QUALITY MINUS JUNK ON THE JSE

by

CONRAD VAN REENEN (1055291)

MASTER OF COMMERCE IN BUSINESS FINANCE

in the

SCHOOL OF ECONOMIC AND FINANCE

at the

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Supervisor: DR Daniel Page

Date of submission:

29 February 2020

Date of resubmission:

31 May 2021

SCHOOL OF ECONOMIC AND
BUSINESS SCIENCES

Declaration Regarding Plagiarism

I (full names & surname):	Conrad van Reenen
Student number:	1055291

Declare the following:

1. I understand what plagiarism entails and am aware of the University’s policy in this regard.
2. I declare that this assignment is my own, original work. Where someone else’s work was used (whether from a printed source, the Internet or any other source) due acknowledgement was given and reference was made according to departmental requirements.
3. I did not copy and paste any information directly from an electronic source (e.g., a web page, electronic journal article or CD ROM) into this document.
4. I did not make use of another student’s previous work and submitted it as my own.
5. I did not allow and will not allow anyone to copy my work with the intention of presenting it as his/her own work.

Signature

31/05/2021

Date

Quality Minus Junk on the JSE

Abstract

Price is theorized to be an indicator of quality. But cam quality be an indicator of price? As price is constituted of a multitude of variables that determines its realizable value and overall return over time as the price fluctuates. Instead of looking at price inherently, it is simpler to study what drives those returns, which entails fundamental factors that affect price itself. One of these is quality, which is a subjective word in principle, as there are various measures of quality. To determine the inherent aspects of quality: profitability, growth, and safety. Determining if this new factor variable has any significance on the JSE will help establish its relevance to the South African market. This study uses an approach to quality sorting, using the central qualities of quality to construct a Quality minus Junk portfolio strategy on the Johannesburg Stock Exchange. Using the results of the Fama-MacBeth regression. Quality stocks do provide risk-adjusted returns on the market, this only being a small amount, though still significant statistically and able to capture more returns than the other established factor variables. Therefore, the QMJ portfolio approach is worth noting in a South African market context. As other factors mainly look for the inherent value being mispriced, identifying a quality spectrum from quality to junk benefits investors in understanding the potential long-run returns of quality and helps take advantage of the volatility of junk.

Contents

1.Introduction

1.1 Background

As South Africa looms on an investment downgrade to junk status, the search for quality is imperative within the context of our investment markets. To realize the potential of a stock through fundamental estimates such as profitability, the most common signifier of a company's current status in terms of good or bad. Growth, which signifies the capability of a company's performance and finally safety which is always a concern in the volatile markets of today. Overall asking if this firm reliable in the long-term to provide me with a significant risk-adjusted returns? This article looked at the quality characteristics identified by Asness, Frazzini and Pedersen, (2018) to assist with creating a new factor, able to differentiate between a quality firm that consists of consistent positive earnings and a junk firm that is inconsistent and volatile. Subsequently developing the QMJ portfolio strategy of going long quality and shorting junk. Along with testing this new method, the most common factor investing strategies were also tested to see their current trustworthiness and how they relate with the new factor in town.

The idea of quality has been around since humans were able to differentiate between two objects, which in theory should be the same in every way. However, identifying certain characteristics made object A better than object B. Now we associate these positive characteristics with the idea of a better-quality product while the opposite side notices the negative characteristics implying a junk status to that product.

Being able to differentiate between quality and junk is a simple process in some instances but most of the time it is a lot more complex to do so. Because we all believe in different definitions of quality and the aspects of it which we each individually value more.

What determines the price of a stock? The age-old question that will forever exist as long as there are opinions and subjectivity within the investment market. When it comes to value and the constituents it consists of, it is all determined on what you think compared to what the market believes. Numerous studies have attempted to crack the "Da Vinci code", either in the name of research to help further the understanding of what value is or to game the market by obtaining the full-proof "get-rich formula".

This study aims to achieve a deeper understanding on the quality as a characteristic of an asset. Quality factor investing is being investigated with more vigour and determination than ever as it aims to capture returns using gross profits, price to earnings, dividends, and free cash flow. What all these indicators have in common is that the higher they are, the stronger the signal that a firm is stable and a safe bet in terms of investment. A quality share is unlikely to have erratic price movements and will continue to make positive gains over the long-term, albeit small gains. Now the antithesis of this notion is junk stocks, where a firm has no stable footing on its fundamentals and is more of a wild card. The price shifting with lots more volatility but a higher potential gain for this unpredictability and a greater net return for investing in this junk stock.

The notion that has been held in the financial world is that with more risk comes higher rewards. This principal is as old as time, but does it always hold true? Asness, Frazzini and Pedersen, (2018) found that investors tend to underestimate the potential excess returns from quality stocks and overvalue the junk stocks. Identifying the excess returns that have been lost over the years due to this, they construct an excess return portfolio consisting of going long quality and short junk stocks.

1.2 Research Objectives

The main aim of this study is to investigate if the quality effect exists on the JSE and to determine if the quality factor can explain firm returns on the JSE. Using the insight gained from Asness, Frazzini and Pedersen, (2018), their definition of quality is applied to these firms, aiming to distinguish between a quality and junk firm. This is an asset pricing study, focusing on whether a new factor of Quality minus Junk (QMJ) has any viability of capturing the variation in returns on the JSE. The Quality factor has entered the research space and now it will benefit the South African market, if proven to be a significant factor.

1.3 Purpose and Benefits of the Study

The goal of this research is to recreate the study done by Asness, Frazzini and Pedersen, (2018) on the Johannesburg Stock Exchange to see if this investment strategy has any empirical value.

The value being that viability of a quality factor portfolio strategy on the JSE as well as further understanding whether the concept of factor investing is applicable too. South Africa is an emerging economy that is highly volatile and constantly adjusting to various external and internal country factors. Do the local investors see beyond the potential value in quality stocks or do they just trust in the risk-reward principle and put too much faith into the junk stocks?

By the end of this study, the potential of a quality factor portfolio strategy on the Johannesburg Stock Exchange will either be established or be non-existent. If established, this will guide future research in terms of applicable factors in the asset pricing universe that hold statistical and significant excess returns. The common risk factors of size, value and momentum have a place, not just in earning excess returns on the market but have explanatory power in capturing the risk premium. Considering the relationship of these factors to the new quality factor as well, to understand where this new model fits in the picture and if a potential new multi-factor model can be used to explain the variation in returns on the Johannesburg Stock Exchange.

This research will assist any further pursuers of factor investing with regards to the JSE. Whether a scholar or investment analyst, this will bring further insight into what type of investing strategy, whether size, value, momentum or quality has become not only a popular method of asset pricing but also a reliable one. This could prove to be a fatal mistake by investors as quality firms do stand the test of time even in times of economic downturn. So, are pricing analysts overvaluing the volatility of junk stocks and undervaluing the consistency of quality stocks?

These questions will be answered once the Quality minus Junk strategy is implemented and tested thoroughly on the South African market. For future studies to look deeper into understanding the quality measure. The alternate reason is to bring researchers and investors one step closer to understanding what determines the price of a stock.

2. Literature Review

2.1 Quality as an Investment Style

Firstly, what is quality investing and how is it measured? Quality is generally identified against a standard measure, whether a stock is considered to be above average or below average quality is dependent on what the investor considers to be average quality. Many researchers have attempted to identify similarities across the well-known quality strategies, as in theory, the average of all investors average definition of quality should be a reliable estimate of what quality is.

