08%	0.16%
Median (%)	0.60%	1.68%	0.58%	1.70%	0.47%	2.59%	0.31%	1.90%	0.24%	1.16%	0.28%	1.40%
Maximum (%)	0.78%	2.06%	0.91%	2.44%	0.85%	3.12%	0.71%	2.45%	0.40%	1.67%	0.50%	2.05%
Swift	0.51%	1.16%	0.78%	1.95%	0.66%	2.10%	0.52%	0.99%	0.77%	2.53%	0.42%	1.89%
Percentile 25 (%)	0.38%	1.27%	0.51%	1.33%	0.31%	1.80%	0.23%	1.54%	-0.07%	-0.20%	0.16%	0.94%
Percentile 75 (%)	0.74%	1.82%	0.63%	2.02%	0.63%	2.97%	0.59%	2.37%	0.29%	1.23%	0.39%	1.74%

	Recovery											
	5FF		3FF		Δ Ratios		Abs Ratios		F Ratios		TR	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Mean (%)	1.38%	1.42%	1.02%	0.95%	1.88%	1.83%	1.89%	2.62%	0.94%	1.32%	1.49%	2.08%
t-stat	11.05	9.27	6.02	7.60	9.76	9.19	8.95	8.10	5.80	5.97	9.02	7.92
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sharpe ratio	3.19	2.67	1.74	2.19	2.82	2.65	2.58	2.34	1.67	1.72	2.61	2.29
t-stat	4.48	4.33	3.80	4.12	4.38	4.32	4.30	4.19	3.74	3.79	4.31	4.17
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Std. Dev. (%)	0.43%	0.53%	0.59%	0.43%	0.67%	0.69%	0.73%	1.12%	0.56%	0.76%	0.57%	0.91%
Skewness	0.14	1.07	0.12	-1.29	-0.08	-0.01	-0.14	0.86	-0.04	0.12	0.03	0.73
Excess kurtosis	0.55	0.54	-0.83	0.77	-0.43	-0.58	-1.42	-0.73	-1.23	-0.06	-0.48	0.20
JB test statistic	0.19	2.46	0.37	3.60	0.11	0.17	1.05	1.73	0.76	0.03	0.12	1.07
p-value	0.91	0.29	0.83	0.17	0.95	0.92	0.59	0.42	0.69	0.98	0.94	0.58
Minimum (%)	0.68%	0.77%	0.06%	0.09%	0.75%	0.70%	0.72%	1.47%	0.14%	0.09%	0.59%	0.70%
Median (%)	1.45%	1.25%	0.98%	1.09%	2.03%	1.82%	1.96%	2.28%	0.94%	1.30%	1.48%	1.93%
Maximum (%)	2.26%	2.47%	1.96%	1.42%	2.98%	2.84%	2.92%	4.74%	1.77%	2.76%	2.49%	3.79%
Swift	1.58%	1.70%	1.90%	1.32%	2.22%	2.15%	2.21%	3.27%	1.63%	2.67%	1.90%	3.10%
Percentile 25 (%)	1.17%	1.16%	0.60%	0.84%	1.41%	1.50%	1.25%	1.79%	0.53%	0.96%	1.16%	1.56%
Percentile 75 (%)	1.54%	1.57%	1.35%	1.23%	2.17%	2.15%	2.57%	3.47%	1.41%	1.93%	1.85%	2.29%

	Stable Market											
	5FF		3FF		Δ Ratios		Abs Ratios		F Ratios		TR	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Mean (%)	2.84%	2.23%	2.12%	2.09%	2.47%	2.00%	2.65%	2.24%	1.27%	1.09%	2.07%	1.73%
t-stat	17.63	18.21	15.81	14.10	21.14	16.23	20.57	15.59	6.95	6.91	20.56	13.96
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sharpe ratio	3.33	3.44	2.99	2.66	4.00	3.07	3.89	2.95	1.31	1.31	3.89	2.64
t-stat	6.89	6.92	6.76	6.61	7.05	6.80	7.03	6.75	5.09	5.08	7.03	6.60
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Std. Dev. (%)	0.85%	0.65%	0.71%	0.78%	0.62%	0.65%	0.68%	0.76%	0.97%	0.83%	0.53%	0.66%
Skewness	0.50	0.43	-0.26	0.35	-0.77	0.28	-0.15	0.68	1.60	1.70	-0.21	0.42
Excess kurtosis	0.89	-0.65	-0.24	0.48	0.77	-0.59	-1.06	-0.44	3.75	4.27	-0.76	-0.67
JB test statistic	2.11	1.37	0.39	0.83	3.44	0.78	1.41	2.38	28.41	34.82	0.86	1.35
p-value	0.35	0.50	0.82	0.66	0.18	0.68	0.49	0.30	0.00	0.00	0.65	0.51
Minimum (%)	1.48%	1.28%	0.64%	0.63%	0.97%	0.97%	1.38%	1.09%	0.10%	0.16%	1.05%	0.70%
Median (%)	2.70%	2.17%	2.20%	2.11%	2.58%	1.85%	2.56%	2.11%	1.04%	0.93%	2.10%	1.67%
Maximum (%)	5.22%	3.60%	3.45%	3.86%	3.63%	3.52%	3.73%	3.76%	4.58%	4.01%	3.03%	3.10%
Swift	3.75%	2.32%	2.82%	3.23%	2.66%	2.55%	2.35%	2.67%	4.48%	3.84%	1.98%	2.40%
Percentile 25 (%)	2.36%	1.69%	1.67%	1.68%	2.23%	1.42%	2.14%	1.63%	0.62%	0.48%	1.73%	1.22%
Percentile 75 (%)	3.45%	2.64%	2.48%	2.37%	2.89%	2.55%	3.25%	2.58%	1.82%	1.38%	2.51%	2.10%

