TECHNISCHE UNIVERSITÄT WIEN Vienna | Austria

Master Thesis

Characteristics of companies with high-quality: Europe vs America

carried out for the purpose of obtaining the degree of Master of Science (MSc or Dipl.-Ing. or DI), submitted at TU Wien, Faculty of Mechanical and Industrial Engineering, by

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Vienna, June 2021

Affidavit

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Vienna, June 2021 *Sergio R. Lopez Solis*

Acknowledgements

I would like to especially thank my thesis adviser Prof. Dr. W. Aussenegg for his guidance, help and constant support during the whole research work.

I also want to say thank you to my wife, children, and parents. Who always remind me what is really important in life and thank all my friends and study colleagues for the great time.

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Abstract

In the asset pricing literature, authors propose different quality variables that should characterize companies. Their results are aimed to represent the importance of quality on the stock performance. Mostly, the 3-factor model of Fama-French is used to control the impact of other variables such as market, size and value.

This study asks whether the high-quality companies perform better that low-quality companies and looks for differences between Europe and the USA in regard to quality.

For that purpose, stock returns and accounting data of European and American companies have been gathered. Then they have been sorted by their quality-values, and by using the 3-factor model the performance of low and high-quality companies have been compared.

The results suggest that companies with high value of gross profit-to-assets, operating profitability and quality score tend to perform better than those with low values. Moreover, pattern differences between quality in Europe and the USA are observed when companies are sorted by enterprise-level operating profitability.

Kurzfassung

Studien aus der „Asset Pricing“ Literatur schlagen unterschiedliche Variablen vor, die die Qualität von Unternehmen charakterisieren sollen. Darüber hinaus zeigen sie, dass die sogenannten Qualitätsvariablen einen Zusammenhang mit der Aktienperformance eines Unternehmens haben. Die Studien basieren auf dem von Fama und French entwickelten sogenannten Dreifaktorenmodell. Dadurch werden andere Faktoren wie Marktrisiko, Größe des Unternehmens und Buchwert-Kurs-Verhältnis von Einfluss auf die Kursentwicklung kontrolliert. Die vorliegende Masterarbeit untersucht auf Basis dieser Faktoren und Definitionen, ob Unternehmen mit höherer Qualität eine bessere Aktienperformance als Unternehmen mit geringerer Qualität haben. Ferner ist zu prüfen, ob es Unterschiede in Bezug auf die Qualität zwischen EU- und US-Unternehmen gibt. Dafür wurden die Aktienkurse und Buchhaltungsdaten von EU- und US-Unternehmen gesammelt. Mit diesen Informationen wurden die Unternehmen nach bestimmten Qualitätsvariablen sortiert und mittels des Dreifaktorenmodells die Aktienperformance von Unternehmen mit hoher und geringer Qualität vergleichen. Die Ergebnisse zeigen, dass Unternehmen mit hoher Qualität eine bessere Performance als jene mit geringerer Qualität haben, wenn sie nach Qualitätvariablen „gross profit-to-assets“, „operating profitability“ und „quality score“ analysiert werden. Außerdem weisen EU- und US-Unternehmen einige Unterschiede auf, wenn sie nach „enterprise-level operating profitability“ analysiert werden.

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List of Abbreviations and Symbols

A .... Total assets
Adm .... Selling, general, and administrative expenses
ACC .... Accruals
BE .... Book equity
CAPM .... Capital Asset Pricing Model
CF .... Cash flow
COGS .... Cost of goods sold
EVOL .... Earnings volatility
GPA .... Gross profit-to-assets
GPOA .... gross profit over assets
GMAR .... gross margin
HML .... High-minus-low portfolio
Inv .... Investments
Lev .... Leverage
LB .... Low beta
O .... Ohlson's score
OP .... Operating profitability
QS .... Quality score
REV .... Revenues
ROE .... Return on equity
ROA .... Return on assets
RVOL .... Return on equity volatility
Z .... Altman's Score

1 Introduction

Since many decades ago, different investment strategies are being tested to find the one which can provide the best prognose of the future performance of companies. The key problem here is to determine the company characteristics that are best correlated with their stock return or better say, which characteristics influence at most the financial performance of a company. Among others, the quality strategies seem to be a very promising one and some of the most renown financial institutions have used them as fundament for the development of financial products (e.g., MSCI Quality Indices).

One of the definitions of quality given by the Oxford dictionary claims that quality refers to "the standard of something when it is compared to other things like it; how good or bad something is". In this regard, within the asset-pricing literature a wide variety of characteristics or quality variables have been proposed, that indeed allow the comparison between companies. They are based mostly in accounting information and might be used to evaluate the financial health in companies. Of course, each author offers a different perspective about quality resulting in variables that may be simple ratios (e.g., Investment and gross profit-to-assets) or complex quality scores (Asness et al., 2019).

Importantly, it seems to be a common procedure to measure how good or bad a quality variable might be: calculating their impact on the stock return. There are many studies which objective is to prove statistically that a certain quality variable explains in some extent the stock return. Therefore, the selection of proper quality variables is the first problem to be addressed. Nonetheless, this study does not attempt to corroborate whether the quality variables proposed by other authors are truly related with the stock return. The sources for this study have been renown financial journals and their results have been tested by a strict peer-review. Instead, a wide literature review will be made to identify the best possible quality variables, dismissing at the same time those that have been proved to have no impact on the stock returns.

Furthermore, portfolios based on quality will be formed to measure their performance, or better said to describe on which manner the quality variables and the stock returns are related.

This will require the design of an adequate statistical test that facilitate to compare the significances between multiple quality variables on the stock return.

Moreover, this study has been designed to provide a deeper insight of the quality variables by testing their results in different contexts. The European and the American are indeed both developed markets but could exist different perceptions about quality that may drive to different valuations in the stock return. In addition, the contrasting of results obtained separately from European and American companies may reaffirm the conclusions of previous studies and the idea that the quality characteristics should be the same, regardless of the region where they are measured (e.g., Asness et al., 2019). On the contrary, differences in quality results may open the possibility to new interpretations about the quality in companies.

The master thesis will be organized as follows. Chapter 2 address the literature review of the quality variables within the asset-pricing theory. The principal purpose is the identification of an adequate set of quality variables as well as the examination of their fundaments and economic explanations about their obtained values. Moreover, the asset-pricing literature describes the instruments that should be applied for the calculation and comparison of the quality variables, i.e., the factor pricing models (Cochrane, 2009). Then, in chapter 3 the procedure for the calculation of the selected quality variables will be described in detail. Also, a factor pricing model will be defined for the evaluation of the quality variables in a sample, that means, it will be determined in what manner the impact of the quality variables on the stock returns can be measured. In chapter 4 the characteristics and limitations of the sample and the data used for this study will be described. In chapter 5 the results related to quality, including their impact on the stock return will be presented. As mentioned before, the analysis will take into account different contexts. Finally, in chapter 6, the conclusions will summarize the study, explaining the results by using the economic fundaments presented in the literature review. Importantly, it will be exposed whether the results are affected by the market where the companies list, i.e., whether the results applied to European companies are distinct from those applied to American companies. Moreover, proposals for future research will be offered.

2 Considerations about quality in finance and accounting literature

2.1 Quality Variables and The Expected Stock Return

Defining Quality Variables. As it will be exposed below, the asset pricing theory usually has as ultimate purpose the construction of the best investment strategies in terms of their return performance. Thus, some strategies are designed to find cheap companies, other are aimed to identify companies with growth potential and other intent to differentiate companies in accordance with certain quality characteristics. Moreover, the theories are based on economic fundaments and variables, that may provide an important framework for the realization of this master thesis.

It is interesting that quality in companies does not have a clear and "universal accepted definition" (Novy-Marx, 2014, p. 1). However, strategies are founded on certain quality characteristics that may vary with the perspective of academics or the experience of investors that have developed them throughout the years. There are thus some characteristics of quality that can be gathered from the literature with the intention of constructing a general definition that may help at least to distinguish them from other type of variables.

Already in the 70s, Haugen (1979), applying the Standard & Poor's quality rankings, has intended to prove a relation with the market risk beta. The results suggest that high quality companies tend to be less risky, and that the risk is positively related with their realized stock returns. Furthermore, Haugen has offered also a possible explanation for the relation between risk and return, failing nonetheless to explain the causality that connect quality and risk. The discussion concerning the determinants and consequences of quality has evolved similarly to its definition along the time and will deserve special attention up ahead.

In a similar way, some authors have considered that there are certain factors that characteristically have been thought "as important determinants for investors' perception of firm quality" (Kyosev et al., 2020, p. 2), and that "quality factors show a considerable dispersion of definitions" (Kyosev et al., 2020, p. 24). Furthermore, it was disclosed in Kyosev et al. (2020), that the variable selection has been conditioned by "particular importance by key academic studies or practitioners" (Kyosev et al., 2020, p. 6). Finally, they have added that only quality variables which predict future earnings growth have predictive power of the future stock return.

Asness et al. (2019) have addressed the impact of quality variables on the stock price. In this way, an original approach has been applied, modelling quality variables directly with the stock price instead of the expected return as in most of related studies – the authors indeed criticize this tendence in the literature. In similar way to other definitions, the authors refer the quality as "characteristics that investors should willing to pay a higher price for, everything else equal". Importantly, that quality stocks are those with significant risk-adjusted returns and with lower exposures to market, size, value and momentum.

Novy-Marx (2013b) has advocated for the inclusion of quality measurements in the valuation of stocks. In this regard, quality strategies are typically those that intend to identify productive assets. That means also that quality strategies may be used to enhance the performance of other strategies while reducing the volatility of the asset portfolios. Moreover, the author has proved the efficacy of the compounded strategies by combining value and quality strategies.

Sloan (1996) has understood quality as the condition that performance variables must accomplish to provide with reliable financial information about certain company. Specifically, he has focused on the earnings performance and the extent of its reliability. In this regard, he has argued that earnings performance based on accruals is less persistent than that based on cash-flows. Thus, the accruals seem to be a determinant in the quality of the earnings measurements.

Dechow et al. (2010) have defined quality variables by addressing the earnings quality[1]. Thus, based on the earnings quality definition, a slight definition of high-quality variables can be formulated: Quality variables are aimed to "provide more information about the features of a firm's financial performance that are relevant to a specific decision made by a decision-

[1] The earnings quality has been considered as a quality variable by some studies e.g., Chan et al. (2006), Novy-Marx (2014), and Asness et al. (2019).

maker" (Dechow et al., 2010, p. 344). Two observations can be made about that sentence. Firstly, it seems practical and logical to evaluate the financial performance of companies by using the financial statement disclosed regularly by the investors. Moreover, this might be useful for this study, since the quality variables can be obtained relatively easily from companies that trade on the stock market. Secondly, the kind of decisions referred by the sentence may be assumed as an investment decision. Thus, that align itself with a common methodological characteristic founded in every reviewed study: the demonstration that a certain quality variable can predict a company's stock return.

Table 1. Definition of quality by authors.

Author	Quality definitions
Haugen (1979)	Quality companies tend to be less risky The higher the risk, the higher the realized stock return
Kyosev et al. (2020)	Quality definition is determined in accordance with the investor's perspective of quality Some quality variables have predictive power of future stock returns
Asness et al. (2019)	Quality are those characteristics that convince an investor to pay more for a stock High risk-adjusted returns Low exposure to market, size, value and momentum
Novy-Marx (2013b)	Quality characterizes profitable assets
Sloan (1996)	Quality is an attribute of variables that provide reliable information
Dechow et al. (2010)	Quality variables provide relevant information in investment decisions

Despite, it does not seem to be possible to propose a definition of quality variables, there are two common characteristics that must be remarked. Firstly, it has become manifest that a

reasonable way to prove the relevance of a quality variable is by measuring their connection with a performance variable, which in the context of the asset pricing theory, is usually the stock return. This may enhance the reliability of the quality variables, since the stock return is a quantitative measurement of company's performance that has been widely used in investment-decision process. Secondly, another observable characteristic of quality variables is that they are accounting-based, and so the data can be relatively easy to access in companies that disclose the information about their business. (e.g., companies that trade in stock exchanges).
Finally, and most importantly, quality stocks tend to have high risk-adjusted returns as well as low exposure to market, size, value and momentum. The exposures can be determined by applying multifactor models, that will be described later.

Investment Strategies. Even when it results obvious that the central point of the literature review turns around the quality strategies and their related quality variables, it may be insightful to describe and explain other related investment strategies. In fact, given the variety of strategies, it may result easy to confuse their fundaments and characteristics, since all of them are aimed to enhance the investments profitability. In addition, the contraposition of quality strategies with other well-known strategies may facilitate the adequate comprehension of the quality, and so delimitate properly the scope of the investigation.[2]

Value & Growth. Fama & French (1992) based on empirical results have proposed a three-factor model that should explain, to a large extent, the cross section of the expected return. This model includes among others the variable book-to-market equity (BE/ME), also known as the value factor.

Before Fama & French (1992) introduce their model, they explain that the market beta of Sharpe, Lintner and Black model was considered as the fundamental variable that should predict the stock expected return. Thus, the market beta should "suffice to describe the cross-section of expected return" (Fama & French, 1992, p. 427). Nonetheless, their results had suggested that the expected returns are influenced by other factors such as size and BE/ME (value).

Fama & French (1992), have shown that value stocks, characterized by high BE/ME outperform growth stocks, characterized by low BE/ME. This anomaly that models based only

[2] Similarly, Chan et al. (2004) has contrasted value and growth strategies.

on beta cannot explain, has been referred to as value premium (Chan et al., 2004). Moreover, Fama & French (1992) have shown evidence that beta has actually not performed well during the period 1963 and 1990, failing to explain the expected return. Thus, they have argued that "size and value capture the cross-sectional variation in average stock return" (Fama & French, 1992, p. 445).

Finally, Fama & French (1992) have also referred about other proposed factors, like for example leverage and earnings. Their results indicate that the effect of such factors on the expected return seem to be contained by size and value.

A consequence of the study of Fama & French (1992) was a wide discussion about value and growth strategies (Chan et al., 2004). Thus, Chan et al. (2004) have aimed to summarize the principal investigations, pointing out the most important results in the matter as well as the most plausible explanations for the value premium. They explain that the development of value strategies has emerged from the perception that there could be companies being undervalued in the stock market, or put it another way, companies having a lower stock price that they actually deserve[3]. Therefore, undervalued stocks or rather value stocks, are usually characterized by having high book-to-market equity ratio (BE/ME), high earnings-to-price ratio (E/P) or high cash-flow-to-price ratio (CF/P). On the contrary, growth stocks, despite of being identified using the same variables for value stocks, exhibit low values for all the mentioned ratios, i.e., low BE/ME, low E/P or low CF/P, being the driving idea of the growth strategies the identification of companies with growth potential.

In further studies, Fama & French (2012), with the intention of testing the robustness of their three-factor model, have expanded the sample to international scope, including developed markets such as USA, Europe, Japan and Asia Pacific. Moreover, the impact of the momentum on the model, as an additional factor, has been analysed as well. The momentum characterises companies that achieve high stock returns and so investors expect they will maintain this performance inertially.

[3] A similar definition of value was given by Novy-Marx (2013a) years later, affirming that value strategies are aimed to buy "inexpensive assets by financing the purchase selling expensive assets".

