QUALITY FACTORS EXPLAINING RETURNS ON THE FTSE/JSE ALL-SHARE

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Abstract

The research done on style ‘anomalies’ such as the book-to-market and the size effect have found that these idiosyncratic factors explain returns better than Beta. These findings have led has to an increased importance of idiosyncratic factors in explaining returns, which is contrary to the popular Capital Asset Pricing Model (CAPM). CAPM only considers Beta or systematic risk in explaining returns and disregards idiosyncratic risk.

This paper has an even greater focus on idiosyncratic factors, by testing company specific factors with no reference to market valuation. These are defined as ‘quality’ factors for the purposes of this paper. The paper done by Asness, Frazzini, and Pedersen (2013), found that quality stocks earned excess returns in 23 of the 24 countries that they tested. This paper followed a similar approach with respect to the definition of quality and tested whether these ‘quality’ factors have explanatory power on the FTSE/JSE All-Share. The explanatory power of the ‘quality’ factors are then combined and compared with some of the style ‘anomalies’.

The results found that nine of the quality factors from the single regression analysis, over the entire period from the 1st of January 1994 until the 1st of November 2014 were significant at a 95% level of confidence. The following ‘quality’ factors were found significant and are ranked according to the absolute t-statistics:: Accruals ratio (ACCRUALS), cash flow return on equity (CFROE), 12-month growth in earnings per share (EPS12M), 12-month growth in cash flow return on equity (CFROE12M), 24-month growth in cash flow return on equity (CFROE24M), 12-month growth in EBITDA margin (EBITDAMARG12M), 36-month growth in cash flow return on equity (CFROE36M), interest coverage before tax (ICBT), return on total capital (ROC). In the single regression results the ACCRUALS ratio ranked higher than the book-value-to-market and the earnings yield. The CFROE also exhibited a higher level of significance than the earnings yield.

In the multiple regression analysis for all factors, the following factors which are ranked according to absolute t-statistics were found to be significant: book-value-to-market, cash flow return on equity (CFROE), 12-month growth in earnings per share (EPS12M), 18-month volatility in return on equity (ROEVOL18M) and the accruals ratio (ACCRUALS).

Finally the cumulative payoff results are consistent with the results found in the regression analysis. In terms of cumulative payoff the ACCRUALS factor ranked first and the CFROE factor ranked fifth.. The ACCRUALS and CFROE factors also had the highest and fifth highest Sharpe ratio respectively. A single 'quality' factor composite of the significant factors found may have an important role to play in asset pricing, due to the high explanatory power and stable positive relationship with returns on the FTSE/JSE All-Share.

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1. Introduction

1.1 Introduction

The theory of asset pricing and understanding what explains future returns has been extensively researched for decades. The traditional asset pricing theories such as the Capital Asset Pricing Model (CAPM) have been contradicted by the empirical work done on style 'anomalies' which found that firm specific factors have significant explanatory power. This paper will focus on the firm specific factors defined as 'quality' factors in explaining returns on the FTSE/JSE All-Share over the period starting on the 1st of January 1994 until the 1st of November 2014.

Quality has been a fundamental principle first recognized by Graham and Dodd (1934), who identified quality stocks trading at favourable valuations. The concept of quality is therefore not a new concept in the world of investing; however, what constitutes a quality stock and the effects of quality is still debated (Trammell, 2014).

Asness, Frazzini, and Pedersen (2013) defined quality as a characteristic that, all else being equal, should demand a premium price for the stock of a quality company compared to the price poor quality company's stock. Companies that are higher quality should therefore be able to get cheaper financing through higher priced equity. The quality factors are more specifically defined by the Dividend Discount Model, which provides a simple framework for defining quality by rearranging the formula in terms of the price-to-book value. The four factors that will be used to identify quality are as follows: profitability, payout, safety and growth. The details of each factor will be elaborated on further in the paper.

In the study by Asness, et al. (2013), the risk-adjusted returns of the quality stock portfolio had a significantly high risk-adjusted return. The factors that classify a stock as 'quality', or the contrary 'junk', will be used to to test in form of single, multiple and rolling regression whether 'quality' factors exhibit significant explanatory power of returns and earn excess returns

This paper will also look at the relationship between quality stock and returns over time as to establish whether quality stocks to earn excess returns have explanatory power in South Africa. If quality factors are found to have explanatory power, tests will be done to see whether quality compliments or persist alongside style factors such as the book-to-market and size factors.

The price paid for quality was at its lowest before the internet bubble and was low in 2007 before the financial crisis in the 24 developing countries used in this paper and in the United States by Asness, et al. (2013). The payoff to quality factors will be tested on the FTSE/JSE All-Share to test whether a similar relationship is found in South Africa.

Finally the paper will test whether a quality factor could be used as an additional factor explaining return on the JSE and other asset pricing applications.

1.2 Motivation for research

There has been extensive work done on the excess returns from the book-to-market effect and various other style characteristics. The reason for the effect has led to many contrasting opinions on whether it is due to mispricing or risk. The interesting extension of this debate, by introducing a quality factor may aid in understanding this anomaly or risk in more detail.

The significant excess returns using the quality found in the paper by Asness, et al. (2013) in developed markets may produce interesting results in an emerging market environment such as that of the FTSE/JSE All-Share.

1.3 Contribution and Objectives

The key objectives of this paper are to test whether the four quality characteristics used by Asness, et al. (2013) are applicable in South Africa. The study concluded that applying a strategy of going long on quality shares and shorting junk shares produced significantly high risk-adjusted returns over two sample periods. The study was done on stocks in the United States and in a further 24 markets globally. It found significantly high risk-adjusted returns in 23 of the 24 countries applying the QMJ strategy. This paper will attempt to follow a similar process followed by that of Asness, et al. (2013) in a South African context in order to test whether the relationships between quality and junk are significant.

The paper will build on existing literature, but with some important explanatory contributions. The four main contributions that this paper will study in a South African context are:

i. The explanatory power of quality factors in predicting returns.
ii. The predictive power of multiple quality factors potentially representing a single 'quality' factor.
iii. The relationship and persistence of quality factors alongside style factors.
iv. The variation in the payoff for quality over time.

The work done by Asness, et al. (2013) applied the QMJ strategy, but included only developed markets. The contribution of the paper will therefore test whether the results are different in a context of a developing market such as South Africa and with the inclusion of style anomolies The JSE is a concentrated market with gold mining and industrial sectors explaining a large proportion of returns (Van Rensberg, 1998).

2. Theoretical Overview

2.1 Introduction

The purpose of a quality minus junk strategy on the JSE is to test whether a potential style anomaly might exist in South Africa. Evidence of such a QMJ strategy showing significant results were found in 23 of 24 countries in a study done in 2013 covering two different sample time periods by Asness, et al. (2013). The presence of an anomaly may suggest that markets are not efficient or be due to an incorrectly specified model. The QMJ strategy is a style analysis and its fundamental foundations are rooted in the academic theory of market efficiency and asset pricing theory. It is therefore necessary first to delve into the two foundations of investment management and portfolio theory before the quality style analysis can be examined. Efficient market theory and asset pricing theory are the most appropriate foundation for testing whether a quality style anomaly exists.

2.2 Efficiency of markets

The concept of efficient markets is one of the fundamental assumptions made in the construction of asset pricing models. Markets are classified as being efficient if all information is reflected in the market prices (Fama, 1970).

The early literature was very general and arguments against market efficiency such as the long-term predictive power of dividend yields in a paper by Campbell & Shiller (1989) made the argument for irrational bubbles. However, Fama (1991) extended the understanding of the early literature by justifying variations in expected returns in similar securities due to different expectations of future investment opportunities and consumption. The argument is extended that these variations exhibit systemic patterns that indicate rational pricing (Fama, 1991).

2.2.1 The Efficient Market hypothesis

The empirical studies that have been done on efficient markets test whether markets reflect all relevant available information in prices. The information that these studies tested has evolved over time; Fama classified the information reflected into three categories: weak form, semi-strong form and strong form efficiency tests (Fama, 1970).

The weak form of market efficiency is when past prices series behaviour and patterns cannot be used to make future prediction to earn enhanced expected gains. No predictions of future returns and prices can be made from past data because all prices in the future are random. The 'fair game' model is more accurate than the random walk literature due to the unrealistic assumption that expected return is always stationary. The 'fair game' model states that all decisions made are independent, the serial covariances between past and future are zero, and finally, that basing decisions on past series of returns or prices will never constantly outperform a 'buy and uninformed hold' strategy. In conclusion, there is zero expected profit from using past prices or information for future speculation (Fama, 1970).

Semi-strong form-efficient markets reflect all relevant pubic information in current prices. Semi-strong is an instantaneous adjustment of current market prices to new information that is available to the public, such as SENS announcements, released financial results and events. The semi-strong form of efficiency includes all past prices and information in the weak form and therefore the semi-strong form includes all publicly available information in current stock prices.

Strong form efficiency is the highest form efficiency in markets and may be seen as somewhat unrealistic in that inside information will not lead to superior returns due to the information advantage over normal market participants.

Evidence has been shown to contradict the form of efficiency in a study done by Scholes. The form of efficiency is adapted to the most knowledgeable of the investment community. Mutual fund managers have in-depth knowledge and years of experience and are paid for their superior analysis and knowledge. Mutual funds on average underperform the market portfolio after fees by almost 15% over a ten-year period, which suggests that these managers do not have access to "special information" (Fama, 1970).

2.3 Asset pricing theory

In its most basic form, asset pricing models form the relationship between risk and return. The relationship is positively related between risk and return due to the fact that investors should require a higher expected return in order to take on additional risk. Investors are assumed to make rational decisions and be risk averse. The return in asset pricing is a total return, which consists of dividends and capital appreciation from shares. Asset pricing theory is very closely linked to the concept of efficient markets, where prices adjust to new information and are assumed to be at the equilibrium. As new information enters the market and investors' perceptions of risk change, the pricing will adjust to a risk and return equilibrium reflected in market prices.

Supply and demand is another factor that affects expected returns. If an asset has a high expected return at a reasonable level of risk it will be desirable to all investors assuming that all investors have the same willingness to take risks. The increase in demand will drive the price up and therefore lead to a lower expected return. Investors will continually look for assets with a higher expected return and therefore an expected return in equilibrium should exist due to this continuing process. Expected returns are not the only factor in assets pricing and therefore a risk premium is added to incorporate risk.

The risk of securities and portfolios is most commonly measured by the dispersion of return around the expected mean and is more commonly known as the variance of expected returns. The variance allows for a standard measure that could be used in assessing security and portfolio risk. The risk of an asset or portfolio increases as the variance of expected returns increases because the possibility of the expected mean not being realized is higher. The use of variance as a risk measure was used by Markowitz (1952) to develop arguably the most important theories in finance.

Markowitz's modern portfolio theory mathematically showed the relationship between risk and return. The theory was instrumental in developing an understanding of the benefits of diversification. Modern portfolio theory showed that investors should focus on individuals' securities risk and return relationship but rather also view risk and return from a total portfolio perspective. The use of mean-variance optimization created the optimal portfolio construction at every level of risk or at each desired level of expected return. The issue with the model is that it makes restricting assumptions and is very sensitive to inputs. Nevertheless, modern portfolio theory is one of the fundamental principles underlying asset pricing models such as the Capital Asset Pricing Model CAPM.

2.3.1 Capital Asset Pricing Model

The CAPM was an extension of the theories done by Markowitz (1952) and Tobin (1958). Tobin introduced the risk-free asset in combination with the optimal portfolio of risky assets. The simple linear relationship between risk and return portrayed by the CAPM is due to the variance being equal to zero of the risk-free asset. The standard deviation or risk of the portfolio of the two asset portfolios is simply the proportion held in risky assets. The capital asset pricing model was largely attributed to by Sharpe (1964) and Lintner (1952), who extended the work done by Tobin (1958). Their additions to the previous work introduced the possibility of short selling and borrowing with no limits by individuals to achieve desired risk and expected return.

The underlying assumptions of the CAPM are very similar to those in modern portfolio theory due to the fact that CAPM is based on Markowitz's work. The most important and relevant assumptions of CAPM are as follows:

- Assume all investors are rational and allocate assets according to expected returns, covariances and standard deviations.
- All investors have the same expected return, covariances and standard deviation.
- Investors can allocate capital any part of their capital to a risk-free asset with a positive yield.
- Investors can also invest any part of their capital in a risky asset, which is traded in a competitive market with no frictions and transaction costs influencing investment decisions.
- Investors can borrow and invest at the same interest rate with no limits on the amount.
- Investors can de-leverage portfolios by allocating more to risk-free assets or investors can leverage portfolios by borrowing at the risk-free rate and investing more in a risky asset portfolio.
- There are no restrictions of short selling in the optimized risky portfolio.
- Markets are assumed to be efficient and therefore reflect all information.
- Investment decisions are made at a point in time for a discrete time period.
- The return on risky assets is the sum of cash dividends received and capital appreciation from common stock.
- Individual investors make investment decisions in a probabilistic manner using a probability distribution of some sort in decision making.

The simple linear line connecting the risk-free asset is tangent to the Markowitz (1952) efficient frontier of risky assets becomes the new efficient frontier. The Capital Market Line (CML) represents an individual's allocation between risk-free and risky asset portfolio according to the individual's risk aversion.

The expected return of the diversified risky portfolio of the CML can be expressed as:

Equation 1: Capital Market Line (CML)

$$E(r_p) = r_f + \frac{\theta_p}{\theta_m}[E(r_m) - r_f]$$

r_p is the return on the risky portfolio.

r_f is the return on the risk-free asset.

θ_p is the standard deviation of the risky portfolio.

θ_m is the standard deviation of the market portfolio.

The Security Market Line relates to individual securities and the risk of each security is solely measured by Beta. Beta standardizes the covariance between the market and the stock by dividing the covariance of the individual risky asset and the market by the market variance. The CAPM uses the Beta coefficient from a regression between the security and the market to estimate Beta.

The equation is as follows:

Equation 2: Beta and Covariance

$$\beta_i = \frac{Cov(r_i, r_m)}{\theta_m^2}$$

$$Cov(r_i, r_m) = \rho_{i,m}\theta_i\theta_m$$

According to CAPM, the construction of a portfolio of risk assets in the CML is not efficient due to the element of unsystematic risk. Unsystematic risk or company-specific risk can be eliminated through diversification and is avoidable. Investors will not be rewarded for taking on avoidable risk. The only risk that is therefore rewarded and priced is the systematic risk. The exposure of a single asset to the market measures its riskiness.

The SML replaces the total risk with systematic risk to calculate the expected return on a single security, which is expressed below:

Equation 3: Security Market Line (SML)

$$E(r_i) = r_f + \beta_i[E(r_m) - r_f]$$

In theory, if markets are efficient all stocks and portfolios should lie on the SML and if they do not, the asset is mispriced. CAPM is simply a special case of the SML and is the market portfolio, which has a Beta of one. The market portfolio is the most optimal portfolio with the weights of each individual assets being value-weighted.

2.3.2 Joint Hypothesis problem

The joint hypothesis problem is simply the fact that in order to test for market efficiency, an asset-pricing model is needed. However, in order to construct an asset-pricing model such as the CAPM, market efficiency needs to be tested. Therefore, market efficiency and asset pricing theory cannot be separated. If an 'anomaly' is found it may be due to markets being inefficient or to an incorrectly specified model.

3. Literature review

3.1 Introduction

The definition of what constitutes a ‘quality’ factor or characteristic is vital for the validity of the analysis and interpretation of the results. Quality is defined by Asness, et al. (2013), as a characteristic that should increase the price of a stock if all other factors are kept constant. The basic framework for what constitutes a quality stock and therefore a stock trading at a higher price can be found in the Dividend Discount Model (DDM).

Equation 4: Dividend Discount Model (DDM)

$$P_0 = \frac{Dividend(1 + growth)}{required\ return - growth}$$

Rearranging the DDM in terms of price to book value ratio:

$$\frac{P}{B} = \frac{Profitability \times Payout\ Ratio}{Required\ return - Growth}$$

The fundamental basis of identifying quality stocks in this paper is based on the price-to-book ratio derived from the DDM. The derived formula is presented in the appendix. The four categories according to the formulae above are therefore: profitability, payout ratio, required return, which will be called ‘safety’ and finally growth.

3.2 The book-to-market effect

The book-to-market effect has been extensively researched and has been found to exhibit strong explanatory power. The idiosyncratic nature of the book-to-market is important to cover before extending to the 'quality' factors, which have no reference to the market value of a company. An overview of the literature surrounding the price-to-book ratio is therefore essential before the individual quality factors can be assessed. The question of whether the excess returns to high book-to-market stocks are due to risk or mispricing needs to be understood and assessed before any potential anomaly related to book-to-market can be tested.

The literature on the book-to-market effect has been extensively researched; however, the interpretation of the high excess returns associated with high book-to-market ratios has led to conflicting opinions. Fama and French (1992) found Beta to have poor explanatory power of average returns and found that book-to-market had a strong role in explaining average returns. The contrast in opinions derives from the question whether the excess returns from high book-to-market is due to mispricing or higher risk.

Fama and French (1992) state that if markets are rational, the higher returns associated with high book-to-market are due to higher risk. They concluded that companies with high book-to-market ratios had exhibited persistent poor earnings compared to low book-to-market companies and therefore it might be assumed that markets rationally incorporated the higher risk, justifying a lower price and therefore high book-to-market ratios.

Vassalou and Xing (2004) found that high book-to-market ratios are associated with companies in distress measured by high default risk. The relationship between high default risk and high book-to-market was found only in the top two quintiles of companies with the highest default risk. The companies in this range were small and had the highest book-to-market ratios. The relationship did not exist for the remaining companies.

Chen and Zhang (1998) ranked firms' risk by classifying them into firms with dividend cuts greater that 25%, and firms with high leverage and volatility in earnings as risky. The paper found that in the five markets tested, the more developed markets such as the United States displayed a value effect, and the two growth markets of Thailand and Taiwan had no significant value effects. Only firms in the more developed markets were found likely to have higher returns due to financial distress, earnings uncertainty and financial leverage (Chen & Zhang, 1998).

Mispricing is the contrasting opinion to risk-based explanations of excess returns exhibited by high book-to-market or so-called value stocks. Griffin and Lemmon (2002) used the Ohlson (1980) indicator for distress risk and could not find a conclusive link between high book-to-market ratios and distress risk. The companies with high distress risk displayed the largest corrections around earnings announcements, which may be an indication of mispricing as opposed to higher risk. La Porta, Lakonishok, Shiefer and Vishny (1997) also argue that the excess returns are due to mispricing because of investors' incorrect expectations. The paper found that over a five-year period much of the excess returns from value stock was due to positive earnings surprises and therefore the higher returns are due to mispricing and not due to higher risk. The potential of expectation errors made by investors that lead to asymmetrical earnings surprises between value and growth stocks measured, by book-to-market were found by Skinner and Sloan (2002). The over-optimism of growth stocks was the main reason for negative returns after earnings announcements.

Bartove and Kim (2004) classified value stocks as companies with book-to-market and low accruals and found that this strategy outperforms a single accrual or book-to-market strategy. The outperformance of the joint strategy did not show any signs of increased risk. Using the same joint strategy to construct a portfolio of glamour stocks produced negative returns in all stocks and abnormally high returns in the value stocks. The negative returns for the glamour stock can only be explained by efficient markets if there is a negative risk premium for a long time period and for a large number of stocks. This seems unrealistic and seems to be more intuitively explained by mispricing and not higher risk.

Ali, Hwang and Thromley (2003) found that the predictive power of book-to-market was higher for stocks with high arbitrage costs and more unsophisticated investors. The question asked by Shliefer and Vishny (1997) was why the anomaly of high book-to-market is not exploited by professional arbitragers, which would quickly eliminate the mispricing? The results in this paper are similar to those of Shliefer and Vishny (1997), who claimed that the high volatility in arbitrage returns is a deterrent for arbitragers and therefore may be the reason for the mispricing.

Lakonishok et al. (1994) also found that value stocks outperform glamour with no apparent higher risk. In the sample period used, from 1968 to 1990, glamour stocks underperformed value. The study concludes that the reason for the long excess returns can be attributable to many factors. Some factors include the short-term mind-set of most institutional investors who should have the skill and knowledge not to be naïve in making investment decisions. However, the excess returns of value typically only materialize between three to five years and therefore the pressure placed on beating the benchmark annually may cause the short-term focus. It is also much easier for institutional investors to justify purchasing in favour stocks due to their popularity, and these in favour companies tend to be good companies trading at potentially unfavourable valuations.

The conflicting opinions of whether excess returns associated with high book-to-market are due to risk or mispricing has no definitive answer. The lack of a definitive answer, therefore, does not disregard the possibility of inefficient markets nor mispricing. The more intuitive arguments supporting mispricing tend to suggest that it is the more probable reason for the excess returns from investing in high book-to-market stocks. The factors defining a stock as being quality will be covered in the following section.

3.3 Quality factors

It seems to be clear that the high book-to-market effect seems to provide excess returns. Many of the firms with high book-to-market multiples experience financial stress with pressure on profitability and margins. The introduction of quality factors can help identify winners especially in the context of value investing where fundamental analysis is more applicable than for glamour or growth stocks.

3.3.1 Profitability

Piotroski (2000) found that investors focusing on high book-to-market stock could increase returns by 7.5% by selecting companies with strong fundamentals. The paper found that only 44% of high book-to-market stocks outperformed the market on a risk-adjusted basis, without taking into account the fundamentals of the stocks. Piotroski used nine factors to measure good fundamentals or the quality of a company. The factors used were the following: positive return on assets, increase in return on assets, increase in operating cash flow, accruals, positive change in gross margin, positive change in current asset turnover, decrease in leverage, increase in firms liquidity and no increase or decrease in equity offerings. All these variables are improvements in fundamentals in the company's fundamentals. The paper found that the healthiest companies produced the best returns especially for medium and small stocks that are thinly traded with little or no analysts' coverage.

The profitability in terms of the rearranged Dividend Discount Model is how profitable a company is per unit of book value. The profitability factors used to determine profitability are: gross profits, earnings, cash flows, accruals and margins.

The first profitability factor used is gross profit, which is the cleanest profitability measure. Novy-Marx (2012) found that firms with high gross profits generated on average higher returns than unprofitable firms. Gross profit divided by total assets yielded similar results to price-to-book value ratios. It seems counterintuitive due to the fact that low price to book is associated with value stocks and high profitability is generally considered a growth strategy.

The similarities between the gross profit-to-book and price-to-book can be explained by looking at it from a different perspective. Value strategies invest in companies that are considered to be trading at a low price relative to assets or book value and sell assets trading at a high price relative to assets or book value.

Gross profit reflects effectively how productive a company is using its assets. High profitability indicates that firms are using assets productively. A profitability strategy allocates capital to high productivity and selling firms with low productivity. In summary, investing in highly profitable firms takes advantage of a different dimension of value, by allocating capital in productive assets compared to the traditional value investing strategy of allocating capital to inexpensive assets.

Novy-Marx (2012) found that the two strategies mentioned both displayed significant abnormal returns and found that profitability is a good predictor of future returns, with similar results to the price-to-book value ratio.

However, Fama (2006, 2008) found that profitability was a poor predictor of returns, and Fama (2008) but confirms that price-to-book is a powerful tool for predicting future returns; however, profitability adds less than 1% of incremental returns. Novy-Marx (2012) argues against the use of earnings as a proxy for true economic profitability due to the unrelated line items in the income statement that are taken into account before net profit or earnings is calculated.

There has been much research done on the validity of earnings as a measure of future profitability. The individual components that account for differences between gross profit and earnings also have a role in predicting future returns.

Research and development (R&D) costs have also exhibited a predicting power for future returns, especially for pharmaceutical and technology companies. These companies have high research and development costs, which in some cases exceed earnings. Chan, L. K. C., Lakonishok, J. & Sougiannis, T., (2001) found that large distortions in earnings arise from not capitalizing research and development costs and subsequently distorts price-to-book value and price-to- earnings ratios.

The predictive power of R&D for future returns is not significant for high spending in isolation; however, R&D as a percentage of market value was found to have significant excess returns (Chan, et al., 2001).

According to Asness, et al. (2013), higher profitability should result in investors paying a higher price. The different measures of profitability may yield very different results, such as gross profit and earnings due to the accruals and the potential explanatory power of each individual line item.

3.3.2 Growth

A company with the ability to grow profits is an attribute of a quality company due to its ability to increase its profits. Companies with growth in earnings should therefore trade at a higher price according to Asness, et al. (2013).

In the literature discussed earlier in the paper, the findings all point towards high book-to-market companies outperforming low book-to-market companies. However, not all low book-to-market firms underperform and there is a disparity between returns in growth companies. One of the main arguments for why growth stocks underperform is due to the lack of a fundamental basis justifying these companies' high prices. La Porta et al. (1997) also made the argument that the underperformance of growth firms is a result of naïve extrapolation of earnings growth.

Mohanram (2005) found that winners and losers could be separated for firms with a low book-to-market using financial statement analysis. The paper developed a strategy using a 'GSCOR', which is a combination of eight fundamental growth signals. The hedged strategy went long companies with a high GSCOR or good fundamentals and took a short position in companies with a low GSCOR. The "GSCORE" is determined by assigning a 1 or a zero for each of the eight criteria relating to the mediun of the stock's industry. The eight factors are assigned a number 1 if the following condition is met: return on assets exceeding the median, cash flow return on assets exceeding the median, cash flow from operations exceeding net income, earnings variability less than median, sales growth variability less median, and R&D,

capital expenditure and advertising greater than medians. Stocks are then assigned a GSCORE by the criteria just mentioned. The strategy had significant positive returns for 21 out of the 23 year-sample period from 1979–2001. Therefore, stocks with growth backed by good fundamentals commands a higher price with investors (Mohanram, 2005).

3.3.3 Safety

The safety variable using the price-to-book replaces the required rate of return with a more intuitive definition. The required return of a stock is still a highly debated concept. The literature has developed from the CAPM to the three-factor model developed by Fama and French (1996) and the APT model developed by Ross (1976). The objective of this paper is not to debate or find a potential solution on this topic and therefore a more intuitive method will be used.

The required return on a stock is inversely related to price and therefore, all else being equal, a lower than the required return should result in a higher price. The lower return should be required for firms that are considered 'safe' and therefore less risky. The measure of safety will use a return-based and a fundamental-based measure of safety (Asness, et al., 2013).

Return-based safety measures are related to external market factors such as Beta and volatility. Frazzini and Pedersen (2014) found that portfolios with high Betas underperform portfolios with low Betas on an absolute and risk-adjusted return basis. The security market line is much flatter than the CAPM predicted in 18 of 19 countries and for stocks in the United States. The same results were also found in other asset classes such as the treasury, corporate bond market and futures market. Similar results were found on the JSE by Van Rensburg and Robertson (2003) for firms with a small market cap and low Betas, which earned excess returns. The paper also found that portfolios with low price-to-earnings ratios also had a low Beta also earned excess returns. It appears from the literature that the assumptions made by CAPM that higher Beta should result in higher returns is clearly contrary to the results found.

The opposite appears to be true and it appears that Beta and returns seem to be inversely related to return (Van Rensburg & Robertson, 2003).

Fundamental-based safety measures are internal factors such as the leverage, financial distress, variability of earnings and credit risk. If a company has safe fundamentals it should trade at a higher price and therefore require a lower expected return. However, George and Hwang (2010) found the opposite relationship between returns and a firm's fundamental risk. The paper found that firms with high leverage had a significant negative relationship with returns and on a risk-adjusted basis the negative relationship is even stronger. Taking into account the distress costs further increases the relationship for firms with low distress costs.

Further evidence of companies with high fundamental risk underperforming was also found by Campbell, Hilscher and Szilagyi (2008). Companies with high bankruptcy risk tend to have abnormally low average returns. Portfolios of high credit risk stock had low returns between the sample periods between 1981 and 2003 and had negative alphas using any leading asset pricing model due to the high Beta, standard deviations and factor loadings using the Fama & French (1993) multifactor model. It seems inconsistent that the price-to-book can be used as a proxy for financial risk due to the negative Alpha of high distress risk companies.

Accruals have been classified as a safety factor due to the fact that a company with high cash flow relative to earnings should be safer. The accruals and cash flow components have been shown to have an important role to play in predicting whether earning will be persistent. Sloan (1996) found that earnings do not seem to price in the component of earnings made up of accruals and cash flow. The market seems to have a narrow-minded view of focusing solely on earnings. Sloan (1996) found that the higher the proportion of accruals in current earnings lead to lower subsequent or negative stock returns compared to earnings with a high cash proportion of current earnings. Richardson, Sloan, Soliman and Tuna (2005) found an even greater mispricing due to low earnings persistence of high accruals in earnings. Constructing a simple hedged portfolio with the least reliable accruals was found to have 18% annual returns (Richardson, et al., 2005).

3.3.4 Payout Ratio

A payout ratio is the proportion of earnings paid to shareholders. There is no obligation to pay out dividends to common equity holders and therefore it is management's capital allocation decision. The decision to pay out dividends is a reward to shareholders for providing equity funding and can therefore be interpreted as the level of shareholder-friendliness. The issuance and repurchases of shares will also be taken into account as well as the net payout (Asness, et al., 2013).

Jensen (1986) argues that the agency issue between managers and shareholders is greater if a firm is generating large amounts of free cash flow. Large amounts of free cash flow gives the managers more options and therefore control to decide what to do with the excess cash flow. Managers have an incentive to grow the firm beyond its optimal size due to remuneration structures and promotions. Issuing debt or paying more debt decreases the agency costs due to the decrease in free cash flows.

In a paper by McLean, Pontiff and Wantanabe (2009), share issuance and share repurchases displayed significant predictive power for cross-sectional returns in 41 stocks outside the United States. Share issuance was negatively associated with returns and share repurchases therefore displayed a positive relationship with returns. The predictive power displayed stronger explanatory power than size and momentum.Share repurchases exhibited similar predictability to the book-to-market ratio. The sample included South Africa and many other emerging markets such as China and India. The predictive power is stronger for countries where share issuance and repurchases can be done with ease. South Africa was one of the nine countries allowed to buy back share over the entire 25-year period. Negative share issuance or share repurchases were positively related to returns but share issuance had stronger predictive power with a negative relationship, which may be due to companies issuing shares when valuations are expensive and taking advantage of inexpensive equity financing.

ap Gwilym, et al. (2006) found that high payout ratios lead to high growth in future earnings growth. The contrary was also found true in which companies with small payout ratios experienced low future growth in earnings. The paper was conducted in 11 countries with the majority of the countries being in Europe with Japan being the exception. The paper is an extension of the work done by Arnott & Asness. (2003), who first discovered the relationship in the United States. There are a few possible explanations for the relationship, with the first relating to mean reversion in earnings. Dividends are far more smoothed and constant than earnings and therefore abnormally high or low earnings tend to revert to the mean in subsequent years and therefore explain the earnings growth related to high payout ratios.

4. South African literature

The international literature has been discussed in detail in this paper; however, the South African market has a few key characteristics that need to be considered.

4.1 Market segmentation on the JSE

In the paper done by Van Rensburg and Slaney (2002) led to changes in the two factors that can be used in the APT model constructed on the JSE by Van Rensburg and Slaney (1997). The two factor APT model has superior explanatory power compared to the CAPM. The paper found that the Resources and Financial-Industrial indices serves as good proxies for explaining what the drivers of returns are on the JSE.

4.2 Concentration

The JSE is the largest stock market in Africa and is ranked 18th in terms of market capitalization in the world ranking of stock exchanges. The JSE/All-share is made up of 168 companies, which represents 99% of the total market cap of ordinary stocks listed on the JSE. The level of concentration is large with the top 40 shares making up over 80% of the total market capitalization of the JSE. The concentration of the JSE places a constraint on the size of active bets that a long only manager can take. The investment management industry in South Africa is predominately long only and the short sale restrictions on funds create a potential inefficiency on the short side (Raubenheimer, 2010).

The reason being that most long only funds can take a maximum long bet of 10% and therefore no active long bet can be taken is shares with a benchmark weight greater that 10%. This also applies to the size of the active short bets that long only funds can take. Many shares have a weight in the benchmark of less than 1% and therefore the active short position will have almost no impact.

To illustrate this point further, the difference in the maximum possible active bet that a long only portfolio can take is 909% compared to 1650% of an unconstrained portfolio, if the maximum limit on active bets is 5%.

Kruger and Van Rensburg (2008) found that the JSE top 40 was the most concentrated of all indices on the JSE. The concentration on the JSE could provide inefficiencies and therefore opportunities for a hedge fund strategy that can take short positions.

4.3 Liquidity

In the paper by Bailey and Gilbert (2007) liquidity have explanatory power of why high excess returns exist on the bottom end of the JSE with low price-to-earnings ratios. Portfolios exceeding R100 million could not invest in these illiquid shares, which exhibit mean reversion, and therefore the remaining shares did not have similar results.