Source: Own Illustration

Appendix 9: Abnormal Returns – Qn+1

Table 23: Abnormal Returns, Qn+1

St. Error for Y intercept												
Degrees of freedom												
Resid. Sum of squares	Δ Ratios						Level Ratios					
Full Time Series	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	-0.0003	-0.0017	0.0005	-0.0012	0.0001	0.0437	-0.0004	-0.0008	0.0000	-0.0009	0.0004	0.0428
St. Error	0.0008	0.0007	0.0004	0.0005	0.0003	0.0019	0.0008	0.0007	0.0004	0.0005	0.0003	0.0019
R2	0.1619	0.0127	#N/A	#N/A	#N/A	#N/A	0.1247	0.0125	#N/A	#N/A	#N/A	#N/A
F stats.	1.9321	50	#N/A	#N/A	#N/A	#N/A	1.4242	50	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0016	0.0080	#N/A	#N/A	#N/A	#N/A	0.0011	0.0078	#N/A	#N/A	#N/A	#N/A
Crisis	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	0.0003	-0.0025	0.0002	0.0000	-0.0010	0.0358	0.0016	0.0014	0.0002	-0.0014	0.0015	0.0345
St. Error	0.0016	0.0015	0.0008	0.0012	0.0005	0.0042	0.0028	0.0026	0.0015	0.0022	0.0009	0.0074
R2	0.8744	0.0047	#N/A	#N/A	#N/A	#N/A	0.6426	0.0084	#N/A	#N/A	#N/A	#N/A
F stats.	2.7857	2	#N/A	#N/A	#N/A	#N/A	0.7191	2	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0003	0.0000	#N/A	#N/A	#N/A	#N/A	0.0003	0.0001	#N/A	#N/A	#N/A	#N/A
Recovery	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	0.0007	-0.0003	-0.0001	0.0009	-0.0002	0.0320	0.0009	0.0015	-0.0008	0.0022	0.0000	0.0348
St. Error	0.0012	0.0012	0.0007	0.0012	0.0004	0.0039	0.0016	0.0016	0.0009	0.0016	0.0005	0.0052
R2	0.3962	0.0080	#N/A	#N/A	#N/A	#N/A	0.2798	0.0105	#N/A	#N/A	#N/A	#N/A
F stats.	0.7875	6	#N/A	#N/A	#N/A	#N/A	0.4663	6	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0003	0.0004	#N/A	#N/A	#N/A	#N/A	0.0003	0.0007	#N/A	#N/A	#N/A	#N/A
Stable Market	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	-0.0013	0.0008	0.0002	-0.0009	0.0000	0.0479	-0.0019	0.0010	0.0008	-0.0009	0.0000	0.0499
St. Error	0.0009	0.0009	0.0005	0.0006	0.0004	0.0022	0.0009	0.0008	0.0005	0.0006	0.0004	0.0021
R2	0.2699	0.0095	#N/A	#N/A	#N/A	#N/A	0.3230	0.0093	#N/A	#N/A	#N/A	#N/A
F stats.	1.6263	22	#N/A	#N/A	#N/A	#N/A	2.0992	22	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0007	0.0020	#N/A	#N/A	#N/A	#N/A	0.0009	0.0019	#N/A	#N/A	#N/A	#N/A

St. Error for Y intercept												
Degrees of freedom												
Resid. Sum of squares	5FF						3FF					
Full Time Series	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	0.0002	-0.0018	-0.0006	-0.0007	0.0003	0.0408	0.0008	0.0003	-0.0006	0.0002	0.0001	0.0309
St. Error	0.0008	0.0006	0.0004	0.0005	0.0003	0.0018	0.0008	0.0007	0.0004	0.0005	0.0003	0.0018
R2	0.2539	0.0115	#N/A	#N/A	#N/A	#N/A	0.0463	0.0121	#N/A	#N/A	#N/A	#N/A
F stats.	3.4028	50	#N/A	#N/A	#N/A	#N/A	0.4860	50	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0022	0.0066	#N/A	#N/A	#N/A	#N/A	0.0004	0.0073	#N/A	#N/A	#N/A	#N/A
Crisis	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	0.0030	-0.0046	-0.0024	0.0031	-0.0003	0.0428	0.0029	-0.0027	-0.0026	0.0042	-0.0009	0.0288
St. Error	0.0006	0.0006	0.0003	0.0005	0.0002	0.0017	0.0021	0.0019	0.0011	0.0016	0.0007	0.0055
R2	0.9814	0.0019	#N/A	#N/A	#N/A	#N/A	0.8399	0.0063	#N/A	#N/A	#N/A	#N/A
F stats.	21.1179	2	#N/A	#N/A	#N/A	#N/A	2.0988	2	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0004	0.0000	#N/A	#N/A	#N/A	#N/A	0.0004	0.0001	#N/A	#N/A	#N/A	#N/A
Recovery	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	0.0009	0.0019	-0.0013	0.0029	0.0002	0.0261	0.0015	0.0010	0.0000	-0.0003	-0.0003	0.0307
St. Error	0.0011	0.0011	0.0006	0.0011	0.0003	0.0034	0.0025	0.0025	0.0013	0.0025	0.0007	0.0079
R2	0.6579	0.0070	#N/A	#N/A	#N/A	#N/A	0.1786	0.0159	#N/A	#N/A	#N/A	#N/A
F stats.	2.3080	6	#N/A	#N/A	#N/A	#N/A	0.2609	6	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0006	0.0003	#N/A	#N/A	#N/A	#N/A	0.0003	0.0015	#N/A	#N/A	#N/A	#N/A
Stable Market	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	0.0003	-0.0008	-0.0011	-0.0001	-0.0002	0.0486	0.0007	0.0014	-0.0008	0.0004	0.0000	0.0365
St. Error	0.0009	0.0008	0.0005	0.0006	0.0004	0.0020	0.0010	0.0009	0.0006	0.0006	0.0004	0.0023
R2	0.2747	0.0089	#N/A	#N/A	#N/A	#N/A	0.1656	0.0098	#N/A	#N/A	#N/A	#N/A
F stats.	1.6669	22	#N/A	#N/A	#N/A	#N/A	0.8731	22	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0007	0.0017	#N/A	#N/A	#N/A	#N/A	0.0004	0.0021	#N/A	#N/A	#N/A	#N/A

St. Error for Y intercept												
Degrees of freedom												
Resid. Sum of squares	F Ratios						TR					
Full Time Series	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	0.0014	-0.0010	-0.0007	-0.0005	0.0004	0.0261	0.0001	-0.0015	0.0000	-0.0008	0.0000	0.0280
St. Error	0.0011	0.0010	0.0006	0.0007	0.0004	0.0027	0.0009	0.0008	0.0005	0.0006	0.0003	0.0021
R2	0.0897	0.0174	#N/A	#N/A	#N/A	#N/A	0.0899	0.0138	#N/A	#N/A	#N/A	#N/A
F stats.	0.9854	50	#N/A	#N/A	#N/A	#N/A	0.9880	50	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0015	0.0152	#N/A	#N/A	#N/A	#N/A	0.0009	0.0095	#N/A	#N/A	#N/A	#N/A
Crisis	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	-0.0064	0.0039	0.0027	-0.0019	-0.0013	-0.0116	-0.0045	0.0027	0.0022	-0.0023	-0.0009	0.0025
St. Error	0.0028	0.0026	0.0015	0.0022	0.0009	0.0074	0.0008	0.0007	0.0004	0.0006	0.0003	0.0021
R2	0.8772	0.0084	#N/A	#N/A	#N/A	#N/A	0.9769	0.0024	#N/A	#N/A	#N/A	#N/A
F stats.	2.8575	2	#N/A	#N/A	#N/A	#N/A	16.8983	2	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0010	0.0001	#N/A	#N/A	#N/A	#N/A	0.0005	0.0000	#N/A	#N/A	#N/A	#N/A
Recovery	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	0.0015	0.0021	0.0010	-0.0008	-0.0004	0.0321	0.0007	0.0015	-0.0010	0.0025	-0.0004	0.0180
St. Error	0.0015	0.0015	0.0008	0.0015	0.0005	0.0049	0.0020	0.0020	0.0011	0.0020	0.0006	0.0064
R2	0.6632	0.0099	#N/A	#N/A	#N/A	#N/A	0.2839	0.0130	#N/A	#N/A	#N/A	#N/A
F stats.	2.3631	6	#N/A	#N/A	#N/A	#N/A	0.4758	6	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0012	0.0006	#N/A	#N/A	#N/A	#N/A	0.0004	0.0010	#N/A	#N/A	#N/A	#N/A
Stable Market	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	0.0029	-0.0002	-0.0006	0.0014	-0.0004	0.0375	0.0002	0.0000	0.0005	-0.0010	0.0000	0.0316
St. Error	0.0011	0.0010	0.0006	0.0007	0.0004	0.0024	0.0010	0.0009	0.0006	0.0006	0.0004	0.0022
R2	0.3948	0.0106	#N/A	#N/A	#N/A	#N/A	0.2083	0.0096	#N/A	#N/A	#N/A	#N/A
F stats.	2.8704	22	#N/A	#N/A	#N/A	#N/A	1.1577	22	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0016	0.0025	#N/A	#N/A	#N/A	#N/A	0.0005	0.0020	#N/A	#N/A	#N/A	#N/A