The supporters of quality include Jeremy Grantham, who uses high quality indicators of low debt, stable return and high return, to help establish MSCI's Quality Indices (Grantham, 2004). This falls in line with the idea of safety, growth and profitability with regards to Asness, Frazzini and Pedersen,(2018) method of constructing a quality variable.

Novy-Marx (2012) finds a recurring theme in the literature, that being the strong relationship between value and quality. Warren Buffet is quoted saying " It is far better to buy a wonderful business at a fair price than to buy a fair business at a wonderful price".) Warren Buffet's investment portfolio, Berkshire Hathaway, generates most of its return through trading quality associated public firms (Frazzini, Kabiller and Pedersen, 2012).

Like two sides of the same coin, quality and value strategies in principle capture the same gain, however this is done by following different strategies and holding different stocks. Low quality firms are considered to be value, while high quality firms are on average more expensive. Novy-Marx (2012) noted that the two factors of value and quality tend to be negatively correlated, finding that when quality performs well, value tends to underperform and vice versa. Implying great diversification between the two factors when implemented together.

Novy-Marx (2012) finds that approaches to take advantage of the quality dimension of value can be profitable as a standalone strategy. Quality and other aspects of value can even greatly improve the performance of a quality measure. Focusing on the common quality measure of profit, gross profitability, it has shown to provide reliable results amongst large cap stocks for long-only investors.

Grantham (2004) defines quality as low earnings volatility, low leverage and high profitability and find that firms with these qualities have beaten other style-based strategies on the market over the long run.

The literature all points to profit, growth in profits and a safety measure as the main determinants of quality. Supported by the fact that these strategies have been proven to work separately, Asness, Frazzini and Pedersen, (2018) refine the quality aspect by looking at all three variables to construct a consistent and reliable measure of quality.

Asness, Frazzini and Pedersen, (2018) discover from there results and sorting firms on quality, that high quality firms generate positive returns while junk stocks generate negative returns. The authors conclude that buying quality stocks while simultaneously selling junk stocks provides a significant abnormal return. Individuals would be willing to pay a higher price if they knew they were receiving a higher quality product. Using the idea of quality, it is broken down into three parts which are used to construct a dynamic asset pricing model.

2.2 Asset pricing Models

Capital Asset Pricing Model

The Capital Asset Pricing Model is an intuitive model that depicts the relation between risk and expected returns and has been used widely to evaluate portfolio performance and to measure the cost of capital of firms. The earliest record of theory on the Capital Asset Pricing Model (CAPM) is explored in the manuscripts: “Market Value, Time and Risk” Treynor (1961) and “Toward a theory of Market Value of Risky Assets” Treynor (1962) where the author explains that the expected return of an asset consists of a risk-free and a market-risk-premium component.

CAPM stems from the mean-variance analysis that is introduced by Markowitz (1959). This mean-variance approach details the optimal portfolio an investor should select and states that an investor selects (or should) an efficient portfolio which is the portfolio with maximum expected returns for a given level of variance or the portfolio with minimum variance for a given level of returns.

In order to simplify the portfolio selection problem, Sharpe (1964) and Lintner (1965) add new assumptions to the Markowitz mean-variance analysis namely, investors have the same riskless rate at which they can borrow or lend and that investors have homogenous expectations regarding the parameters of probability distributions of security returns (correlation coefficients, standard deviations and expected values).

The one period Capital Asset Pricing Model is given by:

$$E(R_j) = R_f + [E(R_m) - R_f)]\beta_j \quad (1)$$

Where: $E(R_j)$ = expected return of security j

$$\beta_j = \frac{cov(R_j, R_m)}{\sigma^2(R_m)} \text{ (systematic beta)} \quad (2)$$

$E(R_m)$ is the expected returns on a 'market' portfolio

CAPM uses an asset's expected return on the market return and states that the expected return on asset j is equal to a risk-free rate plus the asset's risk premium. The market or systematic beta is the slope of the regression and seems to be the hamartia of CAPM. Here is how: the numerator of B_j measures the covariance risk of asset j relative to the market and the denominator measures the variance of the market portfolio returns. Therefore, B_j is the covariance risk of asset j in the tangent "market" portfolio that is measured relative to the variance of returns of the market portfolio. This means that the beta of asset j is proportional to the risk that each rand invested in asset j contributes to the market portfolio. The implication from this explanation is that all asset expected returns are linearly dependent on their betas and no other variable can describe security expected returns.

Early tests of the relation between beta and expected returns show that there is a relation between beta and expected returns however, the relation is too "flat" as discussed by Black, Jensen and Scholes (1972) and Stambaugh (1982). In response to evidence of a "flat" market risk premium, studies have been conducted to provide alternative asset pricing models and/or to extend CAPM. Moreover, there is vast literature which shows that the systematic risk of an asset is not the only variable that can describe an asset's expected return.

Prominent variables which have been found to have strong explanatory power in describing the cross section of expected returns have been the earnings- to-price ratio, leverage, market capitalization, and book-to -market equity. Reinganum (1981) presents evidence that portfolios which are formed on size and earnings-to-price ratios (E/P) earn abnormal returns and that the size effect largely subsumes the E/P effect. Banz (1981) records a size effect which states that small firms have significantly higher risk-adjusted returns than large firms. Average stock returns seem to have a strong positive relationship with a firm's book-to-market ratio (Rosenberg, Reid and Lanstein (1985), Chan, Hamao and Lakonishok (1991)). Furthermore, after controlling for beta and firm size, the debt to equity ratio which represents leverage, is positively related to expected returns, that is, returns for high debt-to-equity ratios are too high given their betas (Bhandari (1988)).

Arbitrage Pricing Model

The Arbitrage Pricing Model constructed by Ross (1980) relaxes the traditional CAPM assumption that the market portfolio is mean-variance efficient and is a multi-period model unlike the single-period described in CAPM. Instead, the model looks at a single risky asset-return's relation to the asset's factor loadings such as macroeconomic variables. The Arbitrage Pricing Theory looks at how investors can use the relationship between a single risky asset's expected return and the risk premium of various macroeconomic factors. This strategy can be used to profit from the mispricing of stocks on the market by noticing the difference between the actual and predicted price calculated by the model. The formula is:

$$E(Ri) = Rf + \beta_1(Risk\ premium\ 1) + \beta_2(Rp_2) + \cdots + \beta_n Rp_n \qquad (3)$$

Fama and French Three factor model

Fama and French (1992) investigate the joint roles of beta, market capitalization, E/P, leverage and the book-to-market ratio. The authors find that beta provides little information on expected returns and that the univariate relations between E/P, leverage, market capitalization and B/M and expected returns are linearly strong. However, when combined, size and B/M subsumes E/P and leverage.

The study on the variables affecting expected returns leads to the Fama and French Three-Factor Model;

$$E(Ri) = Rf + \beta_{im}[E(Rm) - Rf] + \beta_{SMB}(SMB) + \beta_{HML}(HML) \qquad (4)$$

The three factor is an extension of the CAPM that adds a “size” and “value” factor to the original market factor explained in CAPM. SMB (Small minus Big) represents the size effect and is attributed to the observation that small-capitalization stocks are accountable for high portfolio returns. HML (High minus Low) takes on the returns of high book-to-market (value) stocks and low book-to-market (growth) stocks because value stocks tend to outperform growth stocks.

With the Fama and French three-factor model being tested internationally and outperforming the CAPM internationally (Fama and French (1998)), the model has resulted in different conclusions about which of the three factors is reliable in describing expected returns in South Africa.