Their results suggest that there exists a value premium in average returns. Thus, value stocks perform better than growth stocks. Likewise, the momentum factor seems to be determinant too, and “companies which in the past have done well continue to do well” (Fama & French, 2012, p. 457). Furthermore, the results confirm that the size of the company may be meaningful, and consequently the smaller the company, the larger the value premium.

The results have also indicated that the 3-Factor model should be adjusted to regional scale: global models, i.e., models using factors calculated merging global data should not be used “in applications to explain regional portfolio returns” (Fama & French, 2012, p. 471). When a particular region was analysed, the model with factors adjusted by region has demonstrated to explain better the variance of expected returns than the model using global factors.

Quality & Value. Novy-Marx (2013b) has described some attributes of quality strategies, analyzing its performance firstly separately and then jointly with value strategies. His results have shown that quality strategies achieve to buy high-quality assets, but nonetheless despite they are traded usually at premium prices (expensive). This weakness of the quality strategies improves however if they are combined with value strategies, which are aimed to buy assets at bargain prices, despite of their quality. Thus, combined strategies can “help traditional value investors distinguish bargain stocks (i.e., those that are undervalued) from value traps (i.e., those that are cheap for good reasons)” (Novy-Marx, 2013b, p. 16). Quality strategies actually “tilt toward growth stocks” (Novy-Marx, 2013b, p. 7). Consequently, quality strategies can be used to hedge the exposure of value strategies, and so this perfect matching between strategies could be interpreted as quality strategies representing another facet of the value.

Defensive Strategies. Novy-Marx (2016) has argued that defensive strategies are characterized by the preference for low-risk assets or rather for assets with low market beta and low volatility. These strategies have emerged in an environment of high volatility and price decline tendency, that have caused investors to adopt measures to deal with the insecurity. The author has recommended special attention to this anomaly[4], rejecting that the positive performance of the defensive strategy can be explained by the exposure to size and value: “The interest defensive strategies have received in both academia and on Wall Street have led some to call for raising them into the canon of the most important market anomalies” (Novy-Marx, 2016, p. 1). Instead,

[4] Referred to the 3-factor model.

he has attributed the performance to their tendency to profitability, a factor which, despite other studies indicating their adequacy, at that moment was not yet included by the multifactor model of Fama & French. Nonetheless, his results have proved, that the profitability can be considered as "the most significant predictor of low volatility" (Novy-Marx, 2016, p. 2).

Table 2. Quality and other strategies.

Strategy	Characteristics
Value	Search for undervalued stocks High BE/ME, high E/P, high CF/P Outperform growth strategy (value premium) Together with size explain the expected return Can be improved (hedged) by quality strategy
Growth	Search for stock with potential for growth Low BE/ME, low E/P, low CF/P Quality tilts to growth
Defensive	Search for low volatility and low market beta Tilts to profitability Not explained by size and value

Quality variables. In this section it will be discussed which variables have been used in quality strategies in the context of asset pricing theory and are supposed to measure quality in companies. Despite a common and formal definition about quality is missing, an adequate selection of such variables can be made by considering those variables that have arisen from studies published by renowned authors or from specialized journals. Furthermore, the contrast of different studies allows to differentiate adequate quality variables from those which have been proved to have low effect on the stock return.

Importantly, quality variables were sometimes not labeled in that form (e.g., Novy-Marx, 2013a and Gow & Taylor, 2009), however they could have been considered properly by other authors or even by the same author in subsequent studies. This is the case of Novy-Marx (2013a), who, in initial studies, has not labeled the gross-profitability as a quality variable, just from Novy-Marx (2013b) up has begun to refer the gross-profitability as a quality variable.

This change may be interpreted as a gradual complementation or evolution of his work as he became more involved in the topic, precising the terminology of previous studies.

Furthermore, through the literature review obsolete variables have been identified or those which have been proved to fail by not measuring the stock quality have been dismissed. A particular aspect was the discussion about the determinants that may influence the results of the quality variables, including possible managerial manipulations. This topic is exposed in detail by Dechow et al. (2010) and will be commented afterwards in this study.

Gross profit-to-assets. The principal intention of Novy-Marx (2013a) was the demonstration of the gross profitability as a relevant factor for the prediction of the expected return, in opposition to other studies which have omitted it or have rejected its importance (Fama & French, 1992 and 2012). For this purpose, a strategy based on gross profitability was developed and tested, showing that this quality strategy can generate a similar return to those based on value. Consequently, the author has affirmed that such a quality strategy is aimed to buy productive assets by the sale of unproductive assets. Moreover, he has argued that "buying high quality assets without paying premium prices is just as much value investing as buying average quality assets at discount" (Novy-Marx, 2013b, p. 3).

The recommended variable to be used in the portfolio formation is the gross profits-to-assets and it can be calculated by dividing revenues minus cost of goods sold by assets. The results show that gross profits-to-assets has predictive power of the expected return and both are positively related. The same results were reaffirmed years later by Kyosev et al. (2020). Moreover, it was also affirmed that the gross profits-to-assets is negative related with the BE/ME, meaning that both strategies, quality and value, are complementary, and so the value strategy enhance its performance by being controlled by quality, and vice versa: "quality tends to perform best when traditional value suffers large drawdowns" (Novy-Marx, 2013b, p. 17). Interestingly, profitable firms tend to have low BE/ME values converging therefore with growing firms. Therefore, Novy-Marx, (2014) affirms that quality strategies are offered alternatively as growth strategies[5].

[5] According to Novy-Marx (2016) defensive strategies, characterized by buying low volatile stocks, tilt also to quality strategies.

Investments. Cooper et al. (2008) have proved the relation between investments, expressed by yearly assets growth rates, and stock returns. Thus, the results show that companies with relatively low growth rates demonstrate a higher rate of return than companies with high growth rates. Moreover, the results suggest that the “asset expansion (i.e., acquisitions, public equity offerings, public debt offerings, and bank loan initiations) tend to be followed by abnormally low returns, whereas events associated with asset contraction (i.e., spinoffs, share repurchases, debt prepayments, and dividend initiations) tend to be followed by periods of abnormally high returns” (Cooper et al., 2008, p. 1609).

Kyosev et al. (2020), using the measurement for investment proposed by Cooper et al. (2008), has confirmed that investments have predictive power of future stock returns: “low investments positively predict future earnings growth” (Kyosev et al., 2020, p. 14). Furthermore, he has found that the variable fulfils the condition that proper quality variables predict stock returns only if they can predict first of all the earnings growth of a company.

After some studies have pointed out that new factors should be taken into account in the predictions of the expected return (e.g., Novy-Marx, 2013a), Fama & French (2015) have discussed the adequacy of include other factors such as investment to their multivariable model. Thus, based on a dividend model, contemplated to relate stock returns with their proposed explicative factors (e.g., size and value), they have described a possible relation between investment and stock returns, expecting by a higher investment (growth in the book equity) a lower expected return. Also, in the same way as Kyosev et al. (2020), they have defined the investment as the growth of total assets at the end of the fiscal year t-1 divided by total assets at the end of fiscal year t-2 for the formation of portfolios in year t. Finally, they have concluded that “there are patterns in average return related to size, BE/ME, profitability, and investment”, and so the investment should be considered as a factor that predict stock returns.

Operating Profitability. Following the path of Novy-Marx (2013a) and its results suggesting the significance of the gross profitability in the prediction of average stock returns, Fama & French (2015) have tested their five-factor model, including profitability as one of the explicative factors that may be related with the average stock return. Furthermore, in similar way to investments, they have justified its inclusion by using a dividend discount model, where it appears to be positive related with average stock returns.

Their results have shown that, in effect, the profitability contribute to the prediction of average stock returns. Interestingly, even when the authors have based their study on the results of Novy-Marx (2013a) and his gross profitability, they have used a slightly different variable named operating profitability that can be calculated as follows: "…for portfolios formed in June of year t, profitability (measured with accounting data for the fiscal year ending in t-1) is annual revenues minus cost of goods sold, interest expense, and selling, general, and administrative expenses, all divided by book equity at the end of fiscal year t-1" (Fama & French, 2015, p. 4).

Enterprise-level operating profitability. This may be considered as another variable to measure the profitability. It was used by Novy-Marx (2016) to prove that defensive strategies tilts to profitability strategies, suggesting that this may be the reason for their success in the last years in comparison with more "aggressive strategies". Defensive strategies are characterized by the preference for low-risk assets or rather for assets with low market beta.

The enterprise-level operating profitability have been defined as "revenues minus costs of goods sold, and selling, general and administrative expenses, all scaled by assets" (Novy-Marx, 2016, p. 10). Furthermore, according to the author this variable has, among other predictors such as gross profitability or size, "the most power explaining volatility" (Novy-Marx, 2016, p. 10), since both are strong negative related.

Quality score. Asness et al. (2019) have proposed a compounded quality variable to predict the future stock price. Thus, based on a dynamic model (time-varying), three variables seem to be necessary for the measurement of the quality score, i.e., profitability, growth and safety. Moreover, the following statement about the relation of the variables and the stock prices have been made: (1) "Profitability is the profits per unit of book value. All else equal, more profitable companies should command a higher stock price" (Asness et al., 2019, p. 36). Profitability has been measured by taking the average Z-Score of gross profit over assets (GPOA), return on equity (ROE), return on assets (ROA), cash flow over assets (CFOA), gross margin (GMAR) and accruals (ACC). (2) "Growth. Investors should also pay a higher price for stocks with growing profits. We measure growth as the prior five-years growth in each of our profitability measures" (Asness et al., 2019, p. 36). Thus, the growth has been measured through the calculation of a Z-Score of five-years growth of the GPOA, ROE, ROA, CFOA and GMAR. (3) "Safety. Investors should also pay, all-else-equal, a higher price for a stock with a lower required return, that is, a safer stock" (Asness et al., 2019, p. 36). For its measurement, return-based measures of safety (e.g., market beta) and fundamental-based measures of safety (low volatility of profitability, low leverage, and low credit risk) were employed, i.e., the Z-Score and addition of low beta (LB), leverage (LEV), O-Score (O), Z-Score (Z) and ROE volatility (EVOL).

Final results using the quality score have shown that "high-quality firms do exhibit higher prices, on average" (Asness et al., 2019, p. 72), however the quality only explains the 10% of the cross-sectional price. Interestingly, high-quality firms are positive related with high risk-adjusted returns, and so the results suggest that quality firms are riskier than junk stocks (i.e., low-quality stocks). Moreover, it was not possible to find a satisfactory risk-based explanation, since high-quality stocks tend to have low betas and low cash risk.

Earnings volatility. The belief that the earnings volatility could reduce earnings predictability seems logical and, actually according to a survey, it was very common between managers. This idea has motivated Dichev & Tang (2009) to investigate the statistical relation between earnings volatility and earnings predictability. For that purpose, the earnings volatility has been measured using an autoregressive regression, where the earnings of year t-1 are supposed to predict the earnings of year t:

$$E_t = \alpha + \beta E_{t-1} + \varepsilon \qquad (1)$$

After obtaining the variance of both sides of the equation, the variance of the earnings Var(E) represents the earnings volatility, while the variance of the error term Var(ε) represents the earnings predictability. The parameter beta (β) does not only determine if the earnings can predict future earnings, but it can be considered as a measurement of the earnings persistence. According to the authors, the earnings persistence constitutes the link between earnings volatility and earnings predictability. Thus, assuming that the earnings volatility has a negative effect on the earnings predictability, it may also be expected that the earnings volatility has a negative effect on the persistence. The results for the short-term suggest that low-volatility earnings are related with high persistence or rather with high predictability. For the long-term, up to five years, low-volatile earnings remain related with high persistence, und so with high earnings predictability.

Gow & Taylor (2009) have been also engaged in the earnings volatility. They have started questioning the wide impression that analyst share about high earnings volatility as a variable that may increase the expected returns. Thus, they have contemplated the idea that rather, earnings volatility may be a sign of greater informativeness about the firm performance, and hence it may lead to reduce the cost of capital[6]. Furthermore, Dichev & Tang (2009) have shared this idea and have also indicated that incomprehension about the implications of the earnings volatility may exist among analysts.

After the measurement of the earnings volatility, in similar way to Dichev & Tang (2009), and its impact on the risk-adjusted return, the results have shown that "firms with lower earnings volatility earn substantially higher returns than firms with higher earnings volatility" (Gow & Taylor, 2009, p. 32). Furthermore, the results seem to be robust, since the earnings volatility seems to contain or explain most of the asset pricing anomalies (e.g., value-glamour anomaly and investment anomaly). Thus, the perception that higher earnings volatility produces higher cost of capital, or rather higher returns, seems to be not supported by the results. In fact, high earnings volatility may be associated with "fair value accounting" (Gow & Taylor, 2009, 34)[7], and hence with lower cost of capital.

Accruals. The many cases of bookkeeping maneuvers for the improvement of earnings revealed by the Securities and Exchange Commission (SEC) have supported the affirmation of Chan et al. (2006) that earnings offer, in the accounting process, "considerable room for managerial discretion". Furthermore, based on the evidence, that accruals are negative related with the returns, the authors have investigated the relation between earnings, accruals and the average stock return.

The final results reaffirm that the accruals have predictive power of the returns, in agreement also with the results of Kyosev et al. (2020). Also, evidence was presented suggesting that managerial manipulation of earnings may explain the increment of accruals. Moreover, companies with high earnings tend to increase the accruals when the sales begin to slow down, showing dishonestly positive numbers to maintain high returns. Nonetheless, this maneuver

[6] In many parts of the study, the terms cost of capital and expected return have been used, equally. Nonetheless, in the chapter devoted to the research design, it has been specified that the future risk-adjusted return (alpha) is the allocated variable for cost of capital.

[7] This characteristic is aligned with the definition of earnings quality given by Dechow et al. (2010).

must be corrected afterwards in the accountability, therefore a reduction of special items (e.g., inventory write-downs) can be observed after a while.

By contrast, the results of Dichev & Tang (2009) have shown that their proposed earnings volatility is more persistent and "dominate level of accruals in terms of predictive power" (Dichev & Tang, 2009, p. 166). In a similar way, Novy-Marx (2014) have assessed the performance of the accruals below than the gross-profitability to explain the future return. Furthermore, he has pointed out a weak correlation between the earnings quality (accruals) and the other studied strategies (e.g., gross profitability), interpreting that the earnings quality, despite of its name, does not seem to be properly a quality variable, since it appears to be measuring something different to the other quality variables.

Quality score of MSCI and GMO. Novy-Marx (2014) hat revealed that the quality scores proposed by Jeremy Grantham have been used by the GMO to develop its quality strategy. In the GMO White Paper (2004) it was affirmed, in this regard, that in the long term, risky stocks tend to underperform to those known as high-quality stocks, up to minus 15% per year. Furthermore, their selected high-quality stocks are less risky and tend to be stable profit. Their quality stocks are characterized by showing low leverage, high profitability and low earnings volatility.

At least to a large extent, the MSCI Quality Indices are also based on the Grantham's score (Novy-Marx, 2014). Actually, the MSCI (2013) has proposed an index methodology to quantify the quality of companies in a quality score, weighting rations such as Return on Equity (ROE), Debt to Equity (D/E) and Earnings Variability.

Novy-Marx (2014) hat nonetheless shown that Grantham-based quality scores have a strong size bias. While some results have suggested that Grantham quality subsumes other quality variables, showing a notable performance, it seems to be driven by its performance within small stocks. In a later spanning test it could be observed that the performance of the Grantham quality turns weak when it was evaluated within a large cap sample, which according to the author, corresponds to the 90% of the total market capitalization. Such result was reaffirmed when the Grantham quality was tested within small cap stocks, where together with other variables has exhibited a significant abnormal return.