Source: Own illustration

Appendix 10: Abnormal Returns – Qn

Table 24: Abnormal Returns, Qn

St. Error for Y intercept												
Degrees of freedom												
Resid. Sum of squares	5FF						3FF					
Full Time Series	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	-0.0010	-0.0021	0.0010	-0.0013	0.0001	0.0438	-0.0003	-0.0014	0.0003	-0.0010	0.0000	0.0343
St. Error	0.0010	0.0008	0.0005	0.0006	0.0003	0.0022	0.0011	0.0009	0.0006	0.0007	0.0004	0.0025
R2	0.2098	0.0147	#N/A	#N/A	#N/A	#N/A	0.0714	0.0163	#N/A	#N/A	#N/A	#N/A
F stats.	2.6550	50	#N/A	#N/A	#N/A	#N/A	0.7686	50	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0029	0.0108	#N/A	#N/A	#N/A	#N/A	0.0010	0.0133	#N/A	#N/A	#N/A	#N/A
Crisis	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	-0.0004	-0.0019	-0.0004	0.0007	-0.0011	0.0221	-0.0016	0.0013	0.0012	-0.0011	0.0006	0.0208
St. Error	0.0023	0.0022	0.0012	0.0018	0.0008	0.0062	0.0041	0.0038	0.0022	0.0032	0.0013	0.0109
R2	0.5881	0.0070	#N/A	#N/A	#N/A	#N/A	0.3630	0.0124	#N/A	#N/A	#N/A	#N/A
F stats.	0.5711	2	#N/A	#N/A	#N/A	#N/A	0.2280	2	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0001	0.0001	#N/A	#N/A	#N/A	#N/A	0.0002	0.0003	#N/A	#N/A	#N/A	#N/A
Recovery	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	-0.0019	-0.0021	0.0013	-0.0009	0.0001	0.0328	0.0009	0.0033	0.0001	0.0013	0.0000	0.0149
St. Error	0.0011	0.0011	0.0006	0.0011	0.0003	0.0036	0.0010	0.0010	0.0005	0.0010	0.0003	0.0032
R2	0.6392	0.0073	#N/A	#N/A	#N/A	#N/A	0.6814	0.0066	#N/A	#N/A	#N/A	#N/A
F stats.	2.1256	6	#N/A	#N/A	#N/A	#N/A	2.5660	6	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0006	0.0003	#N/A	#N/A	#N/A	#N/A	0.0006	0.0003	#N/A	#N/A	#N/A	#N/A
Stable Market	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	-0.0005	0.0007	0.0002	0.0001	-0.0004	0.0520	0.0012	-0.0022	-0.0016	0.0000	-0.0006	0.0438
St. Error	0.0011	0.0010	0.0007	0.0008	0.0005	0.0026	0.0012	0.0011	0.0007	0.0008	0.0005	0.0028
R2	0.0688	0.0114	#N/A	#N/A	#N/A	#N/A	0.3348	0.0123	#N/A	#N/A	#N/A	#N/A
F stats.	0.3251	22	#N/A	#N/A	#N/A	#N/A	2.2143	22	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0002	0.0029	#N/A	#N/A	#N/A	#N/A	0.0017	0.0033	#N/A	#N/A	#N/A	#N/A

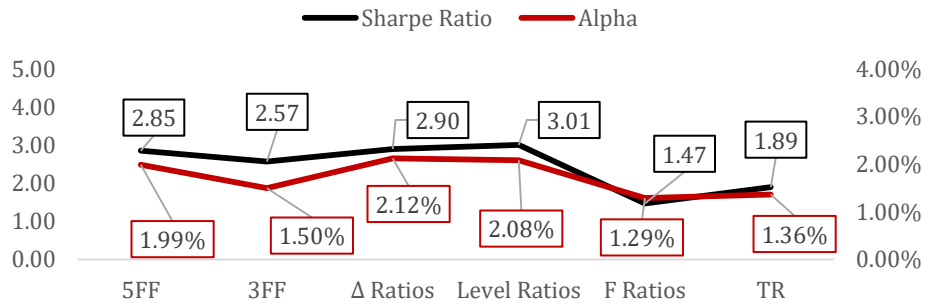
St. Error for Y intercept												
Degrees of freedom												
Resid. Sum of squares	Δ Ratios						Level Ratios					
Full Time Series	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	0.0011	-0.0017	-0.0003	-0.0004	0.0002	0.0412	0.0007	-0.0009	-0.0001	-0.0010	0.0007	0.0427
St. Error	0.0008	0.0007	0.0004	0.0005	0.0003	0.0019	0.0008	0.0007	0.0004	0.0005	0.0003	0.0020
R2	0.1849	0.0122	#N/A	#N/A	#N/A	#N/A	0.2008	0.0130	#N/A	#N/A	#N/A	#N/A
F stats.	2.2680	50	#N/A	#N/A	#N/A	#N/A	2.5124	50	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0017	0.0074	#N/A	#N/A	#N/A	#N/A	0.0021	0.0084	#N/A	#N/A	#N/A	#N/A
Crisis	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	-0.0017	-0.0038	-0.0012	0.0036	-0.0017	0.0326	0.0026	-0.0019	-0.0017	0.0019	0.0002	0.0304
St. Error	0.0023	0.0022	0.0012	0.0018	0.0008	0.0062	0.0020	0.0019	0.0011	0.0016	0.0007	0.0054
R2	0.8288	0.0070	#N/A	#N/A	#N/A	#N/A	0.6890	0.0061	#N/A	#N/A	#N/A	#N/A
F stats.	1.9361	2	#N/A	#N/A	#N/A	#N/A	0.8862	2	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0005	0.0001	#N/A	#N/A	#N/A	#N/A	0.0002	0.0001	#N/A	#N/A	#N/A	#N/A
Recovery	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	0.0005	-0.0019	0.0004	-0.0016	0.0002	0.0401	-0.0003	-0.0003	0.0004	-0.0019	0.0012	0.0437
St. Error	0.0017	0.0017	0.0009	0.0017	0.0005	0.0053	0.0015	0.0015	0.0008	0.0015	0.0004	0.0047
R2	0.4044	0.0107	#N/A	#N/A	#N/A	#N/A	0.6502	0.0095	#N/A	#N/A	#N/A	#N/A
F stats.	0.8149	6	#N/A	#N/A	#N/A	#N/A	2.2310	6	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0005	0.0007	#N/A	#N/A	#N/A	#N/A	0.0010	0.0005	#N/A	#N/A	#N/A	#N/A
Stable Market	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	0.0016	0.0000	-0.0010	0.0003	-0.0002	0.0456	-0.0002	0.0007	-0.0001	0.0003	-0.0006	0.0508
St. Error	0.0011	0.0010	0.0006	0.0007	0.0004	0.0026	0.0013	0.0011	0.0007	0.0008	0.0005	0.0029
R2	0.1269	0.0111	#N/A	#N/A	#N/A	#N/A	0.0858	0.0126	#N/A	#N/A	#N/A	#N/A
F stats.	0.6398	22	#N/A	#N/A	#N/A	#N/A	0.4131	22	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0004	0.0027	#N/A	#N/A	#N/A	#N/A	0.0003	0.0035	#N/A	#N/A	#N/A	#N/A