South African Evidence of Fama and French Three-Factor model shows that in earlier studies Page and Palmer (1991) find that, on the JSE, small-sized firms do not greatly impact portfolio returns but there is a price-to-earnings ratio effect. De Villiers, Lowlings Pettit and Affleck-Graves (1986) also find that there is no size effect on the JSE. Furthermore, van Rensburg and Robertson (2003) find that small stocks and portfolios which contain low price-to-earnings stocks and have lower betas earn greater returns than high price-to-earnings on the JSE; suggesting that returns on the JSE are best described by the price-to-earnings ratio and by the size factor.

Basiewicz and Auret (2010) test the feasibility of the three-factor model on the JSE and find that the size and value factors do show variations in expected returns. Boamah (2015) looks at the applicability of the Fama and French three-factor model and of the Carhart four-factor model on the South African stock market, results show that the size effect and value effect are prevalent. Charteris, Rwishema & Chidede (2017) test the alternative three-factor model (Chen et al., 2011) and the Fama and French five-factor model, concluding that profitability and investment are important factors with regards to emerging markets such as South Africa.

Carhart Four-factor model

Carhart (1997) creates a new model by extending the Fama and French three-factor model. A momentum factor is added, which accounts for the difference of winner stock returns and the returns on loser stocks.

$$E(Ri) = Rf + \beta_{im}[E(Rm) - Rf] + \beta_{SMB}(SMB) + \beta_{HML}(HML) + \beta_{WML}(WML) \qquad (5)$$

Fama and French Five factor model

The addition of investment and profitability is not arbitrary as there is substantial literature on the study of investment as a factor that describes expected returns. One of the earlier studies on investment dates back to Loughran and Ritter (1995) where the authors show that increased investment such as seasoned equity offerings leads to long run negative returns whereas decreased investment such as share repurchases leads to positive returns in the long run (Ikenberry, Lakonishok and Vermaelen (1995)). Furthermore, Titman, Wie and Xie (2004) show that there is a negative relation between capital investment and expected returns by calculating benchmark-adjusted returns. Forming benchmark portfolios, which capture the following characteristics: book to market equity, momentum and size; the benchmark return is then subtracted from a stock's return to find the excess benchmark return. Results show that firms with high abnormal investments earn negative returns. However, these negative returns occur during periods which are characterised by high takeover activity, therefore, the authors examine the capital investment negative relation for hostile-takeover and non-hostile-takeover periods and still find that high investors earn negative returns while low investors earn positive returns and that the negative relationship occurs especially during non-hostile periods. To examine the robustness of results the authors employ nonparametric tests on medians, which confirm that high investors generally underperform relative to low investors. The fact that there is a relation between expected returns and investment shows that the Fama and French three factor may not be sufficient in explaining expected returns. Hou, Xue and Zhang (2012) further show that a multifactor model with the investment variable in it outperforms the Carhart model.

There is a strong relation between profitability and the book-to-market ratio as low book-to-market firms (growth) are usually more profitable than high book-to-market firms are Hirshleifer (2001). To examine whether the book-to-market ratio predicts future profitability, Fama and French (2006) regress B/M and other factors on future earnings and do find that value firms are more profitable than growth firms. Apart from the similarity between profitability and B/M, Sloan (1996) initiates the study of profitability as an explanatory factor and finds that that there is a negative relation between a firm's accruals (accounting earnings minus cash flows) and future profitability. Chan,Chan, Jegadeesh and Lakonishok (2001) confirm the predictive ability of future earnings.

Because of this rich literature on investment and profitability, Fama and French (2015) develop a five-factor model which aims to capture the Size, Value, Investment, Profitability and Market patterns in expected returns. The addition of the two new variables; Investment and Profitability lead to an improved model which, according to the authors, performs better than the Fama and French Three-Factor Model.

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + e_{it} \qquad (6)$$

Asness, Frazzini and Pedersen, (2018) show the outperformance in the alpha of the high-quality stocks with statistical significance being greater than the other factor exposures such as size and value. Good quality stocks tend to maintain negative correlations with other factors, which points to the safety aspect of the quality measure being a defensive by looking at low beta stocks. High-quality stocks are safer than low-quality stocks, as a higher quality is associated with real world attributes that consist of large established firms with stable earnings and a strong position within the market.

Additionally, the study found that the QMJ portfolio results have only limited explanatory power, With the authors attributing this to pricing analysts not fully capturing the returns of high-quality stocks by overvaluing junk stocks. As the common belief is that a higher risk needs to be compensated with a higher risk premium, which does not hold in this instance as high-quality firms' consistency of returns, especially through economic downturns, outperforms the uncertainty of returns from junk firms.

2.3 South African Literature

Flint, Seymour and Chikunrunhe (2016), test the validity of various factor models on the South African market, including the market beta, size, value and momentum, showing that they all have a role to play on the JSE. Size and the market beta not generating significant returns. However, the value factor of HML and momentum factor of UMB both generating positive returns and showing a strong negative correlation supporting the idea of a two-factor model consisting of those factors. Their research also looks at the possibility of a quality factor but proceeds not to test the factor and instead suggest a methodology for identifying a new factor that could possibly capture the risk premia of the stocks in the market. Following these criteria to determine if a new factor is worth testing empirically.

- Support from empirical and practical testing, based on sound economic principles.
- Results showing that there is a significant excess return.
- Have history available during both bear and bullish market times.
- Be implementable in liquid and tradeable instruments.

Using these criteria, quality has grown in support rapidly and is based on sound fundamental reasonings such as profitability of a firm. With the main studies done on the subject concluding that there are significant premiums and are persistent in the long-run (Fama and French, 2006) as well as Novy-Marx (2013). There is substantial justification to test a quality factor in the developing market of South Africa.

Basiewicz and Auret (2009) find support for the size and value effect on the South African market, through the existence of risk premia for those factors. van Rensburg and Robertson (2003) conduct a study of six factors; price-to-NAV, dividend yield, price-to-earnings, cash-flow to price, price to profit and size. The results showing support for a two-factor model with size and price-to-earnings as the explanatory variables. Page, Britten and Auret (2013) find support for a momentum effect on the JSE. The various factors have found support and been challenged in the South African market. Quality factor investing has not been explicitly tested on the JSE, which provide more support and reasoning for the aim and significance of this paper.

3. Methodology

3.1 Data

All the data was collected from Bloomberg, a well-known and established financial news and information provider. Data was extracted for all the companies listed on the JSE ALSI between the period of 2000-2019. All the variables will be discussed below, from the share price to the various accounting figures needed to construct the quality factor. The JSE ALSI Index is the market proxy as it encompasses the majority of the market share whilst the ten-year government bond rate is converted into a monthly yield and used as the risk-free rate.

Shares that do not have data for more than five years consecutively are excluded, as they will not provide the info needed to establish the growth variable within the quality factor. Delisted and newly listed firms are included to avoid survivorship bias, as this can strongly affect the results in any analysis on a stock market. This is adjusted for a year-by-year basis. Following these conditions, each firm within the JSE ALSI index for each month are included from 2000-2019 in the sample, each carrying monthly data for all variables listed. The Accounting data is collected and adjusted for each financial year-end. Using the year for which the data applies to unanimously. For example, is 9 months of data is in the year 2000 and 3 months in 2001, the accounting data will be used for the year 2000.