Earnings. Chan et al. (2006) have considered that Earnings offer plenty of space for "bookkeeping maneuvers", manipulating the accountability to show bottom line numbers that may maintain the expectations about a company. Furthermore, they have supported this affirmation mentioning the numerous cases of misleading accountability detected by the Securities and Exchange Commission (SEC).

In contrast, Dechow et al. (2010) have reviewed in detail the results presented by the SEC and have criticized the applied methodology. They have affirmed that, given the manner the SEC have selected the sample, this "is likely to contain the most egregious misstatements and exclude firms that are aggressive but manage earnings within GAAP" (i.e., Generally Accepted Accounting Principles) (Dechow et al., 2010, p. 371). Furthermore, their evidence shows that investors react negatively to manipulation revelations, suggesting future consequences in the valuation of the company. Finally, they have affirmed that there is no strong evidence of manipulation of the earnings results, in particular, within big companies. Moreover, they have affirmed that recent studies show a positive relation between the size of the companies and the quality earnings, since "the fixed cost of big companies is associated with maintaining adequate control procedures".

However, recently studies have considered Earnings more as a variable that should be predicted rather than a variable to be used for the calculation of the stock return. For example, the prediction of earnings growth was proposed by Kyosev et al. (2020) as a measurable signal of the adequate performance of quality variables instead of being proposed directly for the prediction of the stock returns. Furthermore, other studies have used the Earnings, among others, for the formation of quality scores (Asness et al., 2019), having a very smooth impact on the prediction of the stock prices.

Earnings variability & other proposed quality variables. It must not be confused with earnings volatility, which is actually measured by the earnings variance (see Earnings volatility). Also considered as the volatility of earnings growth (Kyosev et al., 2020), the earnings variability measures the standard deviation of the Return on Equity growth in a period of five years. However, the results indicate that this variable fails to predict the earnings growth, as well as to predict the stock return.

Appealing the same argument, Kyosev et al. (2020) also have rejected other variables such as Return on Equity (ROE), margins, ROE growth and leverage. Similarly, Novy-Marx (2014) have indicated a weak performance in variables such as the Graham score, the return on invested capital (ROIC), the Piotroski financial strength and the defensive equity strategy. Meanwhile, Dichev & Tang (2009) have considered that the Earnings Volatility performs better than the Cash-Flow Volatility, showing “higher explanatory power with respect to earnings predictability”.

Table 3. Quality variables.

Variable	**Characteristics**	**Suggested by**
Gross profit-to-assets	Used to separate productive of unproductive stocks	Novy-Marx (2013a)
	Positive related to stock returns	Novy-Marx (2013a)
	It is negative related to BE/ME	Kyosev et al. (2020)
	Can be confused with growth stocks	Novy-Marx (2014)
Investments	Negative related to stock returns	Kyosev et al. (2020)
	Asset growth (investments) is followed by returns reduction and vice versa	Cooper et al. (2008)
	Related to investment in the five-factor model	Fama & French (2015)
Operating Profitability	Positive related to stock returns	Fama & French (2015)
	Proxy of profitability in five-factor model	Fama & French (2015)
Enterprise-level operating profitability	Positive related to stock returns	Novy-Marx (2016)
	Negative related to volatility	Novy-Marx (2016)
	Related to profitability in the five-factor model	Novy-Marx (2016)
Quality Score	Z-Score based on profitability, growth and safety	Asness et al. (2019)
	Positive related to stock returns	Asness et al. (2019)
	Stocks show typically low betas and cash risk	Asness et al. (2019)
	Related to profitability and investments in the five-factor model	Asness et al. (2019)

Variable	Characteristics	Suggested by
Earnings volatility	Negative related to stock returns	Dichev & Tang (2009)
	High EVOL related to low cost of capital	Gow & Taylor (2009)
	High EVOL might be associated with fair accountability	Gow & Taylor (2009)
	Low EVOL is related to high persistence and earnings predictability	Dichev & Tang (2009)
Accruals	Negative related to future stock returns	Chan et al. (2006)
	EVOL seems to perform better	Dichev & Tang (2009)
	Gross profit-to-assets seems to perform better	Novy-Marx (2014)
Quality Score of MSCI & GMO	Z-Score based on leverage, profitability and volatility	GMO (2004)
	Size bias, performing well only within small stocks	Novy-Marx (2014)
Earnings	Suspicious to be manipulable by managers	Chan et al. (2006)
	Usually predicted instead to be a predictive variable	Kyosev et al. (2020)
	If used as predictor, within other variables forming a score	Asness et al. (2019)
Earnings variability, ROE, margins, ROE growth, leverage	Fail to predict stock returns or have shown low performance	Kyosev et al. (2020)
Graham score, ROIC, Piotroski strength, defensive strategy	Fail to predict stock returns or have shown low performance	Novy-Marx (2014)
Cash-flow volatility	Fail to predict stock returns or have shown low performance	Dichev & Tang (2009)

2.2 Stock Returns in Asset Pricing Models

This study has the aim to compare and describe exhaustively the differences between companies with high or low quality. Thus, it is indispensable to set a clear definition of quality in companies. This may be a difficult task given the subjectiveness of quality and the lack of consensus in the literature (Novy-Marx, 2014). For that reason, to achieve a clarification of the quality definition, the comparison of many quality variables as well as the contraposition of quality strategies with other related strategies is necessary.

However, this approach may be insufficient, and a further description of low and high-quality companies may help to understand better what they actually are. Alone a description of quality by quality-variables seems to be inappropriate, since, as expressed above, these may be based in subjective appreciations. Thus, an objective measure appears to be necessary, and such should be unambiguous and represent the performance of companies according with their quality.

The literature is, in this regard and with few exceptions evident (e.g., Asness et al., 2019), and relies on the stock expected rate of return as the company performance variable par excellence.

The stock return is a fundamental variable in the asset pricing theory, becoming, in fact, decisive in the investment decision-making (e.g., Sharpe, 1964 and Fama & French, 1992). In this sense, it has been used in asset pricing models to calculate the impact of different factors, including quality variables, in the portfolio formation. Bartholdy & Peare (2005) have suggested that the most important models are the Capital Asset Pricing Model (CAPM) and the three-factor model of Fama & French.

The CAPM and The Stock Return. Sharpe (1964) has presented a pricing theory that intends to predict and describe the capital market. Thus, the author based on economic theory has achieved to link the risk with the stock return. Moreover, an economic explanation for the relation between asset expected return and the risk was given, agreeing with the notion that the bigger the risk, the higher the expected return. The expected return is defined as the difference of the investor's wealth after and before the investment divided by investor's wealth before the investment (Sharpe, 1964, p. 428).

Similarly, Lintner (1965), has demonstrated economically that the formation of the optimal stock mix depends on a large extent of the maximization of the return per dollar invested. Moreover, he has indicated clearly the importance of the stock returns for the investment decisions: “we need to establish the relation between the investor’s total investment in any arbitrary mixture or portfolio of individual stocks, his total net return from all his investments (including riskless assets and any borrowing), and the risk parameters of his investment positions” (Lintner, 1965, p. 16).

In summary, the CAPM offers, based on microeconomic fundaments, an instrument to measure and predict the stock performance, by calculating the impact of the risk on the stock returns. E.g., Bartholdy & Peare (2005) have formulated the following representation:

$$E[r_i] - r_f = \beta_i^M (E[r_m] - r_f) \qquad (2)$$

where r_i is the return on stock i, r_f is the risk-free return, r_m is the return on the world market portfolio, β_i^M is the systematic risk of stock i relative to the world market portfolio. Additionally, it has been pointed out that the difference of the expected return i and the risk-free return r_f indicates the expected abnormal return. Then, since the measurement of the world return variables results impossible, it has been approximated by the return on the Index I, r_{It}, which is typically the Standard and Poor’s Composite Index at time t and by the systematic risk of stock i relative to the index I, β_i^I, generating the following series regression (Bartholdy & Peare, 2005, p. 411):

$$r_{it} - r_{ft} = a_i + \beta_i^I (r_{It} - r_{ft}) + \varepsilon_{it} \qquad t = 1, \ldots\ldots, t_0 \qquad (3)$$

The Fama & French Three-factor Model and The Stock Return. Fama and French (1992) have introduced an alternative asset pricing model, which has been proven statistically to perform better than that proposed by Lintner and Sharpe decades before. The authors have disagreed with the affirmation that the market beta can describe sufficiently expected returns. In this regard, the authors have presented evidence demonstrating that the variable beta does not success to explain the average return during 1963 and 1990.

Thus, based on other results, the authors have suggested other variables that might be related to expected returns. Such variables, considered as anomalies since they were not included by the CAPM (Fama & French, 1996b), have been evaluated to prove their effect on the expected return and have been also compared with the performance of the market beta. The variables considered by Fama and French (1996b) include the size and the ratio book-to-market equity (value).

Their results have shown that only beta does not succeed in explaining the cross-section average return and that by considering other factors the model is improved.[8] Thus, the size-factor, calculated by the market equity (ME), and the ratio book-to-market equity (BE/ME) have been consequently proposed as explanatory variables of the expected return.[9]

Further studies and spanning tests have confirmed the results concerning the market beta (e.g., Fama & French, 1996a) and consequently, a multifactor asset pricing model has been proposed (Fama & French, 1996b) to explain the stock average return, intending to cover most of the CAPM anomalies:

$$E(R_i) - R_f = b_i\left[E(R_M) - R_f\right] + s_i E(SMB) + h_i E(HML) \tag{4}$$

Where the expected excess return of a portfolio is given by the difference between the expected return of a portfolio $E(R_i)$ and the risk-free rate R_f, the excess return of the market portfolio is given by the difference between the expected return of the market portfolio $E(R_M)$ and R_f, the small-minus-big portfolio (SMB) is the return difference between big and small stocks and the high-minus-low portfolio (HML) is the return difference between high book-to-market equity and low book-to-market equity. Thus, the equation describes the sensitivity of the expected excess return of a portfolio to the market, the size-effect anomaly and the book-to-market-equity anomaly. Furthermore, the $E(R_M) - R_f$, $E(SMB)$ and $E(HML)$ are also considered as expected premiums, and the sensitivity to the three premiums is determined by the factor sensitivities b_i, s_i and h_i, which can be determined through the time-series regression:

[8] These results were confirmed later by further studies e.g., Fama & French ,1996a.

[9] At the moment this study was published, only suggestion were made about the economic fundaments that may explain the impact of the size and book-to-market equity on the average return.

$$R_i - R_f = \alpha_i + b_i(R_M - R_f) + s_i(SMB) + h_i(HML) + \varepsilon_i \quad (5)$$

Also, it has been argued that the three-factor model explains the effect of other related anomalies such as earnings/price (E/P), cash flow/price (CF/P), and past sales growth on the average stock return. In this regard, the HML appears to measure the relative distress: "Weak firms with persistently low earnings tend to have high BE/ME and positive slopes on HML; strong firms with persistently high earnings have low BE/ME and negative slopes in HML." (Fama & French, 1996b, p. 56)[10]. Moreover, the relative distress is characteristic of high-BE/ME stocks with high E/P, high CF/P and low sales growth which tend to have higher average returns. On the contrary, strong companies with low BE/ME tend to have low E/P, low CF/P, high growth sales and they are related with higher average returns. The size effect expressed as the impact on the stock return attributed to the position in the total market capitalization. These results support the affirmation that the market beta fails to capture the distress risk and the size effect.

Importantly, the authors suggest that, according with their results, the three-factor model explains the average return and achieves to contain most of the CAPM anomalies when a zero intercept ($\alpha_i = 0$) is set for the time-series regression.

2.3 Hypothesis

In accordance with the literature, some result expectations can be specified and formulated in conducting this study to the analysis of the quality in companies. Moreover, to find differences between European and American companies in regard to the quality:

Hypothesis 1: The stock returns of high-quality companies perform better than those of low-quality companies in Europe.

Hypothesis 2: The stock returns of high-quality companies perform better than those of low-quality companies in the USA.

[10] For the first kind and second kind of companies correspond the so-called value and growth stocks, respectively (see Value & Growth).

Hypothesis 3: The stock performance of high-quality companies listing in Europe and the USA does not show any difference, similarly, the stock performance of low-quality companies listing in Europe and the USA do not show any difference.

3 Methodology

After the literature review some quality variables have been selected in function of their relation to the stock performance. Thus, only those variables that have been proved to be strong related with the stock performance have been taken into account for further analysis. This filtering process has also simplified the posterior evaluation by reducing the number of quality variables considered initially in this study.

In this regard, the chapter 3 will describe the manner in which quality variables can be evaluated using the stock performance and the 3-Factor model. For that purpose, the methodology has been organized in the definition of quality variables for their calculation, portfolio characteristics, measurement of the abnormal rate of return, statistical significance and the modelling by regions.

3.1 Calculation of Quality Variables

After a literature review, a set of quality variables have been selected given their strong relation with stock returns in other studies. These quality variables are the fundament for the constitution of quality portfolios and for the determination of the corresponding stock performance:

Gross profit-to-assets (GPA). Novy-Marx (2013a) has measured this variable by using yearly data from 1963 to 2010 and has been actualized every year in June (this study proceeds similarly, and the portfolios are also actualized in June). Then, GPA is formed by the accounting variables revenues (REV), cost of goods sold ($COGS$), and total assets (A). Furthermore, the accounting data used for GPA in year t corresponds to the fiscal year t-1:

$$GPA_t = \frac{REV_{t-1} - COGS_{t-1}}{A_{t-1}} \quad (6)$$

Investments (Inv). Fama & French (2015) have calculated this variable for year t in June from 1963 to 2013 (this study proceeds similarly, and Investments are also actualized in June). The accounting data used for the calculation of Investment at the year t is formed by total assets at the end of fiscal year t-1 and t-2 (A_{t-1}, A_{t-2}):

$$Inv_t = \frac{A_{t-1} - A_{t-2}}{A_{t-2}} \tag{7}$$

Operating Profitability (OP). Fama & French (2015) have calculated this variable for year t in June from 1963 to 2013 (this study proceeds similarly, and OP is also actualized in June). The accounting data used for OP is formed by annual revenues (REV_{t-1}), cost of goods sold ($COGS_{t-1}$), interest expense (Int_{t-1}), selling, general, and administrative expenses (Adm_{t-1}), and book equity (BE_{t-1}). Furthermore, the accounting data used for OP in year t corresponds to the fiscal year t-1:

$$OP_t = \frac{REV_{t-1} - COGS_{t-1} - Int_{t-1} - Adm_{t-1}}{BE_{t-1}} \tag{8}$$

Enterprise-level operating profitability (EOP). Novy-Marx (2016) have calculated this variable using the accounting data revenues (REV_{t-1}), costs of goods sold ($COGS_{t-1}$), selling, general and administrative expenses (Adm_{t-1}), and assets (A_{t-1}). The EOP were calculated every June from 1968 to 2014 (this study proceeds similarly, and the EOP are also actualized every June). Furthermore, the accounting data used for EOP in year t corresponds to the fiscal year t-1:

$$EOP_t = \frac{REV_{t-1} - COGS_{t-1} - Adm_{t-1}}{A_{t-1}} \tag{9}$$

Quality Score (QS). This quality variable is obtained by calculating the average of the Z-Score[11] of profitability, growth and safety, respectively. Asness et al. (2019) have calculated the quality score each June using the data of the last fiscal year from 1957 to 2016 (this study proceeds similarly, and the quality score is also actualized in June):

[11] The Z-Score transforms a random variable X (assuming this is normally distributed) with mean μ and standard deviation σ^2 to the standardized random variable Z with mean 0 and standard deviation 1 (Fahrmeir et al., 2016, p. 274):

$$Z = \frac{X - \mu}{\sigma}$$

$$QS_t = z(Profitability_t + Growth_t + Safety_t) \tag{10}$$

with

$$Profitability_t = z(z_{GPOA_{t-1}} + z_{ROE_{t-1}} + z_{ROA_{t-1}} + z_{CFOA_{t-1}} + z_{GMAR_{t-1}} + z_{ACC_{t-1}}) \tag{11}$$

$$Growth_t = z(z_{\Delta GPOA_{t-1}} + z_{\Delta ROE_{t-1}} + z_{\Delta ROA_{t-1}} + z_{\Delta CFOA_{t-1}} + z_{\Delta GMAR_{t-1}}) \tag{12}$$

$$Safety_t = z(z_{LB_{t-1}} + z_{LEV_{t-1}} + z_{O_{t-1}} + z_{Z_{t-1}} + z_{RVOL_{t-1}}) \tag{13}$$

Where the gross profit over assets (GPOA), the return on equity (ROE), the return on assets (ROA), the cash flow over assets (CFOA), the gross margin (GMAR) and the accruals (ACC) are the corresponding constituting variables for profitability. The constituting variables used for profitability of year t correspond to the fiscal year t-1. Then the profitability value is calculated by taking the average Z-Scores of the constituting variables.