St. Error for Y intercept												
Degrees of freedom												
Resid. Sum of squares	F Ratios						TR					
Full Time Series	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	0.0011	-0.0015	0.0003	-0.0015	-0.0003	0.0226	0.0005	-0.0011	0.0003	-0.0007	0.0002	0.0327
St. Error	0.0010	0.0008	0.0005	0.0006	0.0003	0.0023	0.0009	0.0008	0.0005	0.0006	0.0003	0.0021
R2	0.1727	0.0150	#N/A	#N/A	#N/A	#N/A	0.0927	0.0136	#N/A	#N/A	#N/A	#N/A
F stats.	2.0878	50	#N/A	#N/A	#N/A	#N/A	1.0212	50	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0024	0.0113	#N/A	#N/A	#N/A	#N/A	0.0009	0.0092	#N/A	#N/A	#N/A	#N/A
Crisis	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	-0.0064	0.0039	0.0027	-0.0019	-0.0013	-0.0116	-0.0045	0.0027	0.0022	-0.0023	-0.0009	0.0025
St. Error	0.0028	0.0026	0.0015	0.0022	0.0009	0.0074	0.0008	0.0007	0.0004	0.0006	0.0003	0.0021
R2	0.8772	0.0084	#N/A	#N/A	#N/A	#N/A	0.9769	0.0024	#N/A	#N/A	#N/A	#N/A
F stats.	2.8575	2	#N/A	#N/A	#N/A	#N/A	16.8983	2	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0010	0.0001	#N/A	#N/A	#N/A	#N/A	0.0005	0.0000	#N/A	#N/A	#N/A	#N/A
Recovery	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	0.0004	-0.0023	0.0005	-0.0025	-0.0003	0.0293	-0.0015	0.0005	0.0020	0.0000	-0.0003	0.0391
St. Error	0.0021	0.0021	0.0011	0.0021	0.0006	0.0068	0.0013	0.0013	0.0007	0.0013	0.0004	0.0041
R2	0.2925	0.0138	#N/A	#N/A	#N/A	#N/A	0.6716	0.0084	#N/A	#N/A	#N/A	#N/A
F stats.	0.4962	6	#N/A	#N/A	#N/A	#N/A	2.4543	6	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0005	0.0011	#N/A	#N/A	#N/A	#N/A	0.0009	0.0004	#N/A	#N/A	#N/A	#N/A
Stable Market	CMA	RMW	HML	SMB	Mkt-RF	Alpha	CMA	RMW	HML	SMB	Mkt-RF	Alpha
Beta	0.0015	-0.0022	0.0001	-0.0021	-0.0002	0.0240	0.0002	-0.0002	0.0001	0.0000	-0.0004	0.0394
St. Error	0.0017	0.0016	0.0010	0.0011	0.0007	0.0040	0.0011	0.0010	0.0006	0.0007	0.0005	0.0026
R2	0.2413	0.0172	#N/A	#N/A	#N/A	#N/A	0.0624	0.0113	#N/A	#N/A	#N/A	#N/A
F stats.	1.3990	22	#N/A	#N/A	#N/A	#N/A	0.2927	22	#N/A	#N/A	#N/A	#N/A
Reg. Sum of squares	0.0021	0.0065	#N/A	#N/A	#N/A	#N/A	0.0002	0.0028	#N/A	#N/A	#N/A	#N/A

Source: Own Illustration

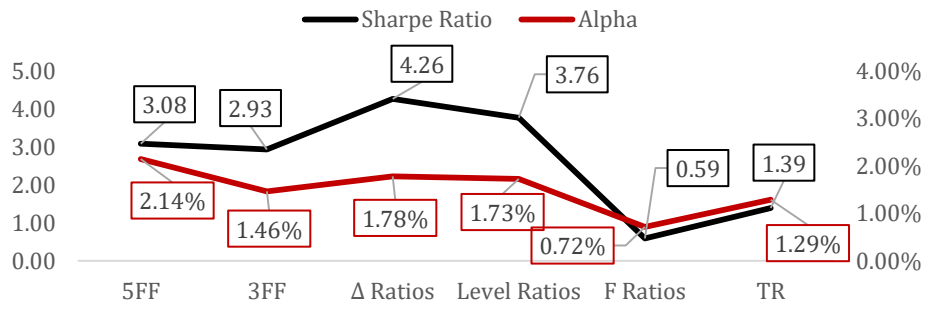
Appendix 11: Portfolio Performances Industry 1

Graph 22: Portfolios performance, full time series, Industry 1



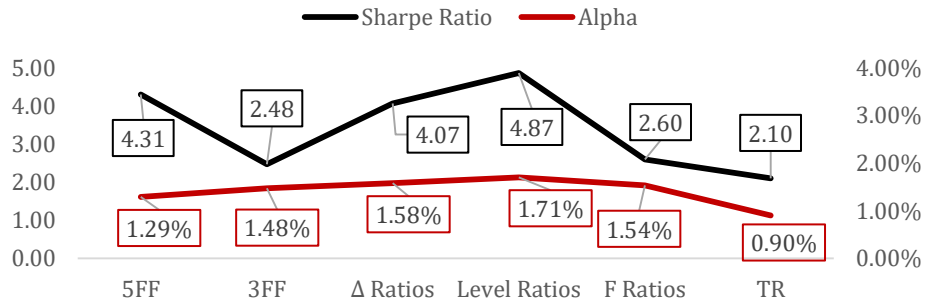
Source: Own illustration

Graph 23: Portfolios performance, crisis period, Industry 1



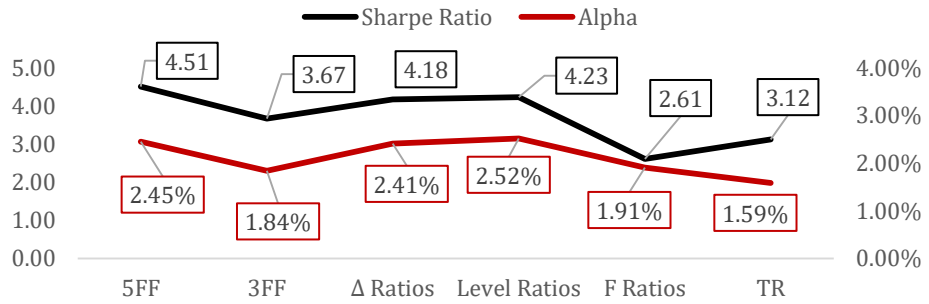
Source: Own illustration

Graph 24: Portfolios performance, market recovery period, Industry 1



Source: Own illustration

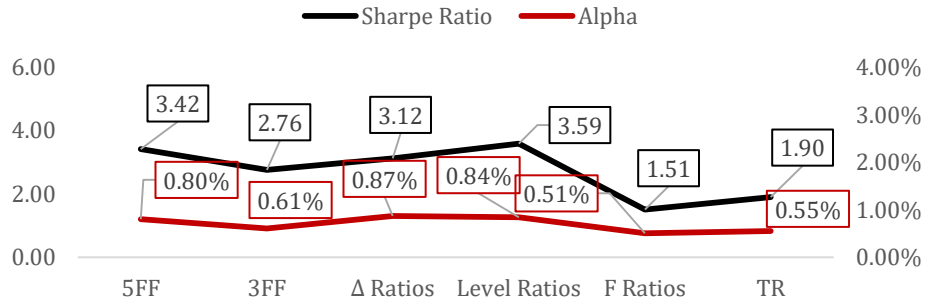
Graph 25: Portfolios performance, stable market, Industry 1