3.2 Variable Construction

Profitability is the gross profit above costs and expenditures when calculated. All else being equal, a more profitable firm is considered to be of a higher quality. Measuring profits through gross profits, margins, earnings, accruals, and cash flows. Growth should command a higher price as a firm continues to grow its profits. Growth is measured as the prior five-year growth in each of the profitability measures. Safety defining a stock that demands a higher price for being sturdy in turbulent times. Using measures such as market beta, low volatility of profitability, leverage, and credit risk.

3.2.1 Quality score

Profitability

Adopting the methodology used by Asness, Frazzini and Pedersen, (2018), each measure is attributed an overall average score. To make each measure equal, each month the variables are converted into ranks. Using the median of the profitability factors for each firm in the JSE ALSI for each month and then ranked into a top half and lower half. The top indicating strong and lower indicating weak for the profitability, growth, and safety components. If a stock indicates strong for all of these factors on a monthly basis, then it will be considered a 'quality firm' for that specific time and vice versa for a stock indicating weak. Meaning any stock not achieving a strong certification for profitability, growth and safety will not be used for that month. This is applied to each component for the entire period from 2000-2019. This helps construct the factor QMJ, longing the quality specified stocks returns for that month and shorting the junk specified stocks.

Profitability consists of these six variables: Gross profits over assets, which equates to revenue minus costs of goods sold divided by total assets. Return on equity, which is the net income divided by book-equity. Return on assets is net income divided by total assets. Cash flow over assets is net income plus depreciation minus changes in working capital divided by total assets. Gross margin which is revenue minus costs of goods sold divided by total sales. Lastly there is accruals which is the deprecation minus changes in working capital.

$$Profitability = z(z_{gpoa} + z_{roe} + z_{roa} + z_{cfoa} + z_{gmar} + z_{acc}) \tag{7}$$

Growth

Growth uses the same measures of profitability excluding gross margin. But looks at the five-year growth of these profitability measures. For example, taking the gross profit for year five minus the first-year profit value divided by the first-year profit value. This should give you the overall change in profits for a five-year period. Moving each year forward for the entire period (2000-2019). This is done for all of the profitability measures.

$$Growth = z(z_{gpoa(5)} + z_{roe(5)} + z_{roa(5)} + z_{cfoa(5)} + z_{acc(5)} \tag{8}$$

Safety

Safety looks at variables that are associated with stability, low uncertainty and distress costs within a firm. There are four measures associated with safety:

Low beta stocks, which is sorted on the basis of median beta for the monthly period . Low leverage stocks, being leverage levels below the median for the monthly period, leverage calculated as total debt over shareholder's equity. Low bankruptcy risk which uses Altman's Z-score and low return on equity volatility which is the standard deviation of quarterly ROE over the past sixty quarters.

$$Safety = z(z_{bab} + z_{lev} + z_z + z_{evol}) \quad (9)$$

Combining these average scores of profitability, growth and safety will create a quality score which is used to rank stocks from junk to quality.

$$Quality = z(Profitability + Growth + Safety) \quad (10)$$

The Quality minus Junk portfolio construction follows Fama and French (1993) and Asness and Frazzini (2013) by taking the average of quality stock minus the average of junk stocks.

$$QMJ = \frac{1}{2}(\,Quality) - \frac{1}{2}(Junk) \quad (11)$$

3.3 Regression Method

The goal of this analysis created by Fama-Macbeth (1973) is to determine the portfolio factor exposures to the market. This is done by using the combination of a time-series and cross-sectional regression to measure how much of a shares return is explained by a specific factor-thereby determining the appropriate risk premium for that share.

In this case, a cross-sectional regression is performed on each of the variables to show the correlations amongst the factors and to see how well each variable explains returns. The risk factors needed for this regression are SML, HML, UMD, QMJ and the Betas for all these factors.

The first step of this process involves regressing the average (60-month) returns of each stock on each of the identified risk factors. Using a 5-year return period as it coincides with the growth factor and ensures there is sufficient data to be able to determine the factor Betas for each stock over the 2000-2019 period. The following formula is used for n portfolios or asset returns and m factors to calculate the regressions for each n portfolios and for every m risk factor (market risk, SMB, HML, UMD, QMJ):

$$R_{n,t} = \alpha_n + \beta_{(n,F1)}F_{(1,t)} + \beta_{(n,F2)}F_{(2,t)} + \cdots + \beta_{(n,Fm)}F_{(m,t)} + \varepsilon_{(n,t)} \qquad (12)$$

$R_{n,t}$ are the previous 60-month returns averaged for each stock for that specific month starting from the 30/11/2002. $F_{(m,t)}$ represents the listed factors used in the five-factor model. $\beta_{(i,Fm)}$, are the factor exposures which are calculated using multiple time-series regressions on each portfolio return against each risk factor- the results being called $\hat{\beta}$. This is done by simply regressing the X array, being the MKT, SML, HML, UMD and QMJ portfolio values for a 60-month period, against the Y array of the excess returns for a 60-month periods. This provides monthly Beta exposures for each stock in those variables, from the 30/11/2002 – 31/12/2019.The next step is to take the cross-section of returns and to regress the portfolio returns against the new $\hat{\beta}$. This will be done for each period in order to work out the risk premium needed to be compensated for the level of risk exposed by the coefficients estimated in equation 13.

$$R_{i,t} = \gamma_{T,0} + \gamma_{(n,1)}\hat{\beta}_{(i,F1)} + \gamma_{(n,2)}\hat{\beta}_{(i,F2)} + \cdots + \gamma_{(m)}\hat{\beta}_{(i,Fm)} + \varepsilon_{(i)} \qquad (13)$$

The average of the single regression will be found over a period. $E(R_i)$ being the average excess monthly return for each stock. The factor exposures $\hat{\beta}$ stay the same as in equation 14; along with the process of estimating the γ risk premia.

$$E(R_i) = \gamma_0 + \gamma_{(1)}\hat{\beta}_{(i,F1)} + \gamma_{(2)}\hat{\beta}_{(i,F2)} + \cdots + \gamma_{(m)}\hat{\beta}_{(i,Fm)} + \varepsilon_{(i)} \quad (14)$$

This time the Y array is the average excess monthly returns for each stock for a specific month and the X array being each variables Beta exposures calculated previously for the same month. This cross-sectional regression is done for all 60 months of the period resulting in the gamma risk premiums of each variable (MKT, SMB, HML, UMD, QMJ) for each month. If the ε (Error terms) are assumed to be independent and identically distributed, then the average of each γ coefficient is calculated over time T to get the risk premium of five risk factors. This process can be simplified into a simple single regression using the averages of the portfolio returns, which are regressed against each of the m factor exposures. The intercepts, R-squared and T-Stat values are also calculated using the Intercept, RSQ and T.TEST function on the same array. Then the average risk premium for each variable is calculated over the entire period.

Through this Fama-MacBeth regression, the intercepts should be indistinguishable from zero and a positive risk-return trade-off is expected. Any possible adjustments to correct for heteroscedasticity or autocorrelation, Newey-West standard errors are used (IHS EViews, 2014).

Vo (2015) tests the Fama- French three-factor model empirically in the Australian market and uses the Fama-MacBeth Cross-sectional regression (1973) and derived the expectations of the model. These expectations are applied to the Fama-French model. The expectations being the estimated coefficients of alpha should be statistically insignificant from all portfolios. Meaning that the average stock returns are partially captured by the Beta, SMB, HML, CMA and RMW factors.