An interesting result in the paper was that mean reversion was found in the high price-to-earnings shares with high liquidity. Excess returns were found by selling short the shares with the highest high price-to-earnings ratios and highest liquidity. This may be justified by the concentration and the short restrictions placed on the long only portfolios mentioned earlier.

4.4 Style factors on the JSE

Van Rensburg, (2001) found that the JSE also displays exposures to style based risk, similar to the international results. The three main exposures found were a value effect measured by low price-to-earnings; a quality factor measured my market capitalization and a momentum factor measured by the past 12 months' positive returns.

The paper found various factors to be significant but for the purposes of this section the focus is on looking at the significant quality factors. The quality factors that were found to be significant were the following: last 12-month positive returns, last six months' positive returns, leverage, cash flow to debt, turnover and three months' past positive returns. In summary, the factors that were found to be significant seem to all have a safety element. The earnings only being positive and the different measures of leverage all can be classified as safety measures.

Muller and Ward (2013) tested three categories of style based effects on the JSE from 1985 to 2011 on the ALSI. The method used in the paper involved ranking stocks according to each style on a quarterly basis into five equally weighted portfolios. Once the portfolios' ranking was complete a time-series approach, which graphically displays the performance of the different portfolios, was used. The category of style based factors that are of particular importance for this paper are the financial ratio based styles.

Financial ratio analysis is related to the fundamentals of the companies and not to the valuation ratios using fundamentals in relation to the market value, such as a price-to-book ratio. These ratios are an indication of the underlying fundamentals of the company. In theory strong fundamentals should command a higher price due to the higher quality and less risk of the company.

Muller and Ward (2013) chose four financial ratios, which are used to measure the quality of the companies, which are: the return on capital, return on equity, interest cover and finally asset growth. The return of capital portfolios show that the lowest ranked portfolios significantly underperformed the higher-ranked portfolios. The lower-ranked portfolios underperformed by 7.4% per annum of the period.

The return on equity showed interesting results, with the highest return-on-equity portfolio and the lowest-ranked portfolio both underperforming the ALSI. The results could be due to a number of factors such as unsustainably of high returns on equity or the market has already priced in the high return on equity leading to poor subsequent returns.

Interest cover was used as the measure for leverage and the results are consistent with capital structure theory that there is an optimal amount of gearing. The fourth portfolio out of the five outperformed the rest of the higher interest cover portfolios and outperformed the ALSI by 5.2% per annum. The worst performing portfolio was that with the least interest cover, which significantly underperformed. Firms that are in financial distress and have excessing gearing should be avoided.

Finally, asset growth was found to be negatively related to returns and consistently underperformed the ALSI over the period. The lower asset growth portfolios outperformed the high asset growth portfolios by over 11% per annum.

5. Data and Descriptive Statistics

5.1 Introduction

The data presented in the following section will be used for the purposes of the analysis in the next sections. The methods used to correct and make adjustments to the data in order to remove any biases or irregularities are explained in this section.

The data was first formatted correctly in Microsoft Excel in order to import the data into the econometrics program. Econometrics View version eight, which was used to conduct the analysis and generate the statistical tests. (EViews8).

5.2 Data

The data used to conduct the analysis in the next section includes market data such as Beta, volatility and prices. However, for the purposes of this paper the majority of data used to conduct the analysis is made up of financial statement data without any relation to the market. The reason for the focus of financial statements it to test the quality of the company in isolation, irrespective of the valuation is to test whether excess returns are earned on quality companies measured by good fundamentals.

All the data mentioned above were obtained from Bloomberg at the Oppenheimer Library on the campus of the University of Cape Town. The Bloomberg data was exported from the Bloomberg add-in in Excel. Importantly, the default settings were changed to adjust data for corporate actions such as stock splits and rights offers in order to prevent the data from being distorted.

5.2.1 JSE share selection

The selections of shares to conduct the analysis are the constituents of the FTSE/JSE All-share index. The 251 shares selected consist of the current and former constituents on the FTSE/JSE All-Share.

The selection of the FTSE/ALSI increased the sample size of stocks compared to using the most commonly used index being the FTSE/JSE top 40 index. The FTSE/JSE All-Share makes up more than 99% of the market cap of all the shares on the JSE and is will therefore be used as the best representation of the total market while excluding shares that are extremely illiquid and available to only a small group of investors, which is not the purpose of this paper. The sample of stocks chosen therefore provides the necessary completeness in order to the strengthen robustness of the results in the analysis.

5.2.2 Continuity and validity of the data

The sample period of data range is from the 1st of January 1994 until the 1st of November 2014. The long sample period provides more power to the analysis done in the next chapter. The fact that in South Africa companies only report financial results on a semi-annual basis compared to quarterly reporting in the United States, makes it particularly important to have a long sample in order to have enough data points for meaningful results.

The long sample period, however, presents some potential problems due to the changes in the constituents of the FTSE/JSE All-share. The index is free float market cap-weighted and therefore any shares which experienced a significant enough increase or decrease in market cap, were included or excluded from the index. The data consist of 251 stocks that have been or are still constituents of the index and the current number of constituents on the FTSE/JSE All-share is 165, therefore 86 companies have been included or excluded during the sample period. The biases and adjustments to correct the biases that result from the changes in constituents will be discussed in detail later in the chapter.

5.2.3 Return data and adjustments

The returns calculated assume that dividends are reinvested to be consistent with the fact that the FTSE/JSE All-share Index also assumes dividends are reinvested. The returns are calculated on a monthly basis over the entire sample. The calculated returns are forward returns; meaning that the return at the point in time the data is collected is calculated for the month in order to test the predictive power at the same time the data was available.

5.2.3.1 Outliers

The data was checked for outliers before any analysis took place. Outliers can be caused by abnormal events or simply errors in the data. The presence of outliers can lead to results that are distorted and therefore meaningless.

The first step in removing outliers was simply done by plotting the histograms of each factor. If the histograms had the appearance of being clearly distorted a dot plot of the data points was used to check extreme outliers. The extreme outliers in the approach mentioned above were removed if the data points were errors.

The second step in cleaning up the outliers used a method called 'windsorisation' after the manual cleanup was done. The data was windsorised in the econometrics package called Eview eighth edition. The method simply calculated the standard deviation and mean of the data. Once this has been calculated, the outliers are removed at a desired distance from the mean. The data in this paper was windsorised to within 99% level of significance. The benefit of the approach is that the information contained in outliers is not lost while at the same time not distorting results in the regression analysis that is particularly sensitive to outliers.

The final step after the outliers had been adjusted for was to generate histograms again for each factor individually in order to do a final check to make sure that the data was correct in order to start the analysis. The histograms are attached in the Appendix of each adjusted factor over the entire period.

5.2.4 Firm specific factors and adjustments

The financial information used in this paper was collected from the Bloomberg terminal and was therefore not collected from the financial statements of the companies. The data is limited to what is published by companies and therefore some stocks have some missing data.

The use of financial information vastly reduces the amount of data points and reduces the power of the test results. The fact that companies in South Africa are required to report financial results only semi annual basis compares to a quarterly basis in America further amplifies this problem and leads to a large amount of static data. The long sample period was selected to attempt to address this potential issue and provide more power to the regression analysis.

The valuation multiple such as the price-to-book discussed above were also used in the regression analysis to test whether quality enhances the value effect. In order to reduce errors in data, many of the multiples were used to construct the company specific financial ratios. As The company-specific 'quality' factors are divided into four categories, namely profitability, payout, safety and growth. The description and calculation of each factor tested is presented in Table 1 below.

Table 1: Definitions and calculations of all factors

The definitions and calculations of all factors in the analysis in this paper are presented in table 1 below. The factors can be divided into two main categories: Quality and Style and Market factors. The quality factors relate to the firm without any reference to the market. The quality factors are divided into four categories: Safety/risk, Profitability, Growth and Payout. The Style and Market factor all have reference to the market.

Category	Sub Category	Code	Definition
QUALITY	Safety/Risk	ACCRUALS	Cash flow/Earnings
		ICBT	EBIT/Interest
		LOGDE	Log(Debt/equity)
		ROEVOL18M	(-18m)Std.Dev of earnings/book value
		EPSVOL24M	(-12m)Std.Dev of earnings/shares outsanding
	Profitability	CFROE	Cash flow/book value
		EBITDAMAR	EBITDA/Sales
		NPM	Earnings/Sales
		ROA	Earnings/Total non-current assets
		ROC	Earnings/Total non-current assets+total debt
		ROE	Earnings/book value
		CFROA	cash flow/Total non-current assets
	Growth	CAPEXTS	Capital expenditure/Sales
		EBITDAMARG12	[EBITDA margin/(-12m)EBITDA margin]-1*100
		EPS12M	[EPS/(-12m)EPS]-1*100
		ROEG12M	[ROE/(-12m)ROE]-1*100
		ROEG24M	[ROE/(-24m)ROE]-1*100
		ROEG36M	[ROE/(-36m)ROE]-1*100
		CFROEG12M	[CFROE/(-12m)CFROE]-1*100
		CFROEG24M	[CFROE/(-24m)CFROE]-1*100
		CFROEG36M	[CFROE/(-36m)CFROE]-1*100
	Payout	DPS12M	[Dividends per share/(-12m)Dividends per share]-1*100
		POUT	Dividends per share/Earnings per share
Style and Market factors	Value	CFTP	Casf flow per share/Price
		EY	Earnings per share/Price
		BVTM	Book value per share/Price
		DY	Dividends per share/Price
		PTS	Price/Sales per share
	Size	SIZE	Log(Market value)
	Risk	VOL6M	-6m Std.Dev of returns
		VOL12M	-12m Std.Dev of returns
		VOL18M	-18m Std.Dev of returns
		BETA	7 year monthly returns relative to the FTSE/JSE All-Share

*** "-" indicates a lagged period and "#m" indicates the number of months lagged**
Eg. (-6m) Dividends per share is the value of dividends twelve months ago.
*** Std. Dev is the standard deviation**

5.2.4.1 Normal distribution

Regression analysis requires the error terms to be normally distributed and not the distributions of each factor. The natural log has been used to transform some of the data presented above due to the presence of many static data points and large outliers created by different scales. The natural log was used to transform the following factors into a more normal distribution: size, change in total non-current assets and debt to equity. The transformation of these factors should lead to far more meaningful results and prevent the explanatory power of these factors tested to be lost in the regression analysis.

5.2.4.2 Standardization for OLS regression comparability

The standardization of each factor is calculated by dividing the mean of each factor each factor by its standard deviation. The standardization of each factor results in a standard deviation equal to one for each factor. The purpose of standardizing each factor is to allow for comparability of regression results. The coefficients can be compared directly between factors after the standardization and is instrumental in interpreting regression outputs that are displayed in the following chapter.

5.2.4.3 Dummy variable

The paper includes a number of dummy variables in order to test the robustness of the results. The inclusion allows for a qualitative aspect to the quantitative analysis to allow for more dynamic and more easily interpretable results. The “DVALUE” dummy variable is for all stocks trading at a price less that the reported book value of the company reported in the latest financial year. The choice of a book-to-market more than one is often associated with deep value due to the assumption that the assets can be liquidated for more than the cost to purchase the equity. The second dummy called “DNEG” includes all the months to the data when the FTSE/JSE All- share had a negative return. The final dummy called “DCFTP” price includes all stocks trading at a cash-flow-to-price more than 0.4. The 0,4 was selected because it is the upper quintile of the cash-flow-to-price distribution and therefore the “cheapest” quintile of stocks.

5.3 Biases and adjustments

In empirical analysis using long periods of data there are many biases that can lead to misleading or meaningless results. The identification of the potential biases as well as the methods adopted to minimize the possibility of biases in this paper will be discussed.

5.3.1 Survivorship bias

Survivorship bias in the data can occur when stocks are excluded from the data because the shares become inactive either from bankruptcy or have a market cap too small to be included in the index.

Survivorship bias can lead to overestimated returns due to only the inclusion of essentially the firms that have remained successful without taking into firms that have performed poorly over the period.

This paper has reduced the impact of survivorship by including all stock as constituents of the FTSE/JSE All-share over the entire period. As mentioned earlier, there are 251 shares in the data over the period and currently only 168 constituents. It is clear that there would have been a large survivorship bias in the analysis if the additional 83 shares were not included.

5.3.2 Look-ahead bias

Look-ahead bias is when predictions using regression analysis are made with data such as financial results before the actual results are released. The bias would increase the predictive power and lead to results that exaggerate the predictive power of the regressions. The bias has been adjusted for in the paper in a conservative manner to ensure that the bias does not lead to misleading and exaggerated results. The data collected is dated to when the financial results were made public at which point in time Professor Paul Van Rensburg recorder the data. The forward returns are then calculated for each month at the point in time the data was collected and therefore further eliminating the possibility of a look ahead bias.

5.4 Descriptive statistics

Table 2: Descriptive statistics

The descriptive statistics are presented in Table 2 below are for all the value, quality and size factors for the full sample. The data is for all factors used in the analysis over the entire sample period from the 1st of January 1994 until the 1st of November 2014. As mentioned earlier, the erroneous outliers were removed and the extreme outliers were windsorised

Factors	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis
ACCRUALS	1,6481	1,3776	5,4234	0,2848	0,9621	1,5691	5,5957
BETA	0,7901	0,7850	1,2611	0,1594	0,2702	0,0529	2,1530
BVTM	0,4135	0,3990	1,0332	0,0713	0,2273	0,4965	2,5356
CFROEG12M	0,1672	-0,0114	4,5894	-3,0367	0,9061	2,6391	12,5675
CFROEG24M	-0,0107	-0,1149	3,0498	-2,0961	0,6065	1,6718	8,0888
CFROEG36M	-0,0637	-0,1449	2,5144	-2,1626	0,5334	1,0508	6,4181
CFTP	0,0945	0,0836	0,2878	0,0061	0,0507	1,2988	4,8750
DPS12M	0,0696	0,0881	1,2885	-1,0000	0,2777	-0,8636	7,3500
DY	0,0299	0,0275	0,0803	0,0031	0,0141	0,9925	4,9958
EBITDAMAR	0,1857	0,1476	0,4427	0,0300	0,1207	0,6971	2,2991
EBITDAMARG12	-0,0242	-0,0189	1,0000	-0,4777	0,1841	1,5525	12,2408
EPS12M	0,1107	0,0976	1,8825	-0,7471	0,3135	0,8995	7,4419
EPSVOL24	1,4574	1,0625	4,0000	0,0321	1,3038	0,8949	2,4529
EY	0,0625	0,0601	0,1546	0,0109	0,0242	1,1486	5,3093
ICBT	9,2416	7,4923	21,9246	0,5774	6,1342	0,9742	2,7606
LOGDE	2,8469	3,3194	5,5293	-1,6445	5394	-1,1814	4,0255
NPM	0,1043	0,0683	0,4688	0,0088	0,0860	1,4609	5,3737
POUT	49,3258	49,3587	100,0000	7,1847	18,4937	0,2052	2,7692
PTS	1,7615	1,0927	8,5388	0,1537	1,4592	1,4562	5,2332
RETURNSFWD	0,0041	0,0040	0,1708	-0,1672	0,0618	0,0483	2,9147
ROC	0,0278	0,0065	0,2773	0,0007	0,0556	2,7663	9,8285
ROE	0,2005	0,1670	0,7083	0,0374	0,1251	1,6214	5,6071
ROA	0,1402	0,1119	0,6177	0,0000	0,1058	1,6275	6,4983
ROEG12M	-0,0301	-0,0513	0,9967	-0,6475	0,2842	0,8684	4,8870
ROEG24M	-0,1010	-0,0804	0,8566	-0,7697	0,3059	-0,0716	2,8695
ROEG36M	-0,0197	-0,0802	4,0000	-1,2236	0,5437	3,5139	25,6689
ROEVOL18	0,0187	0,0143	0,0913	0,0013	0,0158	1,9785	7,5643
CFROE	0,3081	0,2195	1,4372	0,0498	0,2519	2,0277	7,5884
CAPEXTS	0,0870	0,0420	0,4361	0,0085	0,0926	1,6554	4,9180
VOL6M	0,0617	0,0600	0,1303	0,0147	0,0233	0,3913	2,4894
VOL18	0,0625	0,0615	0,0988	0,0338	0,0125	0,1991	2,4814
VOL12	0,0637	0,0616	0,1185	0,0297	0,0169	0,2131	2,5492
SIZE	10,4928	10,2708	14,5137	7,8741	1,6488	0,7047	2,7734

6. Methodology

This chapter explains the methods used to analyze the data described in the previous chapter. The various methods used in this paper cover a broad range of techniques to test the robustness of the results.

The analysis was conducted by first running single cross-sectional regressions for each factor over the time period. The second step was to conduct multiple regressions with the quality factors to find the most explanatory power and significance.

The second section of the analysis incorporates value and size factors into the analysis in order to see if the quality factors still remained significant. The second section applied two steps. The first step was to apply dummy variables in order to test the significance and the coefficient of each quality factor. The second step conducted multiple regression analysis with value and size factors in order to see if the quality factors remain significant in a multifactor model with the most significant value and size factors on the JSE.

Then finally, a single quality factor is constructed from the most robust and significant quality factors in order to test whether there is any evidence that suggests the inclusion of a quality factor as an additional factor explaining returns on the JSE in conjunction with the value and size factors already found to have significant predictive power.

6.1. Regression analysis

6.1.1 Single-factor regression analysis

The first step in the methodology was to test each factor listed in the descriptive statistics. The method used is the same approach followed by Van Rensburg and Robinson (2003), which is similar to the Fama Macbeth approach. Each factor is regression in EViews in a monthly panel data format over the entire period. The equation below explained the single-factor cross-sectional regression:

Equation 5: Single-factor regression

$$r_{i,t+1} = \gamma_{0,t+1} + \gamma_{1,t+1} A_t + \varepsilon_{i,t+1}$$

$r_{i,t+1}$ = Dependent variable representing the realized monthly returns

$\gamma_{0,t+1}$ = Intercept term

$\gamma_{1,t+1}$ = Slope coefficient for the single factor estimated with OLS regression

A_t = Represents the standardized single factor

$\varepsilon_{i,t+1}$ = Error term from the OLS regression

The single-factor regressions are conducted for each factor each month over the entire sample period. The slope over the entire period using Ordinary Least Squares regression is therefore an indication of the 'payoff' to each factor. In order to compare the magnitude of the coefficients among the factors, the factors have been standardized.

Finally, the most significant factors are used determine which factors have a slope coefficient significantly different from zero; a Student's t-test was conducted to rank each factor based on absolute t-Statistics.

6.1.2 Risk-adjusted returns

The single-factor cross-sectional regressions are tested on a risk-adjusted basis by incorporating Beta into the regression analysis. The regression used to conduct the risk-adjusted analysis in presented below:

Equation 6: Risk adjusted regression

$$r_{i,t+1} = \gamma_{0,t+1} + \gamma_{1,t+1} SBeta_t + \gamma_{2,t+1} A_t + \varepsilon_{i,t+1}$$

$r_{i,t+1}$ = Dependent variable representing the realized monthly returns

$\gamma_{0,t+1}$ = Intercept term

$\gamma_{1,t+1}$ = Slope coefficient for the Beta of each stock estimated with OLS regression

$SBeta_t$ = Represents the standardized Beta

$\gamma_{1,t+1}$ = Slope coefficient for the single factor $A_t$estimated with OLS regression

A_t = Represents the standardized single factor A

$\varepsilon_{i,t+1}$ = Error term from the OLS regression

Including Beta as another factor allows the market to explain what it can and then the significance and coefficients of each factor are adjusted for market risk.

6.1.3 Single resgression adjustment for size

The single-factor cross-sectional regressions are tested for size by incorporating the SIZE factor, which is the log of the market value of the shares into the regression analysis. The regression used to conduct the risk-adjusted analysis in presented below:

Equation 7: Size adjusted regression

$$r_{i,t+1} = \gamma_{0,t+1} + \gamma_{1,t+1} SSIZE_t + \gamma_{2,t+1} A_t + \varepsilon_{i,t+1}$$

$r_{i,t+1}$ = Dependent variable representing the realized monthly returns

$\gamma_{0,t+1}$ = Intercept term

$\gamma_{1,t+1}$ = Slope coefficient for the SIZE factor of each stock estimated with OLS regression

$SSIZE_t$ = Represents the standardized SIZE factor

$\gamma_{1,t+1}$ = Slope coefficient for the single factor $A_t$estimated with OLS regression

A_t = Represents the standardized single factor A

$\varepsilon_{i,t+1}$ = Error term from the OLS regression

The SIZE factor is added to determine whether the individual quality factors are not simply a hidden small cap effect.

6.1.4 Multiple factor regression analysis

The significant single factors were used in many different combinations to construct factor models. Once the two factor models of quality factors were constructed more factors were added to until no more factors could add any significance to the explanatory power of the regression. The equation used to conduct the multiple regression analysis regression is presented below:

Equation 8: Multiple regression

$$r_{i,t+1} = \gamma_{0,t+1} + \sum_{K=1}^{K} {}_{K,t+1} A_k + \varepsilon_{i,t+1}$$

$r_{i,t+1}$ = Dependent variable representing the realized monthly returns

$\gamma_{0,t+1}$ = Intercept term

K_{t+1} = 1, 2, ……K factors

A_t = Represents the standardized single factor

$\varepsilon_{i,t+1}$ = Error term from the OLS regression

6.2 Dummy variables

The purposes of the dummy variables in this paper are to add more qualitative meaning to the results and to attempt to enhance the understanding of the results. The inclusion of dummy variables increases the robustness of the quality factors under certain market conditions and in combination with non-quality factors such as value.

The equation used to calculate the effect of the dummy variables is presented below in the equation:

Equation 9: Dummy variables

$$r_{i,t+1} = \gamma_{0,t+1} + \gamma_{1,t+1}A_t + \gamma D_{1,t+1}A_t \times \mathrm{Dummy} + \varepsilon_{i,t+1}$$

$r_{i,t+1}$ = Dependent variable representing the realized monthly returns

$\gamma_{0,t+1}$ = Intercept term

$\gamma_{1,t+1}$ = Slope coefficient for the single factor $A_t$estimated with OLS regression

A_t = Represents the standardized single factor A

$\gamma D_{1,t+1}$ = Slope coefficient for the single factor $A_t$estimated of dummy variable

$\varepsilon_{i,t+1}$ = Error term from the OLS regression

6.2.1 Value dummy variables

The first dummy variable used was to test whether quality factors lead to added "payoff" on stocks that are considered "value". As mentioned earlier, the book-to-market effect has been extensively researched and found to display significant excess returns over time.

The paper by Piotroski (2000) found that 44% of high book-to-market stocks underperform on a risk-adjusted basis. The inclusion of quality or fundamental factors increased the excess returns by separating winners from losers. Applying this thinking, the dummy variable called 'DValue' represents all stocks trading at a book-value-to-market more than one. The reason for the selection of more than one is that in theory the stocks net assets value exceeds the market value and therefore can be liquidated to make a profit regardless of earnings. This in combination of good fundamentals and quality factors were tested to deteremine whether good fundamentals combined with value does enhance returns.

The second dummy variable representing value that was used is the cash-flow-to-price dummy. Cash-flow-to-price was found to be the most significant factor in the single cross-sectional regression analysis. The dummy variable 'CFTP' was created by assigning all shares with a CFTP more than 0,4 a value of 1 to activate the dummy variable in the cross-sectional regression analysis.

The final dummy that was created was to test what the coefficient is of quality factors is when the FTSE/JSE All-shares experienced negative returns in a month. The dummy variable was used instead of selecting the periods when markets experienced a correction due to the lack of data point available to for these infrequent events. The benefit of testing the coefficient for negative months is that it an objective measure and not subjective as is the case in selecting periods based on opinion of what constitutes a market correction.

The coefficient of the dummy-adjusted quality factor represents the additional coefficient to the quality factor A_t. To test whether the slope coefficients of the dummy variables were significantly different from zero, the Student's t-test was used. Each dummy variable was ranked by absolute t-stat rank the significance of each potential quality factor.

6.3 Cumulative monthly regression payoff

The rolling regression is a regression of all the stocks with the factor being the independent variable and the returns forward being the dependent variable. The regression is done for each factor for all stocks on a monthly basis and then repeated for the next month. This process is repeated every month for the entire sample period starting on December 1996, for each factor in order to display the payoff of each factor for all stocks over time. The reason the sample only starts in 1996 is due to the fact that some factors require 36 months of prior data. The later starting date allows for a more direct comparison across factors in terms of total cumulative payoff. To further aid the comparison among factors; the factors have been standardized. The code used to perform this procedure is attached in the appendix.

To conclude the analysis the mean, standard deviation and the Sharpe ratio of payoffs are calculated over the period to rank factors according to Sharpe ratio.

7. Results

The following chapter will present all the results from the analysis done using the methodology described in section 6. All the results are after the data has had outliers removed and been windsorised. Survivorship bias and look-ahead bias have been adjusted for in preparing data for results.

The first section of results is the single factor regressions results of each quality factor over the entire sample period. The methodology is similar to the study done by Van Rensburg and Robinson (2003) where single-factor regressions were tested on many factors including quality or fundamental factors. The results of the single factor regressions will also show how the quality factors rank with the more researched style and market factors such as size, earnings yield, cash-flow-to-price and book-to-market.

The second section includes the results of the multiple factor regressions of the quality factors. This section tests which quality factors are significant in a multiple regression over the entire sample period. This section also discussed whether the quality factor could be included with the style and market factors mentioned in the paragraph above.

The third section of results discussed the results of the dummy variables, which provide the more qualitative aspect to the results. The dummy variable results are separated into two sections. The first section of results relates to when the FTSE/JSE All-share experienced a negative month and the next section related to the performance of 'value' stocks with quality factors.

The fourth section deals results discuss the cumulative payoff of each factor across the entire sample period using a rolling monthly regression. This includes two samples of shares: the total 251 shares and the top 60 measures by market value

7.1 Single regressions analysis

7.1.1 Single regression analysis for all quality factors

Table 3: Single regression results for all quality

The single regression results for all quality factors for the full sample of shares over the entire sample period. From the 1st of January 1994 until the 1st of November 2014. The factors have been standardized and windsorised. The rank of each factor is based on absolute t-Statistics. See table 1 for definitions of the factors in the table below. The factors in the table below are standardized and therefore contain the letter "S" at the beginning of each factors abbreviation or code.

Quality factors						
Rank	Factor	Coefficient	Std. Error	t-statistic	Prob.	R-squared
1	SACCRUALS	0,00573	0,03693	6,44723	0,00000	0,00274
2	SCFROE	0,00425	0,02014	4,73699	0,00000	0,00142
3	SEPS12M	0,00363	0,01359	3,74674	0,00020	0,00105
4	SCFROEG12M	0,00286	0,00807	2,81729	0,00490	0,00066
5	SCFROEG24M	0,00337	0,00934	2,77049	0,00560	0,00088
6	SEBITDAMARG12	0,00395	0,01053	2,66722	0,00770	0,00381
7	SCFROEG36M	0,00405	0,01067	2,63330	0,00850	0,00120
8	SICBT	0,00156	0,00379	2,43202	0,01500	0,00035
9	SROC	0,00205	0,00433	2,11192	0,03470	0,00084
10	SCFROA	0,00204	0,00376	1,84904	0,06450	0,00076
11	LOGDE	-0,00113	0,00181	-1,60033	0,10950	0,00018
12	SROE	-0,00135	0,00209	-1,54923	0,12130	0,00016
13	SCAPEXTS	-0,00118	0,00173	-1,47102	0,14130	0,00020
14	SEBITDAMAR	0,00143	0,00174	1,21282	0,22530	0,00049
15	SROA	0,00133	0,00159	1,19728	0,23130	0,00032
16	SROEVOL18	-0,00107	0,00118	-1,09628	0,27300	0,00010
17	SEPSVOL24	-0,00085	0,00085	-0,99045	0,32200	0,00006
18	SROEG36M	-0,00132	0,00112	-0,84789	0,39650	0,00013
19	SDPS12M	0,00083	0,00069	0,83730	0,40240	0,00006
20	SNPM	0,00084	0,00069	0,82266	0,41070	0,00067
21	SROEG24M	0,00073	0,00044	0,60853	0,54290	0,00005
22	SPOUT	0,00025	0,00011	0,42811	0,66860	0,00001
23	SROEG12M	0,00010	0,00001	0,10269	0,91820	0,00000

The accruals factor has the highest level of significance among the quality factors. There have not been many tests done on this factor on the JSE; however, it seems consistent with research by Sloan (1996) that found low accruals tend to lead to higher performance. Earnings are not robust through time due to the number of adjustments that are made in calculating earnings. Cash flow has been found to be far more robust due to the reduced amount of manipulation or accounting assumptions in its calculation.

Therefore high cash flow relative to earnings indicated that a company has good quality of earnings and therefore is a characteristic of a quality company. The accruals factor also had the highest coefficient and therefore is positively related to returns and is a very good candidate for its inclusion in a multifactor quality regression.

The second most significant factor is the cash flow return on equity. Cash flow return on equity also has the second highest coefficient. The finding seems to be consistent with the accruals ratio that earnings are not persistent and that cash flow is a better measure of future performance. The correlation between the accruals and cash flow return on equity is 0,51, which is fairly high due to because both factors include cash flow in the numerator of the ratio. The correlations between factors can be found in the appendix.

The contrast can be seen when looking at the return on equity, which has a negative relationship with returns. Muller and Ward (2013) found a similar relationship as mentioned earlier where the stocks in the portfolios with the highest return on equity underperformed compared to portfolios with a more modest return on equity.

The third most significant quality factor was 12-month earnings per share growth. Interestingly a growth in earnings was significant and had a positive relationship with returns. This is interesting because the cash flow measures seems to exhibit better explanatory power when earnings are viewed at a point in time, but growth in earnings exhibits a positive relationship with returns.

The fourth most significant factor is the 12-month growth in cash flow return on equity. The coefficient is lower than the 24-month and 36-month and only slightly more significant. The longer the period of growth in cash flow return on equity leads to higher coefficients and therefore more positive relationship with returns. The lower significance of the long periods of growth the returns may simply be due to the reduced number of observations.

The final growth factor that is highly significant is the 12-month growth in EBITDA margin. The growth in 12-month EBITDA margin displayed the second highest coefficient among all the growth factors. The growth in EBITDA margin was much more significant than the EBITDA margin. Interestingly, the only factor relating to profitability that was significant was the cash flow return on equity.

Finally, the only risk factor to be fairly significant is the interest coverage ratio. High-interest coverage was positively related to returns, even though the coefficient was the smallest out of all the quality factors.

In conclusion, nine quality factors were found to be significant at a 95% level of confidence and four factors were found to be highly significant at 99% level of confidence. The four categories of what constitutes a quality stock were not all significant. The payout ratio was not significant and was the third least significant of all the quality factors tested. However, each other category had significant factors that can be used in the multiple regressions.

The results from the single factor regressions are consistent with Asness, et al. (2013), who found that quality returns are associated with excess returns.

7.1.2 Single-regressions results for all factors

Table 4: Single regression results for all factors

Single regression results for all factors or the full sample of shares over the entire sample period from the 1st of January 1994 until the 1st of November 2014. The factors have been standardized and windsorised. The rank of each factor is based on absolute t-Statistics. See table 1 for definitions of the factors in the table below. The factors in the table below are standardized and therefore contain the letter "S" at the beginning of each factors abbreviation or code.