Source: Own illustration

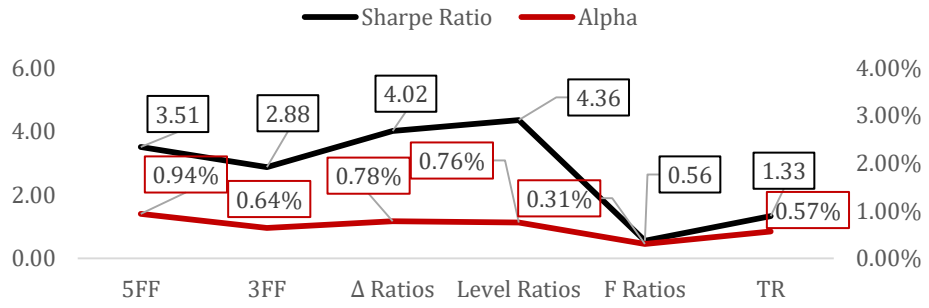
Appendix 12: Portfolio Performances Industry 2

Graph 26: Portfolios performance, full time series, Industry 2



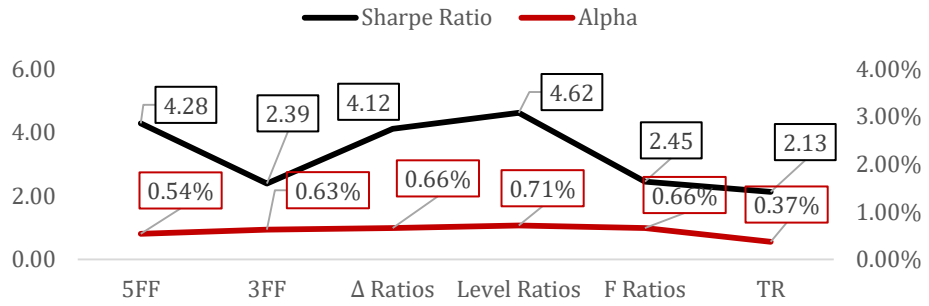
Source: Own illustration

Graph 27: Portfolios performance, crisis period, Industry 2



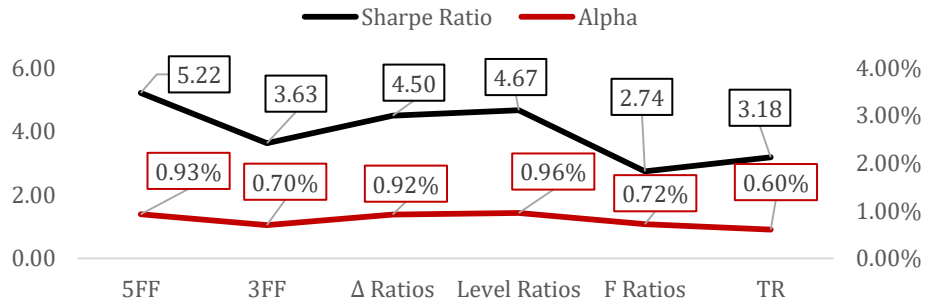
Source: Own illustration

Graph 28: Portfolios performance, market recovery period, Industry 2



Source: Own illustration

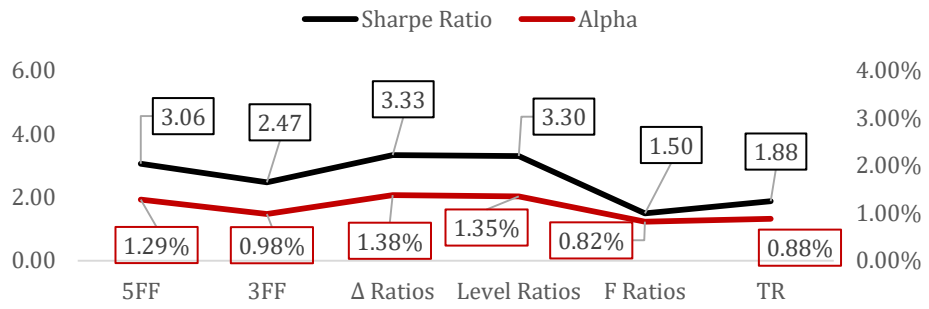
Graph 29: Portfolios performance, stable market, Industry 2



Source: Own Illustration

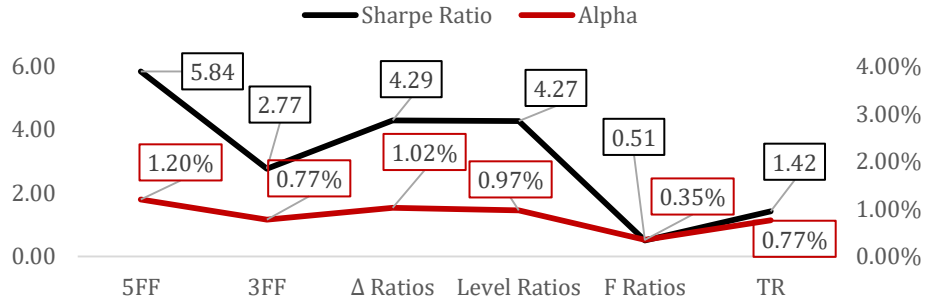
Appendix 13: Portfolio Performances Industry 3