For instance, Haugen and Baker (1996) find that relatively higher average returns are associated with higher rates of profitability (surrogates of profitability being the profit margins, asset turnovers and returns on assets of firms) and that the higher the average returns of the stocks of firms, the more pronounced profitability figures tend to be. Cohen, Gompers and Vuolteenaho (2002) also exhibit that, after controlling for the book-to-market ratios there is a positive relationship between profitability and average returns.

4. Results

4.1 Portfolio returns

Looking at the following figures 1-5, we see the monthly risk-adjusted returns of the constructed portfolios using the methodology stated previously. The returns of the market factor for the period 2000 to 2019 had the overall highest figure of 7.85% also having the lowest overall return with -5.89%. This is supported when looking at the standard deviation of the market portfolio, which is the highest of all the portfolios, 4.02% as the market is considered to be the most volatile as it reacts to any new information the quickest, according to the efficient market hypothesis. While constructing portfolios based on certain factors do limit the variance in the return distribution over the period, as for the rest of the portfolio factors standard deviation range from 1.16% to 2.16%.

There are spikes and dips in the returns of these portfolios (SMB, HML, UMD, QMJ) but when looking at the average of these returns, the picture becomes a lot clearer. The momentum and quality factor actually have an average positive return with 1.89% and 1.37% respectively. Showing the significance of the momentum and quality style on the JSE. While the size and value factor of SMB and HML both have lesser average returns over the entire time (2000-2019) with 1.07% and 0.56% respectively. Showing that size does generate returns while value not gaining as much ground. All these returns are in excess of the risk-free rate, showing that these portfolios constructed on the premises of the previous sections methodology showed excess returns although nothing extraordinary on the Johannesburg Stock Exchange.

Considering the average return with the distributional properties of each of the portfolios, momentum is best performing portfolio. Which is in line with the current South African literature stating that momentum has been outperforming other variables on the JSE, although this studying showing that it is not abnormally higher than the quality factor, which is the main purpose of the study. Whether quality has any significance as a strategy on the JSE.

Table 1 – Overall Portfolio Analysis

	MKT	SMB	HML	UMD	QMJ
MAX	7.85%	2.86%	2.12%	3.95%	2.89%
Average	0.89%	1.07%	0.56%	1.89%	1.37%
MIN	-5.89%	-2.95%	-1.87%	-3.45%	-2.24%
Std Dev	4.02%	1.28%	1.16%	2.16%	1.68%

Constructed using the portfolio methodology of Fama-French (1993) and Asness et.al (2018), using the government monthly risk-free rate of the ten-year bond and the All Share Index monthly returns as the market proxy. Looking at the average yearly returns of all firms shares for the time from 2000-2019. Each factor rebalanced and adjusted every year for the period. Showing the maximum and minimum return over the sample period for each factor. The average return and standard deviation of the portfolios are included as well. Figures 1-5 below are graphs showing a graphical representation of Table 1. These graphs are labelled with percentage returns on the y-axis and time on the x-axis, using period intervals of a year.

Figure 1 – Market Factor portfolio returns (2000 – 2019)

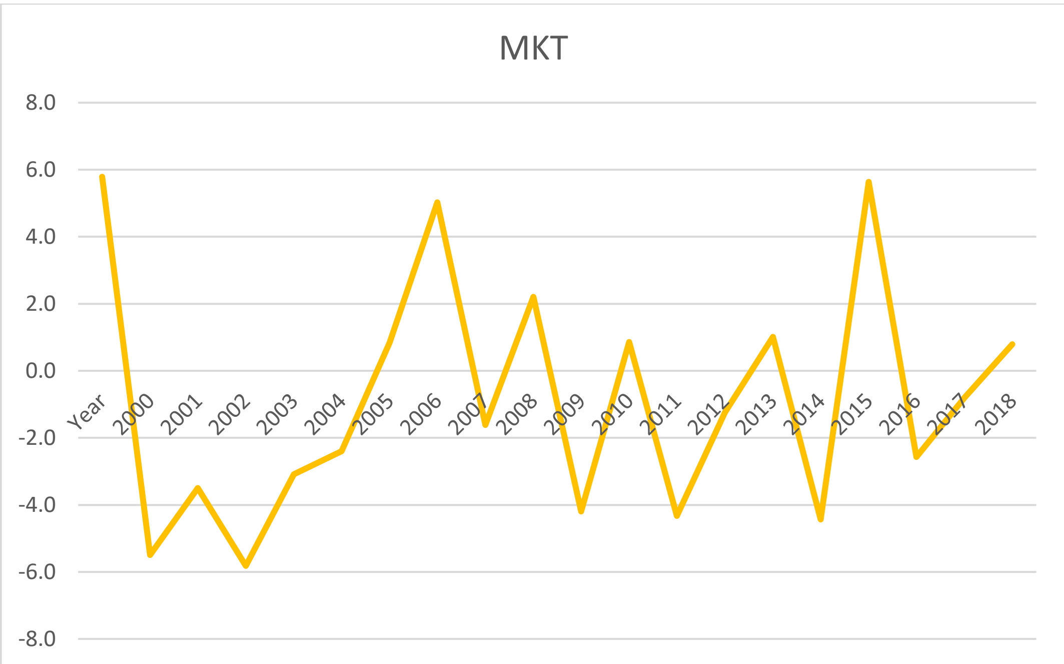


Figure 2 - Size factor portfolio returns (2000 – 2019)

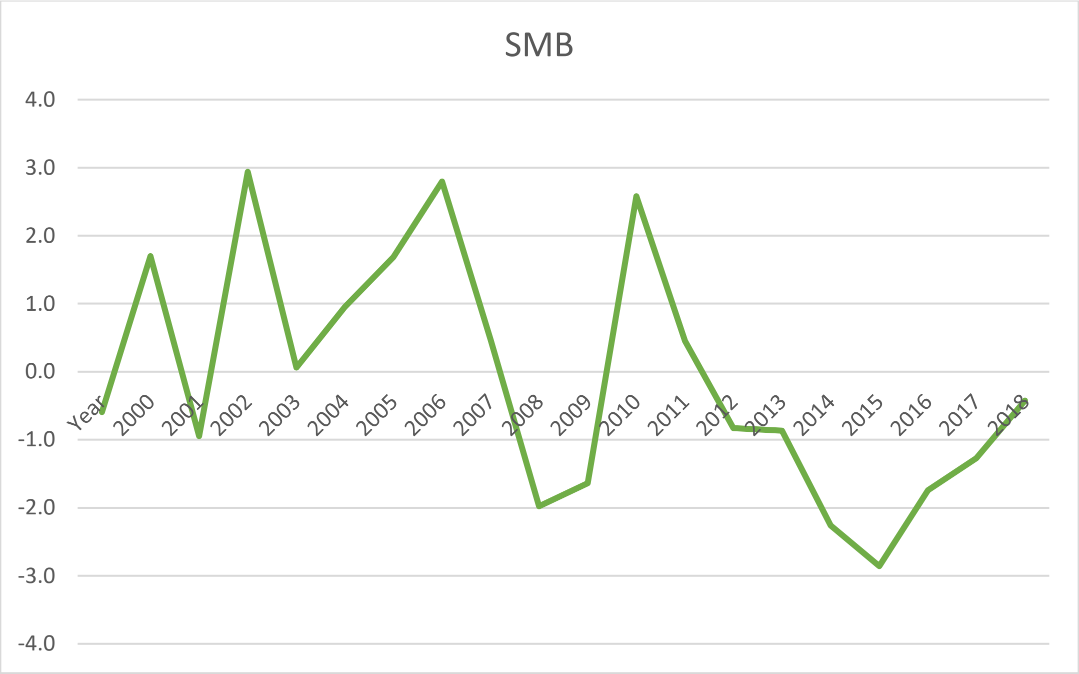


Figure 3 – Value Factor portfolio returns (2000 – 2019)