All Factors						
Rank	Factor	Coefficient	Std. Error	t-statistic	Prob.	R-squared
1	SCFTP	0,00925	0,14902	16,10814	0,00000	0,00798
2	SBVTM	0,00403	0,02828	7,01675	0,00000	0,00155
3	SACCRUALS	0,00573	0,03693	6,44723	0,00000	0,00274
4	SSIZE	-0,00328	0,01701	-5,18658	0,00000	0,00094
5	SCFROE	0,00425	0,02014	4,73699	0,00000	0,00142
6	SEY	0,00393	0,00055	7,10174	0,00000	0,00149
7	SEPS12M	0,00363	0,01359	3,74674	0,00020	0,00105
8	SDY	0,00320	0,01143	3,57256	0,00040	0,00101
9	SCFROEG12M	0,00286	0,00807	2,81729	0,00490	0,00066
10	SCFROEG24M	0,00337	0,00934	2,77049	0,00560	0,00088
11	SEBITDAMARG12	0,00395	0,01053	2,66722	0,00770	0,00381
12	SCFROEG36M	0,00405	0,01067	2,63330	0,00850	0,00120
13	SICBT	0,00156	0,00379	2,43202	0,01500	0,00035
14	SROC	0,00205	0,00433	2,11192	0,03470	0,00084
15	SCFROA	0,00204	0,00376	1,84904	0,06450	0,00076
16	SVOL6M	-0,00090	0,00147	-1,62846	0,10340	0,00008
17	LOGDE	-0,00113	0,00181	-1,60033	0,10950	0,00018
18	SROE	-0,00135	0,00209	-1,54923	0,12130	0,00016
19	SPTS	-0,00158	0,00244	-1,54226	0,12300	0,00012
20	SCAPEXTS	-0,00118	0,00173	-1,47102	0,14130	0,00020
21	SEBITDAMAR	0,00143	0,00174	1,21282	0,22530	0,00049
22	SROA	0,00133	0,00159	1,19728	0,23130	0,00032
23	SROEVOL18	-0,00107	0,00118	-1,09628	0,27300	0,00010
24	SEPSVOL24	-0,00085	0,00085	-0,99045	0,32200	0,00006
25	SBETA	-0,00058	0,00056	-0,96705	0,33350	0,00003
26	SROEG36M	-0,00132	0,00112	-0,84789	0,39650	0,00013
27	SDPS12M	0,00083	0,00069	0,83730	0,40240	0,00006
28	SNPM	0,00084	0,00069	0,82266	0,41070	0,00067
29	SROEG24M	0,00073	0,00044	0,60853	0,54290	0,00005
30	SVOL12	-0,00029	0,00015	-0,51136	0,60910	0,00001
31	SPOUT	0,00025	0,00011	0,42811	0,66860	0,00001
32	SVOL18	0,00016	0,00004	0,27647	0,78220	0,00000
33	SROEG12M	0,00010	0,00001	0,10269	0,91820	0,00000

The results of the single-factor regressions of all factors tested are displayed above in order to determine how the quality factors explanatory power ranks as compared to the more extensively researched market and style factors.

As mentioned earlier, the accruals factor was the most significant quality factor followed by the cash flow return on equity. In comparison with the two most significant factors being cash-flow-to-price and the book-value-to-market, the quality factors ranked slightly below. The cash-flow-to-market has the most superior t-statistic, coefficient and R-squared. The second most significant factor of all the factors is the book-value-to-market, which has been well researched internationally and in South Africa. Interestingly the accruals factor has higher R-squared and a higher coefficient than the book-value-to-market even though it is slightly less significant. The reason why the accruals ratio and the other quality factors might not be as significant is due to the fact that the number of observations is far less due to the infrequently reported data.

Size is the fourth most significant factor above the cash flow return on equity, which was the second-most significant quality factor. Another interesting finding is that the cash flow return on equity and the accruals ratio are more significant than the dividend yield and the earnings yield.

In conclusion, from looking at the single factor regressions, it appears that the quality factors have some significance in explaining returns, due to a number of factors being highly significant. After the comparison of the value factors with the market and style factors it appears that the quality factors have similar and even in some instances more explanatory power than these factors. The high ranking of the quality factors is especially interesting considering the reduced statistical power of these factors compared to the market and style factors due to the infrequent reporting periods.

7.2 Risk-adjusted regression results

Table 5: Risk adjusted results for all factors

The table below displays the regression results for the significant single factors found in section 7.1.2. The factors are ranked in the same order as in section 7.1.2 in order to compare the risk-adjusted results. As mentioned in the methodology, the Betas calculated by using 7 years of monthly returns compared to the FTSE/JSE All-Share index, have been used to test the risk-adjusted coefficients. The data used is for the full sample of shares over the entire sample period. The factors in the table below are standardized and therefore contain the letter "S" at the beginning of each factors abbreviation or code.

Risk adjusted returns				
Factor	**Coefficient**	**t-statistic**	**Prob.**	**R-squared**
C	0.009397	5.123945	0.0000	0.008386
SBETA	-0.001540	-2.435314	0.0149	
SCFTP	0.009486	16.01142	0.0000	
C	0.012671	6.447625	0.0000	0.002032
SBETA	-0.001161	-1.855660	0.0635	
SBVTM	0.004532	7.380085	0.0000	
C	0.003280	1.112588	0.2659	0.002756
SBETA	0.000372	0.377368	0.7059	
SACCRUALS	0.005644	6.197911	0.0000	
C	0.031278	10.41158	0.0000	0.001629
SBETA	0.001978	2.540216	0.0111	
SSIZE	-0.004761	-6.663767	0.0000	
C	0.006562	2.263796	0.0236	0.001329
SBETA	0.000162	0.164797	0.8691	
SCFROE	0.004013	4.393682	0.0000	
C	0.007640	2.462954	0.0138	0.001450
SBETA	0.001457	1.369323	0.1709	
SEPS12M	0.003919	4.000179	0.0001	
C	0.004599	1.368694	0.1711	0.001007
SBETA	0.001418	1.409886	0.1586	
SDY	0.003646	3.444822	0.0006	
C	0.011540	3.580590	0.0003	0.000713
SBETA	-2.47E-06	-0.002235	0.9982	
SCFROEG12M	0.002955	2.876913	0.0040	
C	0.011590	3.015793	0.0026	0.000921
SBETA	-0.000619	-0.466534	0.6408	
SCFROEG24M	0.003422	2.792167	0.0052	
C	0.017259	3.507289	0.0005	0.004445
SBETA	-0.001119	-0.762214	0.4460	
SEBITDAMARG12	0.003938	2.641868	0.0083	
C	0.014135	2.797304	0.0052	0.001658
SBETA	-0.001779	-1.016342	0.3095	
SCFROEG36M	0.004681	2.994791	0.0028	
C	0.022705	11.84336	0.0000	0.001164
SBETA	-0.002576	-3.786037	0.0002	
SICBT	0.001608	2.500793	0.0124	

C	0.012813	4.125736	0.0000	0.000950
SBETA	-0.000501	-0.509673	0.6103	
SROC	0.002021	2.137085	0.0326	
C	0.010139	3.094729	0.0020	0.000283
SBETA	0.000321	0.286474	0.7745	
SACCRUALSG12M	0.001815	1.710519	0.0872	
C	0.014236	4.107155	0.0000	0.001447
SBETA	-0.001695	-1.530053	0.1261	
SCFROA	0.002287	2.144342	0.0321	
C	0.019589	10.90530	0.0000	0.000075
SBETA	-0.000824	-1.316720	0.1879	
SVOL6M	-0.000363	-0.618395	0.5363	
C	0.028832	11.38121	0.0000	0.001322
SBETA	-0.003189	-3.999852	0.0001	
SLOGDE	-0.001159	-1.634042	0.1023	
C	0.009097	2.952585	0.0032	0.000209
SBETA	0.001144	1.173025	0.2408	
SROE	-0.001156	-1.288727	0.1975	

7.2.1 Risk-adjusted results comparison

The risk-adjusted factors have very similar results to the unadjusted results in section 7.2.1. In section 7.2.1 Beta was found to have a negative relationship with returns, but was not statistically significant. However, when including Beta with cash-flow-to-price, book-value-to-market, size, interest coverage before tax and the log of debt to equity. Log of debt to equity and interest coverage before tax are the only two quality factors that make Beta significant in the risk-adjusted regression analysis and Beta still remained negatively related to returns.

All the factors that were significant in section 7.2.1 remained significant except for six-month volatility and in return on equity. In conclusion, the remaining factors persist even after the adjustment for the market risk is taken into account, which indicates that factors other than six-month volatility in prices and return on equity are robust.

7.3 Multiple regression analysis

7.3.1 Multiple regressions results for quality factors

Table 6: Multiple regression results for all quality factors

In table 6 below are the results of the optimal multiple regression for all the quality factors for the full sample over the entire period. The factors are ranked according to absolute t-statistics and the factors have been standardized. The data has been windsorised and the definitions of the factors can be found in table 1.

Dependent Variable: RETURNSFWD_Q
Method: Panel Least Squares
Date: 02/16/15 Time: 12:41
Sample (adjusted): 1995M07 2014M09
Periods included: 183
Cross-sections included: 197
Total panel (unbalanced) observations: 10509

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003766	0.001933	1.948347	0.0514
SACCRUALS	0.003742	0.001208	3.097468	0.0020
SCFROE	0.003335	0.001276	2.614062	0.0090
SEPS12M	0.002671	0.001093	2.444151	0.0145
SROEVOL18M	-0.002367	0.001104	-2.144548	0.0320

R-squared	0.003734	Mean dependent var	0.010062
Adjusted R-squared	0.003355	S.D. dependent var	0.106174
S.E. of regression	0.105996	Akaike info criterion	-1.650360
Sum squared resid	118.0134	Schwarz criterion	-1.646906
Log likelihood	8676.819	Hannan-Quinn criter.	-1.649194
F-statistic	9.842964	Durbin-Watson stat	2.036712
Prob(F-statistic)	0.000000		

In table 6 above is the optimal multifactor model with the most significant factors and the highest R-squared. The four-factor model dominated all other combinations of quality factors. The accruals ratio displayed the most positive relationship with returns, which is consistent with the results from the single regression results in section 7.1.1.

Cash flow return on equity was also consistent with the results in section 7.1.1 with the second most positive relationship with returns. The accruals ratio and cash flow return on equity have a correlation of 0,51 and therefore may explain why the coefficient of each factor is lower than in the single regression results.

The 12-month growth in earnings per share displayed a very similar coefficient as in the single regression results, which may be due to the low correlation it exhibits with the other factors.

The interesting finding from the four-factor model is the increased negative relationship of 18-month return on equity volatility which when included in the four-factor model became significant at the 90% level of significance. In section 7.1.1 the factor was found not to be significant at a 90% level of significance.

The four-factor model contains three out of the four categories of what this paper defines a quality share to be. The accruals and the 18-month return on equity volatility are a measure of risk and safety. The cash flow return on equity is a measure of profitability and finally the 12-month growth in earnings per share is a measure of growth. In conclusion with the exception of payout, which was not found to be significant when included, the four-factor model encompasses the joint characteristics of a quality share. The results are consistent with Asness, et al. (2013) that the quality stocks should produce lower returns due to the expected higher price, but stocks that are defined as quality earn excess returns and are positively related to returns.

In the context of the four factor model, shares that exhibit; low volatility in return on equity in the past 18 months, high cash flow relative to earnings, high cash flow return on equity and high growth in earnings per share of the past twelve months should deliver excess returns.

7.3.2 Multiple regressions results for quality factors adjusted for size

Table 7: Multiple regression results for all quality factors adjusted for size

In table 7 below are the results of the optimal multiple regression for all the quality factors for the full sample over the entire period including the size factor to test whether the relationship is a hidden small cap effect. The factors are ranked according to absolute t-statistics and the factors have been standardized. The data has been windsorised and the definitions of the factors can be found in table 1.

Dependent Variable: RETURNSFWD_Q
Method: Panel Least Squares
Date: 02/16/15 Time: 12:42
Sample (adjusted): 1995M07 2014M09
Periods included: 183
Cross-sections included: 197
Total panel (unbalanced) observations: 10509

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004114	0.005319	0.773367	0.4393
SACCRUALS	0.003738	0.001210	3.090283	0.0020
SCFROE	0.003352	0.001298	2.581450	0.0099
SEPS12M	0.002673	0.001093	2.445030	0.0145
SROEVOL18M	-0.002382	0.001124	-2.119145	0.0341
SSIZE	-8.13E-05	0.001159	-0.070100	0.9441

R-squared	0.003735	Mean dependent var	0.010062
Adjusted R-squared	0.003260	S.D. dependent var	0.106174
S.E. of regression	0.106001	Akaike info criterion	-1.650171
Sum squared resid	118.0134	Schwarz criterion	-1.646026
Log likelihood	8676.821	Hannan-Quinn criter.	-1.648771
F-statistic	7.874608	Durbin-Watson stat	2.036618
Prob(F-statistic)	0.000000		

In the table above the introduction of the size factor does not change the results found in section 7.3.1. The size factor is highly insignificant when added to the four-factor 'quality' model. The regression results above therefore indicate that the four-factor model in 7.3.1 is robust even when taking size into account and is therefore not due to small and illiquid shares leading to different results.

7.3.3 Multiple regressions results for all factors

Table 8: Multiple regression results for all factors

In table 6 below are the results of the optimal multiple regression for all the factors for the full sample over the entire period. The factors are ranked according to absolute t-statistics and the factors have been standardized. The data has been windsorised and the definitions of the factors can be found in table 1.

Dependent Variable: RETURNSFWD_Q
Method: Panel Least Squares
Date: 02/16/15 Time: 13:30
Sample (adjusted): 1995M07 2014M09
Periods included: 183
Cross-sections included: 197
Total panel (unbalanced) observations: 10509

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.008572	0.002820	-3.040033	0.0024
SBVTM	0.007155	0.001192	6.001156	0.0000
SCFROE	0.006750	0.001395	4.839039	0.0000
SEPS12M	0.003362	0.001097	3.065150	0.0022
SROEVOL18M	-0.002344	0.001102	-2.127483	0.0334
SACCRUALS	0.002435	0.001226	1.986616	0.0470

R-squared	0.007139	Mean dependent var	0.010062
Adjusted R-squared	0.006666	S.D. dependent var	0.106174
S.E. of regression	0.105819	Akaike info criterion	-1.653593
Sum squared resid	117.6101	Schwarz criterion	-1.649448
Log likelihood	8694.805	Hannan-Quinn criter.	-1.652194
F-statistic	15.10339	Durbin-Watson stat	2.016976
Prob(F-statistic)	0.000000		

The table above displays the results for the of the optimal multi factor model with the most significant factors at a 95% level of confidence and with the highest R-squared.

The results are consistent with prior research in terms of the strong explanatory power of the book-value-to-market ratio that was discussed in the literature review. The inclusion of the quality factors increases the positive relationship that book-value-to-market exhibits with returns, which is consistent with Piotroski (2001), who found that the returns excess returns associated with high book-value-to-market stocks can be increased with good fundamentals or quality companies trading at high book values relative to the shares' market value.

7.4 Dummy variable

In the following section of results the dummy variables of all the quality factors are tested over the entire sample period from October 1993 until November 2014. All the data has been adjusted for potential biases and has been trimmed as described in the data section.

The first dummy variable is to test what the coefficient of each quality factor generates when the FTSE/JSE All-share experienced a negative monthly return. Value investing has been found to outperform in negative months and therefore the same relationship will be tested for quality factors.

The second set of dummy variable results use the two most significant value factors, namely the book value-to-markets and the cash-flow-to-price. The added excess returns of investing in value stock combined with good fundamentals was found by Piotroski (2000) and therefore the results should show whether this is also the case on the FTSE/JSE All-share.

7.4.1 FTSE/JSE All-share negative monthly returns

Table 9: Negative dummy variable results

The regression results of the top 12 most significant dummy variables for when returns on the FTSE/JSE All-Share are negative. A value of 1 is assigned to the dummy variable when returns are negative. The single-dummy variable regressions are ranked by the absolute t-statistic of the dummy variable. All factors have been trimmed and standardized so that the coefficients can be compared across all factors.

Quality factors when FTSE/JSE All-Share monthly return is negative					
Rank	**Factor**	**Coefficient**	**T-statistic**	**Prob.**	**R-squared**
1	SCFROEG36M	0,00403	2,61969	0,00880	0,00156
	SCFROEG36M*DNEG	0,26354	1,44827	0,14760	
2	SEBITDAMAR	0,00143	1,20898	0,22680	0,00087
	SEBITDAMAR*DNEG	-0,05775	-1,06849	0,28540	
3	CAPEXTS	-0,00118	-1,47519	0,14020	0,00028
	CAPEXTS*DNEG	-0,19059	-0,92478	0,35510	
4	SICBT	0,00156	2,43636	0,01480	0,00039
	SICBT*DNEG	-0,00774	-0,77719	0,43710	
5	SROE	-0,00109	-1,21426	0,22470	0,00014
	SROE*DNEG	0,00961	0,75927	0,44770	
6	SCFROEG12M	0,00289	2,83744	0,00460	0,00071
	SCFROEG12M*DNEG	-0,02665	-0,75029	0,45310	
8	SROEVOL18	-0,00119	-1,20833	0,22690	0,00018
	SROEVOL18*DNEG	0,01634	0,72548	0,46820	
9	SROEG36M	-0,00133	-0,85660	0,39170	0,00022
	SROEG36M*DNEG	0,03948	0,67173	0,50180	
10	SACCRUALSG12M	0,00218	2,08539	0,03710	0,00042
	SACCRUALSG12M*DNEG	-0,01224	-0,63291	0,52680	
11	SCFROE	0,00424	4,72782	0,00000	0,00145
	SCFROE*DNEG	0,00946	0,63026	0,52850	
12	SNPM	0,00089	0,86345	0,38790	0,00010
	SNPM*DNEG	-0,01333	-0,53232	0,59450	
13	LOGDE	-0,00111	-1,56842	0,11680	0,00019
	LOGDE*DNEG	-0,00196	-0,43115	0,66640	
15	SROEG24M	0,00073	0,61199	0,54060	0,00006
	SROEG24M*DNEG	-0,02474	-0,37454	0,70800	
16	SACCRUALS	0,00572	6,43928	0,00000	0,00275
	SACCRUALS*DNEG	0,00447	0,36268	0,71690	

The results above display the performance of quality factors during periods when the monthly market returns were negative but the coefficients are not significant. One potential reason for the insignificance may be a lack of data point when the monthly returns are negative which reduces the power of the test results combined with the infrequent accounting data.

Even though the dummy variable regression results are not significant, there are some interesting findings. Interestingly, the growth in cash flow return on equity over the last 36 months was the most significant. The coefficient is also positive during the months when the index experienced negative returns. The coefficient of 0.263535 is very high compared to the coefficients found in any of the other regressions. The coefficient, however, has a probability of 14.76% of being zero and is not statistically significant.

The two most significant quality factors found in the single regressions are also not statistically significant in times when the market experiences negative monthly returns. Accruals ratio has the highest t-statistic when returns are not negative. The dummy coefficient of the accruals ratio when returns on the FTSE/JSE All-share are negative has a positive coefficient; however, it is not significant. Therefore during times when the market is negative there is no statistically significant relationship with accruals.

The cash flow return on equity is the second most significant when returns are not negative. The coefficient was also positive for the dummy; however, the coefficient was far greater than the coefficient of cash flow return on equity excluding the dummy.

The other interesting but not statistically significant results from the dummy regression analysis are the margins. The EBITDA and Net profit margins have a negative coefficient when returns are negative, compared to profitability measures such as return on equity and return on capital that have a positive relationship. Return on equity was negatively related in the single regressions results over the entire period, but the dummy variable displays a positive relationship.

The growth in return on equity also has a higher coefficient than return on equity, which is consistent with the relationship between cash flow return on equity and the 36-month growth in cash flow return on equity.

Finally, the third most significant dummy variable being, capital expenditure to sales' dummy displayed a high negative coefficient. The capex-to-sales ratio was also negative in the single regressions for the entire period and more negative in periods of negative returns. Capex-to-sales is a fundamental growth measure and companies with a high capex relative to sales tend to be companies with high growth. One thing to bear in mind is that mining companies have large capital expenditures for maintenance and therefore capex-to-sales might have a bias towards mining stocks and not necessarily growth stocks.

All the quality factors had very low and even statistical significance in periods when the index and therefore there is no significant relationship between quality factors and returns of during the periods when the market returns in a month were negative.

7.4.2 Quality factors payoff with value dummy variables

The book-value-to-market and cash-flow-to-price factors were the two most significant factors. These factors are both considered value factors with the book-value-to-market being associated with value on the balance sheet compared to the cash-flow-to-price which is a value factor relating to the cash flow statement. Therefore the two factors have been selected to represent 'value' stocks.

7.4.2. 1 Book-value-to-market dummy variable

Table 10: Book-value-to-market dummy variable

The results using the book-value-to-market dummy variable are displayed for all the factors with a dummy variable significant at a 90% level of confidence. The factors are ranked according to the absolute T-statistics of the dummy variables. The dummy variable called 'DVALUE' is assigned a value of 1 when the book-value-to-market is more than one for all stocks over the entire sample period. The data used has been standardized and the letter "S" represents a factor being standardized.

Quality factors when BVTM>1					
Rank	**Factor**	**Coefficient**	**T-statistic**	**Prob.**	**R-squared**
1	SICBT	0,00116	1,80046	0,07180	0,00278
	SICBT*DVALUE	0,01006	6,42047	0,00000	
2	SCFROE	0,00402	4,46015	0,00000	0,00330
	SCFROE*DVALUE	0,01690	5,75861	0,00000	
3	SPOUT	-0,00044	-0,73236	0,46400	0,00093
	SPOUT*DVALUE	0,00436	4,92897	0,00000	
4	SROEVOL18	-0,00199	-1,98251	0,04740	0,00171
	SROEVOL18 *DVALUE	0,00949	4,30386	0,00000	
5	SLOGDE	-0,00164	-2,28933	0,02210	0,00149
	SLOGDE*DVALUE	0,00573	4,30336	0,00000	
6	SCAPEXTS	-0,00212	-2,52993	0,01140	0,00145
	SCAPEXTS*DVALUE	0,00664	3,68679	0,00020	
7	SCFROEG12M	0,00481	4,12567	0,00000	0,00161
	SCFROEG12M*DVALUE	-0,00814	-3,49387	0,00050	
8	SROE	-0,00110	-1,12577	0,20850	0,00075
	SROE*DVALUE	0,00687	3,02525	0,00250	
9	SEPSVOL24	-0,00156	-1,74489	0,08100	0,00053
	SEPSVOL24*DVALUE	0,00617	2,66204	0,00780	
10	SACCRUALS	0,00498	5,05892	0,00000	0,00295
	SACCRUALS*DVALUE	0,00254	1,78262	0,07470	

The results using the book-value-to-market dummy named 'DNEG' had far more significant results than the negative market dummy in the previous section. Eleven of the quality factors dummy variables were significant for all shares when the book-value-to-market was more than one.

The most significant dummy variable for the quality factors was the interest coverage ratio. The interest coverage ratio also has the third highest positive coefficient when book-value-to-market was above one. The reason the added performance of the interest coverage for companies trading at less than their book values may be due to the risk of bankruptcy. Generally companies that trade below their book values have experienced financial distress and can be liquidated for more than the market value assuming that the book value of assets can be liquidated at book value. If companies have high interest coverage ratios, then the risk of default is lower and the low market value relative to book value may not be justified leading to excess returns due to mispricing.

The second most significant factor is the cash flow return on equity which exhibited a high coefficient on 0.1690 with both the dummy and the cash flow return on equity for stocks with a book-value-to-market not more than one, having a zero probability of having a coefficient equal to zero. The cash flow return on equity has an interesting relationship with the book-value-to-market ratio. If a stock has a high book-value-to-market it may be due to large intangible assets or over-inflated book values. The opposite applies to cash flow return on equity; if the cash flow return on equity is very high it may be due to unjustifiably low book values. The use of both factors seems to mitigate the pitfalls of simply using one of these factors in isolation. The cash flow return on equity can be used as a quality of book value factor when looking at high book-value-to-market stocks. Similar to the cash flow return on equity, the EBITDA to total not-current assets had an almost identical coefficient. This is not surprising due to the similarity between total non-current assets and book value as well as cash flow and EBITDA.

Return on equity was negative for stocks with a book-value-to-market less than one even though this was not statistically significant. However, similar to cash-flow return on equity, return on equity for the dummy variable had a positive coefficient that is statistically significant.

The payout ratio was the third-most significant in terms of absolute t-statistic of the dummy variable. The coefficient of the payout ratio is positive and highly significant even though it was highly insignificant for stocks with a book-value-to-market less than one. The reason for this may be due to the fact that when a company is trading below its book value the risk of liquidation is dramatically reduced if a company has a high payout ratio. The reasons for the lower risk is that companies that pay dividends are profitable and do not need the cash paid out as dividend to continue with operations. High payout reduces the long-term sustainable growth rate; however, the returns from investing in the dummy stocks can be classified as 'value' stocks because the majority of returns should come from re-rating and not from growth. The high coefficient exhibited by the high payout ratio is consistent with value investing where stocks are bought that seem safe and trading at favourable valuation multiples.

The fourth most significant dummy variable was the 18-month return on equity volatility, which was positively related to returns when the company was trading at less than its book value. The 24-month earnings per share volatility also had a positive coefficient that was statistically significant. These factors can be associated with higher risk and in these cases the higher risk may explain the higher return and perhaps not due to mispricing.

The log of debt to equity also exhibits a positive relationship with returns for the 'DVALUE' dummy, but exhibits a negative relationship with returns for stocks with a book-value-to-market less than one. The potential explanation for this may be due to the fact that book value is after debt, which has been subtracted from assets. The market value below the net asset value should produce a return if the company is liquidated, and the returns should be increased further; if the company survives due to the high leverage.

The accruals ratio displayed a positive coefficient, which is consistent with the DNEG dummy in the previous section. The only quality factor that exhibited a negative coefficient was the 12-month growth in cash flow return on equity. This result is countered intuitive; however, it does not necessarily contradict the result found with cash flow return on equity. Growth in cash flow return on equity should be higher for companies with low cash flow return on equities due to the lower base. As found earlier, companies with high cash flow returns on equity display a high positive coefficient and therefore this result may further enforce the robustness of the finding found earlier.

7.4.2.2 Cash-flow-to-price dummy variable

Table 11: Cash-flow-to-price dummy

The results using the book-value-to-market dummy variable are displayed for all the factors with a dummy variable significant at a 90% level of confidence. The factors are ranked according to the absolute T-statistics of the dummy variables. The dummy variable called 'DCFTP' is assigned a value of 1 when the cash-flow-to-price is more than 0,4 for all stocks over the entire sample period. The data used has been standardized and the letter "S" represents a factor being standardized.

Quality factors when CFTP>0,4					
Rank	**Factor**	**Coefficient**	**T-statistic**	**Prob.**	**R-squared**
1	SICBT*DCFTP	0,00135	2,10779	0,35100	0,00305
	SICBT	0,02210	6,76746	0,00000	
2	SPOUT	0,00012	0,20910	0,83440	0,00150
	SPOUT*DCFTP	0,01264	6,27574	0,00000	
3	SEPSVOL24	-0,00136	-1,57127	0,11610	0,00164
	SEPSVOL24*DCFTP	0,02564	4,94971	0,00000	
4	SROE	-0,00164	-1,87836	0,06040	0,00167
	SROE*DCFTP	0,01654	4,85186	0,00000	
5	SROEG24M	0,00007	0,05650	0,95490	0,00113
	SROEG24M*DCFTP	0,01918	2,98696	0,00280	
6	SROEG12M	-0,00063	-0,61909	0,53590	0,00077
	SROEG12M*DCFTP	0,01233	2,97755	0,00290	
7	SROEVOL18	-0,00157	-1,58440	0,11310	0,00087
	SROEVOL18*DCFTP	0,01045	2,97099	0,00300	
8	SCFROE	0,00352	3,77533	0,00020	0,00194
	SCFROE*DCFTP	0,00653	2,84861	0,00440	
9	SCAPEXTS	-0,00129	-1,60641	0,10820	0,00087
	SCAPEXTS*DCFTP	0,01918	2,69896	0,00700	
10	SDPS12M	0,00129	1,29145	0,19660	0,00064
	SDPS12M*DCFTP	-0,01596	-2,68505	0,00730	
11	SACCRUALS	0,00517	5,65319	0,00000	0,00316
	SACCRUALS*DCFTP	0,00582	2,52492	0,01160	
12	SCFROEG24M	0,00271	2,16991	0,03000	0,00158
	SCFROEG24M*DCFTP	0,01416	2,46740	0,01360	
13	SLOGDE	-0,00128	-1,80016	0,07190	0,00060
	SLOGDE*DCFTP	0,00744	2,44105	0,01470	
14	SROEG36M	-0,00192	-1,20004	0,23020	0,00062
	SROEG36M*DCFTP	0,01059	1,62523	0,10420	

The results from the final value dummy called 'DCFTP' had the most significant factors and with the highest coefficients. All the significant factors exhibited a positive coefficient besides the growth in dividends over the last 12 month period.

The most significant dummy factor was the interest coverage before tax, which is consistent with the previous results, found in the book value dummy variable. The coefficient of the interest coverage is the second highest which is also consistent with the first value dummy.

There are a few other factors that are consistent with the book-value-to-market dummy namely the payout ratio that is more significant in this case. Return on equity, cash flow returns on equity, accruals, log debt to equity, 12-month earnings per share volatility, capital expenditure to sales, 18-month return on equity volatility are all factors that were found significant earlier. These factors were all positive and significant in both; however, there are a few differences in the magnitudes of the coefficients.

The 24-month earnings per share volatility was the third most significant and had the highest coefficient of 0.2564. Earnings volatility is associated with risk and therefore as mentioned earlier the high return relative to the market may be due to higher risk.

The interesting difference between the book value and the cash flow to market ratio is the growth in the profitability factors. The return on equity growth for the last 36-month, 24-month and 12-months are all significant and all have a fairly high coefficient. The 12-month growth in cash flow return on equity exhibited a negative coefficient again, but was highly insignificant. The 24-month growth in cash flow return on equity was interestingly positively related to earnings for the dummy variable.

In conclusion for the value dummy variables seems to have similar results, but with some key differences. The coefficients of the cash-flow-to-price dummy variable were much higher than the book-value-to-market dummy variable. In addition to the higher coefficients, there were also more factors that were significant in the test using the cash-flow-to-price dummy. A possible explanation for this may be due to the fact that the cash-flow-to-price had the highest coefficient and significance in the single regressions of all the factors.

The second conclusion is that it seems that interest coverage seems to be robust for both dummies. The reduced risk associated with the interest coverage before tax in combination with a favourable market price could indicate mispricing. However, the debate between mispricing compared to more risk is not the purpose of this paper.

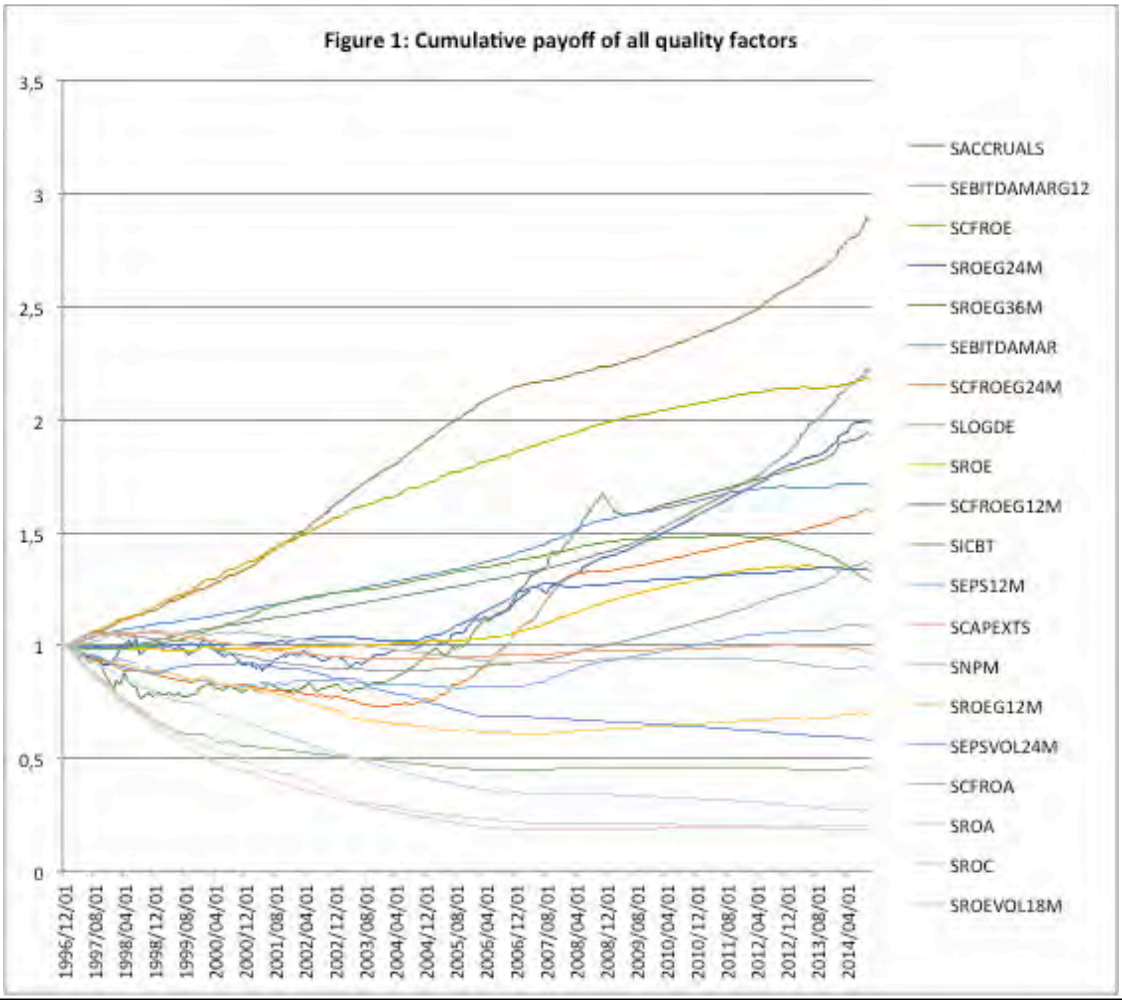
The key difference between the value dummies related to the growth in return on equity and cash flow return on equity is that were negatively related to returns for the book value dummy and were positive related to returns and significant for the cash-flow-to-price dummy.