Graph 30: Portfolios performance, full time series, Industry 3



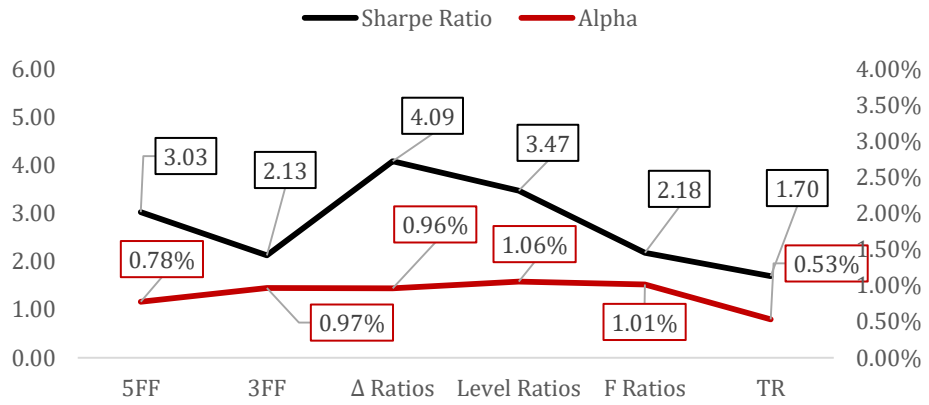
Source: Onw illustration

Graph 31: Portfolios performance, crisis period, Industry 3



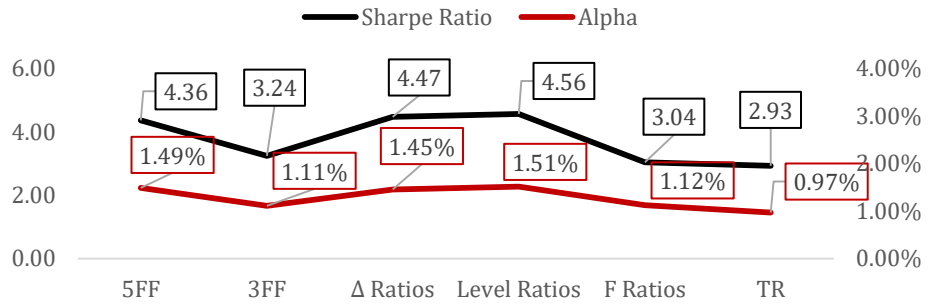
Source: Own Illustraton

Graph 32: Portfolios performance, market recovery period, Industry 3



Source: Own Illustration

Graph 33: Portfolios performance, stable market, Industry 3



Source: Own Illustration

Appendix 14: Descriptive Statistics Industry 1 – Qn+1

Table 25: Descriptive Statistics, Industry 1, Qn+1

	Full Time Series						Crisis					
	5FF	3FF	Δ Ratios	Lev. Ratios	F Ratios	TR	5FF	3FF	Δ Ratios	Lev. Ratios	F Ratios	TR
Mean (%)	1.95%	1.53%	2.06%	2.09%	1.29%	1.29%	1.35%	1.12%	1.44%	1.46%	0.39%	0.74%
t-stat	*21.36*	*19.24*	*21.70*	*22.52*	*10.99*	*14.17*	*8.72*	*8.29*	*12.04*	*10.64*	*1.68*	*3.93*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.09*	*0.00*
Sharpe ratio	2.85	2.57	2.90	3.01	1.47	1.89	3.08	2.93	4.26	3.76	0.59	1.39
t-stat	*9.48*	*9.27*	*9.51*	*9.58*	*7.62*	*8.48*	*3.64*	*3.60*	*3.80*	*3.74*	*1.55*	*2.80*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.12*	*0.01*
Std. Dev. (%)	0.68%	0.59%	0.71%	0.70%	0.88%	0.68%	0.44%	0.38%	0.34%	0.39%	0.66%	0.54%
Skewness	-0.06	-0.64	-0.67	-0.69	-0.19	-0.31	1.52	-0.36	-1.06	0.41	-0.81	0.81
Excess kurtosis	0.43	-0.24	0.18	0.57	-0.60	-0.46	2.43	-0.37	0.30	1.56	-0.75	-0.28
JB test statistic	0.48	3.98	4.24	5.20	1.17	1.38	5.06	0.22	1.52	1.04	1.07	0.90
p-value	0.79	0.14	0.12	0.07	0.56	0.50	0.08	0.90	0.47	0.60	0.59	0.64
Minimum (%)	0.00%	0.00%	0.00%	0.00%	-0.66%	-0.39%	0.97%	0.47%	0.81%	0.83%	-0.66%	0.22%
Median (%)	1.95%	1.73%	2.11%	2.10%	1.33%	1.45%	1.20%	1.14%	1.54%	1.41%	0.62%	0.64%
Maximum (%)	3.53%	2.56%	3.09%	3.09%	3.10%	2.72%	2.27%	1.66%	1.78%	2.17%	1.14%	1.72%
Swift	3.53%	2.56%	3.09%	3.09%	3.76%	3.11%	1.31%	1.19%	0.98%	1.34%	1.80%	1.50%
Percentile 25 (%)	1.56%	1.17%	1.58%	1.59%	0.67%	0.76%	1.06%	0.89%	1.30%	1.30%	0.06%	0.32%
Percentile 75 (%)	2.26%	1.92%	2.68%	2.71%	1.97%	1.77%	1.52%	1.39%	1.69%	1.59%	0.81%	1.01%

	Recovery						Stable Market					
	5FF	3FF	Δ Ratios	Lev. Ratios	F Ratios	TR	5FF	3FF	Δ Ratios	Lev. Ratios	F Ratios	TR
Mean (%)	1.60%	1.43%	1.53%	1.88%	1.43%	1.04%	2.40%	1.83%	2.41%	2.52%	1.79%	1.58%
t-stat	*14.92*	*8.58*	*14.10*	*16.87*	*9.02*	*7.29*	*23.87*	*19.44*	*22.12*	*22.39*	*13.80*	*16.52*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Sharpe ratio	4.31	2.48	4.07	4.87	2.60	2.10	4.51	3.67	4.18	4.23	2.61	3.12
t-stat	*4.65*	*4.25*	*4.63*	*4.70*	*4.31*	*4.07*	*7.14*	*6.98*	*7.09*	*7.10*	*6.58*	*6.82*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Std. Dev. (%)	0.37%	0.58%	0.38%	0.39%	0.55%	0.49%	0.53%	0.50%	0.58%	0.60%	0.69%	0.51%
Skewness	-1.62	-0.26	1.10	-0.91	0.02	0.33	0.13	-1.75	-1.85	-2.14	-0.22	0.05
Excess kurtosis	2.99	-1.85	0.98	-0.17	0.01	-1.19	-0.13	4.37	5.61	6.26	-0.76	-0.06
JB test statistic	9.70	1.85	2.91	1.65	0.00	0.93	0.09	36.61	52.65	67.08	0.90	0.02
p-value	0.01	0.40	0.23	0.44	1.00	0.63	0.96	0.00	0.00	0.00	0.64	0.99
Minimum (%)	0.67%	0.62%	1.12%	1.18%	0.48%	0.30%	1.18%	0.19%	0.29%	0.29%	0.64%	0.70%
Median (%)	1.62%	1.61%	1.49%	2.05%	1.58%	0.91%	2.26%	1.88%	2.43%	2.73%	1.85%	1.57%
Maximum (%)	1.98%	2.14%	2.37%	2.39%	2.48%	1.85%	3.53%	2.56%	3.09%	3.09%	3.10%	2.72%
Swift	1.32%	1.52%	1.25%	1.21%	2.00%	1.55%	2.34%	2.38%	2.79%	2.80%	2.46%	2.02%
Percentile 25 (%)	1.58%	0.89%	1.23%	1.67%	1.04%	0.66%	2.03%	1.74%	2.12%	2.29%	1.33%	1.32%
Percentile 75 (%)	1.86%	1.89%	1.62%	2.11%	1.68%	1.55%	2.83%	2.08%	2.81%	2.91%	2.31%	1.88%