Growth is formed by using as constituting variables the change over the last five years of GPOA, ROE, ROA, CFOA and GMAR. The constituting variables used for growth of year t correspond to the fiscal year t-1. Then the growth value is calculated by taking the average Z-Scores of the constituting variables.

Safety is formed by using as constituting variables the low beta (LB), the leverage (LEV), the Ohlson's O-Score (O),[12] the Altman's Z-Score (Z),[13] and the ROE volatility (RVOL). The constituting variables used for growth of year t correspond to the fiscal year t-1. Then the growth value is calculated by taking the average Z- Scores of the constituting variables.

Earnings volatility (EVOL). Dichev & Tang (2009) have calculated this variable by measuring the standard deviation of the earnings over the last five years:

$$EVOL_t = \sqrt{\frac{1}{n-1} \sum_{i=t-6}^{t-1} (Earnings_i - \overline{Earnings})^2} \tag{14}$$

[12] O is a measure for bank risk, and it is formed by variables such as book and market equity, consumer price, book value of debt, current assets, current liabilities, and income.

[13] Z is, in similar way to O, a measure for bank risk. (Asness et al., 2019, p. 75) considers Z as a weighted average formed by variables such as working capital, retained earnings, earnings before interest and taxes, market equity, sales, and total assets.

Dichev & Tang (2009) have defined earnings as earnings before extraordinary items (EBI) deflated[14] by average total assets (ATA)[15]:

$$Earnings_t = \frac{EBI_t}{ATA_t} \tag{15}$$

Earnings values for the year t are calculated using the EBI and ATA of year t. Dichey & Tang (2009) do not indicate when the portfolios have to be formed, however, to maintain coherence with the calculation of the previous described quality variables, this study actualizes EVOL every June.

3.2 Portfolios Formation

Gow & Taylor (2009) explain an additional advantage of dividing the sample in quintiles for the portfolio formation and running separately linear regressions for each quintile. Regressions assume per se linearity between the factors, and this is a condition that hardly can be fulfilled by the model factors and the returns.

By dividing the sample in quintiles, the linear regression has to approximate the model factors to a smaller span of return values. Thus, the factor loadings and the alphas (for the corresponding five quintiles) approach better the stock returns. As a consequence, standard error correction might be avoided, as well as outlier problems reduced (Gow & Taylor, 2009, p. 14).

Based on the GP/A, the Inv, the OP, the EOP and the $EVOL$-values, the stocks will be sorted in quantiles, forming portfolios. The portfolios are formed in June of the year t and the values of the corresponding quality variables will be obtained from accounting information of prior years. The portfolios are equal-weighted (Gow & Taylor, 2009, Novy-Marx, 2014), beginning with an initial investment I, the portfolios will be rebalanced every June (Buy-and-hold strategy).

[14] Jackson (2018, p. 141) describes the deflation of multiple accounting variables by dividing their values by the total assets.

[15] Jewel & Mankin (2011) have considered for average total assets (ATA) the total assets of the last two years.

In case of stocks delisted from the index, the corresponding market value will be held to be reinvested in the next portfolio formation without considering additional interest:

$$p_{GP/A} \in \left\{Q1_{\frac{GP}{A}}, Q2_{\frac{GP}{A}}, Q3_{\frac{GP}{A}}, Q4_{\frac{GP}{A}}, Q5_{\frac{GP}{A}}\right\}, with\ R_{p_{GP/A}t} \quad (16)$$

$$p_{Inv} \in \{Q1_{Inv}, Q2_{Inv}, Q3_{Inv}, Q4_{Inv}, Q5_{Inv}\}\ with\ R_{p_{Inv}t} \quad (17)$$

$$p_{OP} \in \{Q1_{OP}, Q2_{OP}, Q3_{OP}, Q4_{OP}, Q5_{OP}\}\ with\ R_{p_{OP}t} \quad (18)$$

$$p_{EOP} \in \{Q1_{EOP}, Q2_{EOP}, Q3_{EOP}, Q4_{EOP}, Q5_{EOP}\}\ with\ R_{p_{EOP}t} \quad (19)$$

$$p_{Z} \in \{Q1_{Z}, Q2_{Z}, Q3_{Z}, Q4_{Z}, Q5_{Z}\}\ with\ R_{p_{Z}t} \quad (20)$$

$$p_{EVOL}\{Q1_{EVOL}, Q2_{EVOL}, Q3_{EVOL}, Q4_{EVOL}, Q5_{EVOL}\}\ with\ R_{p_{EVOL}t} \quad (21)$$

Where the portfolio $p_{Quality}$ is one of the formed quintiles $Q_{i,Quality}$ and a corresponding monthly return $R_{p_{Quality},t}$ has to be calculated. The monthly return is the average return of the companies listed in the portfolio $p_{Quality}$ for the month t.

3.3 Measurement of Abnormal Returns

The application of the anterior three-factor model seems to be adequate for the calculation of the abnormal returns. By doing so, the effect of the size, market and BE/ME will be absorbed by the factor loadings, and the alpha value can describe better the effect of the quality variables on the stock performance.

Then, by inserting the monthly return of the quality portfolios in the three-factor model (Fama & French, 1996b), in a similar way to Gow & Taylor (2009), the abnormal returns (α) for each quality variable will be obtained through the time-series regression:

$$R_{p_{GP/A}t} - R_{ft} = \alpha_{p_{GP/A}} + b_{p_{GP/A}}\left(R_M - R_f\right)_t + s_{p_{GP/A}}(SMB)_t + h_{p_{GP/A}}(HML)_t + \varepsilon_{p_{GP/A}t} \quad (22)$$

$$R_{p_{Inv}t} - R_{ft} = \alpha_{p_{Inv}} + b_{p_{Inv}}\left(R_M - R_f\right)_t + s_{p_{Inv}}(SMB)_t + h_{p_{Inv}}(HML)_t + \varepsilon_{p_{Inv}t} \quad (23)$$

$$R_{p_{OP}t} - R_{ft} = \alpha_{p_{OP}} + b_{p_{OP}}\left(R_M - R_f\right)_t + s_{p_{OP}}(SMB)_t + h_{p_{OP}}(HML)_t + \varepsilon_{p_{OP}t} \quad (24)$$

$$R_{p_{EOP}t} - R_{ft} = \alpha_{p_{EOP}} + b_{p_{EOP}}\left(R_M - R_f\right)_t + s_{p_{EOP}}(SMB)_t + h_{p_{EOP}}(HML)_t + \varepsilon_{p_{EOP}t} \quad (25)$$

$$R_{p_{Z}t} - R_{ft} = \alpha_{p_{Z}} + b_{p_{Z}}\left(R_M - R_f\right)_t + s_{p_{Z}}(SMB)_t + h_{p_{Z}}(HML)_t + \varepsilon_{p_{Z}t} \quad (26)$$

$$R_{p_{EVOL}t} - R_{ft} = \alpha_{p_{EVOL}} + b_{p_{EVOL}}\left(R_M - R_f\right)_t + s_{p_{EVOL}}(SMB)_t + h_{p_{EVOL}}(HML)_t + \varepsilon_{p_{EVOL}t} \quad (27)$$

Where R_f is the risk-free rate, $\left(R_M - R_f\right)$ is the excess return of the market portfolio, (SMB) is the return difference between big and small stocks, (HML) is the return difference between high book-to-market equity and low book-to-market equity, and the sensitivity to the three premiums is determined by the factor sensitivities b_i, s_i and h_i.

Gow & Taylor (2009) explain the manner $\left(R_M - R_f\right)$, (SMB) and (HML) must be calculated. The $\left(R_M - R_f\right)$ is the value-weighted return on the monthly returns of all sample stocks minus the one-month Treasury bill rate. For the (SMB) construction, the stocks have been sorted according with their market capitalization (ME) and divided then in six portfolios. Therefore, depending on the stock market, i.e., the US or the European market, the breakpoints are the median or the 80th percentile, respectively. After that, each side is divided in further three portfolios and their corresponding average returns are calculated, forming a Small Value, Small Neutral, Small Growth, Big Value, Big Neutral and Big Growth-portfolio. The portfolios are actualized every month, and so the SMB is then determined by the average return (Gow & Taylor, 2009, p. 76):

$$SMB = 1/3(Small\ Value + Small\ Neutral + Small\ Growth) \\ -1/3(Big\ Value + Big\ Neutral + Big\ Growth) \tag{28}$$

Similarly, for the (HML) have been divided in value (high BE/ME) and growth portfolio (low BE/ME). After that, each side have been further divided in two portfolios and their average return calculated, forming a Small Value, Big Value, Small Growth and Big Growth-portfolio. The portfolios are actualized every month, and so the HML is the determined by the average return (Gow & Taylor, 2009, p. 76):

$$HML = 1/2(Small\ Value + Big\ Value) - 1/2(Small\ Growth + Big\ Growth) \tag{29}$$

This study has obtained the values of the factors $\left(R_M - R_f\right)$, (SMB) and (HML) directly from the French open data library. Moreover, as it was recommended by Fama & French (2012), the factors values considered for this study are adjusted by region, i.e., the factor for the QV analysis of European stocks are different from those for the QV analysis of US-stocks.

3.4 Statistical significance

As expressed before, this study is aimed essentially to compare the alpha-values (portfolio performances) between different portfolios based on quality by using linear regressions. Then it is necessary to consider the statistical significance of the alphas and the factors to determine whether they are truly important for the linear regression or whether they can be dismissed.

Based on Fahrmeir et al. (2016), the relevance of the parameters will be examined by calculating their t-values and the corresponding p-values. Given a linear regression with p parameters (Fahrmeir et al., 2016, p. 456):

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 x_{i1} + \cdots + \hat{\beta}_p x_{ip} \quad (30)$$

Where $\hat{\beta}_p$ is the fitted coefficients of the parameter p and x_{ip} is the corresponding given regressor. Then, the way to demonstrate whether an explanatory variable is significant in the model, is by evaluating the following hypothesis:

$$H_0: \beta_j = \beta_{0j}, \qquad H_1: \beta_j \neq \beta_{0j} \quad (31)$$

where $\beta_{0j} = 0$ and β_j is the coefficient of parameter j.

The null-hypotheses represents the possibility that the parameter does not have any impact in the model and therefore it can be removed from it. Then, assuming that the parameters are normally distributed a t-value can be determined as the ratio of the fitted coefficients and the corresponding standard deviation (Fahrmeir et al., 2016, p. 458):

$$T_j = \frac{\hat{\beta}_j - \beta_{0j}}{\hat{\sigma}_j} \quad (32)$$

The T-value is then compared with the values of the t-student distribution given for a degree of freedom n-p-1 (n is the number of observations) and a predetermined limit value α[16] (significance level). The significance level is predetermined and sets the limits in which a null-hypothesis can be accepted:

[16] The significance level is usually pointed out as α in the literature and must not be confused with the abnormal returns.

$$|T_j| > t_{1-\frac{\alpha}{2}}(n-p-1) \tag{33}$$

If the inequity results to be true than the null-hypothesis can be rejected and the $\hat{\beta}_j$ is statistically significant. Moreover, a p-value can be also calculated. The p-value estimates the probability that the rejection of null-hypothesis results to be false, therefore the smaller the p-value, the lower the chance of error. Then by comparing the p-value with the significance level α, the null-hypothesis can be accepted or rejected. Typically, the literature indicates that the significance level should be 5% and the coefficients with p-values above this limit can be considered as not significant.

3.5 Comparison Europe vs USA

On the one hand, the expansion of a study sample to international scope may improve the obtained results. Asness et al. (2019) have used a global sample, including the USA and twenty-four countries, enhancing in that manner the reliability of their results. Similarly, Fama & French (2012) have taken a wide sample of twenty-three countries, with the purpose of analyse whether country-restricted factors perform better explaining the return than aggregated (global) factors.

On the other hand, this study will have two samples, with the purpose of find differences between two regions, i.e., Europe and the USA. Supposing that the perception of quality is different in both regions, and given the variety of applied quality variables, the distinction in the sample will it make easier to identify which characteristics seem to be more relevant for each region. On the contrary, if the results demonstrate that the companies do not have clear differences, when they have been sorted by quality, the notion that quality, regardless of the world region, have the same importance in the performance of a company will be reinforced.

4 Data and descriptive statistics

4.1 Data source

With the purpose of represent the companies from Europe and the USA, the sample is constituted by companies considered in the S&P 500 and the STOXX600 Index between 2000 and 2020. For simplicity no exclusion of financial firms has been made as recommended by Kyosev et al. (2020). Considering that the index constituents are frequently actualized and in order to avoid distortions in the study, all the companies have been taken into account during that period of time. This has resulted in a sample with 1115 companies for the European and 1002 companies for the US sample.

Monthly company stock return data were gathered from Refinitiv Datastream and contain all price adjustments including dividend payments. The Fama & French factors were obtained directly from the Kenneth French open library, which contains adjusted values for the American and European stock market. This distinction has been proved to enhance the accuracy of the final results when different markets have been compared (Fama & French, 2012). The risk-free rates correspond to the 1-month U.S. Treasury bill rates, and they have been also obtained from the Kenneth French data library.

In addition, the accounting data required for the measurement of the quality variables (QV) have been gathered from Worldscope Datastream. For the calculation of the QV gross profit-to-assets and the QV investments, revenues (Worldscope #01001), cost of goods sold (#01051) and total assets (#02999) are required. For the calculation of the QV earnings volatility, the income before extraordinary items (#01551) is needed. The QV enterprise-level operating profitability required additionally the selling, general and administrative expenses (#01101). For the calculation of the QV operating profitability, the interest expenses (#01075) and the book value of equity (#03995) are also required. Finally, for the calculation of the QV quality-score, net income (#01706), depreciation (#01148), working capital (#03151), preferred stock (#03451), split-adjusted number of shares outstanding (#05301), long term debt (#03251), short term debt (#03051), minority interest (#03426), market equity (#08001), current assets

(#02201), current liabilities (#03101), pre-taxes income (#01401), total liabilities (#03351), retained earnings (#03495) and earnings before interest and taxes (#18191) are also required.