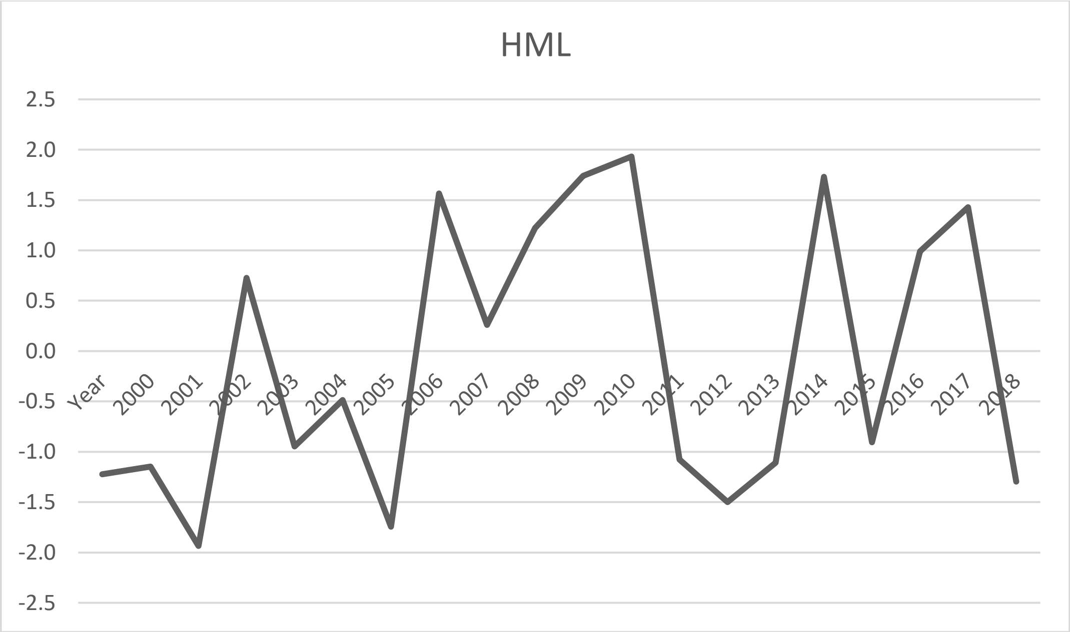


Figure 4 – Momentum factor portfolio returns (2000 - 2019)

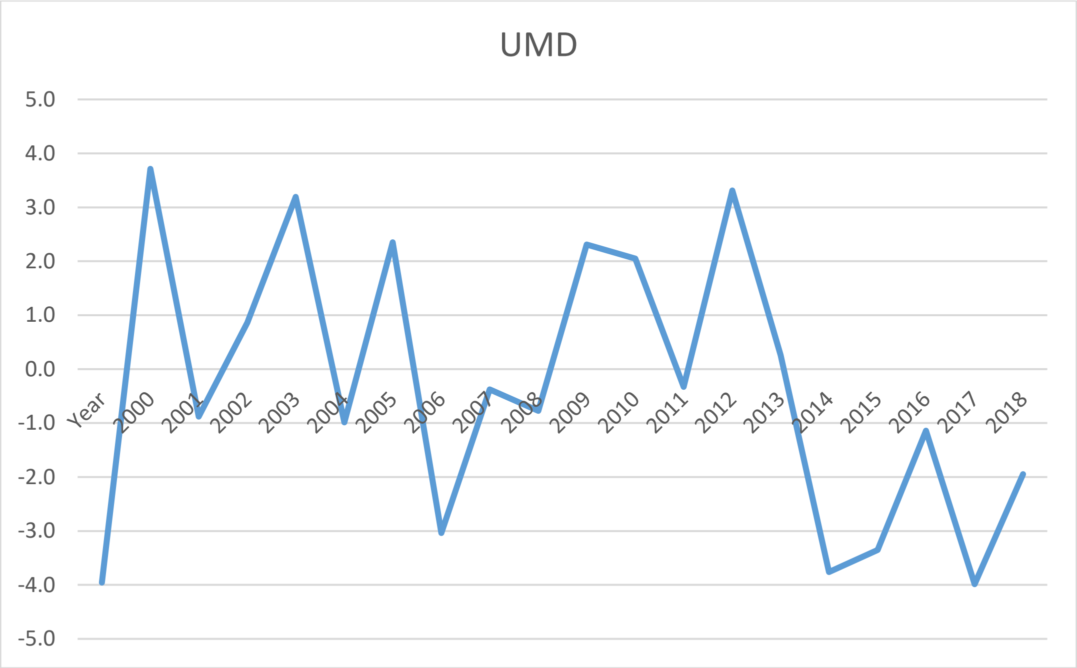
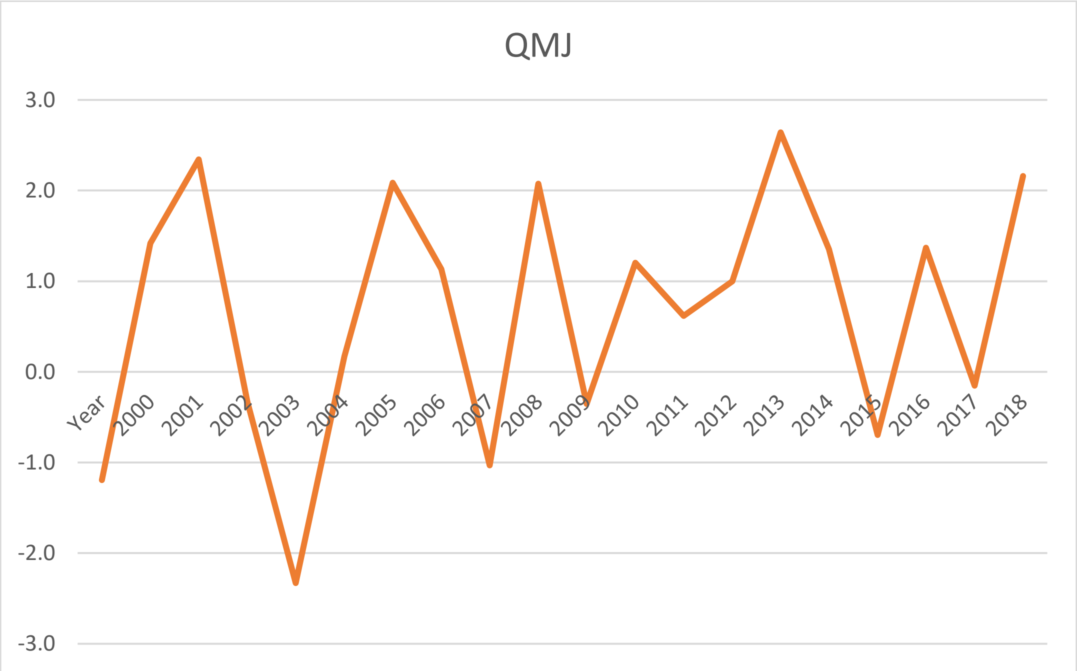


Figure 5 – Quality factor portfolio returns (2000 – 2019)



4.2 Correlation of Returns

<u>Table 2 – Portfolio Returns correlations</u>

Each factors average portfolio returns on one another for the period (2000-2019) to give the correlation coefficients of each combination possible.