Finally, the inclusion of value factors with value seem to be consistent with Piotroski (2000) findings that good fundamentals separate the winners from the losers for value stocks. The finding is not entirely consistent due to the positive coefficients of the factors such as earnings per share volatility and debt to equity, which are associated with risk.

7.5 Cumulative payoffs to each factor

Figure 1: Cumulative payoff of all quality factors

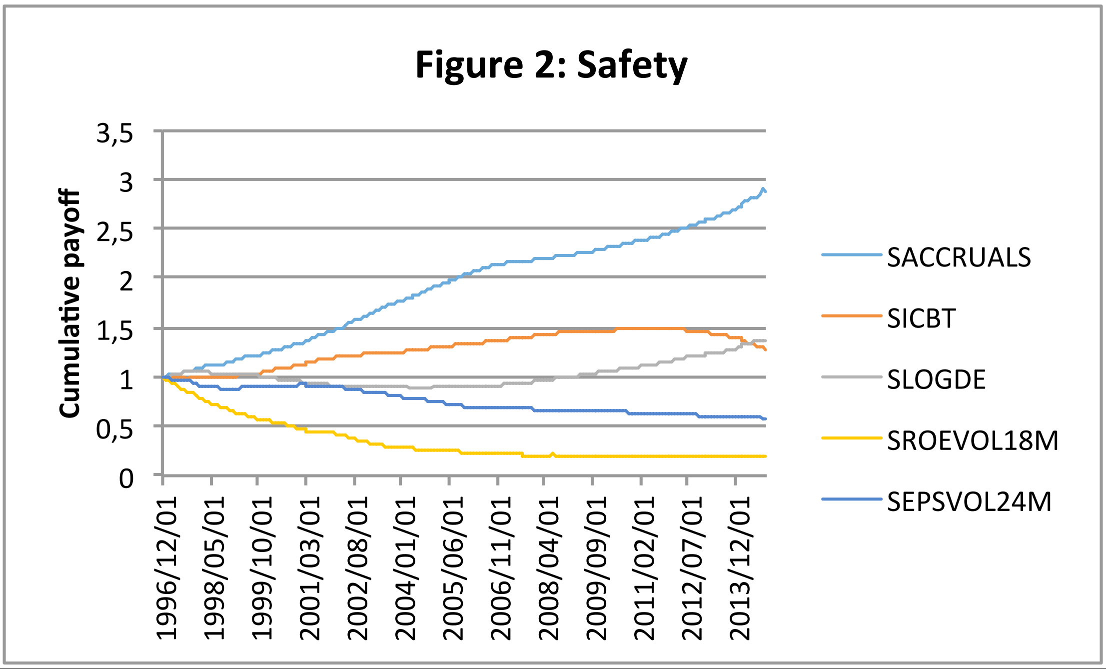
The figure below displays the cumulative payoff of the quality factors for the full sample. The data used is for the full sample of shares over the entire sample period. The factors are listed in descending order of cumulative payoff to aid the identification off factors in figure 1. The factors in the table below are standardized and therefore contain the letter "S" at the beginning of each factors abbreviation or code. The definitions of each factor and code can be found in table one.



7.5.1 Safety

Figure 2: Safety cumulative payoff

In figure 2 below displays the monthly payoff of the 'Safety' quality factors used to describe a firm's safety. The quality factors in the graph below are the following: Accruals ratio, debt to equity ratio, the log of the debt to equity ratio, interest coverage before taxation, 18-month volatility of return on equity and the 24-month volatility of earnings per share. The cumulative payoff is calculated using the coefficients of the rolling monthly regression over the entire period from December 2006 until November 2014.



The accruals ratio had the highest cumulative payoff of all the safety factors over the entire sample period. An interesting point to observe is that accruals experience a period of flat returns over the period leading up to the crash in 2008. After the crash it appears that the payoff continued on a similar upward trend as the periods before the crash. This is consistent with the paper by Asness, et al. (2013), which found that the premium paid for quality was the lowest leading up to a crash. The accruals ratio may be a good indicator of a build up to a large market correction or over exuberance.

The safety factor with the second largest payoff was the log of the debt to equity ratio. It appears that the log of debt to equity is a far better measure than simply just the debt to equity ratio. The first reason for this is evident when looking at the single regressions were the log of debt to equity is far more significant. The second and more intuitive reason can be seen in the figure were the payoff to the log of debt to equity seems to be negatively related to interest coverage.

There are a few interesting findings when looking at the results of the payoff to debt to equity. The first interesting finding is that debt to equity exhibited a negative payoff in the single regression analysis over the entire period. The second interesting finding is that the factor was positive up until the emerging market crisis in 1998 and exhibited poor performance until mid 2003. The payoff since then has increased steadily. The payoff to the factor has experience a significant increase since the financial crisis which; may be due to the low interest rate environment reducing financing costs for highly levered companies.

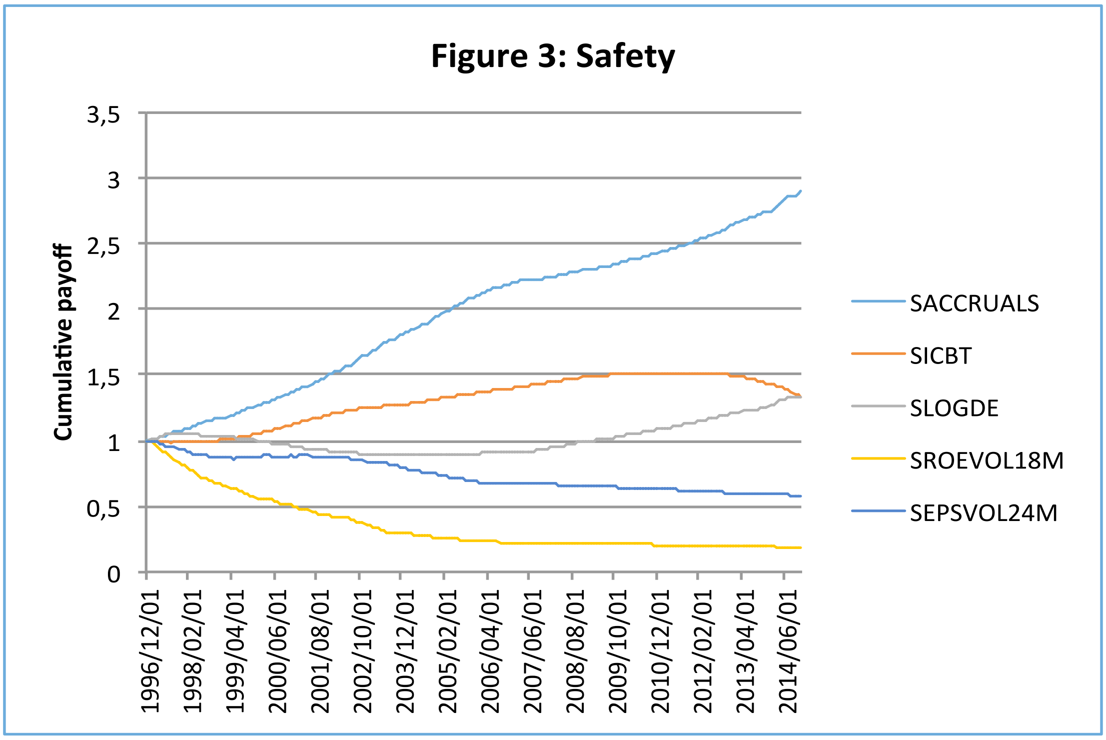
Interest coverage displayed a negative relationship with the log of debt to equity and displayed an opposite payoff. After the emerging market crisis in 1998 the reward for investing in safer companies associated with high interest coverage resulted in good returns. However, since the beginning of 2009 the payoff flattened out and started declining fairly steeply until the end of 2012. This may be a sign that investors have become less risk-averse and not concerned with the threat of potential bankruptcy.

The other two measure 18-month return on equity volatility and 24-month earnings per share volatility are not associated with being safe and were not rewarded. Both these factors were punished over the entire period with poor returns.

7.5.1.1 Safety payoff for the top 60

Figure 3: Top 60 Safety cumulative payoff

In figure 3 below displays the monthly payoff of the 'Safety' quality factors used to describe a firm's safety for the top 60 shares measured by market value. The quality factors in the graph below are the following: accruals ratio, debt to equity ratio, the log of the debt to equity ratio, interest coverage before taxation, 18-month volatility of return on equity and the 24-month volatility of earnings per share. The cumulative payoff is calculated using the coefficients of the rolling monthly regression over the entire period from December 2006 until November 2014.

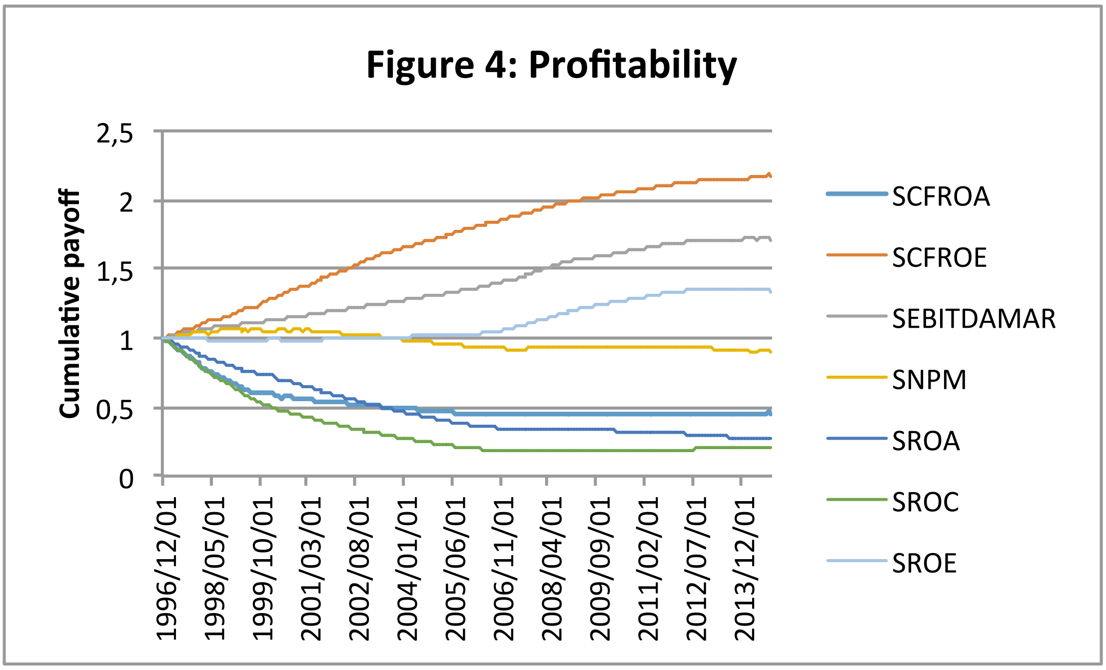


In order to remain consistent the payoff to each 'Safety' factor is displayed in order to observe any potential differences. Interestingly there is no noteworthy difference in the pattern of the payoff for the 'Safety' factors or in the cumulative payoff. This is consistent with section 7.3.2 were the size factor had a very slight impact on the results but nothing statistically significant.

7.5.2 Profitability

Figure 4: Profitability cumulative payoff

In figure 4 below displays the monthly payoff of the quality factors used to describe a firm's profitability. The quality factors in the graph below are the following: cash flow return on assets, cash flow return on equity, EBITDA margin, net profit margin, return on assets, return on capital and return on equity. The cumulative payoff is calculated using the coefficients of the rolling monthly regression over the entire period from December 2006 until November 2014.



The cash flow return on equity exhibited the highest cumulative payoff over the period and was the second most significant quality factors in the single regression analysis. The payoff that has consistently been positive over the sample period appears to have started to increase at a slower rate since the beginning of 2007. This result is similar to the accruals ratio in the previous section 7.5.1 were the payoff seemed robust throughout time and positive.

EBITDA margin had the second highest cumulative payoff in the monthly regression analysis. The EBITDA margin wasn't significant in the single cross-sectional regression analysis over the entire sample period and therefore could be misleading.

The payoff to profitability measures seems to significantly drop off as the profitability measures move away from cash flow in the numerator and earnings gets introduced. All the profitability measures using earnings in the numerator have a negative payoff with the exception of return on equity.

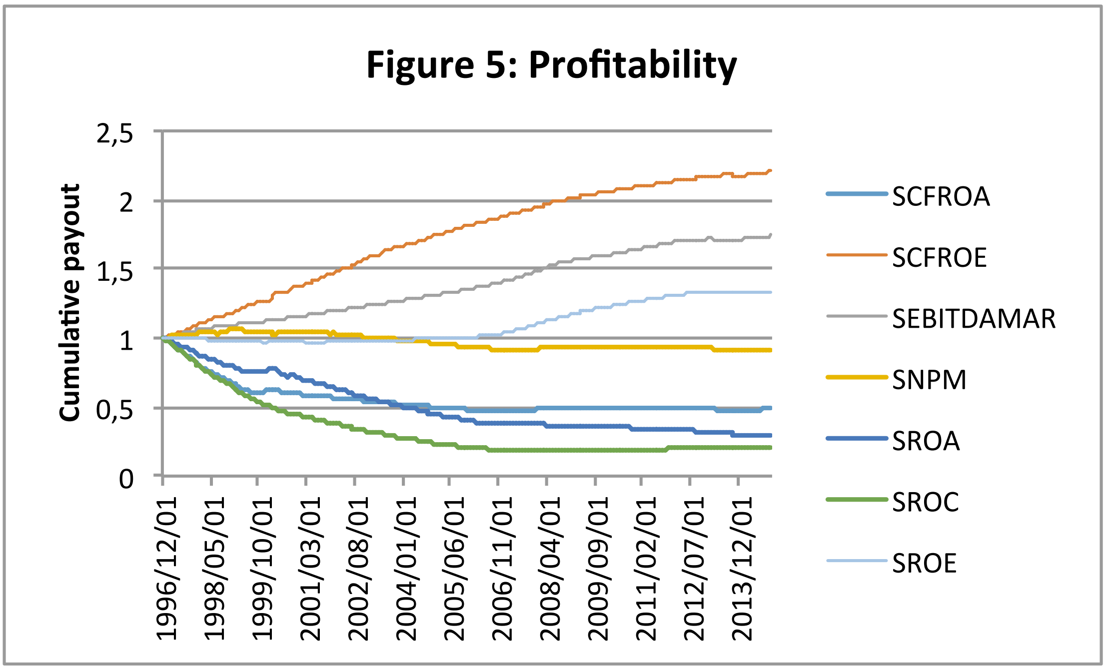
A similar result is found with return on equity as with the log of debt to equity. Both of the factors exhibited a negative coefficient in the single regressions over the entire sample period but have a positive payoff in the cumulative monthly results. The explanation in both cases seems to be due to leverage. Leverage is one of the three major components used to calculate return on equity using a Du Pont analysis. The return on equity seems to have a positive payoff in the similar period as the log of the debt to equity ratio. However, the positive payoff of debt to equity does not seem to have increased the payoff to return on equity in the period leading up to the year 2000.

The factors excluding return on equity displayed a negative cumulative payoff over the period. The reason for this may be due to increased competition that may be attracted by such high profitability. The other explanation could be due to the poor persistence of earnings that may be due to manipulation by management. The reason why this may be the case is that the cash flow return on assets and equity displayed a steady positive payoff compared to the profitability measurers using earnings in the numerator. This seems to be consistent with the research on the lack of persistence of earning and the poor predictive power that was found by Fama (2006, 2008), Novy-Marx (2012), and Sloan (1996).

7.5.2.1 Profitability payoff for the top 60

Figure 5: Top 60 Profitability cumulative payoff

In figure 5 below displays the monthly payoff of the 'Profitability' quality factors used to describe a firm's safety for the top 60 shares measured by market value. The quality factors in the graph below are the following: cash flow return on assets, cash flow return on equity, EBITDA margin, net profit margin, return on assets, return on capital and return on equity. The cumulative payoff is calculated using the coefficients of the rolling monthly regression over the entire period from December 2006 until November 2014.

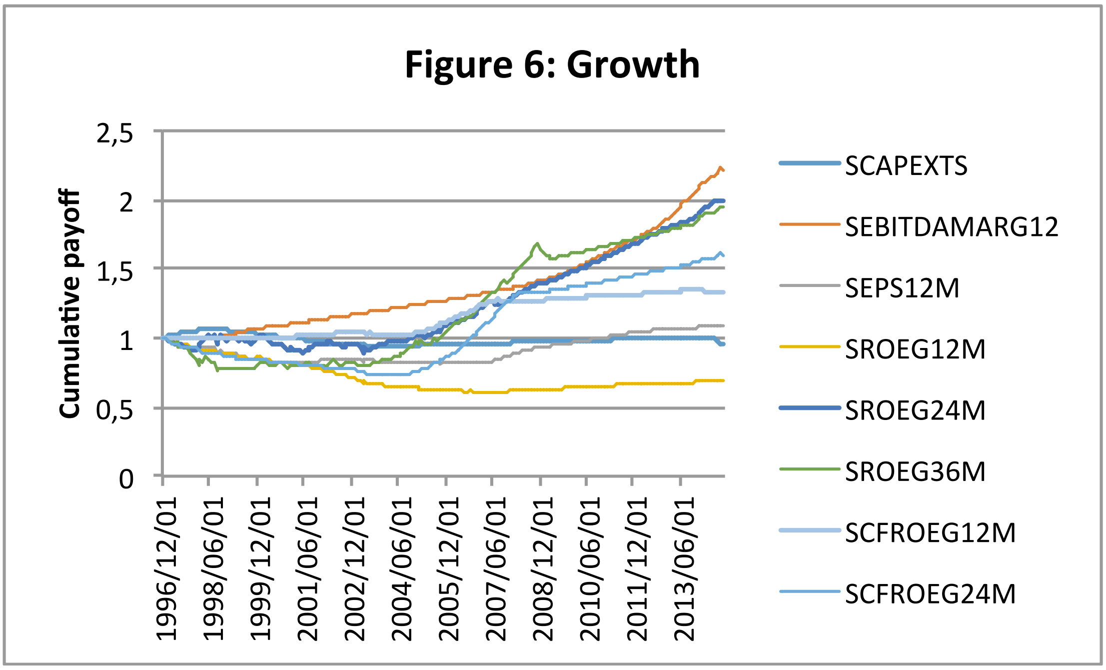


The top 60 for the 'Profitability' quality factors also do not appear to have any noteworthy differences. The patterns and total cumulative payoff are almost identical , which is similar to the safety results and consistent with the findings in section 7.3.2.

7.5.3 Growth

Figure 6: Growth cumulative payoff

In figure 6 below displays the monthly payoff of the quality factors used to describe a firm's growth. The quality factors in the graph below are the following: capital expenditure to sales ratio, EBITDA margin 12-month growth, 12-month growth in earnings per share, 12-month growth in return on equity, 24-month growth in return on equity, 36-month growth in return on equity, 12-month growth in cash flow return on equity and 24-month growth in cash flow return on equity. The cumulative payoff is calculated using the coefficients of the rolling monthly regression over the entire period from December 2006 until November 2014.



The first point to note is that it appears that growth with the exception of the 12-month growth in EBITDA margin performed poorly after the emerging market crisis in 1998 up until the end of 2003.

The highest growth payoff is the 12-month growth in EBITDA margin, which had a steady positive linear payoff up until the financial crisis in 2007/2008. Since the crisis the payoff to this factor has performed well and appears to be increasing exponentially.

The 24-month growth in return on equity exhibited the second largest cumulative payoff and was very similar to the 36-month growth in return on equity. Interestingly the 12-month growth actually exhibited a negative cumulative payoff and was the worst performing factor over the period.

The 24-month growth in cash flow return on equity exhibited the third highest payoff followed by the 12-month growth in cash flow return on equity. The 24-month growth in cash flow return on equity appears to be more volatile than the shorter 12-month growth over the period.

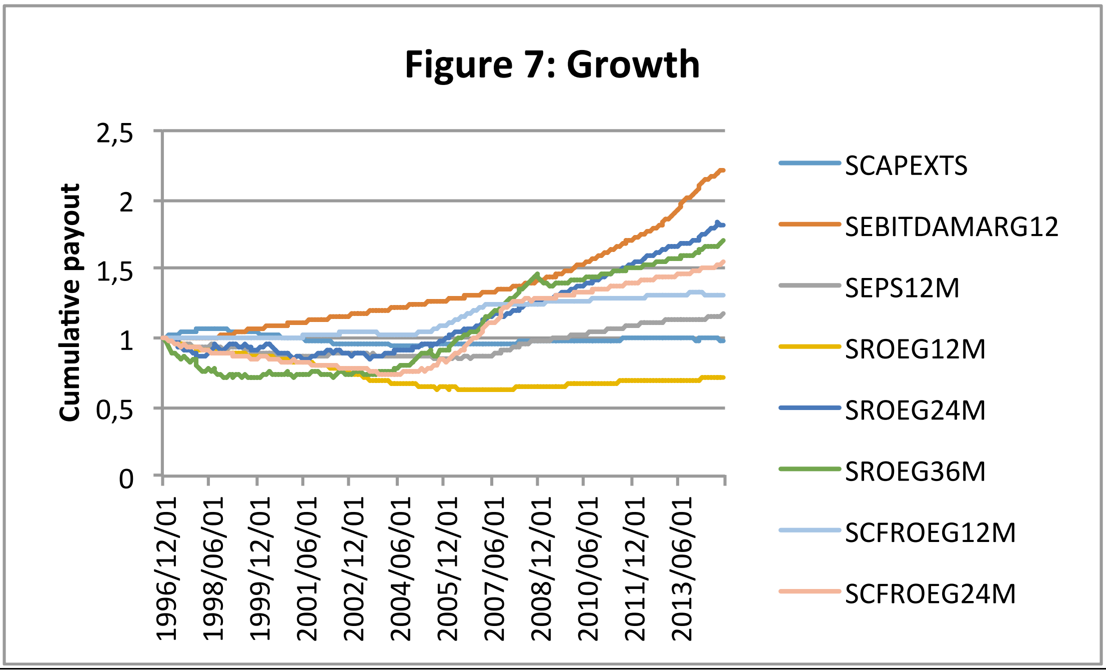
Twelve month earnings growth was the second worst performing factor until the beginning of 2007 where the payoff to the factor has been steadily increasing even throughout the financial crisis.

Finally, CAPEXTS exhibited a very flat payoff ending slightly below 1 at the end of the period.

7.5.3.1 Growth payoff for the top 60

Figure 7: Top 60 Growth cumulative payoff

The graph below displays the monthly payoff of the 'Growth' quality factors used to describe a firm's safety for the top 60 shares measured by market value. The quality factors in the graph below are the following: capital expenditure to sales ratio, EBITDA margin 12-month growth, 12-month growth in earnings per share, 12-month growth in return on equity, 24-month growth in return on equity, 36-month growth in return on equity, 12-month growth in cash flow return on equity and 24-month growth in cash flow return on equity. The cumulative payoff is calculated using the coefficients of the rolling monthly regression over the entire period from December 2006 until November 2014.

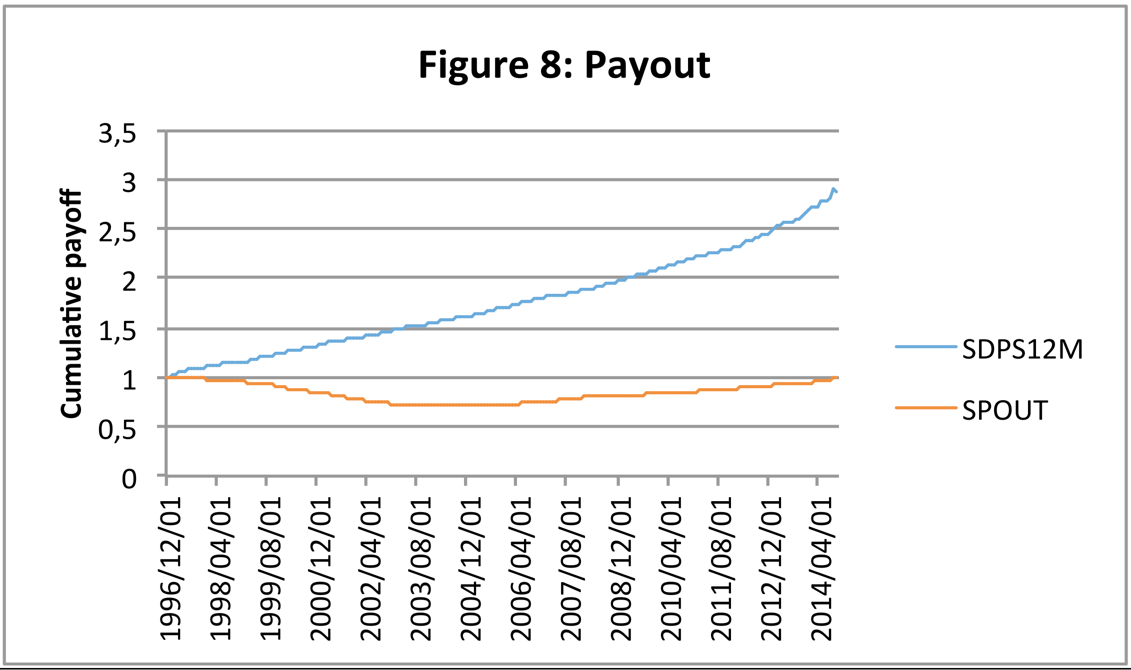


The top 60 for the 'Growth' quality factors also do not appear to have any noteworthy differences. However, there are some small differences such as the payoff to 12-month growth in EBITDA margin displayed a higher payoff and has a higher relative payoff compared to the other factors. The twenty-month growth in return on equity also appears to outperform the 36-month ROEG by a larger margin. The minor differences do not appear to be significant enough to be able to draw inferences from.

7.5.4 Payout

Figure 8: Payout cumulative payoff

In Figure 8 below displays the monthly payoff of the 'Payout' quality factors used to describe a firm's growth. The quality factors in the graph below are the following: payout ratio and 12-month dividend growth. The cumulative payoff is calculated using the coefficients of the rolling monthly regression over the entire period from December 2006 until November 2014.



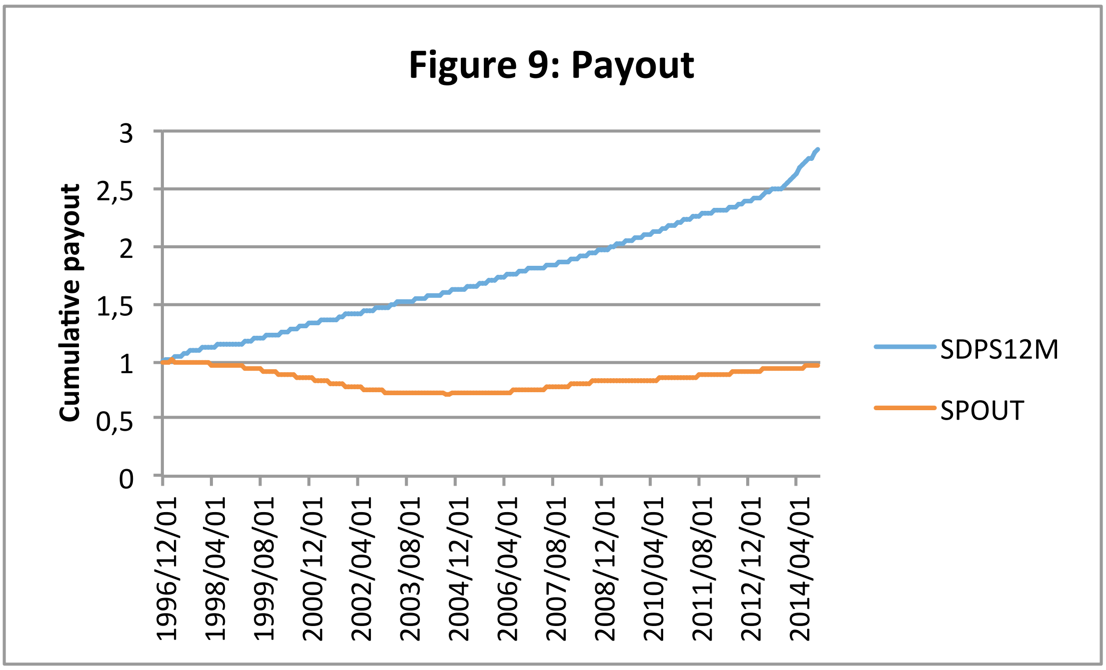
In Figure 8 above it is clear that the payout ratio has been fairly flat over the entire period. After the emerging market crisis in 1998 the payout ratio had a lower payoff. The possible explanation for this may be that companies maintained dividends but the earnings declined leading to a higher payout ratio but still poor earnings performance. And therefore may lead to poor stock performance. However, since 2005 the payout ratio has displayed a positive payoff, but has not been very high.

The opposite is true for the 12-month growth in dividends per share that has displayed a constant positive payoff over the entire period. In the earlier section the same was not found for earnings growth. The explanation for this may be due to the fact that dividends are far smoother than earnings. The second reason may be that management will only increase a dividend if they are confident that the company will be able to pay dividends in the foreseeable future, especially considering the negative sentiment associated with a decrease in dividend payments.

7.5.4.1 Payout payoff for the top 60

Figure 9: Top 60 Payout cumulative payoff

In Figure 9 below displays the monthly payoff of the 'Payout' quality factors used to describe a firm's safety for the top 60 shares measured by market value. The quality factors in the graph below are the following: payout ratio and 12-month dividend growth. The cumulative payoff is calculated using the coefficients of the rolling monthly regression over the entire period from December 2006 until November 2014.



Finally the cumulative payoffs for the 'Payoff' quality factor are consistent with the 'Safety', 'Profitability' and 'Growth' quality factors cumulative payoff were there appears to be no significant difference in the results. The differences may be due to the fact that the smaller sample period for the top 60 reduced the power of the test making many factors not significant and with contradicting results. However, from the graphical depiction of the payoffs there seems to be no significant difference.

7.6 Risk adjusted payoff results

Table 12: Risk adjusted payoff results

In table 12 below are the results of the results of the 23 factors tested in section 7.5. The mean, standard deviation and the Sharpe ratio are displayed below. The Sharpe ratio for the purposes of this paper is the mean divided by the standard deviation. The factors are ranked according to Sharpe ratio to determine which factors have the highest risk adjusted payoffs. The cumulative payoff is calculated using the coefficients of the rolling monthly regression over the entire period from December 2006 until November 2014.

	Mean	Std. Dev	Sharpe ratio
SACCRUALS	0,0050	0,0029	1,7163
SEBITDAMAR	0,0025	0,0015	1,6886
SEBITDAMARG12	0,0037	0,0027	1,3770
SDPS12M	0,0050	0,0040	1,2364
SCFROE	0,0036	0,0030	1,2162
SROE	0,0014	0,0022	0,6165
SCFROEG36M	0,0052	0,0114	0,4511
SLOGDE	0,0014	0,0034	0,4179
SCFROEG12M	0,0013	0,0032	0,4176
SICBT	0,0012	0,0031	0,3778
SCFROEG24M	0,0022	0,0081	0,2728
SROEG24M	0,0033	0,0121	0,2696
SROEG36M	0,0032	0,0157	0,2041
SEPS12M	0,0004	0,0057	0,0702
SPOUT	-0,0001	0,0040	-0,0184
SCAPEXTS	-0,0002	0,0021	-0,0897
SNPM	-0,0005	0,0031	-0,1648
SROEG12M	-0,0017	0,0048	-0,3516
SCFROA	-0,0036	0,0064	-0,5604
SEPSVOL24M	-0,0026	0,0035	-0,7391
SROC	-0,0074	0,0079	-0,9410
SROEVOL18M	-0,0079	0,0079	-0,9965
SROA	-0,0062	0,0043	-1,4218

The accruals ratio exhibited the highest average monthly return over the entire period and had the highest risk adjusted returns. The cash flow return on equity also remained in the top five factors and is alongside the accruals ratio in the optimal four factor quality model, as well as the optimal five factor model. The surprise was the low mean return displayed by the 12-month growth in earnings per share and the high standard deviation in the payoff.

8. Summary and conclusion

8.1 Summary of results

The work done by Asness, et al. (2013) found that quality stocks earn excess returns and that the premium paid for quality was too low. The presence of quality factors explaining returns in a South African context has been tested in this paper. The further contribution to the paper done by Asness, et al. (2013), was the inclusion of the extensively research style factors such as the book-value-to-market and size factors which have been found to have better explanatory power that the traditional CAPM.