The initial samples (Europe and USA) with accounting data required for the QV calculation is presented in Table 4. In there has been summarized the number of companies gathered from the Worldscope DataStream with data availability. The samples collect the annual disclosed accounting data for the period between 2000 and 2020. for the QV calculation.

In general Panel A and B show that there is larger data availability for the European than for the American sample. It can be also observed that the interest expenses (see Int. expenses in Table 4) have much lower availability than other accounting data. This occurs for both, the European and US-sample. Interest expenses is required for the calculation of the QV operating profitability and the data restriction seems to affect even more the US-sample.

Selling, general and administrative expenses (see Adm. Expenses in table 4) in Panel A seems to be restricted when compared with book value of equity (see BE in table 4). Selling, general and administrative expenses are required for the calculation of QV enterprise-level operating profitability. Similarly, depreciation in Panel B seems to be restricted when compared with book value of equity (see BE in table 4). Depreciation is required for the calculation of QV quality score.

Table 4. Number of firms with data availability.

Year	Revenues	COGS	Assets	EBEI	Adm. expenses	Int. expenses	BE	Net_income	Depreciation
Panel A: Europe (Worldscope DataStream), 2000 - 2020									
2000	902	866	902	1060	635	188	1060	1061	802
2001	921	891	922	1076	659	190	1075	1076	834
2002	955	926	956	1110	707	193	1109	1110	875
2003	950	914	951	1100	701	191	1100	1100	869
2004	956	915	956	1106	719	191	1105	1106	882
2005	949	907	950	1099	760	192	1100	1099	810
2006	937	894	934	1085	751	190	1083	1085	794
2007	918	871	918	1055	739	180	1055	1055	789
2008	901	860	901	1032	741	175	1032	1032	791
2009	903	864	902	1027	747	169	1026	1027	786
2010	899	860	900	1022	753	169	1023	1022	797
2011	899	863	899	1023	758	170	1023	1023	801
2012	903	871	902	1028	769	173	1027	1028	829
2013	898	887	898	1020	764	172	1020	1020	849
2014	904	898	904	1027	766	170	1027	1027	857
2015	889	885	887	1011	755	170	1009	1011	845
2016	883	878	883	1004	748	171	1004	1004	857
2017	871	853	871	991	738	171	991	991	844
2018	855	834	855	972	731	168	972	972	830
2019	829	806	827	944	709	167	944	944	804
2020	689	640	647	773	539	119	744	772	513

Year	Working capital	Preferred stocks	Shares outstanding	Long term debt	Short term debt	Minority interest	Market equity
Panel A: Europe (Worldscope DataStream), 2000 - 2020							
2000	824	1044	1046	1059	1030	1050	1002
2001	841	1063	1060	1073	1049	1064	1014
2002	872	1098	1092	1109	1084	1094	1023
2003	866	1087	1081	1098	1075	1086	999
2004	872	1097	1090	1104	1080	1093	1013
2005	863	1091	1086	1097	1082	1092	1031
2006	847	1077	1072	1082	1069	1079	1037
2007	831	1052	1047	1055	1040	1055	1025
2008	813	1031	1020	1032	1016	1032	996
2009	812	1024	1014	1025	1010	1026	976
2010	808	1021	1016	1023	1006	1023	975
2011	809	1019	1020	1023	1007	1023	967
2012	808	1024	1024	1027	1009	1027	962
2013	806	1016	1019	1019	1010	1019	957
2014	806	1024	1026	1026	1016	1025	970
2015	791	1004	1007	1006	999	1006	965
2016	784	1000	1003	1002	995	1003	961
2017	773	988	989	990	978	990	952
2018	758	971	971	972	968	971	937
2019	730	943	942	943	942	942	917
2020	570	718	731	736	701	725	907

Year	Current assets	Current liabilities	Pre-taxes income	Total liabilities	Retained earnings	EBIT
Panel A: Europe (Worldscope DataStream), 2000 - 2020						
2000	824	825	824	1044	1046	1059
2001	841	842	841	1063	1060	1073
2002	872	872	872	1098	1092	1109
2003	867	866	866	1087	1081	1098
2004	872	872	872	1097	1090	1104
2005	863	863	863	1091	1086	1097
2006	847	847	847	1077	1072	1082
2007	831	831	831	1052	1047	1055
2008	813	813	813	1031	1020	1032
2009	812	812	812	1024	1014	1025
2010	809	808	808	1021	1016	1023
2011	809	810	809	1019	1020	1023
2012	808	809	808	1024	1024	1027
2013	807	807	806	1016	1019	1019
2014	806	808	806	1024	1026	1026
2015	791	793	791	1004	1007	1006
2016	784	786	784	1000	1003	1002
2017	773	776	773	988	989	990
2018	758	761	758	971	971	972
2019	730	734	730	943	942	943
2020	574	570	570	718	731	736

Year	Revenues	COGS	Assets	EBEI	Adm	Int. expenses	Book equity	Net income	Depreciation
Panel B: USA (Worldscope DataStream), 2000 - 2020									
2000	735	694	736	814	695	99	815	815	444
2001	737	695	734	813	714	98	810	813	520
2002	740	702	734	817	723	101	810	817	548
2003	745	711	737	823	735	102	815	823	573
2004	747	717	740	818	753	96	811	818	590
2005	738	707	731	808	750	92	801	808	588
2006	723	691	719	789	738	90	785	789	582
2007	716	683	709	780	728	85	773	780	584
2008	710	679	701	768	720	81	760	768	576
2009	712	679	703	770	717	79	760	770	584
2010	709	671	702	767	712	80	756	766	566
2011	696	664	695	753	705	79	749	753	569
2012	687	660	684	745	701	78	738	745	558
2013	683	680	682	740	695	79	738	740	583
2014	672	670	671	729	683	74	728	727	587
2015	650	647	648	705	659	74	702	704	567
2016	634	633	630	689	646	73	684	689	568
2017	618	612	615	673	632	72	670	673	558
2018	605	598	605	658	617	72	658	658	550
2019	591	585	591	643	604	71	643	643	547
2020	566	559	565	618	578	69	615	618	517

Year	Working capital	Preferred stock	Shares outstanding	Long term debt	Short term debt	Minority interest	Market equity
Panel B: USA (Worldscope DataStream), 2000 - 2020							
2000	679	806	806	812	796	775	779
2001	674	799	795	805	792	781	777
2002	672	801	797	808	795	787	778
2003	681	805	804	813	801	796	775
2004	686	802	802	809	800	797	777
2005	679	795	792	800	796	788	773
2006	664	778	783	784	774	769	763
2007	656	770	767	772	763	768	750
2008	644	757	751	759	750	756	735
2009	644	755	750	759	740	753	731
2010	640	750	756	757	738	751	725
2011	639	745	750	750	740	745	723
2012	628	736	740	739	732	736	714
2013	634	736	737	738	718	736	710
2014	623	725	726	727	722	725	709
2015	599	701	701	702	696	701	693
2016	582	683	682	684	675	683	670
2017	568	669	668	670	662	669	658
2018	558	658	656	658	655	658	641
2019	544	643	640	643	640	643	632
2020	518	613	613	616	610	615	618

Year	Current assets	Current liabilities	Pre-taxes income	Total liabilities	Retained earnings	EBIT
Panel B: USA (Worldscope DataStream), 2000 - 2020						
2000	679	679	815	809	786	792
2001	674	674	812	801	787	797
2002	672	672	817	804	788	804
2003	681	681	823	812	796	811
2004	686	686	818	811	792	808
2005	679	679	808	801	783	797
2006	665	665	789	784	774	776
2007	656	656	779	772	761	768
2008	644	644	767	757	745	759
2009	644	644	767	758	742	760
2010	640	640	763	754	736	751
2011	639	639	751	749	736	744
2012	628	628	744	738	730	731
2013	633	632	739	738	731	730
2014	623	623	727	728	724	717
2015	599	599	702	703	699	696
2016	582	582	688	685	681	679
2017	568	568	673	670	665	664
2018	558	558	658	658	653	651
2019	544	544	643	643	640	636
2020	520	520	618	617	599	612

4.2 Descriptive statistics

Table 5 presents the descriptive statistics of the six quality variables considering the final sample used for the QV calculations. The final sample used for each quality variable is formed only by those companies with complete accounting data for a certain year. In this regard, some data limitations have affected this study as demonstrated in 4.1.

The descriptive statistics showed by Table 5 are the number of observations N, mean, standard deviation, median, 25th percentile, 75th percentile, maximum and minimum. The descriptive statistics are showed by region. The N-observations are equal to the stock-years from those companies with complete accounting data for the calculation of the QV in a certain year[17]. Therefore, different number of observations can be appreciated for each sample. In most of the cases over 11 000 observations have been made for the calculation of the QVs. The sample for the QV operating profitability, as mentioned before, was affected by the reduced availability of the accounting data interest expenses (#01075). The QV enterprise-level operating profitability, which is similar but differs by the interest expenses, shows, as a consequence, a much larger number of observations.

Also, the QV quality score presents to a lower extent a small number of observations. In the US-sample, it could be caused by data restriction of depreciation (see 4.1). However, the small number of observations might be also a consequence of the complexity of the quality variable. The quality score is constituted by 18 different accounting variables. Since the final sample only consider companies with complete data availability, the chances of dismissing companies because of lack accounting data are high.

[17] Compare to Dichev & Tang (2009).

Table 5. Descriptive statistics.

Variables	**N**	**Mean**	**Std. Dev.**	**Median**	**Minimum**	**25th percentile**	**75th percentile**	**Maximum**
Panel A: Europe (STOXX600), 1999 - 2020								
Investments	20129	1.547	194.856	0.044	-0.998	-0.024	0.136	27,638.120
Gross profit-to-assets	18158	0.306	0.248	0.254	-0.754	0.148	0.398	4.410
Operating profitability	1218	0.214	1.175	0.065	-20.397	0.037	0.132	25.265
Enterprise-level operating profitability	13768	0.134	0.136	0.121	-1.395	0.075	0.177	3.354
Earnings volatility	14823	0.041	0.097	0.021	6.6E-05	0.010	0.046	6.504
Quality score	5650	0.014	0.328	-0.015	-5.701	-0.138	0.135	3.547
Panel B: USA (S&P500), 1999 - 2020								
Investments	14693	0.128	1.252	0.054	-0.993	-0.012	0.142	141.544
Gross profit-to-assets	13865	0.355	0.235	0.299	-0.557	0.189	0.466	2.883
Operating profitability	748	0.209	0.790	0.170	-17.739	0.119	0.235	6.152
Enterprise-level operating profitability	13471	0.153	0.123	0.137	-1.771	0.095	0.196	2.657
Earnings volatility	11039	0.039	0.061	0.021	0.000	0.010	0.045	2.109
Quality score	3717	0.012	0.336	-0.011	-3.554	-0.158	0.165	2.547

The QV Investment-values for the Europe can be considered as expected when compared with the literature. In Panel A, the median, the 25th and 75th percentile are very close to the values obtained by Kyosev et al. (2020, p.33).[18] Nonetheless, the mean and the standard deviation differ notoriously from the values obtained by Kyosev et al. (2020). Especially, the standard deviation reaches a large value that seems to be provoked by outliers present in the data. Indeed, the 75th percentile and maximum value are 0.136 and 27,638.120, respectively. Supposing the Investment-values are normally distributed, this suggests that not too many values should be close to the maximum. In panel B, the mean value, median, the 25th and 75th percentile approach the values obtained be Kyosev et al. (2020, p. 33). A substantial mean difference between Panel A and B can be also appreciated.

The data statistics of QV gross profit-to-assets have been compared to those obtained by Novy-Marx (2013a, p. 5). In both cases, Panel A and B, the mean, median, 25th and 75th percentile lie inside referential intervals.[19] Furthermore, the values obtained in Panel A do not differ notoriously from those obtained in Panel B.

Similarly, the data statistics of QV operating profitability are compared with referential intervals suggested by Fama & French (2015, p. 14).[20] The mean value, median, 25th and 75th percentile of both Panel, A and B, lie inside the referential intervals.

Despite Novy-Marx (2016) detailed analysis of the QV enterprise-level operating profitability, there is not description of this QV data statistics.

[18] For an appropriate comparison, it must be considered that Kyosev et al. (2020, p. 33) have measured investment as $\frac{A_t}{A_{t-1}} - 1$. Thus, their investments calculations have a mean value, standard deviation, median, 25th and 75th percentile of 1.10, 0.19, 1.06, 1.00 and 1.14, respectively.

[19] This study has considered as referential intervals the five average portfolio values of GPA given by Novy-Marx (2013a, p.5). Novy-Marx (2013a) sorts the stocks in quintiles by their GPA-values to form portfolios (in similar way to this study). The average GPA values for the five portfolios are 0.10, 0.20, 0.30, 0.42 and 0.68.

[20] Fama & French (2015, p. 14) present time-series average of operating profitability. Fama&French (2015) sort the stocks in quintiles by their OP-values to form portfolios (in similar way to this study). This study takes as referential intervals the average OP values for the five portfolios: -0.37, 0.19, 0.25, 0.32 and 1.63.

The mean value and minimum of QV earnings volatility, of Panel A and B, approximates nearly the values obtained by Dichev & Tang (2009, p. 164)[21]. Instead, the maximum and standard deviation differ notoriously with the referential values.

Finally, the descriptive statistics showed by the QV quality score lie in the referential intervals when they are compared to Asness et al. (2019, p. 46)[22], especially the median values of both Panels (-0.015 for Panel A and -0.011 for Panel B) seem to approach the referential values (the average quality score of portfolios 5 and 6 are -0.07 and 0.15, respectively). Instead, the values of the 25th and 75th percentile seem to be too close to each other when compare with the referential values. This might be a sign that the data is concentrated in a narrow span.

[21] Dichev & Tang (2009, p. 164) present the QV earnings volatility data statistics for the total sample. The mean value, standard deviation, minimum and maximum are 0.040, 0.157, 0.000 and 12.448, respectively.

[22] The referential intervals are based on the portfolios of Asness et al. (2019, p. 46) and their corresponding average quality scores. Thus, 10 portfolios are formed by sorting the stocks by their quality score. The average quality score values for the ten portfolios are -1.44, -0.83, -0.53, -0.29, -0.07, 0.15, 0.38, 0.65, 0.99 and 1.64, respectively.

5 Results

This section presents the results obtained after the analysis of portfolios based on the quality variables. Following the proposed methodology, the performance of the portfolios has been measured by using the 3-factor model of Fama & French. The purpose is to describe on which manner the increment of the quality has an impact on the stock returns and try to find a pattern looking for similarities and differences between European and American companies.

The statistical significance considered for this study is 5%. Thus, those parameters that do not obtain a p-value under 5% will be considered as not significant (see 3.4).

The results will be oriented in answer the three proposed hypotheses. Firstly, in comparing the performance of portfolios with low and high quality, and secondly comparing the performance of high-quality portfolios and middle-quality portfolios. By doing so, it is also expected to realise the similarities and differences between American and European companies.