	MKT	*SMB*	*HML*	*UMD*	*QMJ*
MKT	1				
SMB	0.0032	1			
HML	0.0975	-0.3567	1		
UMD	0.1134	-0.1574	0.05436	1	
QMJ	0.2875	-0.1689	-0.03456	0.1904	1

Table 2 looks at the correlations between all the constructed portfolios to see the relationship between each factor, the explanatory power collaborated with each other factor. As seen in the table, the lowest correlation coefficient of 0.0032 is between the market and size factors. This is mainly due to the fact the JSE ALSI Index, although consisting of majority of the market cap on the JSE, there are mostly small cap firms and only a few large cap firms. Those large cap companies do however own majority of the market capitalization of the JSE. The size factor looks at the size of the firm through its market cap and therefore the market factor is a completely difference picture, due to the large companies dominating with their huge market ownership.

The strongest correlation coefficient of 0.2875 is between the quality and the market factor, which intuitively makes sense as the quality principle applies to the entire market because as long as the market consists of at least n number firms, there will be quality and junk amongst those firms.

Note the correlation coefficient of 0.1904 between momentum and quality, which strongly supports the literature of Novy-Marx (2012) saying that quality and momentum complement one another. Following the reasoning that in the quality score, the consistent growth of the firm over time is closely linked to the principle of the momentum factor construction method.

4.3 Fama-MacBeth Regression

Table 3 – Fama-MacBeth Regression analysis results

Constructed using the methodology set out in the paper, first by running a time-series regression and then a cross-sectional regression to produce the risk premia for each variable on a monthly basis for the lagged period of five years from the start of 2000 therefore showing results for 2000-2019. Then taking the average of the entire period for each factor, showing results for the risk premium, intercept value, R-squared value, and t-statistic.

	RISK PREMIA	ALPHA	RSQ	ADJ RSQ	TSTAT
MARKET	0.7864%	0.003578	11.5254%	1.0678%	7.1276
SMB	0.0376%	0.008674	17.1618%	12.9636%	12.5678
HML	0.1567%	0.008764	15.3865%	10.8564%	24.6781
UMD	0.7893%	0.007823	18.8973%	14.9634%	15.7346
QMJ	0.4528%	0.005694	17.8234%	13.8345%	13.7541

Table 3 shows the results of regressing the average excess monthly returns against each variables' monthly betas. This gives us the gammas of the Fama-MacBeth regression, which is the premium captured by each variable for the risk in each individual stock. This table provides the average results for each factor for the entire period (2000-2019). Here we notice that the market factor captures the second highest risk premia of 0.7864% but still surprising that the market factor of beta designed by CAPM has captured most of the returns of the stocks on a monthly rebalancing basis from 2000-2019. This could be related to the strength of the ALSI continuously outperforming any market or investment portfolio strategy.

Notably, although still small in the grand scheme of actual risk premia, the quality factor is the second best, which bodes well for the research of this paper. Not only that but the second highest R-squared and adjusted R-squared value, 17.82% and 13.83% respectively, showing that the quality factor designed by Asness, Frazzini and Pedersen, (2018) does explain a relatively decent amount of the returns of the stock on the Johannesburg Stock Exchange. Which is still worth noting as far as statistical validation goes, as it still has viable impact within the South African market as a strategy to implement.

All the intercepts for each variable are quite small (nothing exceeding 0.01) showing that majority of the stock returns are captured by the risk premium. The highest factor in terms of risk and return is momentum, with 0.7893%, confirms the fact that momentum is a reliable and proven strategy to practice with a high R-squared value of 18.89% as well. Most of the top-performing stocks have been consistent with the momentum principle of continual gains and then reversing.

An astonishing result would be that the size factor, with the lowest average risk premia for the period of 0.03% has a R-squared value of 17.16%. Showing that although it only captures a small portion of risk for return on the pool of stock, it has the most explanatory power and also statistically significant. Using the size factor is therefore the most reliable according to the Fama-MacBeth regression analysis within the context of the study. The value factor of HML being the lowest ranked in terms of significance, which is peculiar knowing how closely this value strategy is related with the concept of quality.

The quality variable sorted on size has mixed results from the study, not being the strongest in capturing returns. This could be attributed to, when looking at the individual factors of size and quality, that the size sorting decreased the strength of the quality constructed variable. Having decent explanatory power compared to the sample.

These results of the analysis performed on the constructed variables according to the methodology, are still important in showing that quality is a statistically viable strategy on the JSE, showing that the combination of profitability, growth, and safety according to Asness, Frazzini and Pedersen, (2018) does separate firms from quality to junk, contributing to the success of the Quality minus Junk (QMJ) portfolio strategy.

Proving that the QMJ factor does capture returns on the JSE, having explanatory power in some capacity. This can further support this by constructing quality portfolios in an adjusted South African market, taking into consideration the constituents and history of the market. As according to the literature, momentum has been proven to capture risk, while the size and value variable are on the fence on significance and whether the SA market is able to replicate the size effect or value effect in the market.

4.4 Feasibility of Models

Table 4 – Correlations of Risk premia

The average risk premium for each variable for the entire period (2002-2019) on each factor,

	MKT	*SMB*	*HML*	*UMD*	*QMJ*
MKT	1				
SMB	0.5012	1			
HML	-0.4637	-0.4398	1		
UMD	-0.0324	-0.3267	0.5578	1	
QMJ	0.0207	-0.0765	0.2143	0.5423	1

to show the correlation coefficients of each combination possible.

Finally looking at Table 4, we see the viability of the different factors working together with one another by creating a correlation matrix using the risk premia. Once again, as seen in the previous correlation matrix of portfolio returns, the QMJ and UMD factors are strongly correlated with 0.5423 as there is a possible link between long run performing stocks and the quality of the firms. While the reversal takes place when the market enters into an economic growth phase thereby assisting low-quality small firms with more growth prospects for that period.

Now to focus on the relationship of each factor, starting with the market and size, a correlation value of 0.5012 shows that they do move together in the same direction but in only half the move for every movement up or down. The value factor of HML does well collaborating with size and the market factor with correlations of -0.4398 and -0.4637. Thus, in terms of the overall results and diversification benefits against the market and size, it is a strong factor to use, this coupled with the previous statement shows the viability of the Fama-French 3 factor model on the South African market. Quality also shows that it is slightly correlated with value with a value of 0.2143 due to the link between quality and value stocks while junk being linked to growth stocks.

4.5 Robustness

One constraint could be the fact that in the real world, investors are not always able to short sell, therefore only being able to hold long high-quality stocks and to see if that still generates significant returns. How often each factor is rebalanced is another problem as time is the biggest driver of returns and in this theoretical approach, the transaction costs are ignored for rebalancing every month. Finally, what is the correct definition of quality within the real of the stock market? No-one can truly answer that, so besides the comprehensive quality measure used in this study, there could be an even better one in future studies.

5. Conclusion

The QMJ factor did prove to provide risk-adjusted returns in the portfolio construction step as well as showing through the Fama-MacBeth regression that there is a risk premium associated with the quality identified characteristics of profitability, growth and safety and all the multiple accounting measures used to construct each. This coming with a fairly significant significance of a decent positive return with a diversification benefit against the market and other common variables. All the other variables did prove to have significance on the market and capturing return but less than the quality factor. Momentum did show to provide good results as well, which concurs with the current South African literature on that factor. Even collaborating with quality quite well, which could aim to the possibility of a market, momentum and quality model, that future studies could test the viability of, on the JSE.