The first objective was to test whether quality factors exhibited any predictive or explanatory power of future returns. The single regression results in section 7.1.1 found that nine of the quality factors were statistically significant at a 95% level of confidence and four factors were found to be highly significant at a 99% level of confidence. The factors that were found to have explanatory power of future returns over the entire sample were the following ranked according to absolute t-statistic: Accruals ratio (ACCRUALS), cash flow return on equity (CFROE), 12-month growth in earnings per share (EPS12M), 12-month growth in cash flow return on equity (CFROE12M), 24-month growth in cash flow return on equity (CFROE24M), 12-month growth in EBITDA margin (EBITDAMARG12M), 36-month growth in cash flow return on equity (CFROE36M), interest coverage before tax (ICBT), return on total capital (ROC).

The second objective was to test whether multiple quality factors could be combined to create a single quality factor. The multiple regression results had various different combinations, which can be seen in the appendix. The optimal multifactor quality model is made up of four factors. The four factors that can potentially be combined to form a single quality factor ranked according to absolute t-statistic are the following: accruals ratio, cash flow return on equity, 12-month growth in earnings per share and 18-month volatility in return on equity.

The third objective was to test the persistence and relationship of the quality factors in conjunction with style factors. The quality factors were first ranked individually in the single regression analysis with the style factors. The results found that the cash-flow-to-price was the most significant and had the most positive relationship with returns. Interestingly the accruals ratio exhibited the second most positive relationship with returns and was more significant than the size factor and earnings yield. Cash flow return on equity exhibited the third most positive relationship with returns and was also more positive than the earnings yield over the full sample.

The relationship between the quality factors and the two value dummy variables had interesting results. The results indicate that the quality factors had a positive relationship for stocks with a book-value-to-market more than one and a cash-flow-to-price more than 0,4. Including quality factors in combination with stocks classified as value stocks as defined by the dummy variable appear to in general lead to enhanced returns for a value strategy.

The optimal four factor model for quality was tested by including the style factors to test the robustness of the quality factors. The optimal model with the most significant factors and the highest R-squared for the full sample period contained the following factors ranked according to absolute t-statistic: book-value-to-market, cash flow return on equity, 12-month growth in earnings per share, 18-month volatility in return on equity and the accruals ratio.

The final objective was to test the payoff of the quality factors over time. The two most prominent quality factors in terms of positive relationship with returns and statistical significance displayed very stable returns throughout the sample period. The accruals ratio did perform worse before the financial crisis 2007, which is consistent with Asness, et al. (2013) who found that quality is not rewarded before a crisis. The accruals ratio exhibited the highest cumulative payoff over the full sample. Cash flow return on equity exhibited a stable positive cumulative return over the period and exhibited the third highest cumulative payoff over the full sample.

8.2 Conclusion

The theory of finance has evolved from the fundamentals of mean variance optimization, which lead to the Capital Asset Pricing Model (CAPM). The objective has always been to understand what the relationship is between risk and returns and therefore what explains the cross section of returns over time. The earlier methods mentioned were developed using a deductive and logical approach however empirical work has led to new finding that further aid our understanding of what explains returns.

The empirical studies done have found that style factors such as ‘value’ and ‘size’ have been found to far better explain the cross section of return than Beta. The power of idiosyncratic factors relating to characteristics of a firm has led to a major shift in from the traditional theories of finance such as the CAPM.

This paper has contributed to the work done on firm specific factors defined as ‘quality’ factors in a South African context. The quality factors are purely idiosyncratic and have no reference to the market price of the firms. The strong explanatory power of these ‘quality’ factors in comparison and alongside the style factors may call on further research to be conducted on a single ‘quality’ factor to be included in asset pricing.

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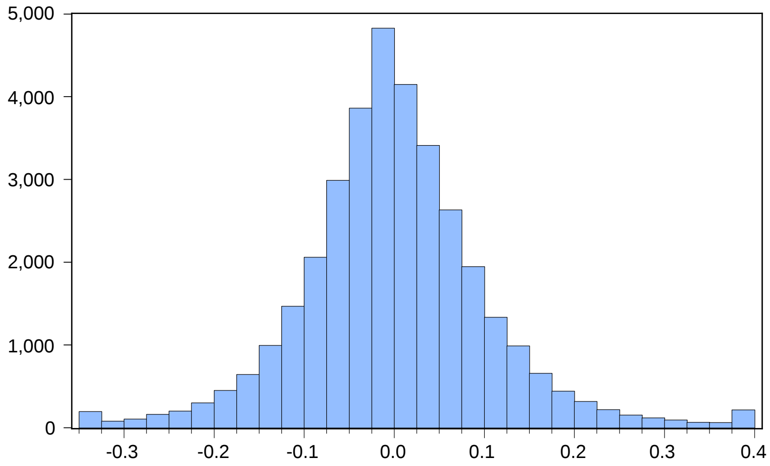
Appendix

i) DDM derived

1 $$\frac{P}{B} = \frac{1}{B}\frac{Dividend}{required\ return - growth} = \frac{\frac{net\ income}{B} \times payout\ ratio}{required\ return - growth}$$

ii) Histograms

The histograms for each factor can be seen for each factor after all data adjustments and winsorisation has been completed.



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Minimum	-0.345778
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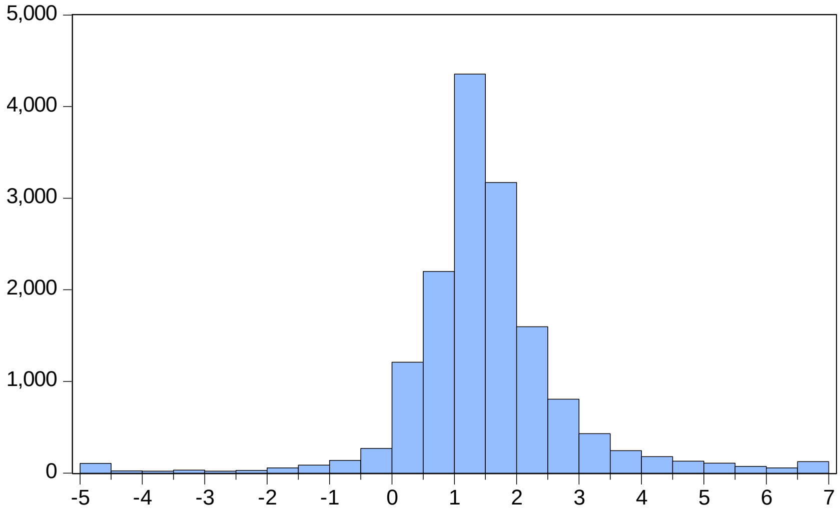
Kurtosis	4.927130
Jarque-Bera	5877.443
Probability	0.000000



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Minimum	-4.969584
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Kurtosis	9.202295
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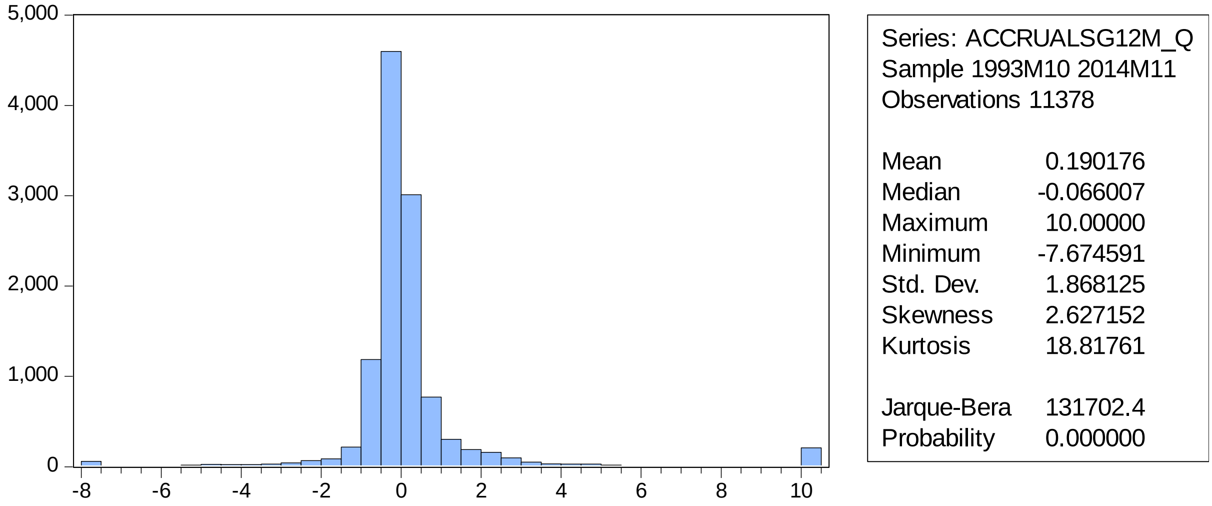
Probability	0.000000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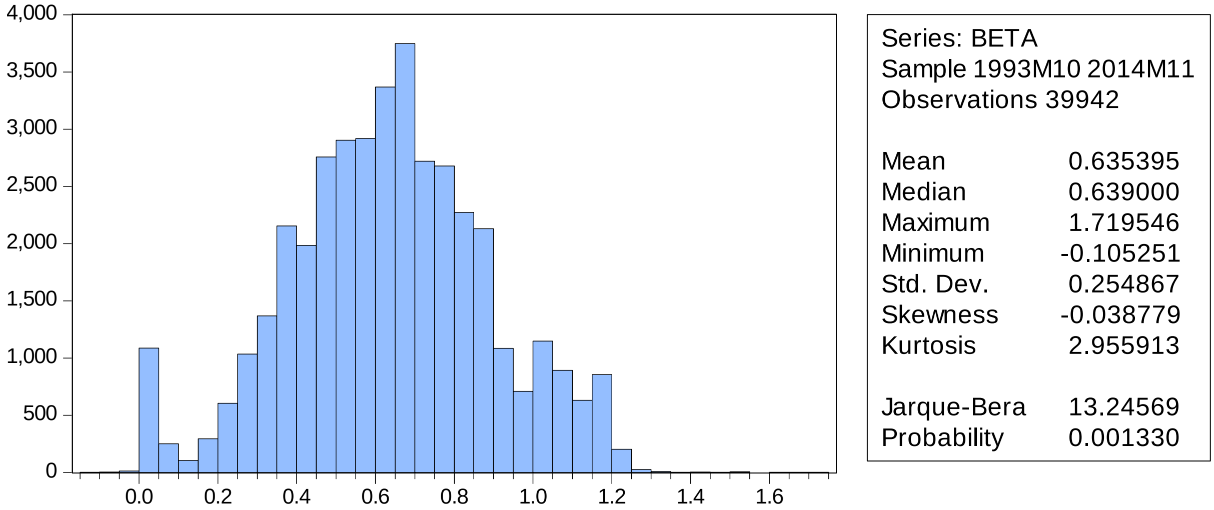
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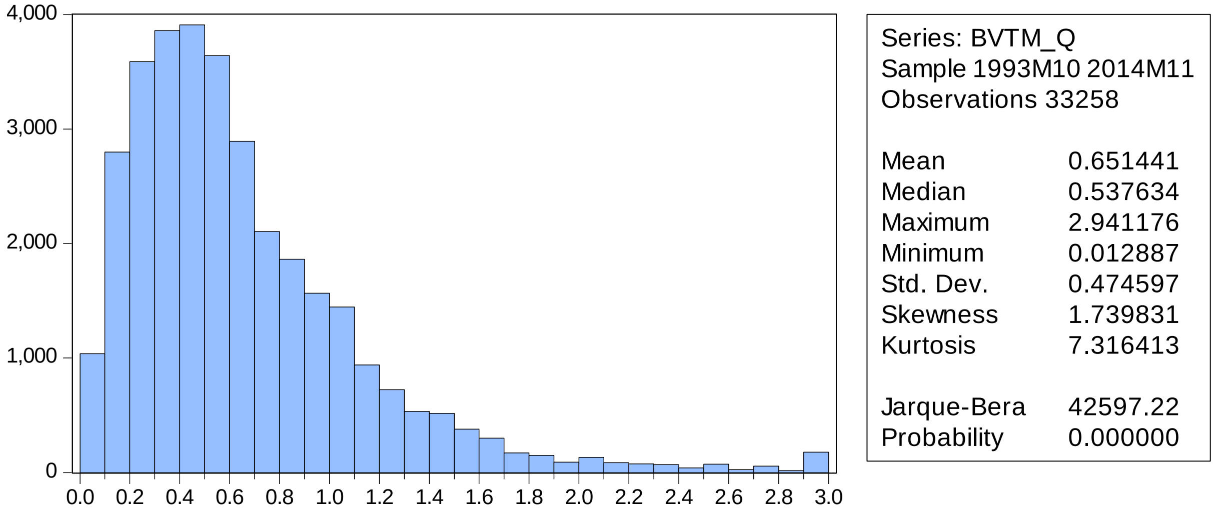
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Maximum 2.941176
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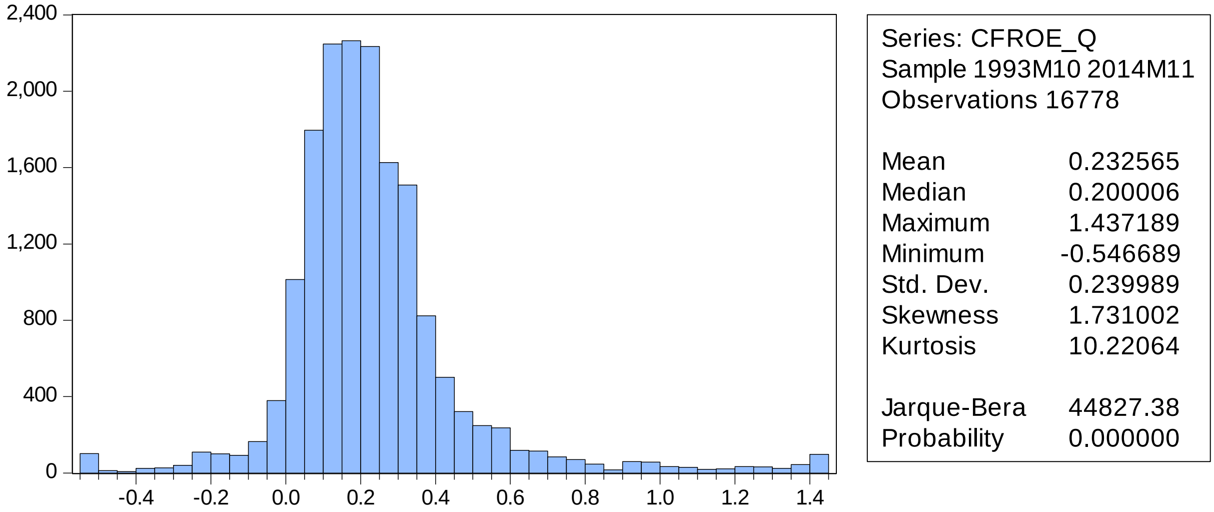
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Skewness 1.731002
Kurtosis 10.22064
Jarque-Bera 44827.38
Probability 0.000000
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1,200
800
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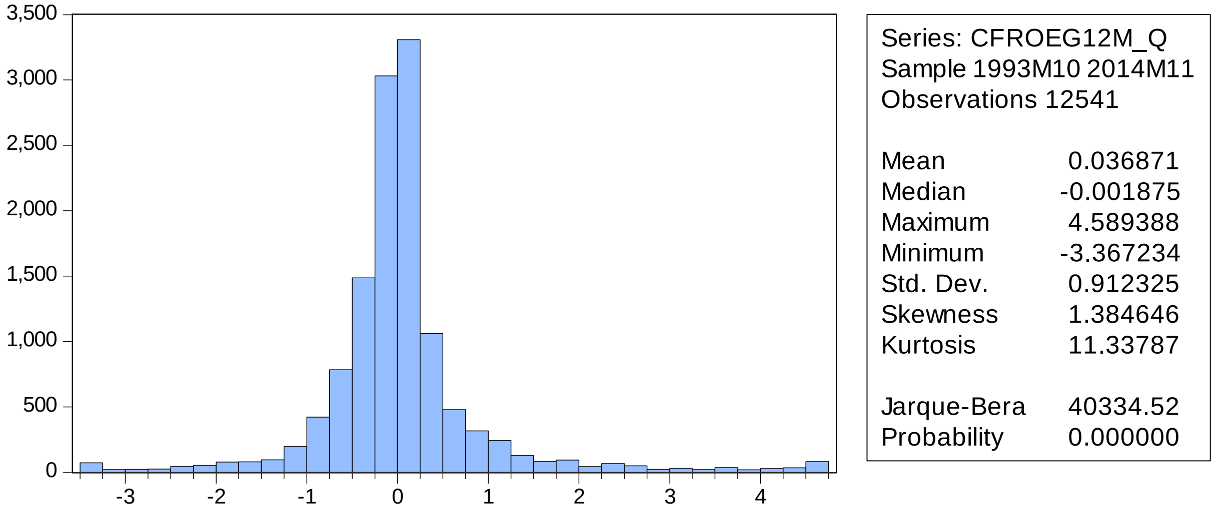
1.4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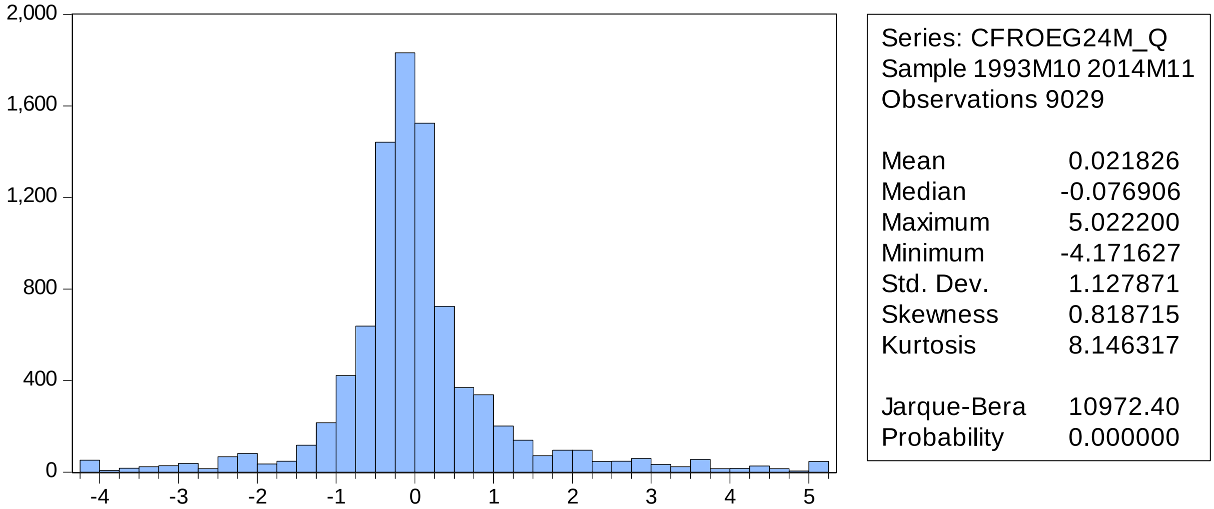
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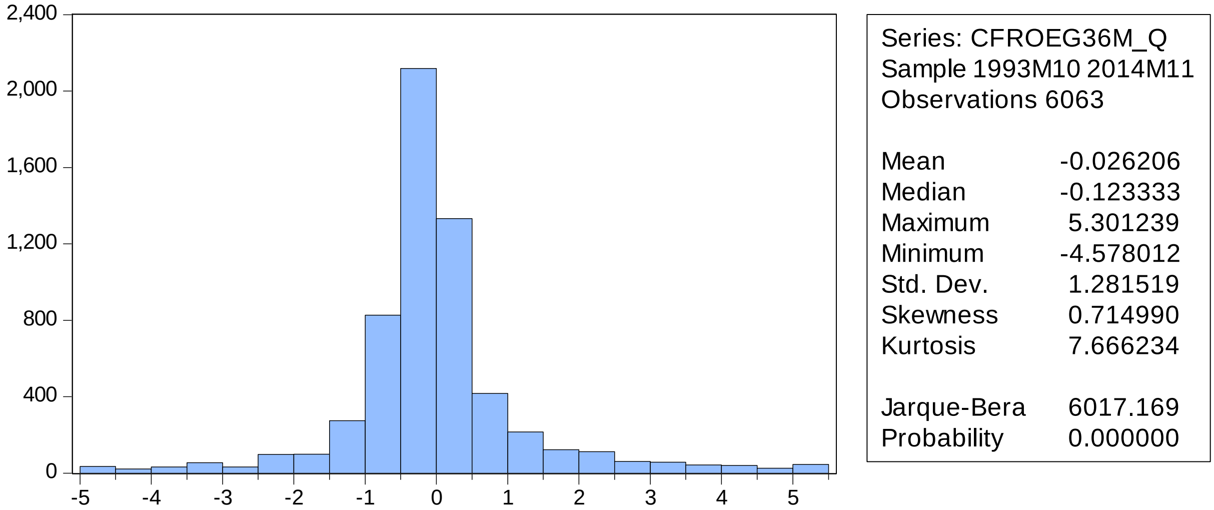
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Observations 6063
Mean -0.026206
Median -0.123333
Maximum 5.301239
Minimum -4.578012
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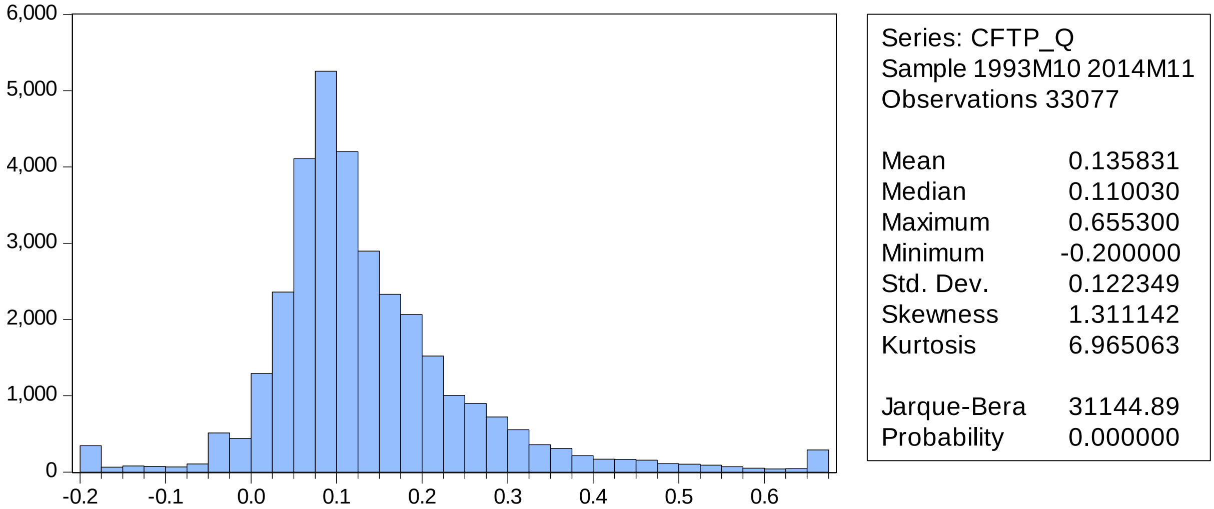
Jarque-Bera 6017.169
Probability 0.000000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0.4
0.5
0.6
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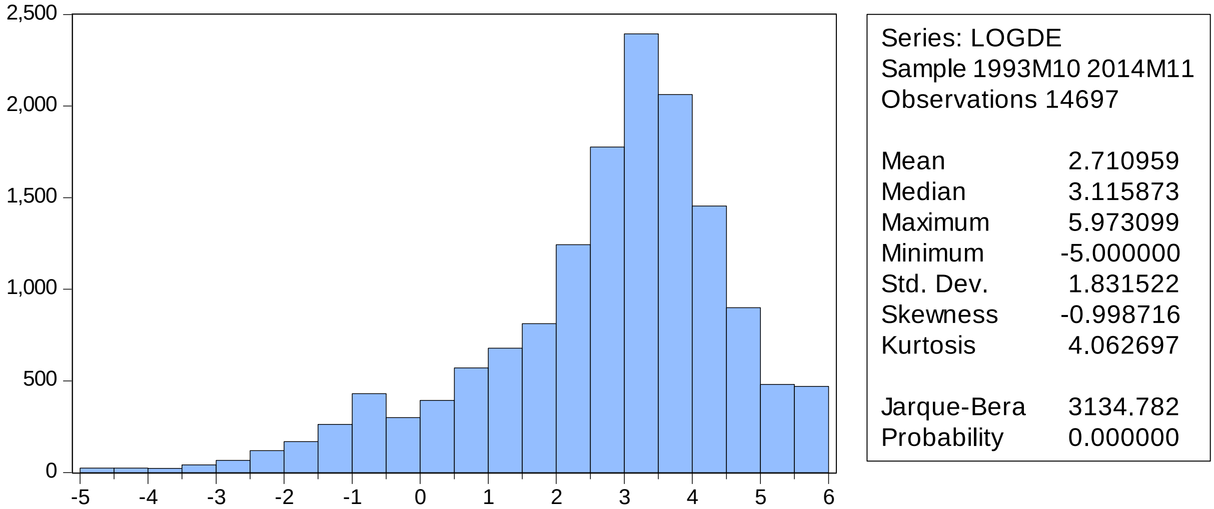
Kurtosis 6.965063
Jarque-Bera 31144.89
Probability 0.000000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Sample 1993M10 2014M11
Observations 14697
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Median 3.115873
Maximum 5.973099
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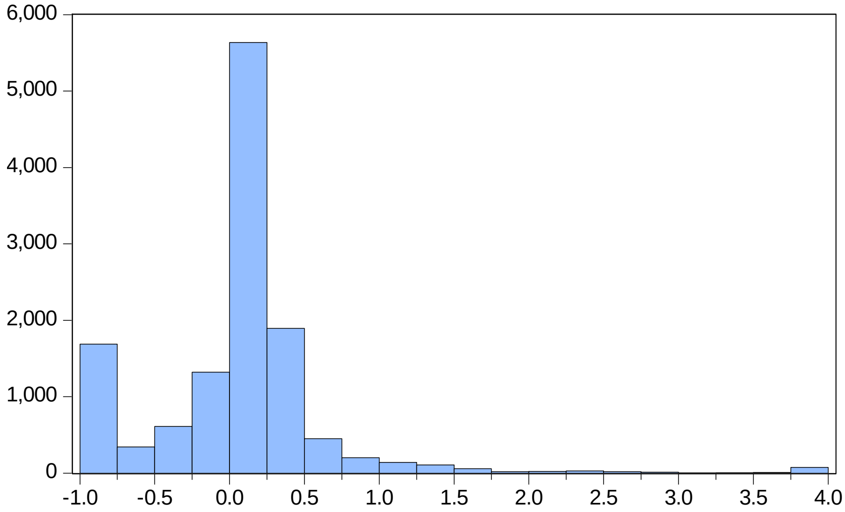
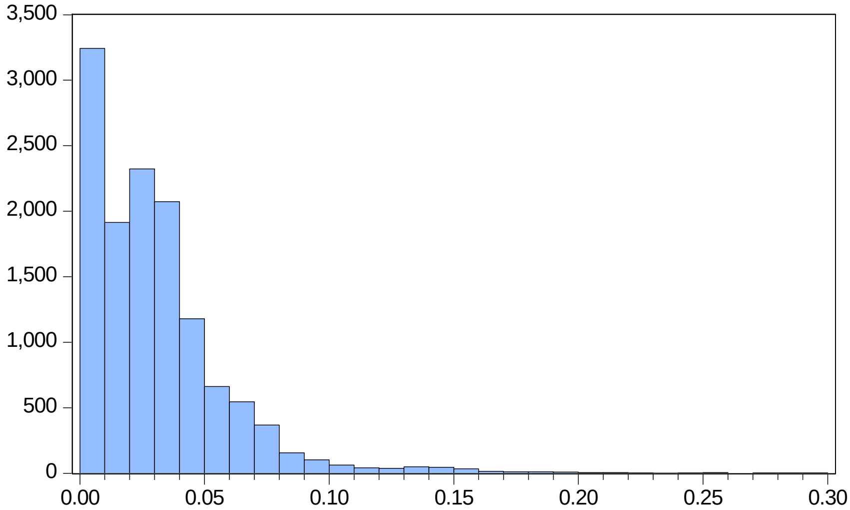
Probability 0.000000



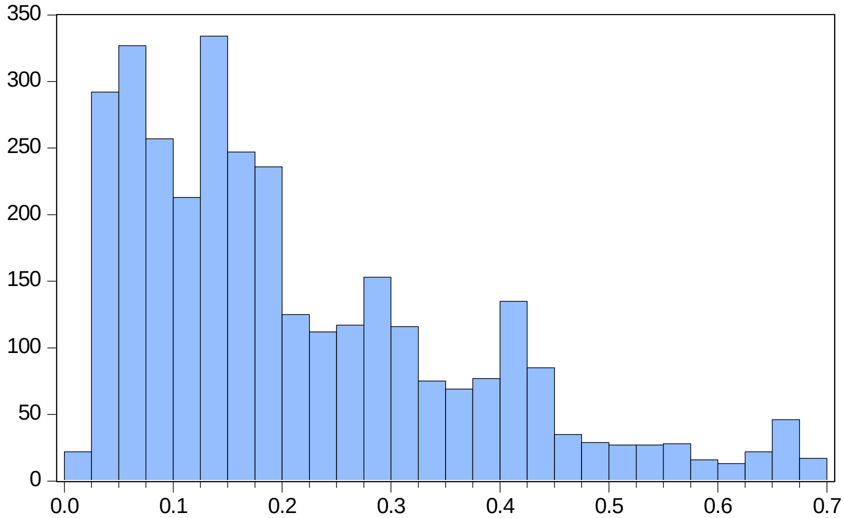
Series: DPS12M_Q
Sample 1993M10 2014M11
Observations 12634

Mean	0.041645
Median	0.096065
Maximum	3.975794
Minimum	-1.000000
Std. Dev.	0.626400
Skewness	1.694359
Kurtosis	13.30306
Jarque-Bera	61925.81
Probability	0.000000



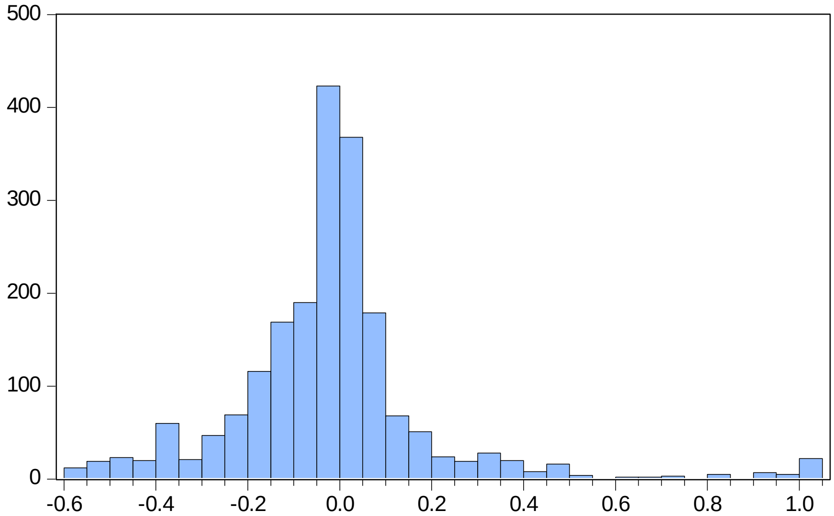
Series: DY
Sample 1993M10 2014M11
Observations 12906

Mean	0.030121
Median	0.025900
Maximum	0.295939
Minimum	4.67e-06
Std. Dev.	0.028980
Skewness	2.259854
Kurtosis	12.63770
Jarque-Bera	60934.11
Probability	0.000000