5.1 Investments

Table 6 shows the results for the QV Investments. Panel A presents the average Investment-values, the Fama-French α's, as well as its corresponding t-values and p-values for the quintiles based on the European sample. The adjusted R2 and the number of observations (stock-years) for each quintile are also presented. Analogy, Panel B shows the respective values for the US-sample.

Table 6. Investments portfolio characteristics.

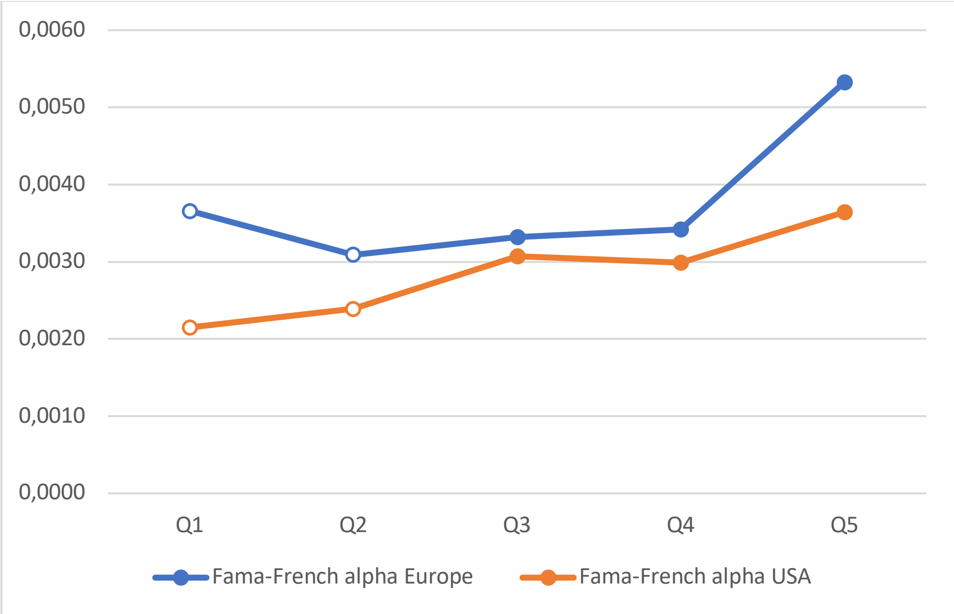
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Panel A: Europe					
Investments	-0.1568	-0.0094	0.0559	0.1386	0.7778
Fama-French α	0.0037*	0.0031*	0.0033**	0.0034**	0.0053***
t-value	1.9377	1.8545	2.0708	2.1576	3.1098
p-value	0.0540	0.0651	0.0396	0.0321	0.0021
Adjusted R^2	0.7016	0.7395	0.7279	0.7414	0.7368
N-observations	3,695	3,685	3,688	3,684	3,679
Panel B: USA					
Investments	-0.1350	0.0028	0.0623	0.1378	0.5594
Fama-French α	0.0021	0.0024*	0.0031**	0.0030**	0.0036**
t-value	1.3590	1.7450	2.2460	2.0330	2.2080
p-value	0.1755	0.0825	0.0257	0.0433	0.0283
Adjusted R2	0.8661	0.8592	0.8529	0.8409	0.8206
N-observations	2,690	2,683	2,685	2,682	2,674

*** 1% significance, ** 5% significance, * 10% significance

The results show that in Panel A and Panel B the 3rd, 4th, and 5th quintiles are statistically significant. As expected, the Fama-French model explain to a large extent the variance of the stock returns. In Panel A the adjusted R^2 values lie between 70% and 74%, while in Panel B they lie between 82% and 86%.

Figure 1 shows the alpha-values by quintile and region. The alpha-values with a p-value lower than 5% are pointed with filled circles, while those with a higher p-value are pointed with circles. It can be observed that all portfolios are economically important, since the α-values are all positive.

Fig. 1. Fama-French alpha-values by quintiles for investments.



Even when the alpha-values are not increasing monotonically across the quintiles, a growth tendency can be observed in Panel A when the 3rd (low investments) and 5th quintile (high investments) are compared, the α-values rise from 0,33% to 0,53%. In similar manner, the α-values in Panel B between 3rd and 5th quintile tend to increment when Investments become higher, from 0,31% to 0,36%. Surprisingly, these results do not corroborate the expectations, that higher investment rates produce lower future returns.[23] Moreover, the exposures to other factors cannot explain neither this relation. In table 12 in Appendix, Panel A shows that the exposure to the factors (Mkt-Rf) and (SMB) increase simultaneously with the alpha-value, explaining the increment of the alpha-values. In Panel B, however, the same tendency cannot be observed, and any factor increases together with the alpha-values.

5.2 Gross profit-to-assets

Table 7 shows the results for the QV gross profit-to-assets. Panel A presents the average gross profit-to-assets, the Fama-French α's, as well as its corresponding t-values and p-values for the quintiles based on the European sample. The adjusted R2 and the number of observations (stock-years) for each quintile are also presented. Analogy, Panel B shows the respective values for the US-sample.

[23] Compare to Kyosev et al. (2020).

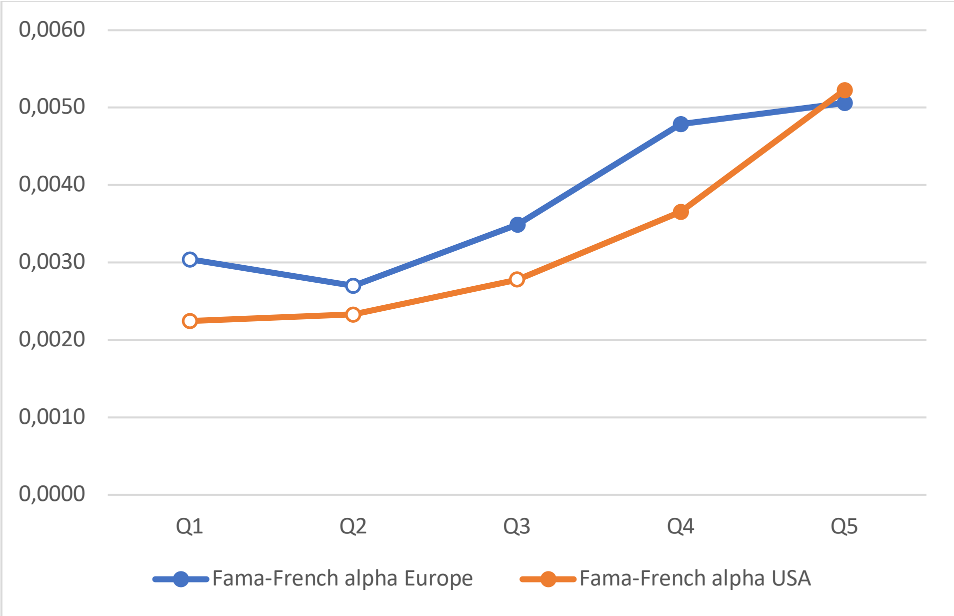
Table 7. Gross profit-to-assets portfolio characteristics.

	Q1	Q2	Q3	Q4	Q5
Panel A: Europe					
Gross profit-to-assets	0.0691	0.1732	0.2611	0.3698	0.6464
Fama-French α	0.0030*	0.0027	0.0035**	0.0048***	0.0051***
t-value	1.8832	1.5460	2.0754	2.7566	3.1100
p-value	0.0610	0.1235	0.0391	0.0063	0.0021
Adjusted R^2	0.7282	0.7193	0.7288	0.7021	0.6838
N-observations	3,175	3,167	3,172	3,165	3,161
Panel B: USA					
Gross profit-to-assets	0.1165	0.2243	0.3195	0.4515	0.7425
Fama-French α	0.0022	0.0023	0.0028*	0.0037***	0.0052***
t-value	1.2972	1.6114	1.9679	2.6576	3.6661
p-value	0.1959	0.1085	0.0503	0.0084	0.0003
Adjusted R^2	0.8116	0.8353	0.8576	0.8506	0.8142
N-observations	2,409	2,403	2,404	2,400	2,394

*** 1% significance, ** 5% significance, * 10% significance

The results in Panel A show that the Fama-French α's of the 3rd, 4th and 5th quintile are statistically significant. In Panel B the 4th and 5th quintile are statistically significant as well. Despite that, some of the alpha-values are not statistical significant, the Fama-French model seems to work well, and the model provide high adjusted R^2. Thus, the model explains between 68% and 72% of the return variance in Panel A, and 81% and 85% of the return variance in Panel B.

Fig. 2. Fama-French alpha-values by quintiles for gross profit-to-assets.



The economic importance of the portfolios is demonstrated by the positive values of the Fama-French α's. Moreover, an increment of Fama-French α's can be observed when the low-GPA-quintiles and high-GPA quintiles are compared. In Panel A, they increase from 0,35% to 0,51%. In Panel B, the α-values increase from 0,28% to 0,52%. Moreover, in both cases a monotonic increment of the α-values across the quintiles can be appreciated (when only significant alphas are considered), when the average quintile values of gross profit-to-assets rise.

Figure 2 shows the alpha-values by quintile and region. The alpha-values with a p-value lower than 5% are pointed with filled circles, while those with a higher p-value are pointed with circles. In Figure 2 the increment of the alpha-values together with the increment of the gross-profit-to-assets is also represented. Moreover, these results agree with literature, which indicates that higher values of GPA are related with higher returns.[24]

5.3 Operating profitability

Table 8 shows the results for the QV operating profitability. Panel A presents the average operating profitability-values, the Fama-French α's, as well as its corresponding t-values and

[24] Compare Novy-Marx (2013a) and Kyosev et al. (2020).

p-values for the quintiles based on the European sample. The adjusted R2 and the number of observations (stock-years) for each quintile are also presented. Analogy, Panel B shows the respective values for the US-sample.

Table 8. Operating profitability portfolio characteristics.

	Q1	Q2	Q3	Q4	Q5
Panel A: Europe					
Operating profitability	-0.2389	0.0378	0.0717	0.1420	0.7956
Fama-French α	-0.0001	0.0035	0.0052**	0.0059***	0.0021
t-value	-0.0523	1.2206	2.2719	2.6427	0.9015
p-value	0.9584	0.2235	0.0240	0.0088	0.3683
Adjusted R^2	0.4862	0.476	0.4255	0.5157	0.5258
N-observations	221	220	217	216	206
Panel B: USA					
Operating profitability	0.0627	0.1385	0.1719	0.2149	0.4076
Fama-French α	0.0064	0.0035	0.0048	0.0066**	0.0037
t-value	1.6126	0.9035	1.5103	1.9897	1.1511
p-value	0.1082	0.3672	0.1324	0.0478	0.2509
Adjusted R^2	0.4925	0.4482	0.5526	0.4755	0.6102
N-observations	135	131	136	126	124

*** 1% significance, ** 5% significance, * 10% significance

The results in Panel A show that only the alpha-values obtained in the 3rd and 4th quintile are statistically significant. Similarly, the α-values in Panel B, with exception of the 4th quintile, are all not significant. This might be an effect of the small final sample used for this QV. The difference of number of observations of operating profitability with other QV is evident. As it was explained before (see 4.1), the calculation of this QV depends on the accounting data interest expenses (#01075), which resulted to be unfrequently available. By the same token, the adjusted R^2 values obtained for both panels are much lower than those obtained before for other QVs.

Fig. 3. Fama-French alpha-values by quintiles for operating profitability.

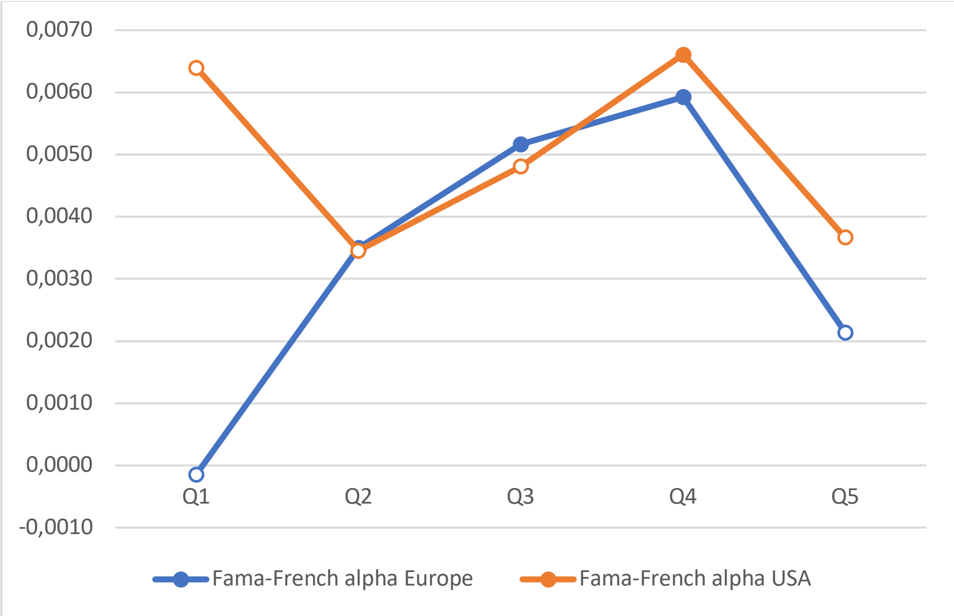


Figure 3 shows the alpha-values by quintile and region. The alpha-values with a p-value lower than 5% are pointed with filled circles, while those with a higher p-value are pointed with circles. The statistical significance of the alpha-values reduces the analysis to the 3rd and 4th quintile, where an increment of the alpha-values can be appreciated when the operating profitability increases[25].

5.4 Enterprise-level operating profitability

Table 9 shows the results for the QV enterprise-level operating profitability. Panel A presents the average enterprise-level operating profitability, the Fama-French α's, as well as its corresponding t-values and p-values for the quintiles based on the European sample. The adjusted R^2 and the number of observations (stock-years) for each quintile are also presented. Analogy, Panel B shows the respective values for the US-sample.

[25] Compare with Fama & French (2015). They affirm that that the stock returns increase together with the operating profitability.

Table 9. Enterprise-level operating profitability portfolio characteristics.

	Q1	Q2	Q3	Q4	Q5
Panel A: Europe					
Enterprise-level operat. profita.	-0.0063	0.0893	0.1258	0.1679	0.2819
Fama-French α	0.0034*	0.0022	0.0029*	0.0061***	0.0050***
t-value	1.6777	1.1860	1.6796	3.7840	3.0483
p-value	0.0948	0.2369	0.0944	0.0002	0.0026
Adjusted R^2	0.6821	0.7293	0.7174	0.6994	0.7032
N-observations	2,530	2,525	2,525	2,522	2,515
Panel B: USA					
Enterprise-level operat. profita.	0.0189	0.1063	0.1434	0.1892	0.3155
Fama-French α	0.0018	0.0041***	0.0027*	0.0027**	0.0052***
t-value	0.9932	2.9491	1.9041	1.9851	3.7159
p-value	0.3217	0.0035	0.0582	0.0484	0.0003
Adjusted R^2	0.8442	0.8495	0.8391	0.8417	0.8109
N-observations	2,473	2,472	2,463	2,471	2,458

*** 1% significance, ** 5% significance, * 10% significance

Panel A shows that 4th and 5th quintiles are statistically significant. Similarly, in Panel B the 2nd, 4th and 5th quintiles are significant. The 3-factor model seems to explain the variance of the returns. In Panel A, the adjusted R^2 values lie between 68% and 72%. In Panel B the adjusted R^2 values are higher and lie between 81% and 84%.