Source: Own Illustration

Appendix 15: Descriptive Statistics Industry 2 – Qn+1

Table 26: Descriptive Statistics, Industry 2, Qn+1

	Full Time Series						Crisis					
	5FF	3FF	Δ Ratios	Abs Ratios	F Ratios	TR	5FF	3FF	Δ Ratios	Abs Ratios	F Ratios	TR
Mean (%)	0.78%	0.62%	0.84%	0.84%	0.51%	0.52%	0.62%	0.52%	0.67%	0.67%	0.17%	0.35%
t-stat	*25.58*	*20.65*	*23.38*	*26.84*	*11.28*	*14.20*	*9.93*	*8.16*	*11.37*	*12.33*	*1.59*	*3.77*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.11*	*0.00*
Sharpe ratio	3.42	2.76	3.12	3.59	1.51	1.90	3.51	2.88	4.02	4.36	0.56	1.33
t-stat	*9.78*	*9.42*	*9.64*	*9.85*	*7.72*	*8.49*	*3.71*	*3.59*	*3.77*	*3.80*	*1.48*	*2.74*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.14*	*0.01*
Std. Dev. (%)	0.23%	0.22%	0.27%	0.24%	0.34%	0.28%	0.18%	0.18%	0.17%	0.15%	0.31%	0.26%
Skewness	-0.76	-0.84	-0.85	-1.50	-0.43	-0.28	1.64	-0.44	-0.77	0.28	-0.83	1.18
Excess kurtosis	1.38	0.08	1.11	3.09	-0.24	-0.51	2.77	-0.97	0.03	1.40	-0.63	1.10
JB test statistic	9.81	6.58	9.60	43.38	1.82	1.32	6.17	0.57	0.79	0.76	1.06	2.26
p-value	0.01	0.04	0.01	0.00	0.40	0.52	0.05	0.75	0.67	0.68	0.59	0.32
Minimum (%)	0.00%	0.00%	0.00%	0.00%	-0.33%	-0.17%	0.47%	0.22%	0.38%	0.42%	-0.33%	0.11%
Median (%)	0.80%	0.66%	0.88%	0.92%	0.55%	0.54%	0.56%	0.52%	0.72%	0.66%	0.27%	0.28%
Maximum (%)	1.23%	0.95%	1.29%	1.15%	1.23%	1.06%	1.00%	0.73%	0.90%	0.95%	0.53%	0.86%
Swift	1.23%	0.95%	1.29%	1.15%	1.55%	1.23%	0.53%	0.51%	0.51%	0.53%	0.86%	0.76%
Percentile 25 (%)	0.66%	0.45%	0.66%	0.70%	0.27%	0.29%	0.51%	0.42%	0.61%	0.63%	0.03%	0.16%
Percentile 75 (%)	0.95%	0.78%	1.04%	0.99%	0.76%	0.71%	0.68%	0.68%	0.77%	0.71%	0.37%	0.44%

	Recovery						Stable Market					
	5FF	3FF	Δ Ratios	Abs Ratios	F Ratios	TR	5FF	3FF	Δ Ratios	Abs Ratios	F Ratios	TR
Mean (%)	0.67%	0.60%	0.64%	0.79%	0.61%	0.43%	0.91%	0.69%	0.92%	0.95%	0.67%	0.60%
t-stat	*14.84*	*8.26*	*14.27*	*16.01*	*8.48*	*7.38*	*27.60*	*19.20*	*23.80*	*24.74*	*14.52*	*16.85*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Sharpe ratio	4.28	2.39	4.12	4.62	2.45	2.13	5.22	3.63	4.50	4.67	2.74	3.18
t-stat	*4.65*	*4.21*	*4.63*	*4.68*	*4.24*	*4.08*	*7.22*	*6.97*	*7.14*	*7.16*	*6.65*	*6.84*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Std. Dev. (%)	0.16%	0.25%	0.16%	0.17%	0.25%	0.20%	0.17%	0.19%	0.20%	0.20%	0.25%	0.19%
Skewness	-1.31	-0.22	1.28	-0.73	0.13	0.31	-0.71	-1.60	-2.43	-2.93	-0.31	-0.24
Excess kurtosis	2.04	-1.78	1.65	-0.29	0.19	-1.15	1.53	3.35	9.29	11.30	-0.12	-0.36
JB test statistic	5.49	1.68	4.63	1.11	0.05	0.85	5.10	25.05	128.07	189.09	0.46	0.43
p-value	0.06	0.43	0.10	0.57	0.98	0.65	0.08	0.00	0.00	0.00	0.79	0.81
Minimum (%)	0.29%	0.27%	0.46%	0.48%	0.19%	0.12%	0.39%	0.08%	0.10%	0.10%	0.24%	0.24%
Median (%)	0.68%	0.68%	0.63%	0.85%	0.66%	0.38%	0.94%	0.73%	0.92%	0.97%	0.72%	0.60%
Maximum (%)	0.86%	0.95%	1.00%	1.03%	1.09%	0.76%	1.23%	0.95%	1.22%	1.15%	1.23%	0.95%
Swift	0.57%	0.68%	0.55%	0.55%	0.91%	0.64%	0.84%	0.87%	1.12%	1.05%	0.99%	0.72%
Percentile 25 (%)	0.63%	0.36%	0.52%	0.69%	0.43%	0.29%	0.79%	0.62%	0.84%	0.93%	0.51%	0.50%
Percentile 75 (%)	0.78%	0.81%	0.66%	0.88%	0.71%	0.61%	1.03%	0.80%	1.04%	1.08%	0.84%	0.71%

Source: Own Illustration

Appendix 16: Descriptive Statistics Industry 3 – Qn+1

Table 27: Descriptive Statistics, Industry 3, Qn+1

	Full Time Series						Crisis					
	5FF	3FF	Δ Ratios	Abs Ratios	F Ratios	TR	5FF	3FF	Δ Ratios	Abs Ratios	F Ratios	TR
Mean (%)	1.27%	1.00%	1.33%	1.36%	0.83%	0.84%	0.98%	0.84%	1.07%	1.08%	0.26%	0.53%
t-stat	*22.88*	*18.50*	*24.91*	*24.72*	*11.20*	*14.04*	*16.52*	*7.84*	*12.13*	*12.08*	*1.45*	*4.03*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.15*	*0.00*
Sharpe ratio	3.06	2.47	3.33	3.30	1.50	1.88	5.84	2.77	4.29	4.27	0.51	1.42
t-stat	*9.61*	*9.19*	*9.74*	*9.73*	*7.69*	*8.45*	*3.89*	*3.56*	*3.80*	*3.80*	*1.36*	*2.84*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.17*	*0.00*
Std. Dev. (%)	0.41%	0.40%	0.40%	0.41%	0.55%	0.45%	0.17%	0.30%	0.25%	0.25%	0.51%	0.37%
Skewness	-0.51	-0.28	-1.18	-1.09	-0.47	-0.28	0.78	-0.51	0.30	-0.30	-0.94	1.32
Excess kurtosis	0.10	-0.25	1.68	1.72	-0.26	-0.79	1.01	0.03	-1.07	1.12	-0.46	1.84
JB test statistic	2.42	0.86	19.62	17.90	2.21	2.18	1.16	0.35	0.50	0.54	1.24	3.44
p-value	0.30	0.65	0.00	0.00	0.33	0.34	0.56	0.84	0.78	0.76	0.54	0.18
Minimum (%)	0.00%	0.00%	0.00%	0.00%	-0.60%	-0.25%	0.76%	0.30%	0.75%	0.63%	-0.60%	0.17%
Median (%)	1.30%	1.04%	1.44%	1.41%	0.91%	0.86%	0.98%	0.87%	1.01%	1.08%	0.43%	0.46%
Maximum (%)	1.93%	1.80%	1.85%	1.97%	1.88%	1.66%	1.30%	1.27%	1.44%	1.49%	0.76%	1.30%
Swift	1.93%	1.80%	1.85%	1.97%	2.48%	1.91%	0.54%	0.96%	0.69%	0.86%	1.35%	1.13%
Percentile 25 (%)	1.01%	0.77%	1.07%	1.13%	0.46%	0.46%	0.87%	0.68%	0.92%	1.00%	0.04%	0.25%
Percentile 75 (%)	1.61%	1.27%	1.61%	1.64%	1.25%	1.25%	1.04%	1.06%	1.24%	1.20%	0.58%	0.67%