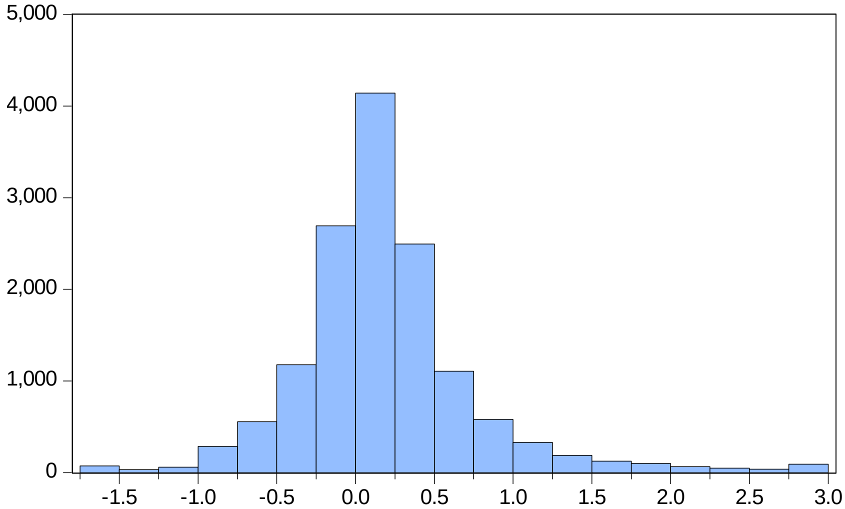


Series: EBITDAMAR_Q
Sample 1993M10 2014M11
Observations 3252

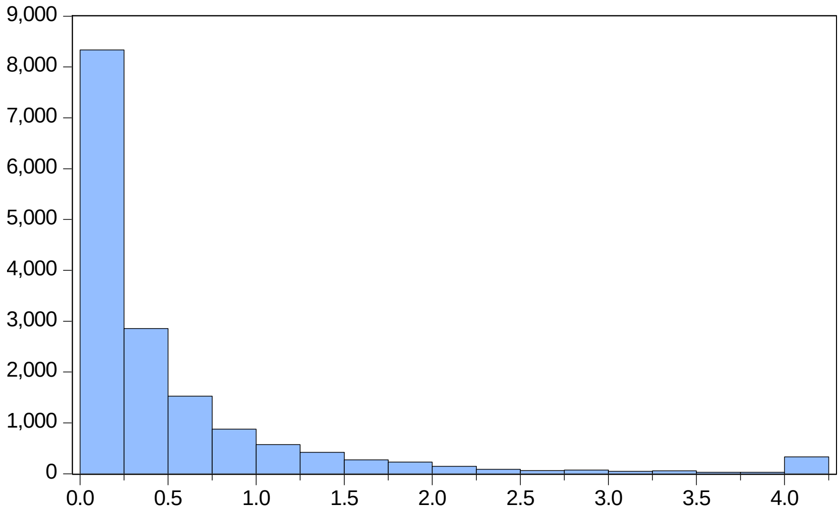
Mean	0.213719
Median	0.169031
Maximum	0.690781
Minimum	0.017843
Std. Dev.	0.154396
Skewness	1.048874
Kurtosis	3.515774
Jarque-Bera	632.3207
Probability	0.000000



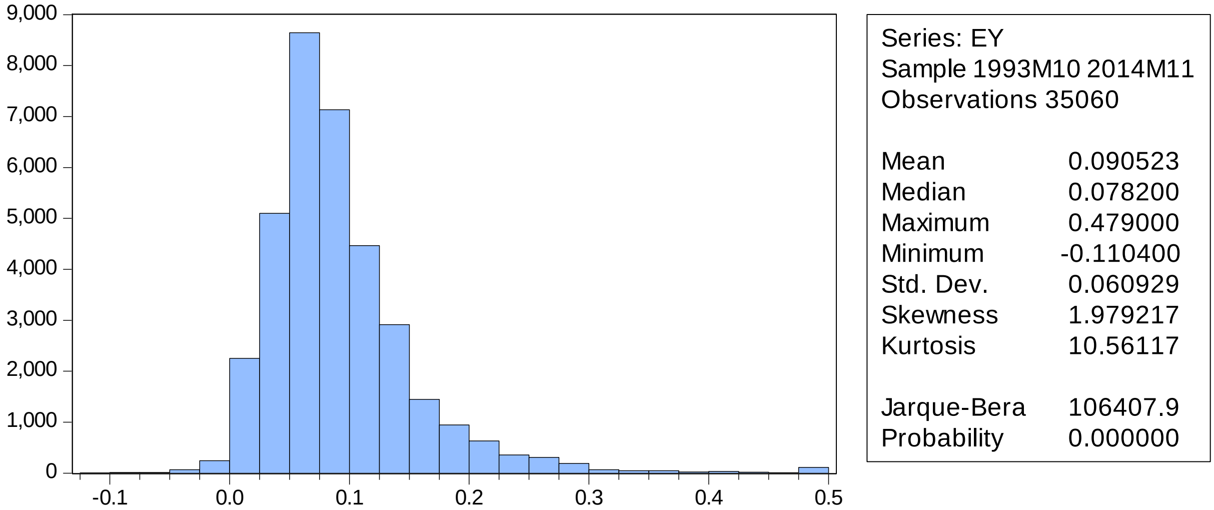
Series: EBITDAMARG12_Q	
Sample 1993M10 2014M11	
Observations 2000	
Mean	-0.018611
Median	-0.016879
Maximum	1.000000
Minimum	-0.558597
Std. Dev.	0.223474
Skewness	1.479725
Kurtosis	9.254937
Jarque-Bera	3990.215
Probability	0.000000

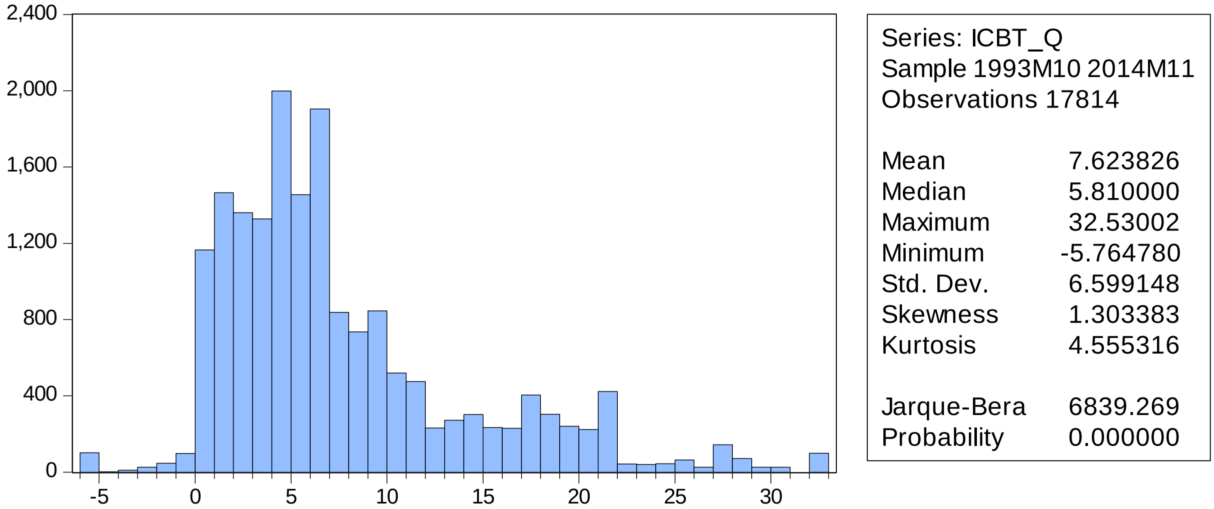


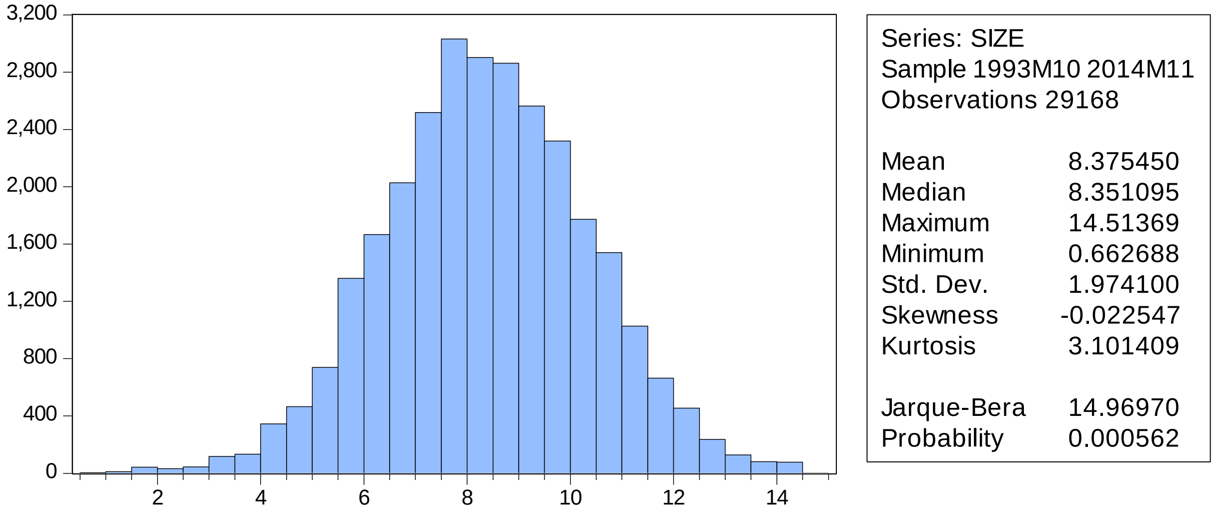
Series: EPS12M_Q/100	
Sample 1993M10 2014M11	
Observations 14176	
Mean	0.189688
Median	0.132730
Maximum	2.961820
Minimum	-1.523519
Std. Dev.	0.576354
Skewness	1.311453
Kurtosis	7.888477
Jarque-Bera	18178.85
Probability	0.000000

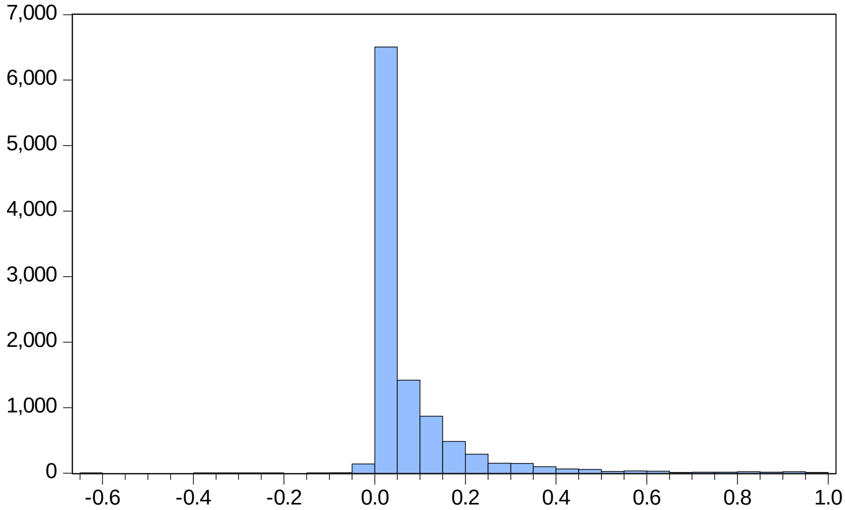


Series: EPSVOL24_Q	
Sample 1993M10 2014M11	
Observations 15933	
Mean	0.528539
Median	0.231567
Maximum	4.000000
Minimum	0.003469
Std. Dev.	0.777910
Skewness	2.814669
Kurtosis	11.50368
Jarque-Bera	69044.35
Probability	0.000000


Series: EY
Sample 1993M10 2014M11
Observations 35060
Mean 0.090523
Median 0.078200
Maximum 0.479000
Minimum -0.110400
Std. Dev. 0.060929
Skewness 1.979217
Kurtosis 10.56117
Jarque-Bera 106407.9
Probability 0.000000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
-0.1
0.0
0.1
0.2
0.3
0.4
0.5

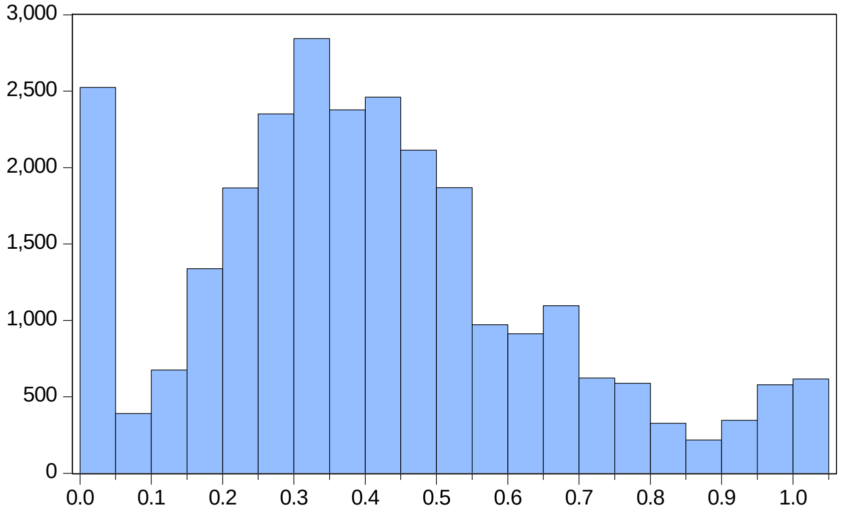

Series: ICBT_Q
Sample 1993M10 2014M11
Observations 17814
Mean 7.623826
Median 5.810000
Maximum 32.53002
Minimum -5.764780
Std. Dev. 6.599148
Skewness 1.303383
Kurtosis 4.555316
Jarque-Bera 6839.269
Probability 0.000000
2,400
2,000
1,600
1,200
800
400
0
-5
0
5
10
15
20
25
30


Series: SIZE
Sample 1993M10 2014M11
Observations 29168
Mean 8.375450
Median 8.351095
Maximum 14.51369
Minimum 0.662688
Std. Dev. 1.974100
Skewness -0.022547
Kurtosis 3.101409
Jarque-Bera 14.96970
Probability 0.000562
3,200
2,800
2,400
2,000
1,600
1,200
800
400
0
2
4
6
8
10
12
14



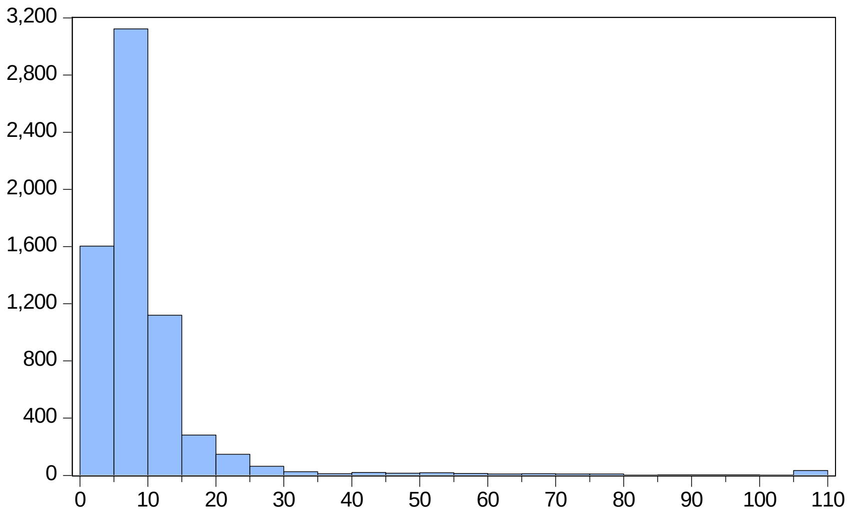
Series: NPM
Sample 1993M10 2014M11
Observations 10413

Mean	0.067200
Median	0.002133
Maximum	0.995515
Minimum	-0.642285
Std. Dev.	0.125962
Skewness	3.333972
Kurtosis	17.83843
Jarque-Bera	114820.9
Probability	0.000000



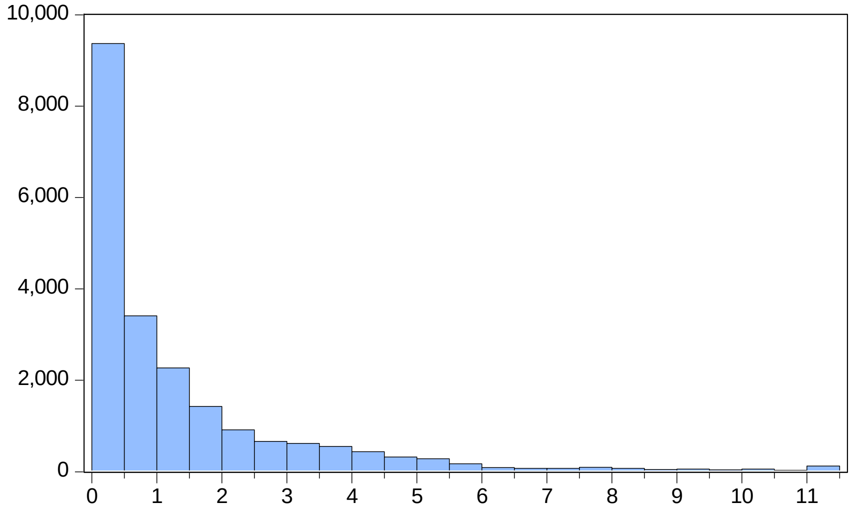
Series: POUT_Q/100
Sample 1993M10 2014M11
Observations 27084

Mean	0.405750
Median	0.381472
Maximum	1.000000
Minimum	0.000600
Std. Dev.	0.245198
Skewness	0.485430
Kurtosis	2.963003
Jarque-Bera	1065.232
Probability	0.000000

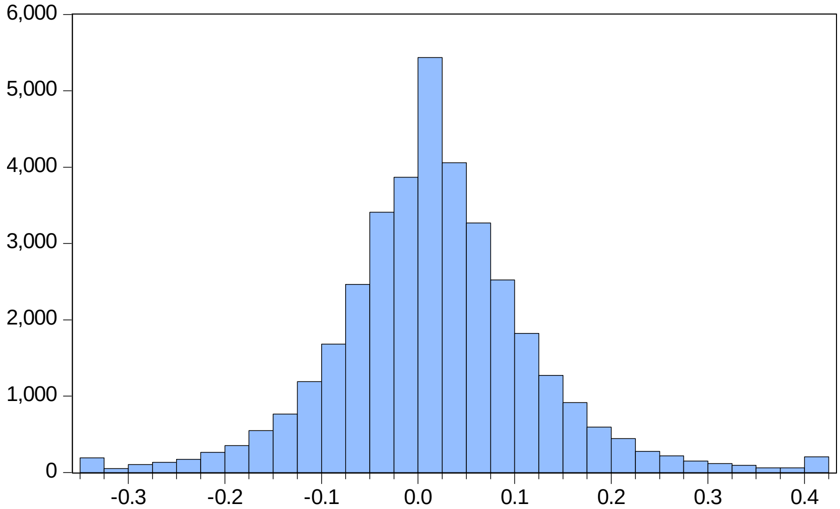


Series: PTEBITDA_Q
Sample 1993M10 2014M11
Observations 6531

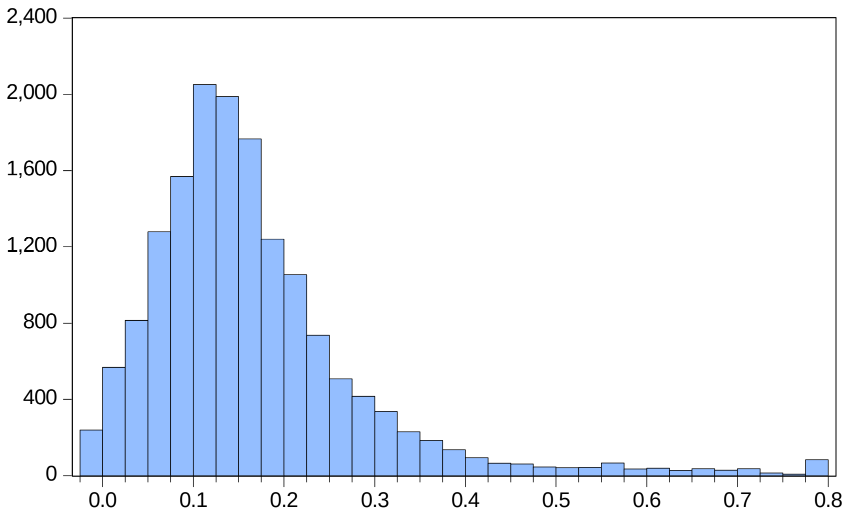
Mean	9.731646
Median	7.557500
Maximum	107.2634
Minimum	0.112990
Std. Dev.	11.54076
Skewness	5.485360
Kurtosis	40.19705
Jarque-Bera	409269.7
Probability	0.000000



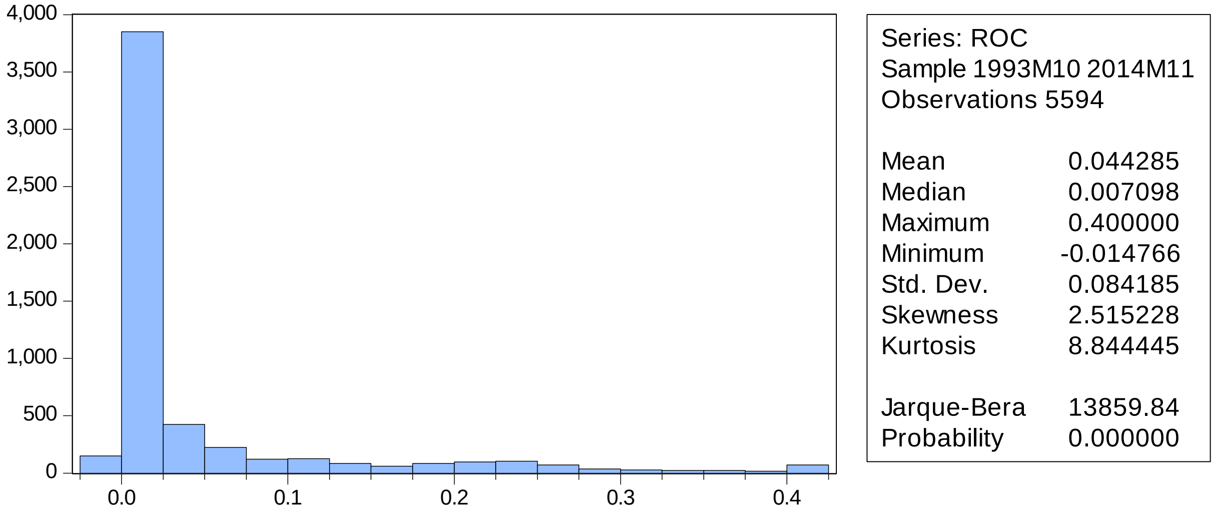
Series: PTS_Q	
Sample 1993M10 2014M11	
Observations 21224	
Mean	1.390982
Median	0.663400
Maximum	11.36918
Minimum	1.42e-07
Std. Dev.	1.957226
Skewness	2.444646
Kurtosis	10.06287
Jarque-Bera	65254.35
Probability	0.000000

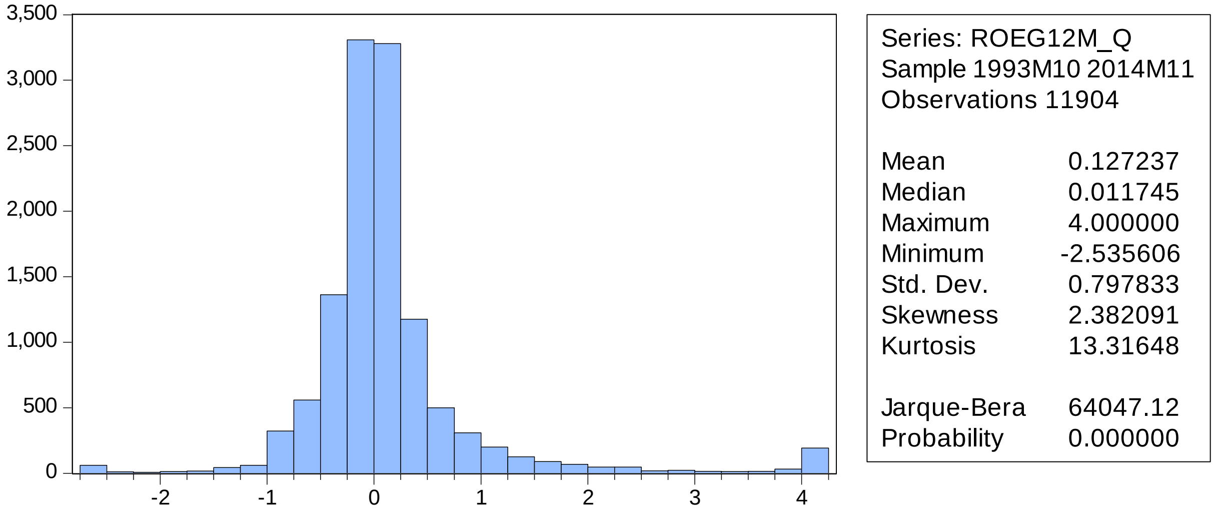


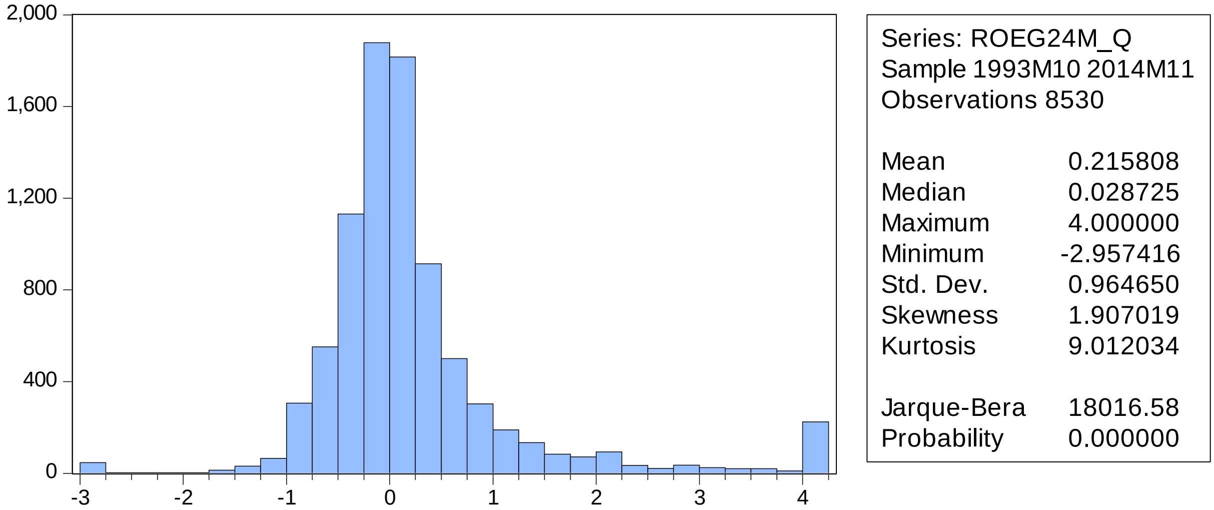
Series: RETURNSFWD_Q	
Sample 1993M10 2014M11	
Observations 36695	
Mean	0.016785
Median	0.012739
Maximum	0.410584
Minimum	-0.327505
Std. Dev.	0.104876
Skewness	0.252855
Kurtosis	4.883454
Jarque-Bera	5814.844
Probability	0.000000

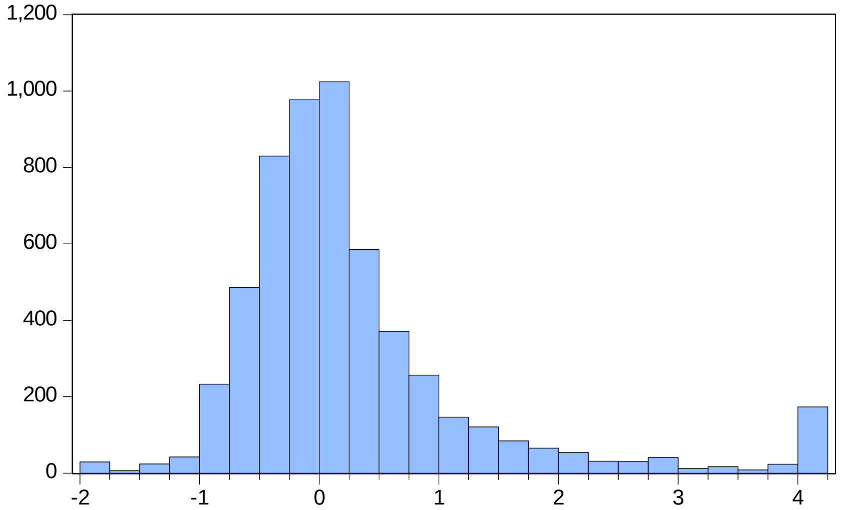


Series: ROE_Q	
Sample 1993M10 2014M11	
Observations 15831	
Mean	0.166724
Median	0.141847
Maximum	0.791362
Minimum	-0.020013
Std. Dev.	0.122748
Skewness	2.043560
Kurtosis	9.234131
Jarque-Bera	36654.66
Probability	0.000000

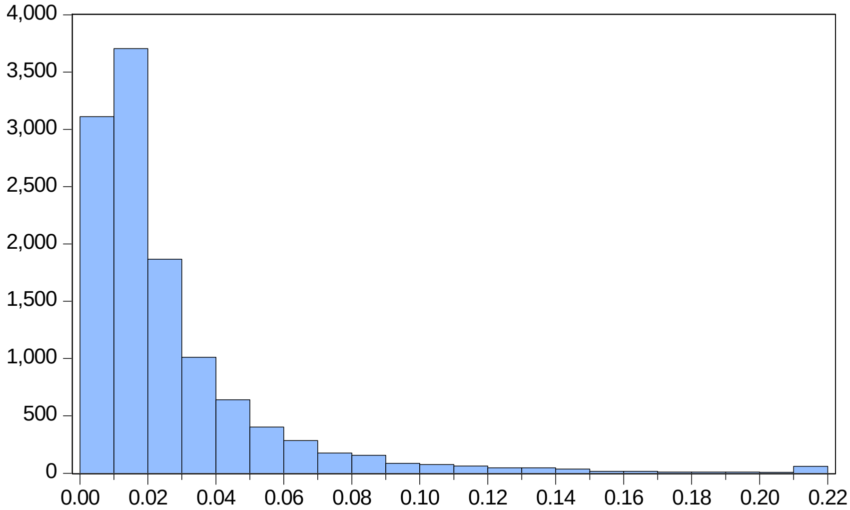

Series: ROC
Sample 1993M10 2014M11
Observations 5594
Mean 0.044285
Median 0.007098
Maximum 0.400000
Minimum -0.014766
Std. Dev. 0.084185
Skewness 2.515228
Kurtosis 8.844445
Jarque-Bera 13859.84
Probability 0.000000


Series: ROEG12M_Q
Sample 1993M10 2014M11
Observations 11904
Mean 0.127237
Median 0.011745
Maximum 4.000000
Minimum -2.535606
Std. Dev. 0.797833
Skewness 2.382091
Kurtosis 13.31648
Jarque-Bera 64047.12
Probability 0.000000

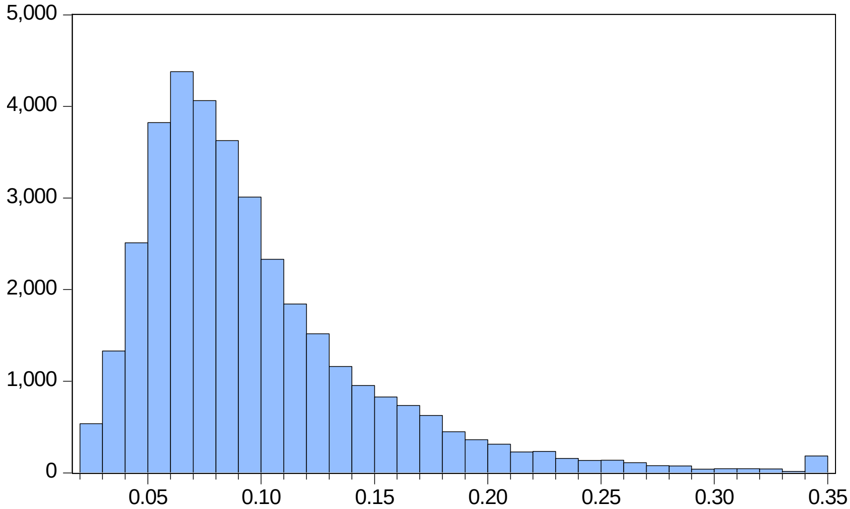

Series: ROEG24M_Q
Sample 1993M10 2014M11
Observations 8530
Mean 0.215808
Median 0.028725
Maximum 4.000000
Minimum -2.957416
Std. Dev. 0.964650
Skewness 1.907019
Kurtosis 9.012034
Jarque-Bera 18016.58
Probability 0.000000