Fig. 4. Fama-French alpha-values by quintiles for enterprise-level operating profitability.

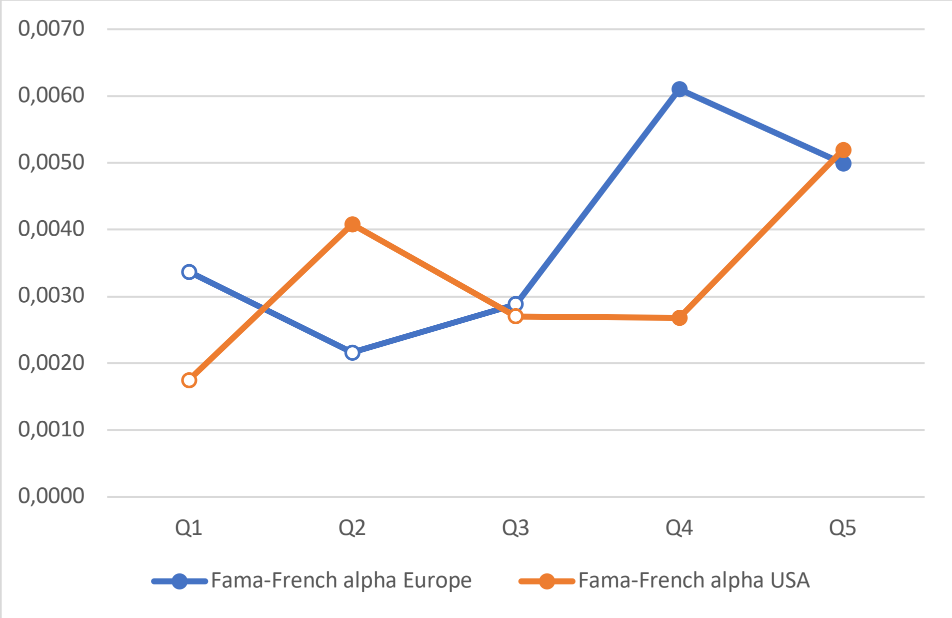


Figure 4 shows the alpha-values by quintile and region. The alpha-values with a p-value lower than 5% are pointed with filled circles, while those with a higher p-value are pointed with circles. Then it can be observed that in Figure 4 only the 4th and 5th quintile of the European sample can be compared. Thus, it can be observed that the alpha-values decrease when the enterprise-level operating profitability increases. Differently, the 2nd and 5th quintile of the US-sample can be compared. Thus, a different pattern occurs, and the alpha-values increase together with the enterprise-level operating profitability.[26]

5.5 Earnings volatility

Table 10 shows the results for the QV earnings volatility. Panel A presents the average earnings volatility, the Fama-French α's, as well as its corresponding t-values and p-values for the quintiles based on the European sample. The adjusted R^2 and the number of observations (stock-years) for each quintile are also presented. Analogy, Panel B shows the respective values for the US-sample.

[26] Compare to Novy-Marx(2016). He affirms that higher ELOP-values are related to higher returns.

Table 10. Earnings volatility portfolio characteristics.

	Q1	Q2	Q3	Q4	Q5
Panel A: Europe					
Earnings volatility	0.0038	0.0122	0.0228	0.0414	0.1238
Fama-French α	0.0013	0.0039**	0.0053***	0.0041**	0.0044**
t-value	0.6477	2.1284	2.9116	2.1931	2.2828
p-value	0.5181	0.0348	0.0041	0.0297	0.0237
Adjusted R^2	0.7639	0.7133	0.7432	0.7544	0.7687
N-observations	2,641	2,634	2,635	2,634	2,628
Panel B: USA					
Earnings volatility	0.0049	0.0128	0.0226	0.0411	0.1321
Fama-French α	0.0019	0.0021	0.0025	0.0016	0.0005
t-value	1.0183	1.2515	1.4746	0.8292	0.2549
p-value	0.3100	0.2125	0.1422	0.4082	0.7991
Adjusted R^2	0.8192	0.8344	0.8587	0.8499	0.8582
N-observations	1,961	1,957	1,958	1,954	1,950

*** 1% significance, ** 5% significance, * 10% significance

The results in Panel A show that the alpha-values are statistically significant with exception of the 1st quintile. Contrarily, the p-values of Panel B are too high, and any alpha-value can be considered as statistically significant. Contrarily, the R-squared-values in both Panels, A and B, lie above the 71% and the 82%, respectively. Then, despite the no significance of the alpha-values, the 3-factor-model successes to explain the returns in a large extent.

Fig. 5. Fama-French alpha-values by quintiles for earnings volatility.

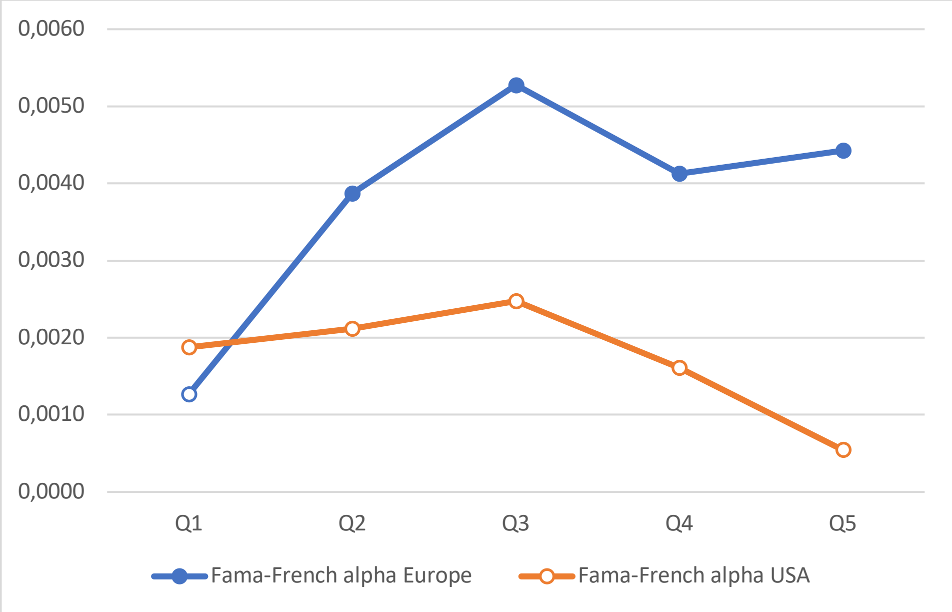


Figure 5 shows the alpha-values by quintile and region. The alpha-values with a p-value lower than 5% are pointed with filled circles, while those with a higher p-value are pointed with circles. When the alpha-values of the European sample are compared, an increment of the alpha-values can be observed between the 2st (low EVOL) and 5th (high EVOL) quintile from 0,39% to 0,44%. These results disagree with the expectation that high-volatility companies are related with lower returns.[27] It becomes difficult to make a statement about the US-sample since any alpha-value is significant.

5.6 Quality score

Table 11 shows the results for the QV quality score. Panel A presents the average quality scores, the Fama-French α's, as well as its corresponding t-values and p-values for the quintiles based on the European sample. The adjusted R^2 and the number of observations (stock-years) for each quintile are also presented. Analogy, Panel B shows the respective values for the US-sample.

[27] Compare to Gow & Taylor (2009).

Table 11. Quality score portfolio characteristics.

	Q1	Q2	Q3	Q4	Q5
Panel A: Europe					
Quality score	-0.3249	-0.1023	-0.0024	0.1223	0.4607
Fama-French α	0.0020	0.0035	0.0054**	0.0054***	0.0060***
t-value	0.9359	1.6297	2.5874	2.7090	2.9754
p-value	0.3508	0.1052	0.0106	0.0075	0.0034
Adjusted R^2	0.7673	0.7417	0.7091	0.6993	0.718
N-observations	1,050	1,043	1,045	1,041	1,040
Panel B: USA					
Quality score	-0.3549	-0.1201	-0.0153	0.1049	0.3366
Fama-French α	0.0015	0.0009	0.0012	0.0030	0.0040**
t-value	0.6448	0.4627	0.6182	1.4572	2.0876
p-value	0.5200	0.6442	0.5374	0.1471	0.0385
Adjusted R^2	0.8575	0.855	0.846	0.8107	0.8172
N-observations	707	703	704	700	697

*** 1% significance, ** 5% significance, * 10% significance

The results in Panel A show that the 3rd, 4th and 5th quintile have statistically significant alpha-values. On the contrary, in Panel B only the 5th quintile is statistically significant. In regard to the adjusted R^2 values, the 3-factor-model seems to perform well, explaining, in Panel A, between 69% and 76% of the return variances for each quintile, and in Panel B explaining between 81% and 85% of return variances.

Also, the number of observations seem to be small when the quality score is compared with other QVs. As explained in chapter 4, the complexity of this QV might reduce the number of final observations. Given the 18 different accounting data used for its calculation the chances of dismissing companies because of lack accounting data are high (see 4.2).

Fig. 6. Fama-French alpha-values by quintiles for quality score.

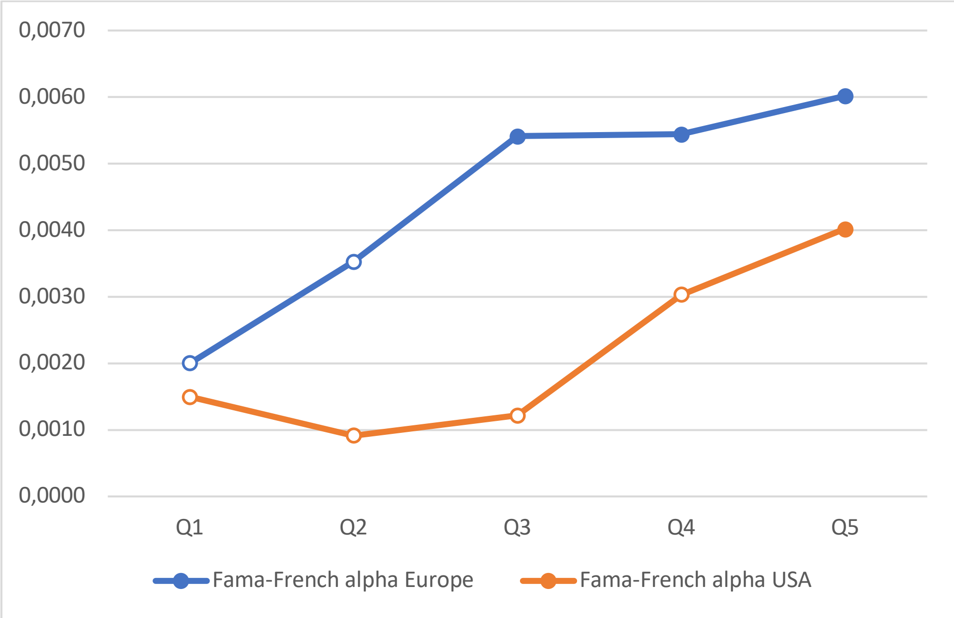


Figure 6 shows the alpha-values by quintile and region. The alpha-values with a p-value lower than 5% are pointed with filled circles, while those with a higher p-value are pointed with circles. Then, considering the significant values, an increment of the alpha-values between the 3rd and the 5th quintile can be observed. These results agree with the literature that high-quality-score companies are related with high returns. [28] In Panel B, since most of the alpha-values are not statistically significant, no statement can be made about the QV and the stock returns.

[28] Compare to Asness et al. (2019).

6 Conclusions

This master thesis has the aim to discover the characteristics of high-quality companies and to control whether differences, in regard to the quality perception, exist in European and American companies. In this concern, the variables that should characterize high-quality companies are obtained from the asset pricing literature. Moreover, it is indicated in what manner the influence on the stock return can be measured. In general, it is expected that high-quality companies perform better in the stock market than those with lower quality. The quality variables selected for this study are investments, operating profitability, enterprise-level operating profitability, gross profit-to-assets, earnings volatility and quality score.

The 3-Factor model of Fama & French is used to control for performance differences along different portfolios. The portfolios represent levels of quality, and they are formed when the companies are sorted in quintiles by the value of the quality variables. The application of the model also allows to control by the effects that the factors (Mkt-Rf), (SMB) and (HML) might have on the stock returns. Thus, the abnormal returns alpha measures the relation of the quality variables with the stock returns.

The descriptive statistics of the quality variables have been compared with those obtained by other authors. In this manner, the obtained quality values are validated. Thus, the descriptive statistics show that the values obtained for all the quality variables lie in referential intervals obtained from the literature. Furthermore, the size of the final samples used for the linear regressions has been estimated: operating profitability has a low number of observations when compared with the other quality variables. This can be attributed to accounting data restrictions.

The results of QV operating profitability contain many insignificant alpha-values that prevent the comparison between European and US-companies. However, the alpha-values from the 3rd and 4th quintile of the European sample can be compared. It can be observed that companies with high operating profitability perform better than companies with low operating profitability.

The reason for the insignificance of the alphas in operating profitability seem to be on the one hand, the small number of observations considered in the linear regression (see chapter 4).

On the other hand, the stock returns seem to be explained by the factors (Mkt-Rf), (SMB) and (HML) of the 3-Factor model. They show for most of the quintiles significant coefficient values (see table 14 in Appendix).

The QV earnings volatility presents some curious results, where any alpha-value of the US-sample is significant. The reason for the insignificance of the alphas in earnings volatility might be the factors (Mkt-Rf), (SMB) and (HML) which are in many cases significant (see Table 16 in Appendix). Therefore, a comparison between American and European companies is not possible. However, when the significant values of the 2nd and 5th quintile of the European sample are compared, it can be observed that companies with high volatilities perform better than those with low volatilities. The literature suggest however that high-volatility companies are related with lower returns (Gow & Taylor, 2009).

Similarly, the QV quality score presents many insignificant alpha-values, that prevent the comparison between European and American companies. However, the 3rd and 5th quantile of the European sample can be compared. Thus, it can be observed that companies with high quality score perform better than those with low quality score. Similarly, the insignificance of the alpha-values might be explained by the factors (Mkt-Rf), (SMB) and (HML), which present mostly significant values (see Table 17 in Appendix).

The results of QV-Investment indicate a positive relation between Investments and stock returns, when 3rd and 5th are compared. This suggest that companies with the highest Investments tend to perform better than those with the lowest Investments. It occurs similarly when the significant alphas of 3rd and 5th quintile of the US-sample are compared and performance increase with higher Investment-values. Nonetheless, this relation has not been expected. Indeed, a negative relation has been indicated by the literature. But, even when the model results do not match with the expectations, they should not be invalidated given the adjusted R^2 values and the significance of most of the Fama&French factors (see Table 12 in Appendix). Furthermore, any dual-sorted analysis, as proposed by Gow & Taylor (2009) has been applied. The results might be an indication that certain QV might be subsumed by other

QV or even by the Fama&French factor.[29] Thus, this might be seen as a topic for further analysis of the QV's.

The QV gross profit-to-assets shows that this quality variable has a similar impact on the return in European as well as in American companies. Thus, the results support a positive relation between this QV and the stock return. When the 3rd and 5th quintile of the European sample are compared, the companies with higher gross profit-to-assets perform better. The same occurs when the 4th and 5th quintile of the US-sample are compared. This agrees with the expectations, that by increasing the GPA, or better say, by increasing this quality characteristic, the stock returns tend also to rise.