The goal of this study was to recreate the Asness, Frazzini and Pedersen, (2018) study on the South African market, this was done in a similar manner in terms of the quality factor construction but differed in the analysis method. However, the results still came out strong in favour of sorting firms according to this method and seeking out the quality within the JSE, to unlock the underlying value within these shares and to prove what is a characteristic investors are willing to pay a premium for but also earn a higher excess return than predicted by trusting in quality and all the future potential it holds in South Africa.

Viewing all these possibilities there are many ways that quality could have reflected a better performance, this could be done in future studies on the South African market. Factor investing is becoming more and more prominent in today's literature, a factor zoo of where any fundamental figure can be tested to see if it has explanatory power but only the ones with true underlying quality can actually prove to be significant in a real-world application. That is why it is pertinent to understand more than ever, what drives returns? Showing that that the quality aspect has held form for many years and this method of quality does provide returns for the risk taken on the Johannesburg Stock Exchange. From the quality minus junk portfolio results to the regression results, quality does have a place not just in asset pricing but in finance literature itself.

6. References

Asness, C., Frazzini, A. and Pedersen, L. (2018). Quality minus junk. *Review of Accounting Studies*, 24(1), pp.34-112.

Asness, C., Frazzini, A., Israel, R. and Moskowitz, T. (2015). Fact, Fiction, and Value Investing. *SSRN Electronic Journal*.

Basiewicz, P.G. and Auret, C.J. (2009). Another look at the cross-section of average returns on the JSE. *Investment Analysts Journal*, 38(69), pp.23-38.

Basiewicz, P.G., & Auret, C.J., (2010). Feasibility of the Fama and French three factor model in explaining returns on the JSE, *Investment Analysts Journal*, *39(71)*, 13-25, https://www.tandfonline.com/doi/abs/10.1080/10293523.2010.11082516

Black, F, Michael C. Jensen, and Myron Scholes. (1972) "The Capital Asset Pricing Model: Some Empirical Tests." In *Studies in the Theory of Capital Markets*, edited by M. C. Jensen. New York: Praeger

Black, F. (1972). Capital Market Equilibrium with Restricted Borrowing. *The Journal of Business,45*(3), 444. doi:10.1086/295472

Boamah, N. A. (2015). Robustness of the Carhart four-factor and the Fama-French three-factor models on the South African stock market. *Review of Accounting and Finance, 14*(4), 413-430. doi:10.1108/raf-01-2015-0009

Charteris, A. and Chipunza, K., 2021. Stock prices and dividends: A South African perspective. [online]Available.at:<https://www.tandfonline.com/doi/abs/10.1080/10293523.2019.1682786> [Accessed 31 May 2021].

Chen, L., Novy-Marx, R. and Zhang, L. (2011). An Alternative Three-Factor Model. *SSRN Electronic Journal*.

Fama, E. F., & French, K. R. (1992). The Cross-Section of Expected Stock Returns. *The Journal of Finance, 47*(2), 427-465. doi:10.1111/j.1540-6261.1992.tb04398.x

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics, 33*(1), 3-56. doi:10.1016/0304-405x(93)90023-5

Fama, E. F., and French, K. R. (2006). Profitability, investment and average returns. *Journal of Financial Economics*, 82(3),491-518.doi-10.1016/j.jfineco.2005.09.009

Fama, E. F., and French, K. R. 2008. Average Returns, B/M, and Share Issues. The Journal of Finance, 63(6), pp.2971-2995.

Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, *116*(1), 1-22. doi:10.1016/j.jfineco.2014.10.010

Fama, E. F., & French, K. R. (2017). International tests of a five-factor asset pricing model. *Journal of Financial Economics*, *123*(3), 441-463. doi:10.1016/j.jfineco.2016.11.004

Fama, E. F., & Macbeth, J. D. (1973). Risk, Return, and Equilibrium: Empirical Tests. *Journal of Political Economy*, *81*(3), 607-636. doi:10.1086/26006

Flint, E., Seymour, A. and Chikurunhe, F. (2016). Factor Investing in South Africa. *SSRN Electronic Journal*.

Graham, B., Dodd, D. and Buffett, W. (2009). *Security analysis*. New York: McGraw-Hill.

IHS Eviews. (2014, June 30). *Fama-Macbeth Two-Step Regression* [PDF file]. http://didattica.unibocconi.it/mypage/dwload.php?nomefile=fama-macbeth20141115121157.pdf

Lowe, J. (1994). *Benjamin Graham on value investing*. [Chicago, Ill.]: Dearborn Financial Pub.

Markowitz, H. (1959). Portfolio Selection: Efficient Diversification of Investments. *OR*, 10(4), p.253. doi-10.2307/3006625

Mayers, D. (1972). Nonmarketable Assets and the Determination of Capital Asset Prices in the Absence of a Riskless Asset. *The Journal of Business*, *46*(2), 258. doi:10.1086/295528

Merton, R. (1973). An Intertemporal Capital Asset Pricing Model. *Econometrica*, 41(5).doi-10.2307/1913811

Novy-Marx, R. (2010). The Other Side of Value: Good Growth and the Gross Profitability Premium. doi:10.3386/w15940

Novy-Marx, R. (2012). Quality Investing. *Graduate School of Business at the University of Rochester, New York*.

Novy-Marx, R. (2013). The Quality Dimension of Value Investing. *In-text: (Novy-Marx, 2012) Your Bibliography: Novy-Marx, R. (2012). Quality Investing. Graduate School of Business at the University of Rochester, New York*.

Page, D., & Auret, C. J. (2014). A time-series approach to testing cash flow beta on the JSE. *Investment Analysts Journal*, 43(80): 59-69.

Page, D., Britten, J., & Auret, C. J. (2013). Momentum and Liquidity on the Johannesburg Stock Exchange. *International Journal of Economics and Finance Studies*, 5(1): 56-73.

Page, D., Britten, J. and Auret, C. (2016). Idiosyncratic risk and anomaly persistence on the Johannesburg Stock Exchange (JSE). *Investment Analysts Journal*, 45(1), pp.31-46.

Rensburg, P. and Robertson, M. (2003). Style characteristics and the cross-section of JSE returns. *Investment Analysts Journal*, 32(57), pp.7-15.

Ross, S. A. (1976). The arbitrage theory of capital asset pricing. *Journal of Economic Theory, 13*(3), 341-360. doi:10.1016/0022-0531(76)90046-6

Rouwenhorst, G. (1999). Local Return Factors and Emerging Stock Markets. *Journal of Finance*, 54(4): 1439-16464.

Sharpe, W. (1964). CAPITAL ASSET PRICES: A THEORY OF MARKET EQUILIBRIUM UNDER CONDITIONS OF RISK*. *The Journal of Finance*, 19(3),doi-10.1111/j.1540-6261.1964.tb02865.x

Strugnell, D., Gilbert, E., & Kruger, R. (2012). Beta, size and value effects on the JSE 1994-2007. *Investment Analysts Journal*, 40(74): 1-17.

van Rensburg, P. (2002). Market Segmentation on the Johannesburg Stock Exchange II. *Journal for Studies in Econometrics and Economics*, 26(1): 83 - 99.

Wahal, S., & Yavuz, M. D. (2013). Style investing, comovements and return predictability. *Journal of Financial Economics*, 107(1): 136-154.

Ward, M., & Muller, C. (2012). Empirical Testing of the CAPM on the JSE. *Investment Analysts Journal*, 2012(76): 1-12.