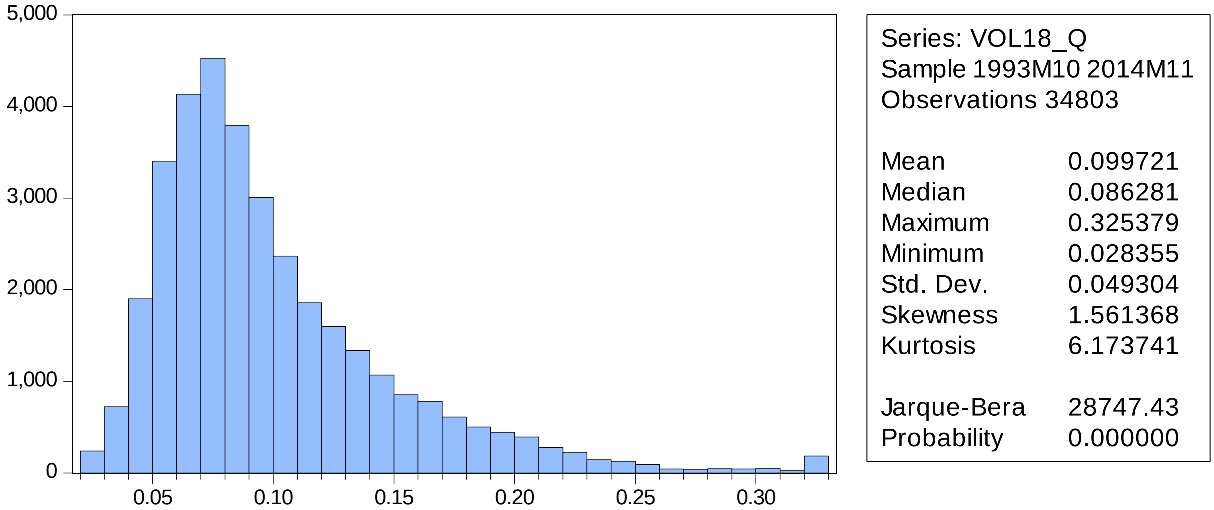
Series: ROEG36M_Q	
Sample 1993M10 2014M11	
Observations 5668	
Mean	0.279431
Median	0.044500
Maximum	4.000000
Minimum	-1.805480
Std. Dev.	1.034440
Skewness	1.913269
Kurtosis	7.280937
Jarque-Bera	7786.136
Probability	0.000000

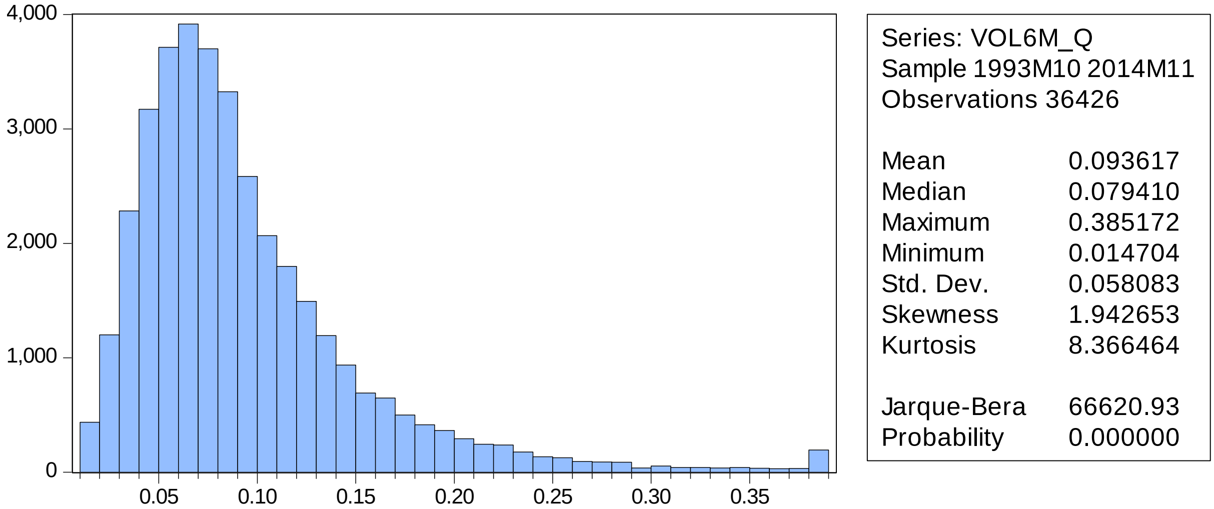


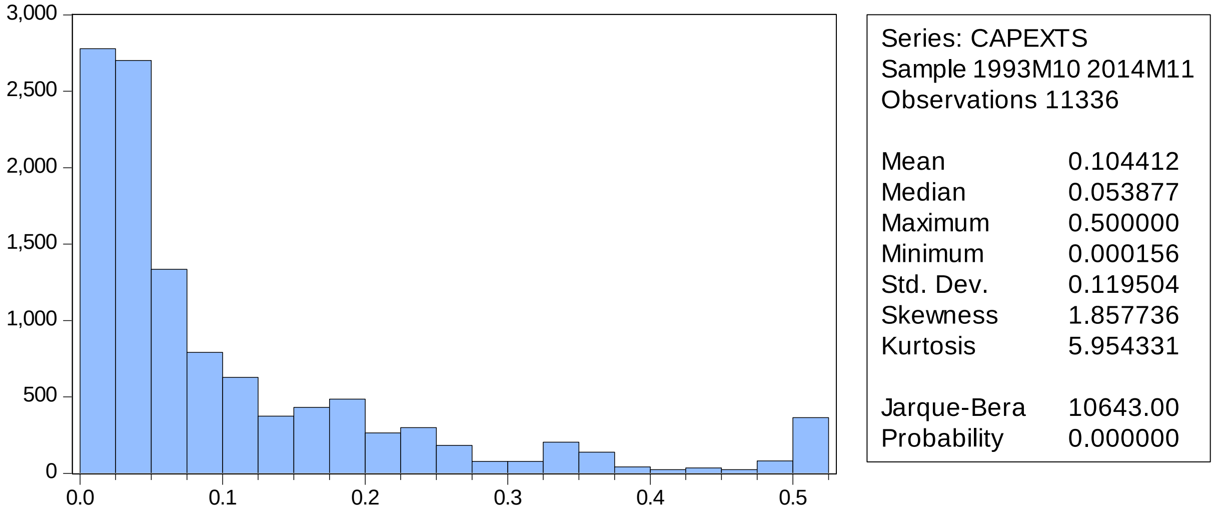
Series: ROEVOL18_Q	
Sample 1993M10 2014M11	
Observations 11838	
Mean	0.026579
Median	0.016902
Maximum	0.212276
Minimum	0.001239
Std. Dev.	0.029599
Skewness	3.066106
Kurtosis	15.34625
Jarque-Bera	93734.25
Probability	0.000000

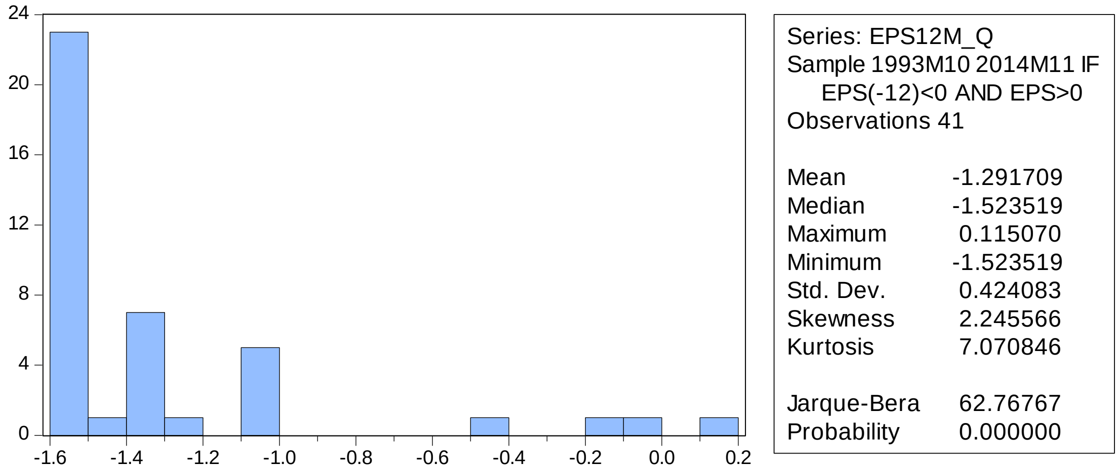


Series: VOL12_Q	
Sample 1993M10 2014M11	
Observations 35914	
Mean	0.097017
Median	0.083440
Maximum	0.341463
Minimum	0.023306
Std. Dev.	0.052415
Skewness	1.713893
Kurtosis	6.864785
Jarque-Bera	39933.80
Probability	0.000000


Series: VOL18_Q
Sample 1993M10 2014M11
Observations 34803
Mean 0.099721
Median 0.086281
Maximum 0.325379
Minimum 0.028355
Std. Dev. 0.049304
Skewness 1.561368
Kurtosis 6.173741
Jarque-Bera 28747.43
Probability 0.000000


Series: VOL6M_Q
Sample 1993M10 2014M11
Observations 36426
Mean 0.093617
Median 0.079410
Maximum 0.385172
Minimum 0.014704
Std. Dev. 0.058083
Skewness 1.942653
Kurtosis 8.366464
Jarque-Bera 66620.93
Probability 0.000000


Series: CAPEXTS
Sample 1993M10 2014M11
Observations 11336
Mean 0.104412
Median 0.053877
Maximum 0.500000
Minimum 0.000156
Std. Dev. 0.119504
Skewness 1.857736
Kurtosis 5.954331
Jarque-Bera 10643.00
Probability 0.000000


24
20
16
12
8
4
0
-1.6
-1.4
-1.2
-1.0
-0.8
-0.6
-0.4
-0.2
0.0
0.2
Series: EPS12M_Q
Sample 1993M10 2014M11 IF EPS(-12)<0 AND EPS>0
Observations 41
Mean -1.291709
Median -1.523519
Maximum 0.115070
Minimum -1.523519
Std. Dev. 0.424083
Skewness 2.245566
Kurtosis 7.070846
Jarque-Bera 62.76767
Probability 0.000000

iii) Risk adjusted returns

Risk adjusted returns				
Factor	**Coefficient**	**t-statistic**	**prob,**	**R-squared**
C	0.009397	5.123945	0.0000	0.008386
SBETA	-0.001540	-2.435314	0.0149	
SCFTP	0.009486	16.01142	0.0000	
C	0.012671	6.447625	0.0000	0.002032
SBETA	-0.001161	-1.855660	0.0635	
SBVTM	0.004532	7.380085	0.0000	
C	0.003280	1.112588	0.2659	0.002756
SBETA	0.000372	0.377368	0.7059	
SACCRUALS	0.005644	6.197911	0.0000	
C	0.031278	10.41158	0.0000	0.001629
SBETA	0.001978	2.540216	0.0111	
SSIZE	-0.004761	-6.663767	0.0000	
C	0.006562	2.263796	0.0236	0.001329
SBETA	0.000162	0.164797	0.8691	
SCFROE	0.004013	4.393682	0.0000	
C	0.007640	2.462954	0.0138	0.001450
SBETA	0.001457	1.369323	0.1709	
SEPS12M	0.003919	4.000179	0.0001	
C	0.004599	1.368694	0.1711	0.001007
SBETA	0.001418	1.409886	0.1586	
SDY	0.003646	3.444822	0.0006	
C	0.011540	3.580590	0.0003	0.000713
SBETA	-2.47E-06	-0.002235	0.9982	
SCFROEG12M	0.002955	2.876913	0.0040	
C	0.011590	3.015793	0.0026	0.000921
SBETA	-0.000619	-0.466534	0.6408	
SCFROEG24M	0.003422	2.792167	0.0052	
C	0.017259	3.507289	0.0005	0.004445
SBETA	-0.001119	-0.762214	0.4460	
SEBITDAMARG12	0.003938	2.641868	0.0083	
C	0.014135	2.797304	0.0052	0.001658
SBETA	-0.001779	-1.016342	0.3095	
SCFROEG36M	0.004681	2.994791	0.0028	
C	0.022705	11.84336	0.0000	0.001164
SBETA	-0.002576	-3.786037	0.0002	
SICBT	0.001608	2.500793	0.0124	
C	0.012813	4.125736	0.0000	0.000950
SBETA	-0.000501	-0.509673	0.6103	
SROC	0.002021	2.137085	0.0326	

C	0.010139	3.094729	0.0020	0.000283
SBETA	0.000321	0.286474	0.7745	
SACCRUALSG12M	0.001815	1.710519	0.0872	
C	0.014236	4.107155	0.0000	0.001447
SBETA	-0.001695	-1.530053	0.1261	
SCFROA	0.002287	2.144342	0.0321	
C	0.019589	10.90530	0.0000	0.000075
SBETA	-0.000824	-1.316720	0.1879	
SVOL6M	-0.000363	-0.618395	0.5363	
C	0.028832	11.38121	0.0000	0.001322
SBETA	-0.003189	-3.999852	0.0001	
SLOGDE	-0.001159	-1.634042	0.1023	
C	0.009097	2.952585	0.0032	0.000209
SBETA	0.001144	1.173025	0.2408	
SROE	-0.001156	-1.288727	0.1975	

iV) Correlation

	RETURNSFWD	BVTM	CFTP	DY	EY	SIZE
RETURNSFWD	1,00	0,03	0,07	0,03	0,03	0,00
BVTM		1,00	0,54	0,28	0,55	-0,44
CFTP			1,00	0,13	0,55	-0,36
DY				1,00	0,40	-0,11
EY					1,00	-0,45
SIZE						1,00

	RETURNSFWD	ACCRUALS	EPSVOL24	ICBT	LOGDE	ROEVOL18
RETURNSFWD	1,00	-0,01	-0,07	-0,05	0,01	-0,03
ACCRUALS		1,00	0,06	-0,11	0,13	0,09
EPSVOL24			1,00	0,18	0,06	0,24
ICBT				1,00	-0,58	0,04
LOGDE					1,00	0,07
ROEVOL18						1,00

	RETURNSFWD	CFROE	EBITDAMAR	NPM	ROA	ROC	ROE
RETURNSFWD	1,00	0,03	0,02	0,01	0,01	0,00	0,02
CFROE		1,00	0,26	0,13	0,27	0,26	0,80
EBITDAMAR			1,00	0,60	0,06	-0,07	0,24
NPM				1,00	0,24	0,07	0,31
ROA					1,00	0,48	0,51
ROC						1,00	0,47
ROE							1,00

	RETURNSFWD	CAPEXTS	CFROEG12M	CFROEG24M	CFROEG36M	DPS12M	EBITDAMARG12	EPS12M	ROEG12M	ROEG24M	ROEG36M
RETURNSFWD	1,00	0,03	-0,03	0,04	0,01	0,14	0,09	0,01	0,01	0,04	0,00
CAPEXTS		1,00	-0,13	-0,09	-0,04	-0,13	0,16	-0,16	-0,19	-0,34	-0,19
CFROEG12M			1,00	0,50	0,53	0,09	-0,02	0,03	0,06	0,12	0,07
CFROEG24M				1,00	0,74	0,31	0,22	0,25	0,24	0,33	0,23
CFROEG36M					1,00	0,27	0,16	0,16	0,15	0,29	0,17
DPS12M						1,00	0,33	0,54	0,47	0,54	0,28
EBITDAMARG12							1,00	0,32	0,25	0,21	0,02
EPS12M								1,00	0,89	0,61	0,33
ROEG12M									1,00	0,62	0,38
ROEG24M										1,00	0,60
ROEG36M											1,00

V) Multiple quality regressions

Dependent Variable: RETURNSFWD_Q
Method: Panel Least Squares
Date: 01/07/15 Time: 10:09
Sample (adjusted): 1998M07 2014M09
Periods included: 64
Cross-sections included: 113
Total panel (unbalanced) observations: 3566

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003227	0.003902	0.827091	0.4082
SROC	0.009380	0.003097	3.028815	0.0025
SLOGDE	0.004817	0.001952	2.468071	0.0136
SEPS12M	0.002952	0.001345	2.195389	0.0282

R-squared	0.004255	Mean dependent var	0.013958
Adjusted R-squared	0.003416	S.D. dependent var	0.074020
S.E. of regression	0.073893	Akaike info criterion	-2.371270
Sum squared resid	19.44926	Schwarz criterion	-2.364339
Log likelihood	4231.975	Hannan-Quinn criter.	-2.368799
F-statistic	5.073690	Durbin-Watson stat	1.928109
Prob(F-statistic)	0.001661		

Dependent Variable: RETURNSFWD_Q
Method: Panel Least Squares
Date: 01/07/15 Time: 10:09
Sample (adjusted): 2011M12 2014M09
Periods included: 34
Cross-sections included: 117
Total panel (unbalanced) observations: 3272

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.016476	0.001668	9.877121	0.0000
SROC	0.002753	0.001111	2.477681	0.0133
SICBT	-0.002726	0.000972	-2.804405	0.0051
SEPS12M	0.002266	0.001263	1.794212	0.0729

R-squared	0.003850	Mean dependent var	0.014404
Adjusted R-squared	0.002936	S.D. dependent var	0.063191
S.E. of regression	0.063098	Akaike info criterion	-2.687025
Sum squared resid	13.01119	Schwarz criterion	-2.679576
Log likelihood	4399.973	Hannan-Quinn criter.	-2.684357
F-statistic	4.210192	Durbin-Watson stat	1.991329
Prob(F-statistic)	0.005565		

Dependent Variable: RETURNSFWD_Q
Method: Panel Least Squares
Date: 01/07/15 Time: 10:08
Sample (adjusted): 1995M07 2014M09
Periods included: 183
Cross-sections included: 200
Total panel (unbalanced) observations: 11442

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000945	0.001727	0.547242	0.5842
SACCRUALS	0.004356	0.001171	3.719114	0.0002
SCFROE	0.002965	0.001216	2.438509	0.0148
SEPS12M	0.003007	0.001068	2.816814	0.0049

R-squared	0.003712	Mean dependent var	0.009763
Adjusted R-squared	0.003451	S.D. dependent var	0.109459
S.E. of regression	0.109270	Akaike info criterion	-1.589634
Sum squared resid	136.5698	Schwarz criterion	-1.587066
Log likelihood	9098.294	Hannan-Quinn criter.	-1.588770
F-statistic	14.20587	Durbin-Watson stat	2.028008
Prob(F-statistic)	0.000000		

Dependent Variable: RETURNSFWD_Q
Method: Panel Least Squares
Date: 01/07/15 Time: 10:01
Sample (adjusted): 1995M07 2014M09
Periods included: 183
Cross-sections included: 184
Total panel (unbalanced) observations: 9493

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002874	0.002567	1.119707	0.2629
SACCRUALS	0.004096	0.001312	3.121456	0.0018
SEPS12M	0.002785	0.001285	2.167111	0.0303
SPOUT	0.001961	0.000979	2.002691	0.0452

R-squared	0.001659	Mean dependent var	0.011578
Adjusted R-squared	0.001344	S.D. dependent var	0.102733
S.E. of regression	0.102664	Akaike info criterion	-1.714292
Sum squared resid	100.0128	Schwarz criterion	-1.711276
Log likelihood	8140.889	Hannan-Quinn criter.	-1.713269
F-statistic	5.257084	Durbin-Watson stat	2.060731
Prob(F-statistic)	0.001271		

Dependent Variable: RETURNSFWD_Q
Method: Panel Least Squares
Date: 01/07/15 Time: 09:51
Sample (adjusted): 1995M07 2014M09
Periods included: 183
Cross-sections included: 184
Total panel (unbalanced) observations: 9404

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001457	0.002635	0.553117	0.5802
SACCRUALS	0.003484	0.001438	2.422783	0.0154
SCFROE	0.002244	0.001242	1.806758	0.0708
SEPS12M	0.002816	0.001303	2.161209	0.0307
SPOUT	0.001656	0.000986	1.679838	0.0930

R-squared	0.002186	Mean dependent var	0.011453
Adjusted R-squared	0.001762	S.D. dependent var	0.102241
S.E. of regression	0.102151	Akaike info criterion	-1.724206
Sum squared resid	98.07617	Schwarz criterion	-1.720405
Log likelihood	8112.214	Hannan-Quinn criter.	-1.722915
F-statistic	5.148970	Durbin-Watson stat	2.057642
Prob(F-statistic)	0.000384		

Dependent Variable: RETURNSFWD_Q
Method: Panel Least Squares
Date: 01/07/15 Time: 09:53
Sample (adjusted): 1995M07 2014M09
Periods included: 183
Cross-sections included: 197
Total panel (unbalanced) observations: 10509

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003766	0.001933	1.948347	0.0514
SACCRUALS	0.003742	0.001208	3.097468	0.0020
SCFROE	0.003335	0.001276	2.614062	0.0090
SEPS12M	0.002671	0.001093	2.444151	0.0145
SROEVOL18M	-0.002367	0.001104	-2.144548	0.0320

R-squared	0.003734	Mean dependent var	0.010062
Adjusted R-squared	0.003355	S.D. dependent var	0.106174
S.E. of regression	0.105996	Akaike info criterion	-1.650360
Sum squared resid	118.0134	Schwarz criterion	-1.646906
Log likelihood	8676.819	Hannan-Quinn criter.	-1.649194
F-statistic	9.842964	Durbin-Watson stat	2.036516
Prob(F-statistic)	0.000000		

Dependent Variable: RETURNSFWD_Q
Method: Panel Least Squares
Date: 01/07/15 Time: 09:55
Sample (adjusted): 1995M07 2014M09
Periods included: 183
Cross-sections included: 180
Total panel (unbalanced) observations: 8765

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003489	0.002810	1.241478	0.2145
SACCRUALS	0.002707	0.001471	1.840664	0.0657
SCFROE	0.003176	0.001357	2.340635	0.0193
SEPS12M	0.002687	0.001335	2.013130	0.0441
SROEVOL18M	-0.002355	0.001321	-1.782598	0.0747
SPOUT	0.001573	0.000999	1.573944	0.1155

R-squared	0.002479	Mean dependent var	0.011527
Adjusted R-squared	0.001910	S.D. dependent var	0.099599
S.E. of regression	0.099504	Akaike info criterion	-1.776560
Sum squared resid	86.72269	Schwarz criterion	-1.771715
Log likelihood	7791.775	Hannan-Quinn criter.	-1.774909
F-statistic	4.353942	Durbin-Watson stat	2.068428
Prob(F-statistic)	0.000585		

Multiple regressions results for style and market factors

The three tables below present the results from the multiple regressions of the style and market factors after the single factor regressions results were tested. The results below are for the entire sample period using the adjusted and trimmed data. The single factors in the multiple cross-sectional regressions are ranked according to absolute t-statistics.

Table

Variable	Coefficient	Std. Error	t-Statistic	Prob.	R-squared
C	0.003907	0.001075	3.634978	0.0003	0.007516
SCFTP	0.008568	0.000627	13.66618	0.0000	
SBVTM	0.001380	0.000615	2.242838	0.0249	

Variable	Coefficient	Std. Error	t-Statistic	Prob.	R-squared
C	0.006480	0.001170	5.538968	0.0000	0.002574
SEY	0.003342	0.000666	5.019944	0.0000	
SBVTM	0.002825	0.000688	4.103616	0.0000	

Variable	Coefficient	Std. Error	t-Statistic	Prob.	R-squared
C	0.020946	0.003470	6.036230	0.0000	0.001330
SEY	0.002487	0.000666	3.736958	0.0002	
SSIZE	-0.002096	0.000686	-3.056290	0.0022	

Variable	Coefficient	Std. Error	t-Statistic	Prob.	R-squared
C	0.001121	0.002125	0.527295	0.5980	0.004655
SEY	0.007973	0.001426	5.591194	0.0000	
SBVTM	0.003060	0.001462	2.093065	0.0364	

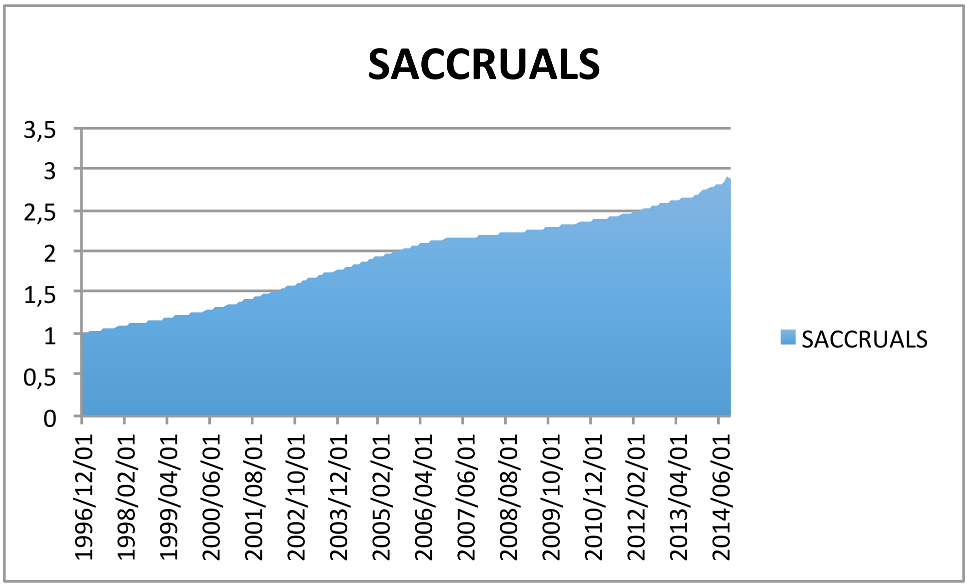
Variable	Coefficient	Std. Error	t-Statistic	Prob.	R-squared
C	0.002697	0.001830	1.473723	0.1406	0.006287
SCFTP	0.008911	0.001332	6.691674	0.0000	
SBVTM	0.002611	0.001473	1.772253	0.0764	

Variable	Coefficient	Std. Error	t-Statistic	Prob.	R-squared
C	0.014071	0.008375	1.680039	0.0930	0.003720
SEY	0.008010	0.001349	5.937677	0.0000	
SSIZE	-0.001807	0.001540	-1.173520	0.2407	