When the significant alpha-values of the 4nd and 5th of the European sample are compared, it is observed that companies with high ELOP do not perform better than those with low ELOP. However, when the significant alpha-values of the 2nd and 5th of the American sample are compared the contrary is observed. Companies with high ELOP perform better than companies with low ELOP (this last pattern agrees with Novy-Marx, 2016). Thus, the European and US-sample present different performance patterns that might be considered as a difference between the European and US-sample in regard to quality.

[29] Given the possibility that certain quality variables may measure the same facet of the quality, it may happen, for instance, that the quality variable X subsumes the effect on the return of the quality variable Y. In this regard, Gow & Taylor (2009) have explained precisely a procedure, based on Fama & French methodology, for the control of variables over- lapping.

Let suppose that the quality variable X and Y have to be compared. Firstly, the companies will be sorted in quintiles, based on the values of the quality variables. Then the intersection of both X and Y quintiles results in the formation of twenty-five (5x5) portfolios. Next, the construction of hedge portfolios within quintile of X controlled by Y are determined to be positive. Similarly, the construction of hedge portfolios within quintile of Y controlled by X are determined to be positive. Thus, if the return of the hedge portfolios, within X quintile hedge for Y, and within Y hedge for X are significant, that will indicate that both variables X and Y have an impact on the return. But, let say that the return of hedge portfolios within X quintile hedge for Y are significant, and the return of hedge portfolios within Y hedge for X are insignificant, then that will be evidence that only the variable Y have an impact on the return.

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Appendix

Table 12. Investments portfolio Fama&French factors.

	Q1	Q2	Q3	Q4	Q5
Panel A: Europe					
Fama-French α	0.0037**	0.0031*	0.0033**	0.0034**	0.0053***
t-value	1.9377	1.8545	2.0708	2.1576	3.1098
p-value	0.0540	0.0651	0.0396	0.0321	0.0021
Mkt-Rf	0.0072***	0.0071***	0.0068***	0.0073***	0.0080***
t-value	18.2745	20.5627	20.3530	22.1193	22.2873
p-value	0.0000	0.0000	0.0000	0.0000	0.0000
SMB	0.0021**	0.0017**	0.0007**	0.0012	0.0032***
t-value	2.1192	1.9628	0.8163	1.4426	3.4986
p-value	0.0352	0.0510	0.4153	0.1506	0.0006
HML	0.0031***	0.0023***	0.0017**	0.0001	-0.0010
t-value	3.3702	2.8699	2.1236	0.0700	-1.1909
p-value	0.0009	0.0045	0.0349	0.9443	0.2350
Adjusted R^2	0.7016	0.7395	0.7279	0.7414	0.7368
N-observations	3,695	3,685	3,688	3,684	3,679
Panel B: USA					
Fama-French α	0.0021	0.0024*	0.0031**	0.0030**	0.0036**
t-value	1.3590	1.7450	2.2460	2.0330	2.2080
p-value	0.1755	0.0825	0.0257	0.0433	0.0283
Mkt-Rf	0.0112	0.0100***	0.0098***	0.0103***	0.0011***
t-value	1.3590	29.1100	28.6440	28.0060	26.6320
p-value	0.1750	0.0000	0.0000	0.0000	0.0000
SMB	0.0050***	0.0026***	0.0023***	0.0022***	0.0031***
t-value	7.0700	4.2160	3.7810	3.2810	4.1940
p-value	0.0000	0.0000	0.0002	0.0012	0.0000
HML	0.0040***	0.0031***	0.0029***	0.0022***	-0.0001
t-value	6.6920	5.9320	5.5050	3.9090	-0.1060
p-value	0.0000	0.0000	0.0000	0.0001	0.9155
Adjusted R^2	0.8661	0.8592	0.8529	0.8409	0.8206
N-observations	2,690	2,683	2,685	2,682	2,674

*** 1% significance, ** 5% significance, * 10% significance

Table 13. Gross profit-to-assets portfolio Fama&French factors.

	Q1	Q2	Q3	Q4	Q5
Panel A: Europe					
Fama-French α	0.0030*	0.0027	0.0035**	0.0048***	0.0051***
t-value	1.8832	1.5460	2.0754	2.7566	3.1100
p-value	0.0610	0.1235	0.0391	0.0063	0.0021
Mkt-Rf	0.0072***	0.0079***	0.0079***	0.0078***	0.0071***
t-value	21.8822	22.0550	22.9623	21.8819	21.2847
p-value	0.0000	0.0000	0.0000	0.0000	0.0000
SMB	0.0025***	0.0022**	0.0025***	0.0025***	0.0026***
t-value	2.9816	2.4582	2.8428	2.7860	3.0252
p-value	0.0032	0.0147	0.0049	0.0058	0.0028
HML	0.0011	0.0000	-0.0008	-0.0017**	-0.0025***
t-value	1.4727	0.0178	-1.0408	-2.0989	-3.2296
p-value	0.1422	0.9858	0.2991	0.0369	0.0014
Adjusted R^2	0.7282	0.7193	0.7288	0.7021	0.6838
N-observations	3,175	3,167	3,172	3,165	3,161
Panel B: USA					
Fama-French α	0.0022	0.0023	0.0028**	0.0037***	0.0052***
t-value	1.2972	1.6114	1.9679	2.6576	3.6661
p-value	0.1959	0.1085	0.0503	0.0084	0.0003
Mkt-Rf	0.0105***	0.0102***	0.0106***	0.0103***	0.0091***
t-value	24.7796	28.9621	30.8125	30.6234	26.0139
p-value	0.0000	0.0000	0.0000	0.0000	0.0000
SMB	0.0044***	0.0026***	0.0039***	0.0036***	0.0037***
t-value	5.9491	4.3221	6.5972	6.1400	6.2042
p-value	0.0000	0.0000	0.0000	0.0000	0.0000
HML	0.0036***	0.0016***	0.0013**	0.0001	0.0011**
t-value	5.6426	2.9445	2.5300	0.2022	2.0980
p-value	0.0000	0.0036	0.0121	0.8399	0.0370
Adjusted R^2	0.8116	0.8353	0.8576	0.8506	0.8142
N-observations	2,409	2,403	2,404	2,400	2,394

*** 1% significance, ** 5% significance, * 10% significance

Table 14. Operating profitability portfolio Fama&French factors.

	Q1	Q2	Q3	Q4	Q5
Panel A: Europe					
Fama-French α	-0.0001	0.0035	0,0052**	0.0059***	0.0021
t-value	-0.0523	1.2206	2.2719	2.6427	0.9015
p-value	0.9584	0.2235	0.0240	0.0088	0.3683
Mkt-Rf	0.0069***	0.0073***	0.0050***	0.0063***	0.0073***
t-value	12.0869	12.3724	10.6610	13.6653	15.0604
p-value	0.0000	0.0000	0.0000	0.0000	0.0000
SMB	0.0030**	0.0007	0.0010	0.0030**	0.0015
t-value	2.0632	0.4562	0.8155	2.5519	1.2158
p-value	0.0402	0.6487	0.4157	0.0114	0.2253
HML	0.0035***	0.0025**	0.0028***	0.0012	-0.0014
t-value	2.7084	1.9023	2.6450	1.1502	-1.2857
p-value	0.0073	0.0584	0.0087	0.2513	0.1999
Adjusted R^2	0.4862	0.476	0.4255	0.5157	0.5258
N-observations	221	220	217	216	206
Panel B: USA					
Fama-French α	0.0064*	0.0035	0.0048	0.0066**	0.0037
t-value	1.6126	0.9035	1.5103	1.9897	1.1511
p-value	0.1082	0.3672	0.1324	0.0478	0.2509
Mkt-Rf	0.0109***	0.0094***	0.0099***	0.0082***	0.0107***
t-value	11.2871	10.1167	12.6903	10.0713	13.8024
p-value	0.0000	0.0000	0.0000	0.0000	0.0000
SMB	0.0046***	0.0031**	0.0026**	0.0040***	0.0047***
t-value	2.7527	1.9252	1.9578	2.8225	3.4742
p-value	0.0064	0.0555	0.0515	0.0052	0.0006
HML	0.0060***	0.0068***	0.0068***	0.0066***	0.0073***
t-value	4.0825	4.7786	5.7760	5.3941	6.1845
p-value	0.0001	0.0000	0.0000	0.0000	0.0000
Adjusted R^2	0.4925	0.4482	0.5526	0.4755	0.6102
N-observations	135	131	136	126	124

*** 1% significance, ** 5% significance, * 10% significance

Table 15. Enterprise-level operating profitability portfolio Fama&French factors.

	Q1	Q2	Q3	Q4	Q5
Panel A: Europe					
Fama-French α	0.0034*	0.0022	0.0029*	0.0061***	0.0050***
t-value	1.6777	1.1860	1.6796	3.7840	3.0483
p-value	0.0948	0.2369	0.0944	0.0002	0.0026
Mkt-Rf	0.0084***	0.0083***	0.0079***	0.0072***	0.0075***
t-value	20.4089	22.3337	22.4215	21.6540	22.4895
p-value	0.0000	0.0000	0.0000	0.0000	0.0000
SMB	0.0028***	0.0030***	0.0024***	0.0025***	0.0024***
t-value	2.6933	3.2058	2.6918	3.0287	2.8142
p-value	0.0076	0.0015	0.0076	0.0027	0.0053
HML	-0.0006	0.0005	-0.0010	-0.0014*	-0.0031***
t-value	-0.6459	0.5332	-1.2817	-1.8956	-4.0806
p-value	0.5190	0.5944	0.2013	0.0593	0.0001
Adjusted R^2	0.6821	0.7293	0.7174	0.6994	0.7032
N-observations	2,530	2,525	2,525	2,522	2,515
Panel B: USA					
Fama-French α	0.0018	0.0041***	0.0027*	0.0027**	0.0052***
t-value	0.9932	2.9491	1.9041	1.9851	3.7159
p-value	0.3217	0.0035	0.0582	0.0484	0.0003
Mkt-Rf	0.0122***	0.0099***	0.0100***	0.0098***	0.0091***
t-value	28.4324	29.3251	28.7489	29.7240	26.5349
p-value	0.0000	0.0000	0.0000	0.0000	0.0000
SMB	0.0058***	0.0038***	0.0034***	0.0027***	0.0029***
t-value	7.7253	6.4815	5.6007	4.7616	4.9741
p-value	0.0000	0.0000	0.0000	0.0000	0.0000
HML	0.0016**	0.0021***	0.0016***	0.0011**	0.0006
t-value	2.4915	4.0741	3.1216	2.1603	1.2371
p-value	0.0134	0.0001	0.0020	0.0318	0.2173
Adjusted R^2	0.8442	0.8495	0.8391	0.8417	0.8109
N-observations	2,473	2,472	2,463	2,471	2,458

*** 1% significance, ** 5% significance, * 10% significance

Table 16. Earnings volatility portfolio Fama&French factors.

	Q1	Q2	Q3	Q4	Q5
Panel A: Europe					
Fama-French α	0.0013	0.0039**	0.0053***	0.004**1	0.0044**
t-value	0.6477	2.1284	2.9116	2.1931	2.2828
p-value	0.5181	0.0348	0.0041	0.0297	0.0237
Mkt-Rf	0.0069***	0.0066***	0.0071***	0.0073***	0.0079***
t-value	16.9726	17.4677	18.7966	18.6324	19.6220
p-value	0.0000	0.0000	0.0000	0.0000***	0.0000***
SMB	0.0007	0.0013	0.0015	0.0031	0.0039
t-value	0.6618	1.3659	1.5885	3.1249	3.8507
p-value	0.5090	0.1738	0.1141	0.0021	0.0002
HML	0.0048***	0.0003	0.0003	0.0013	0.0008
t-value	5.2817	0.3200	0.3921	1.4883	0.9320
p-value	0.0000	0.7494	0.6955	0.1386	0.3527
Adjusted R^2	0.7639	0.7133	0.7432	0.7544	0.7687
N-observations	2,641	2,634	2,635	2,634	2,628
Panel B: USA					
Fama-French α	0.0019	0.0021	0.0025	0.0016	0.0005
t-value	1.0183	1.2515	1.4746	0.8292	0.2549
p-value	0.3100	0.2125	0.1422	0.4082	0.7991
Mkt-Rf	0.0095***	0.0096***	0.0106***	0.0117***	0.0128***
t-value	21.3533	23.6603	26.3390	25.0323	24.9422
p-value	0.0000	0.0000	0.0000	0.0000	0.0000
SMB	0.0007	0.0022***	0.0023***	0.0037***	0.0062***
t-value	0.8190	2.8970	3.0268	4.1723	6.3875
p-value	0.4140	0.0043	0.0029	0.0000	0.0000
HML	0.0047***	0.0019***	0.0016***	0.0015**	0.0014*
t-value	7.1180	3.1744	2.7223	2.1142	1.8218
p-value	0.0000	0.0018	0.0072	0.0360	0.0703
Adjusted R^2	0.8192	0.8344	0.8587	0.8499	0.8582
N-observations	1,961	1,957	1,958	1,954	1,950

*** 1% significance, ** 5% significance, * 10% significance

Table 17. Quality score portfolio Fama&French factors.

	Q1	Q2	Q3	Q4	Q5
Panel A: Europe					
Fama-French α	0.0020	0.0035	0.0054**	0.0054***	0.0060***
t-value	0.9359	1.6297	2.5874	2.7090	2.9754
p-value	0.3508	0.1052	0.0106	0.0075	0.0034
Mkt-Rf	0.0074***	0.0076***	0.0071***	0.0069***	0.0074***
t-value	17.3465	17.6287	16.9720	17.1392	18.2808
p-value	0.0000	0.0000	0.0000	0.0000	0.0000
SMB	0.0049***	0.0014	0.0015	0.0016	0.0034***
t-value	4.4302	1.2297	1.4125	1.5457	3.2496
p-value	0.0000	0.2207	0.1598	0.1243	0.0014
HML	0.0033***	0.0013	-0.0002	-0.0013	-0.0027***
t-value	3.4061	1.3038	-0.2242	-1.4817	-2.9713
p-value	0.0008	0.1943	0.8229	0.1405	0.0034
Adjusted R^2	0.7673	0.7417	0.7091	0.6993	0.718
N-observations	1,050	1,043	1,045	1,041	1,040
Panel B: USA					
Fama-French α	0.0015	0.0009	0.0012	0.0030	0.0040**
t-value	0.6448	0.4627	0.6182	1.4572	2.0876
p-value	0.5200	0.6442	0.5374	0.1471	0.0385
Mkt-Rf	0.0125***	0.0115***	0.0111***	0.0108***	0.0104***
t-value	22.9429	24.8149	24.0502	22.1403	23.1146
p-value	0.0000	0.0000	0.0000	0.0000	0.0000
SMB	0.0049***	0.0022**	0.0023***	0.0024***	0.0021**
t-value	4.7252	2.5126	2.6505	2.6133	2.4400
p-value	0.0000	0.0130	0.0089	0.0099	0.0158
HML	0.0044***	0.0021***	0.0017**	-0.0007	-0.0017**
t-value	5.4997	3.0520	2.4315	-0.9253	-2.5145
p-value	0.0000	0.0027	0.0162	0.3563	0.0130
Adjusted R^2	0.8575	0.855	0.846	0.8107	0.8172
N-observations	707	703	704	700	697

*** 1% significance, ** 5% significance, * 10% significance