	Recovery						Stable Market					
	5FF	3FF	Δ Ratios	Abs Ratios	F Ratios	TR	5FF	3FF	Δ Ratios	Abs Ratios	F Ratios	TR
Mean (%)	1.15%	1.03%	1.08%	1.35%	1.05%	0.76%	1.49%	1.13%	1.49%	1.55%	1.08%	0.99%
t-stat	*10.49*	*7.37*	*14.16*	*12.02*	*7.55*	*5.88*	*23.09*	*17.14*	*23.68*	*24.13*	*16.10*	*15.51*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Sharpe ratio	3.03	2.13	4.09	3.47	2.18	1.70	4.36	3.24	4.47	4.56	3.04	2.93
t-stat	*4.44*	*4.08*	*4.63*	*4.54*	*4.11*	*3.76*	*7.12*	*6.86*	*7.14*	*7.15*	*6.79*	*6.74*
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Std. Dev. (%)	0.38%	0.48%	0.26%	0.39%	0.48%	0.45%	0.34%	0.35%	0.33%	0.34%	0.35%	0.34%
Skewness	-0.04	0.12	0.72	-0.29	0.24	1.00	-1.06	-0.75	-2.59	-2.52	-0.63	-0.47
Excess kurtosis	-0.76	-1.46	-0.17	-1.26	-0.46	0.04	0.58	1.20	9.06	9.83	-0.52	-0.63
JB test statistic	0.29	1.09	1.04	0.97	0.22	2.01	5.63	4.27	127.13	142.31	2.17	1.48
p-value	0.86	0.58	0.59	0.62	0.89	0.37	0.06	0.12	0.00	0.00	0.34	0.48
Minimum (%)	0.51%	0.39%	0.76%	0.75%	0.26%	0.21%	0.57%	0.14%	0.16%	0.16%	0.40%	0.38%
Median (%)	1.08%	1.11%	1.04%	1.42%	1.00%	0.62%	1.56%	1.15%	1.53%	1.60%	1.17%	1.01%
Maximum (%)	1.75%	1.80%	1.61%	1.90%	1.88%	1.66%	1.93%	1.71%	1.83%	1.97%	1.63%	1.59%
Swift	1.25%	1.41%	0.85%	1.15%	1.63%	1.46%	1.36%	1.57%	1.67%	1.81%	1.23%	1.21%
Percentile 25 (%)	0.94%	0.59%	0.89%	1.08%	0.73%	0.46%	1.37%	0.91%	1.43%	1.42%	0.91%	0.82%
Percentile 75 (%)	1.42%	1.39%	1.26%	1.64%	1.29%	0.92%	1.73%	1.36%	1.70%	1.76%	1.33%	1.27%

Source: Own Illustration

Appendix 17: Industry Segmentation based on SIC code (Compustat)

Table 28, Industry segmentation of NYSE (1/2)

Industry 1 - Consumer Services/Other	Industry 2 - Consumer Goods	Industry 3 - Production/Heavy Industry
175 Services (Commercial & Consumer)	112 Agricultural Products	0 Aerospace/Defense
215 Personal Care	120 Automobiles	115 Aluminum
217 Distributors (Food & Health)	130 Auto Parts & Equipment	147 Biotechnology
218 Distributors (Durables)	135 Trucks & Parts	155 Building Materials
222 Electronics (Component Distributors)	140 Beverages (Alcoholic)	160 Chemicals
245 Entertainment	145 Beverages (Non-Alcoholic)	165 Chemicals (Diversified)
250 Foods	150 Broadcasting (Television, Radio & Cable)	167 Chemicals (Specialty)
262 Gaming, Lottery & Parimutuel Companies	180 Communications Equipment	170 Coal
280 Health Care (Diversified)	185 Computers (Software & Services)	200 Conglomerates
283 Health Care (Drugs-Generic & Other)	187 Computers (Networking)	202 Construction (Cement & Aggregates)
285 Health Care (Drugs-Major Pharmaceuticals)	188 Computers (Peripherals)	205 Containers (Metal & Glass)
287 Health Care (Managed Care)	190 Computers (Hardware)	210 Containers & Packaging (Paper)
289 Health Care (Long Term Care)	203 Consumer (Jewelry, Novelties & Gifts)	225 Electronics (Defense)
290 Health Care Miscellaneous	220 Electrical Equipment	230 Electronics (Instrumentation)
292 Health Care (Specialized Services)	265 Gold & Precious Metals Mining	235 Electronics (Semiconductors)
295 Health Care (Hospital Management)	270 Hardware & Tools	240 Engineering & Construction
300 Health Care (Medical Products & Supplies)	315 Household Furn. & Appliances	247 Equipment (Semiconductors)
305 Homebuilding	320 Household Products (Non-Durables)	340 Machine Tools
310 Lodging-Hotels	325 Housewares	345 Machinery (Diversified)
330 Insurance Brokers	350 Manufactured Housing	355 Manufacturing (Diversified)
335 Leisure Time	370 Office Equipment & Supplies	357 Manufacturing (Specialized)
426 Retail (Computers & Electronics)	400 Paper & Forest Products	358 Metal Fabricators
430 Retail (Department Stores)	403 Photography/Imaging	360 Metals Mining
432 Retail (Discounters)	405 Waste Management	365 Miscellaneous
435 Retail (Drug Stores)	410 Publishing	375 Oil & Gas Drilling
440 Retail (Food Chains)	415 Publishing (Newspapers)	380 Oil & Gas (Exploration & Production)
445 Retail (General Merchandise)	420 Restaurants	382 Oil & Gas (Refining & Marketing)
447 Retail (Home Shopping)	455 Footwear	385 Oil (Domestic Integrated)
449 Retail (Specialty)	456 Services (Advertising/Marketing)	390 Oil (International Integrated)
450 Retail (Building Supplies)	457 Services (Employment)	395 Oil & Gas (Drilling & Equipment)
452 Retail (Specialty-Apparel)	458 Specialty Printing	460 Iron & Steel
453 Services (Data Processing)	459 Services (Facilities & Environmental)	
454 Services (Computer Systems)	465 Textiles (Apparel)	

Source: Compustat, own illustration

Table 29: Industry segmentation of NYSE (2/2)

Industry 1 - Consumer Services/Other	Industry 2 - Consumer Goods	Industry 3 - Production/Heavy Industry
461 Services (Payroll Processing)	467 Textiles (Home Furnishings)	
462 Telecommunications (Cellular/Wireless)	468 Textiles (Specialty)	
463 Telecommunications (Long Distance)	470 Tobacco	
464 Services (Rental)	475 Leisure Time (Products)	
605 Airlines		
610 Railroads		
612 Shipping		
615 Truckers		
620 Air Freight		
705 Electric Companies		
710 Natural Gas		
715 Telephone		
720 Power Producers (Independent)		
725 Water Utilities		
810 Banks (Money Center)		
815 Banks (Major Regional)		
817 Banks (Regional)		
820 Other Major Banks		
822 Investment Banking/Brokerage		
823 Investment Management		
825 Insurance (Life/Health)		
830 Insurance (Multi-Line)		
835 Insurance (Property-Casualty)		
837 REITS		
840 Savings & Loan Companies		
845 Consumer Finance		
850 Financial (Diversified)		

Source: Compustat, own illustration