iV) Cumulative payoffs

Eviews code for quality factors for factor payoffs

```
!minmonth=1
!maxmonth=251
!totalshares=251
!totalmonths=251

Table Slopes
!row=1
Smpl @all


for !month = !minmonth to !maxmonth
Smpl 1994.1 + !month-1 1994.1 + !month-1
!row=!row+1

Slopes(!row,1)=!month
!column=1
For %0 SACCRUALS SBETA SBVTM SCAPEXTS SCFROA SCFROE SCFTP SDE SDPS12M SDY
SEBITDAMAR SEBITDAMARG24 SEBITDAMARG12 SEBITDAMARG36 SEPS12M SEY SICBT SIZE
Saccrualsg12m SLOGDE SNPM SPTEBITDA SPTS SROA SROC SROE SROEG12M SROEG24M
SROEG36M SROEVOL18M SSIZE STOT_CAPITAL STOT_DEBT SVOL12M SVOL18M SVOL6M
SCFROEG12M SCFROEG24M SCFROEG36M SEPS12M SEPSVOL24M SPOUT SPTEBITDA

!column=!column+1
Slopes(1,!column)=%0

'!counter=0
'!zero=0
'if !counter > 1 then
'if !zero > 1 then
equation stuff.ls RETURNSFWD_q c {%0}
slopes(!row,!column) = c(2)
'endif
'endif
next
next
```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1999/04/01
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2002/10/01
2003/12/01
2005/02/01
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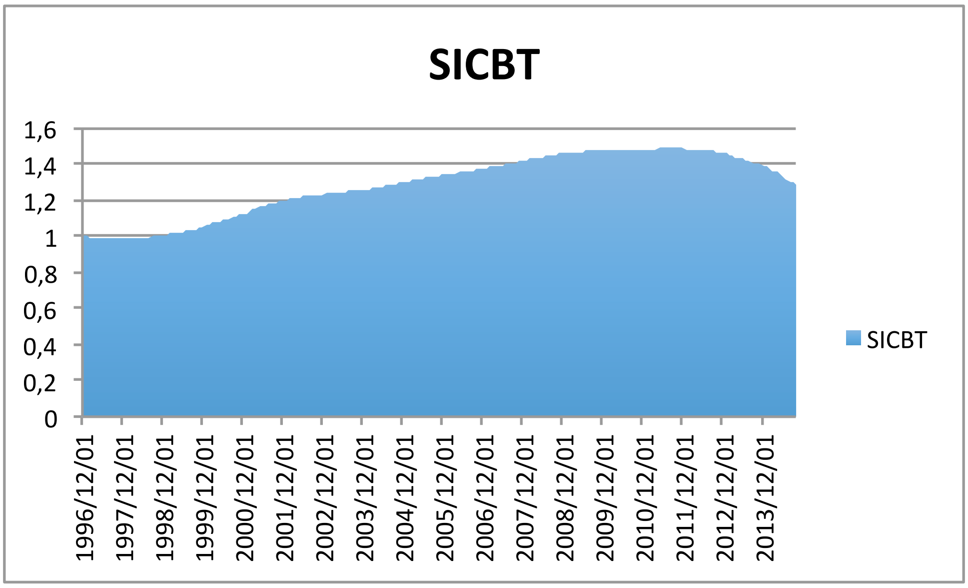
2014/06/01
SACCRUALS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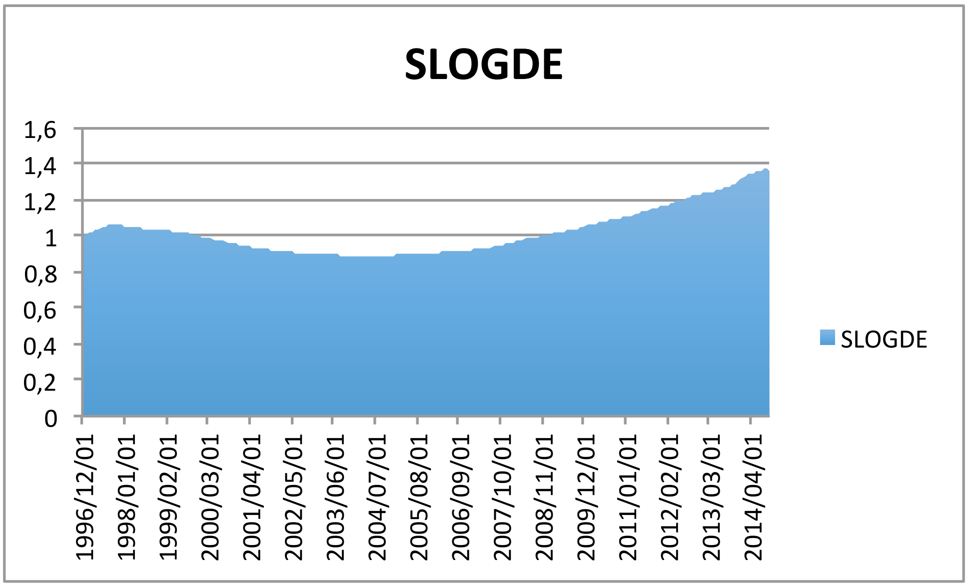
2013/12/01
SICBT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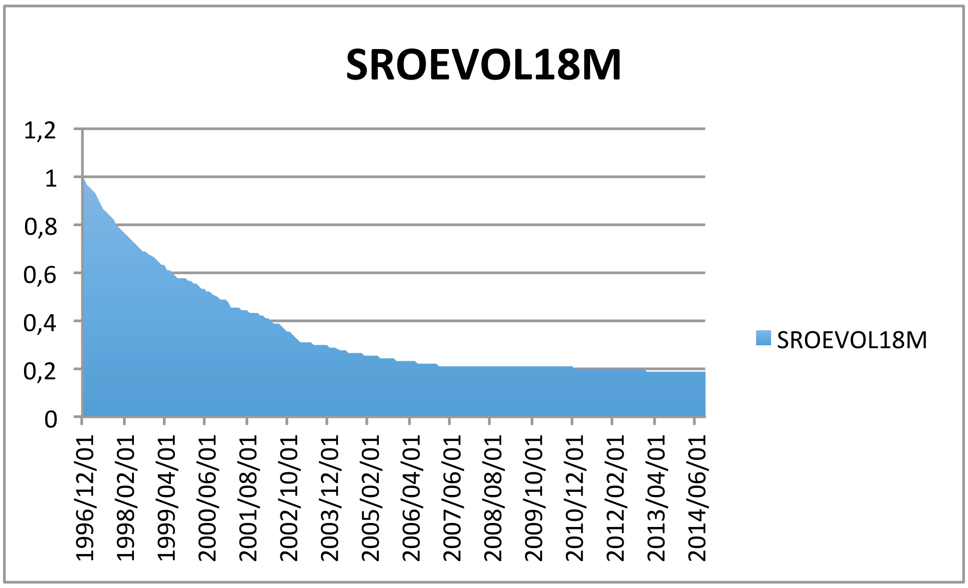
2014/04/01
SLOGDE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1999/04/01
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2003/12/01
2005/02/01
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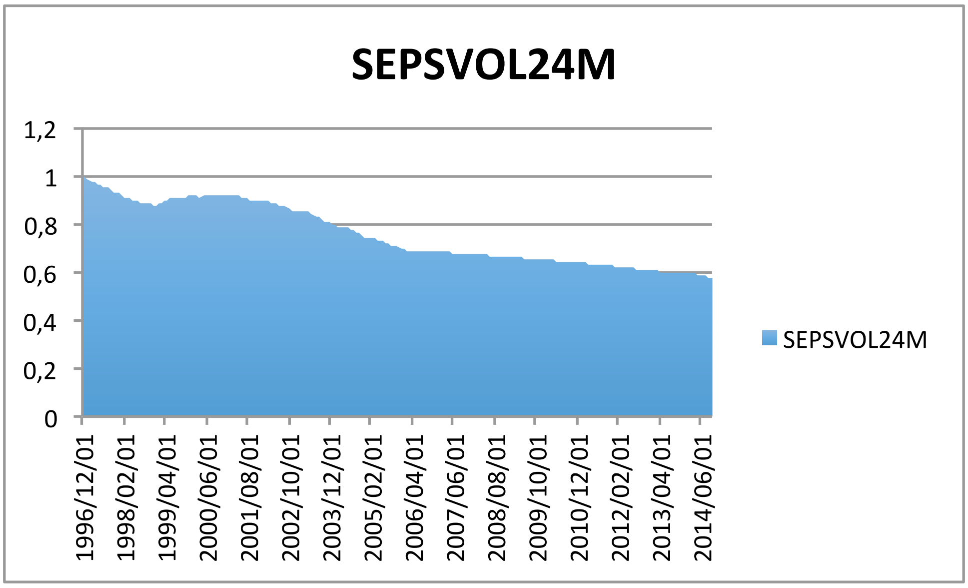
2014/06/01
SROEVOL18M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1998/02/01
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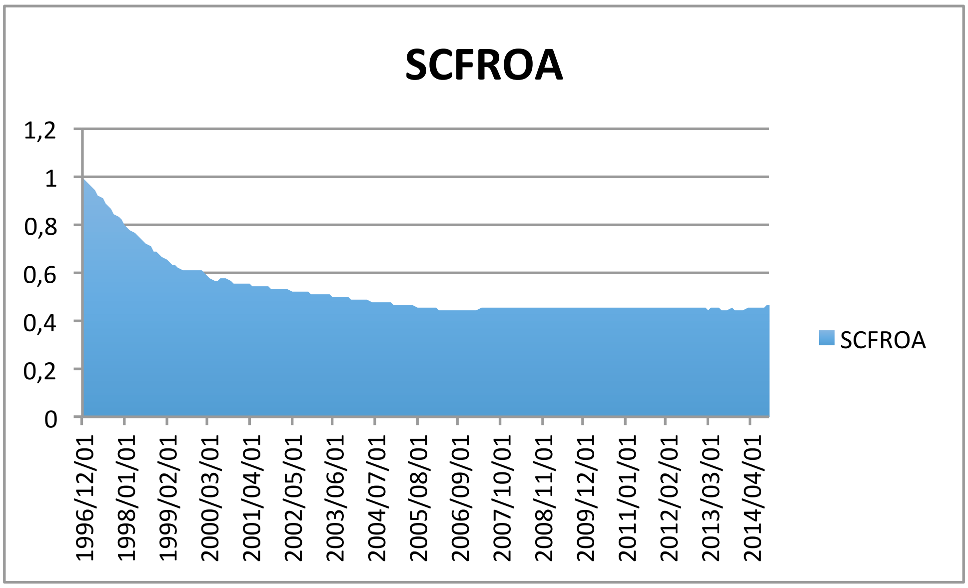
2014/06/01
SEPSVOL24M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0,4
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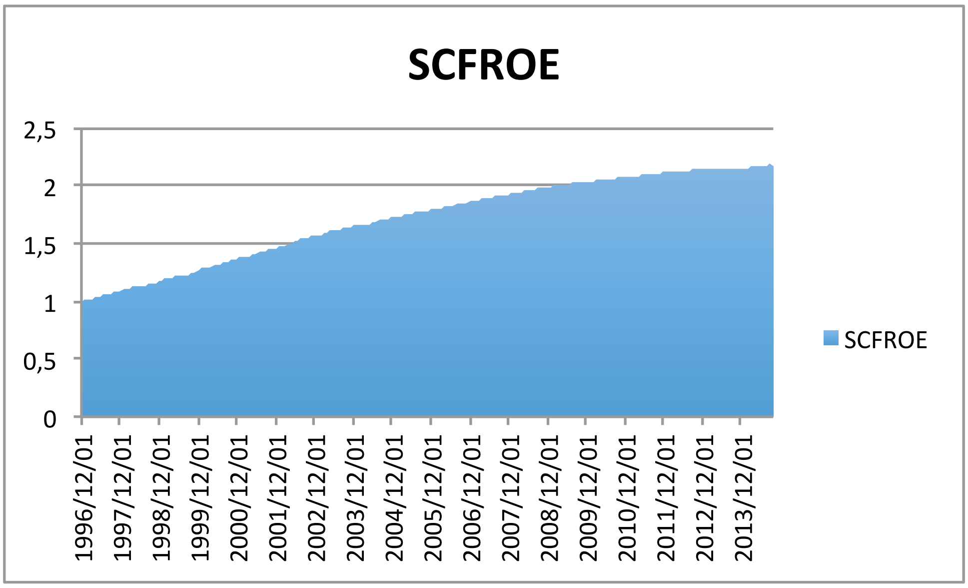
2014/04/01
SCFROA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1998/12/01
1999/12/01
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2005/12/01
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2009/12/01
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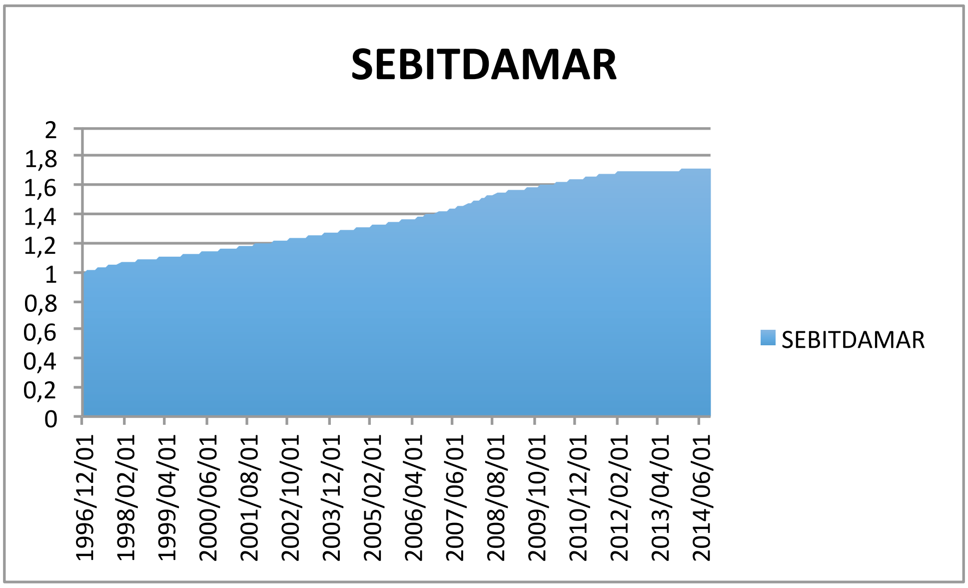
2013/12/01
SCFROE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2000/06/01
2001/08/01
2002/10/01
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2005/02/01
2006/04/01
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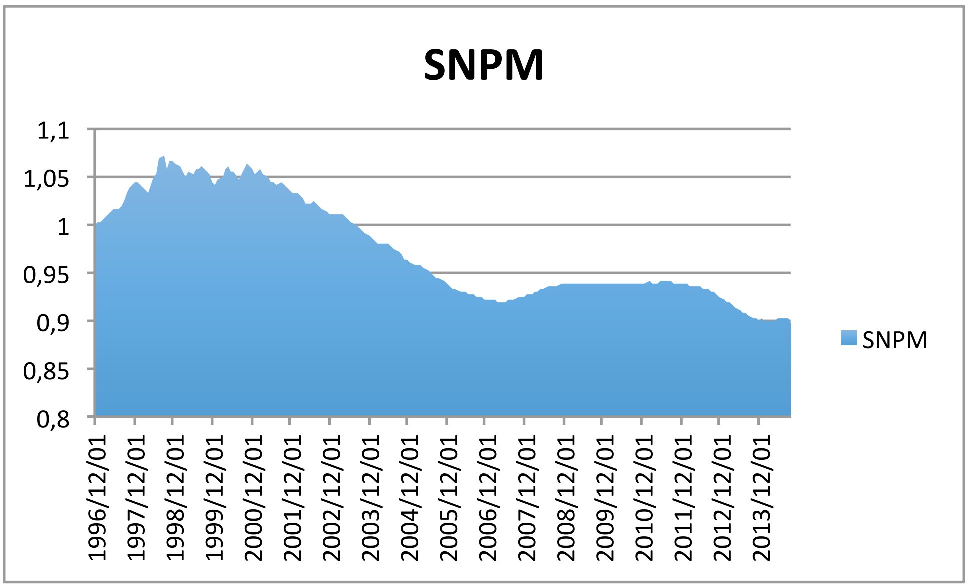
2013/04/01
2014/06/01
SEBITDAMAR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1997/12/01
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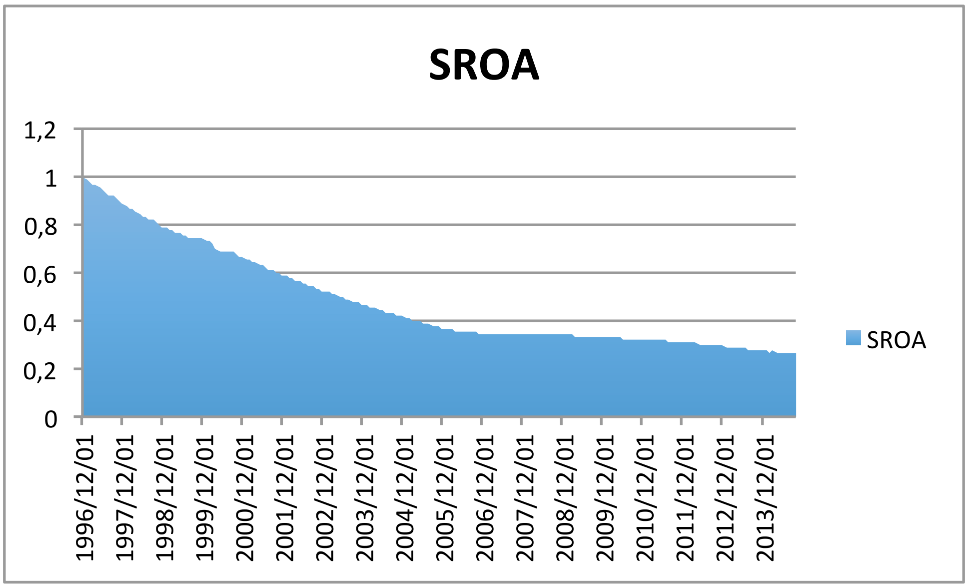
SNPM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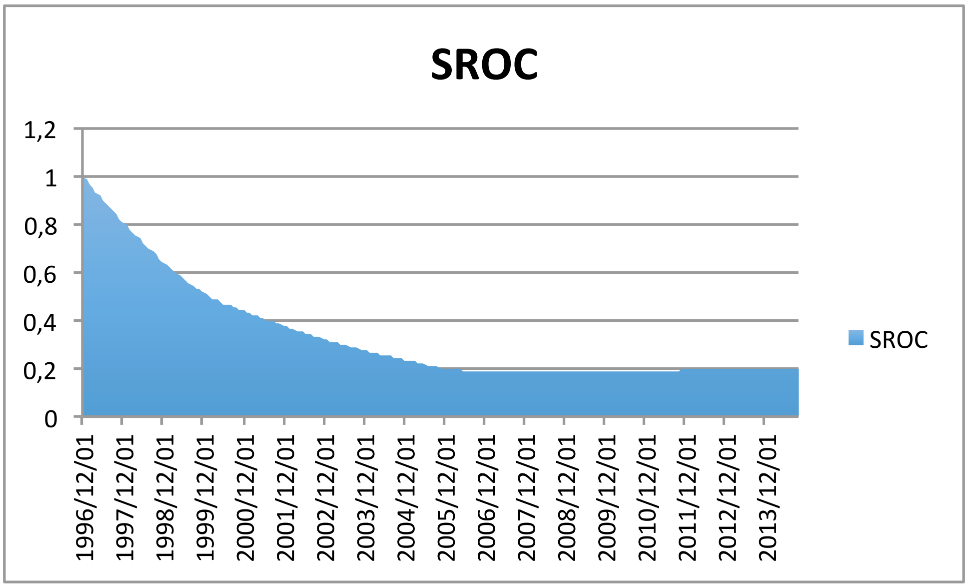
2013/12/01
SROA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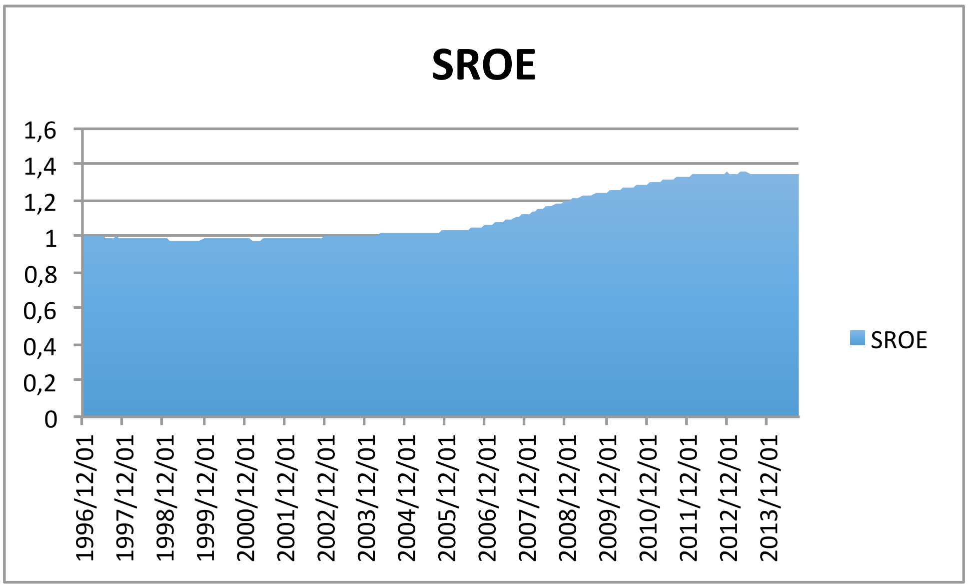
2013/12/01
SROC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2012/12/01
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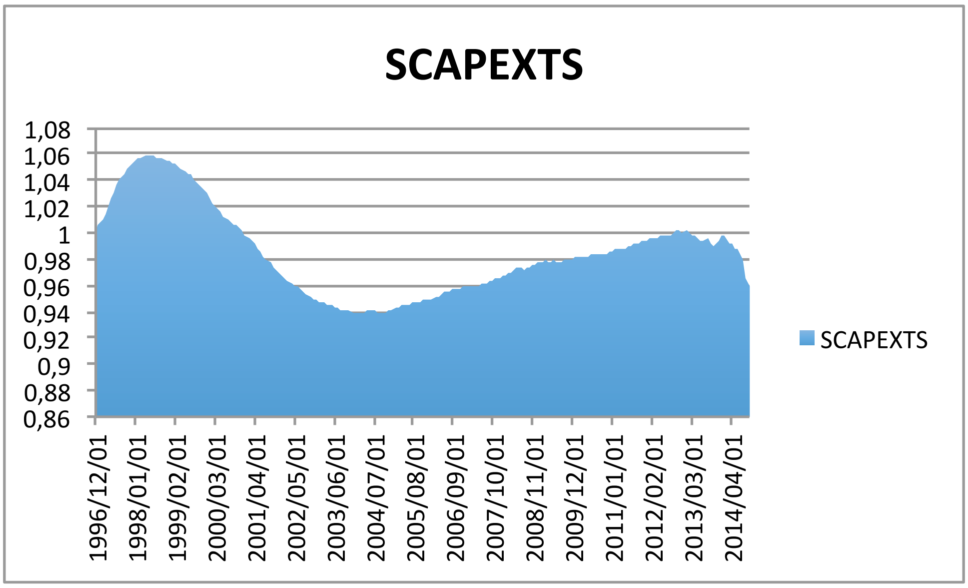
SROE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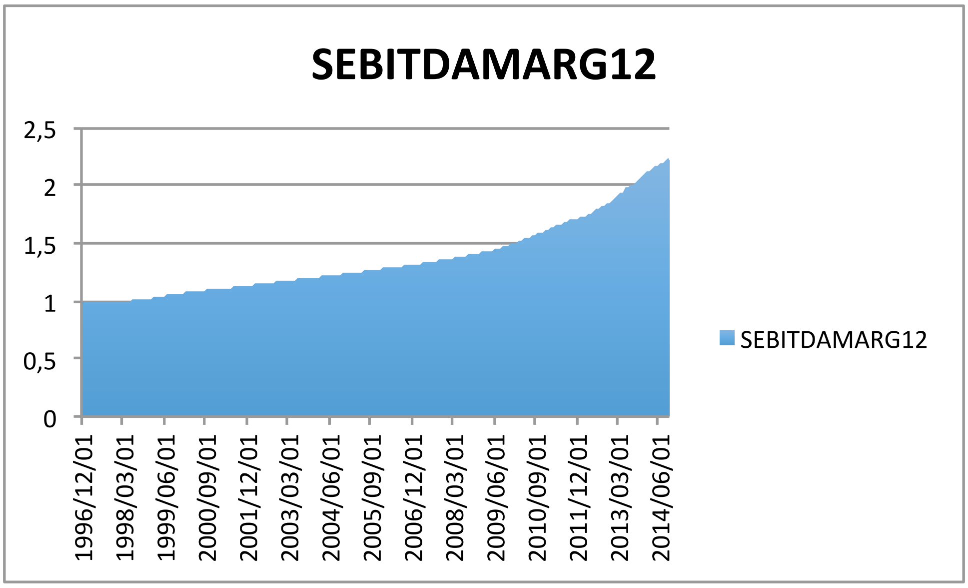
2014/04/01
SCAPEXTS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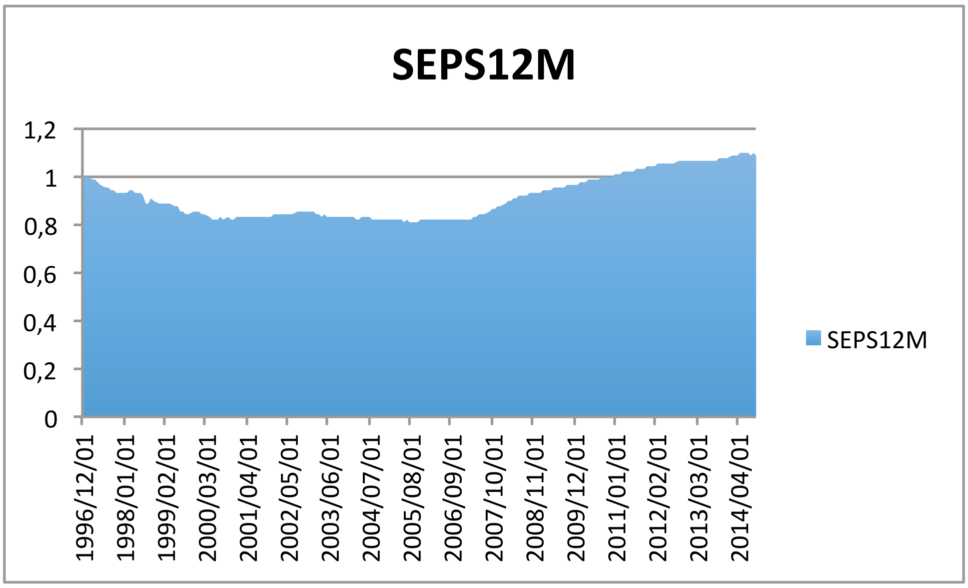
2014/06/01
SEBITDAMARG12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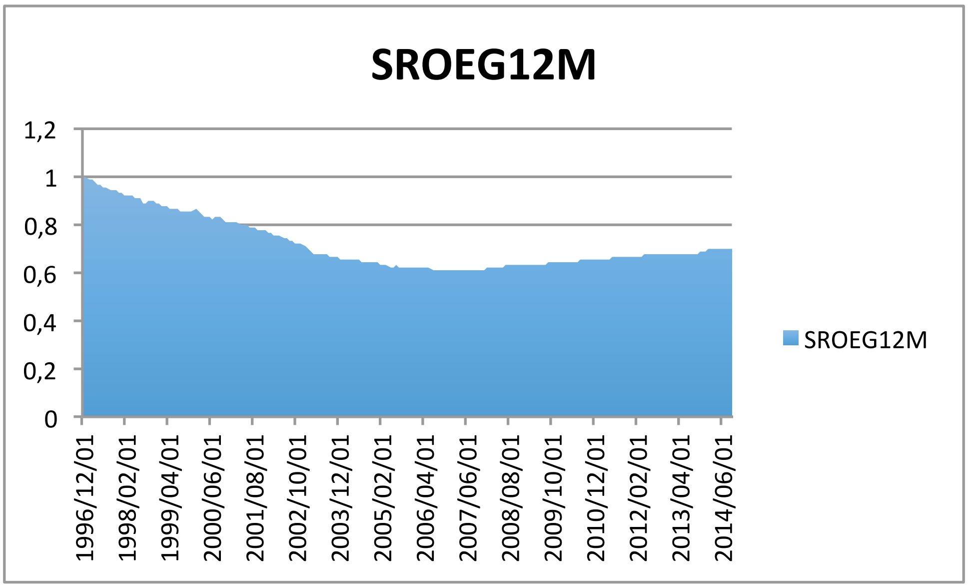
2014/04/01
SEPS12M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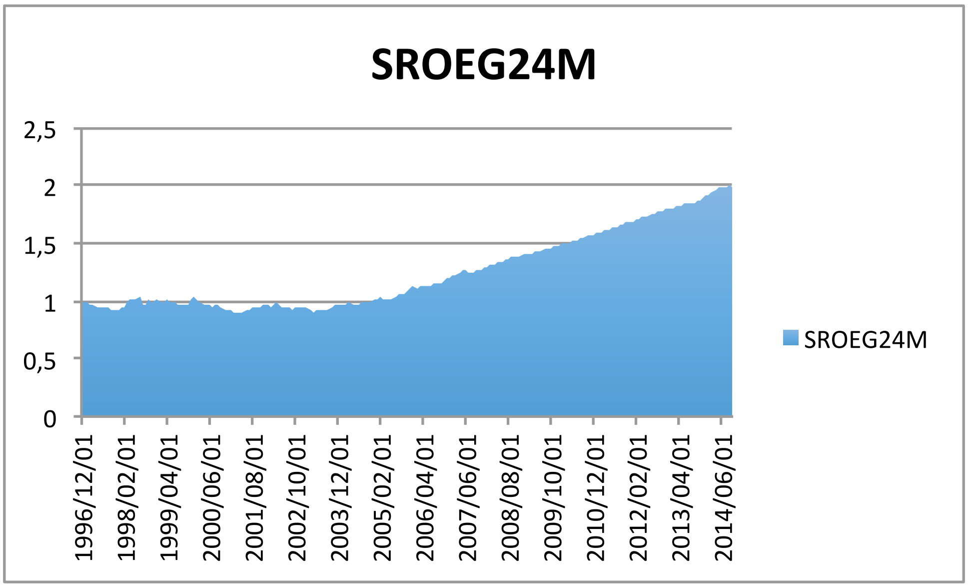
2014/06/01
SROEG12M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1999/04/01
2000/06/01
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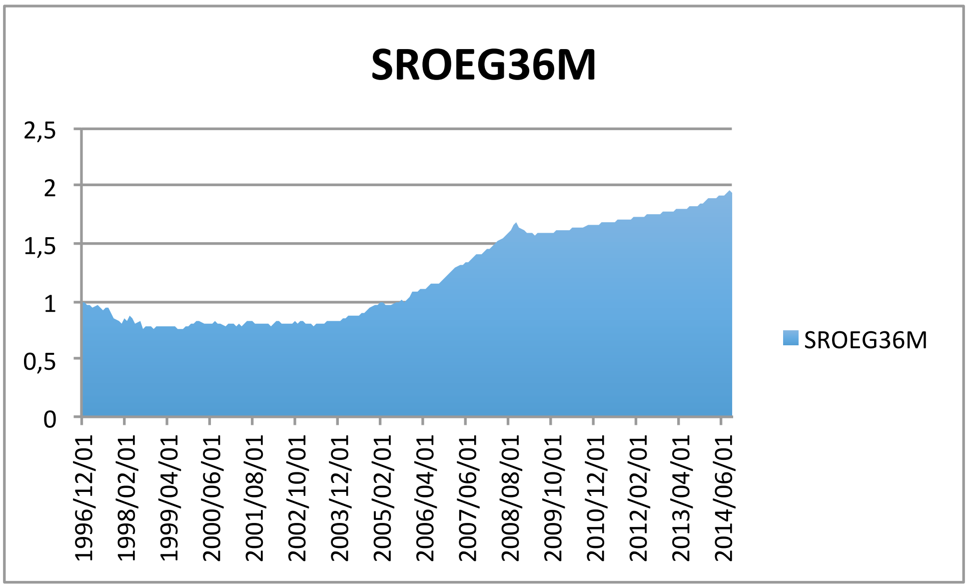
2014/06/01
SROEG24M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2009/10/01
2010/12/01
2012/02/01
2013/04/01
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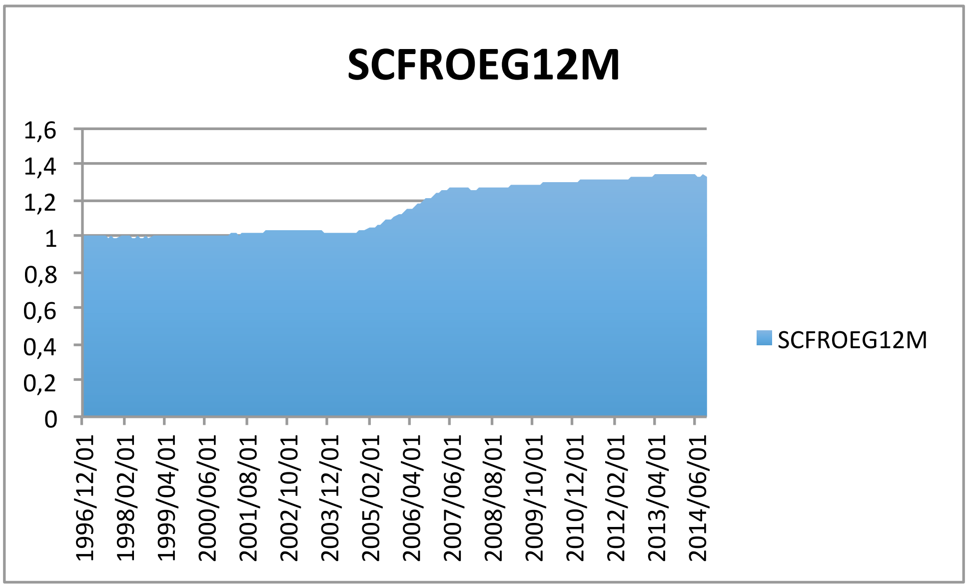
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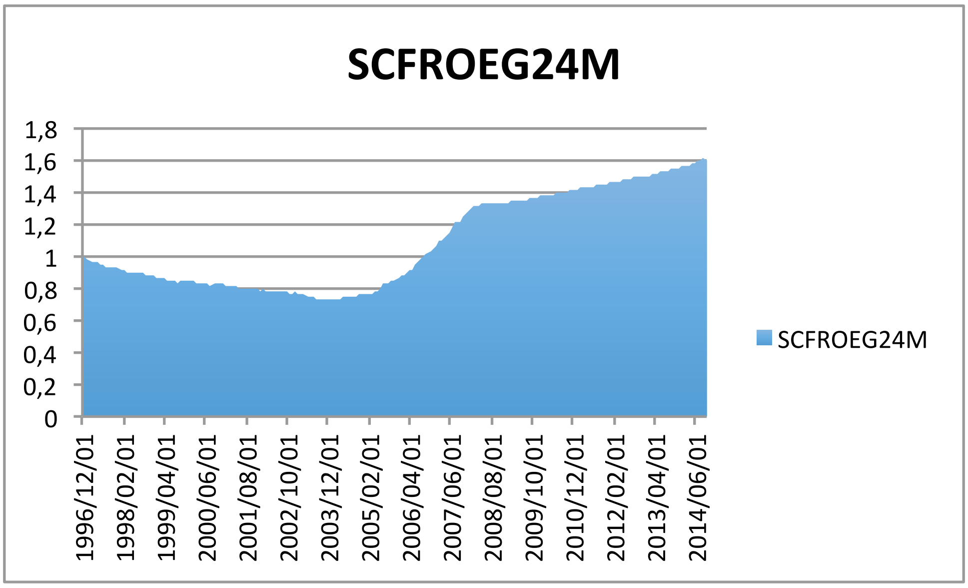
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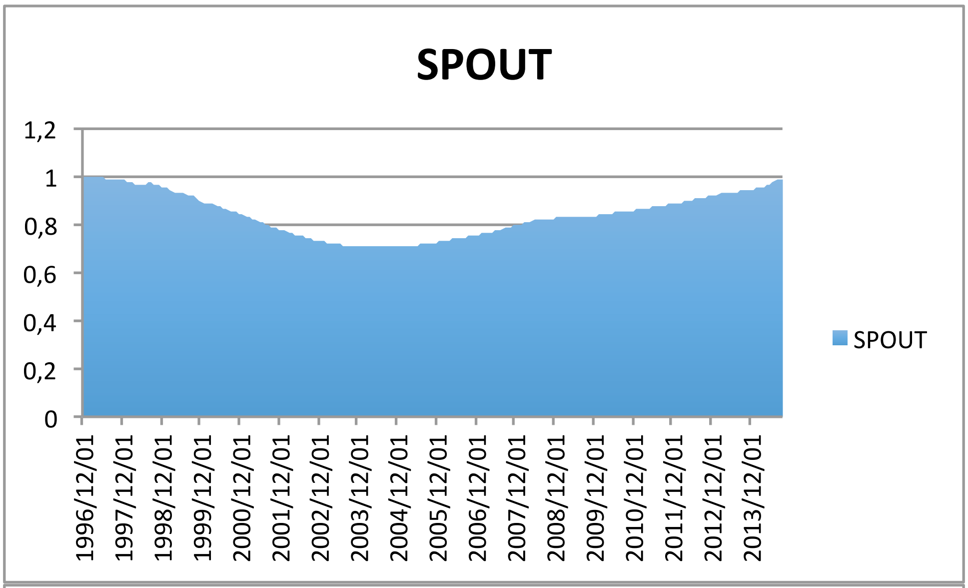
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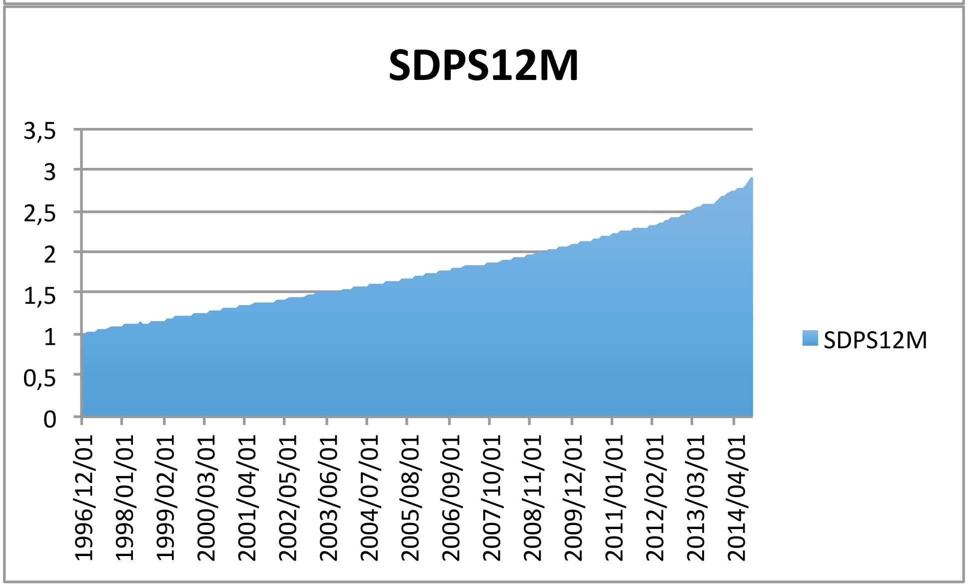
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