Combining Value Investing with Quality Investing:

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1 - INTRODUCTION

Can you systematically beat the stock market? Both academics and investment professionals frequently debate this topic. As a matter of fact, obtaining returns that exceed the benchmark implies a significant reward for portfolio managers and investors alike. Yet, beating a given market index is arguably a hardly achievable task. Indeed, only 2% of the US mutual funds manage to outperform the market, while about 80% fail to generate any significant risk-adjusted excess returns, and around 21% perform significantly worse compared to the market (Barras et al., 2009). A more recent evidence from the European markets tells that more than 89% of Europe equity funds and more than 94% of Eurozone equity funds underperformed the market (represented respectively by the S&P Europe 350 and the S&P Eurozone BMI index). In line with such strong evidence, the Efficient Market Hypothesis (EMH) argues that over the long term an investor cannot beat the market, while the whole group of active investors (and clients investing in their portfolios) think the opposite, supported by the empirical evidence of brilliant investors like Warren Buffet and Peter Lynch consistently succeeding in this goal.

Value investors are among those aiming to overcome this challenge, value investing being among the most popular investing strategies, also thanks to successful investors like Warren Buffett. It all started in 1934, when Graham and Dodd published "Security Analysis", and then it further developed in 1949, when Graham published "The Intelligent Investor". In both books a solid and structured framework for value investing was established. Value investing is based on the fundamental premise that the stock market is efficient only in the long-term, which potentially enables a rational investor to profit from overly optimistic or pessimistic valuations established by the stock market. Specifically, value investors should select those securities that are selling below the levels apparently justified by fundamentals. Although speculative factors cause market prices to temporarily deviate from intrinsic value, the tendency for the resulting disparities is to correct over time through the adjustment of price to value. As a consequence, securities priced below intrinsic value are expected to generate superior long-term performance.

Behind such irrationality is the idea of an imaginary 'Mr. Market', introduced by Graham in his book. Mr. Market is likely to have significant mood swings on a daily basis, which match the overall movements of the stock market. According to Graham, a value investor should rely exclusively on his/her own analysis and act accordingly, not letting Mr. Market even enter the decision making process. On the contrary, the smart value investor can consistently outperform the market by carefully picking those stocks that Mr. Market (i.e., most investors) overlooks. Already in the first half of the 20th century, Graham experienced this phenomenon firsthand, achieving a return twice as high as the Dow Jones index by selecting stocks based exclusively on specific valuation metrics.

In value investing, two main paths can be followed. There is the qualitative approach, according to which a value investor should not stop at assessing the value of the company's assets and/or earnings, but also consider more qualitative factors like the earnings power, growth potential, profit margin, management of the firm, etc. (Greenwald et al., 2001). The other approach, namely the quantitative approach, is the one often adopted across the financial literature, and which reduces the whole concept of value to a few easily calculable financial ratios, disregarding the characteristics and growth potential of the market in which the given company operates.

It took some time before Benjamin Graham's work was acknowledged in the financial literature. Nicholson (1960) arguably conducted one of the first researches on value anomaly. It was based on the US stock market and he concluded that low P/E stocks outperformed their high P/E counterparties. Basu (1977) achieved similar results in his research that was over the 1957-

1971 period. Following these publications, research on value investing was expanded to some other accounting ratios, and evidence on the value premium has consolidated. Arguably one of the most popular was an article published by Fama and French in 1998 titled "The International Evidence", in which the two researchers documented the discovery of a value premium in 12 tested markets (out of 13). Such value premium has also been found over the period 1985-2006 (Athanassakos, 2011). Overall, a lot of evidence exists to support the statement that portfolios made of value stocks could be earning higher returns compared to a market index.

However, a few different studies have reported weakening performance of formulaic based value investing (e.g., Asness et al., 2015; Kok et al., 2016). The strongest evidence in favor of growth outperforming value over the last decade was found in the US, although consistent empirical evidence of this might still be missing in other markets. According to Kok et al. (2016), value investing has been increasingly associated with strategies using some simple ratios which do not appropriately capture the complexity and intrinsic value of the given stock. In addition, these strategies tend to select companies which have temporarily inflated accounting figures. The general belief in the market is that value has been underperforming growth investing in the US after the financial crisis, which made the Federal Reserve start its quantitative easing program and cause a long period of low interest rates, benefitting growth stocks. Furthermore, deep technological developments have determined a significant rise in the stock price of several technology and software stocks.

This may have led researchers to explore strategies other than value and growth investing, and one that became increasingly popular is quality investing. Similarly to value investing, also quality investing is within the bottom-up investing domain, which assumes that numerous pricing inefficiencies (anomalies) exist in the market. Specifically, the basic idea of quality investing is about selecting stocks based on some fundamental "quality" characteristics. However, it is quite challenging to find in the existing financial literature a shared and precise definition of what exactly quality is.

The aim of this thesis is to combine a widely researched investing style such as value investing with a more recently popular one such as quality investing. From a theoretical perspective, it is likely to be a proper match, as quality refers to characteristics such as high gross profitability (Novy-Marx, 2013), return on capital (Greenblatt, 2006) and low level of debt (Graham, 1973). The cost of such stocks is that they are generally priced at a significant premium, which seems not to be in line with value investing. As a consequence, it has to be seen which of these two effects prevails over the other, making the match either successful or not. Specifically, strategies based on specific value and quality metrics will be back tested up to 2001 in the European stock market (STOXX Europe 600 index is the benchmark). After a thorough examination of metrics, the adopted value metrics are P/E, P/B, P/CF, EV/EBIT and EV/EBITDA. On the other hand, the quality metrics are Return on Invested Capital (last year), Return on Invested Capital (last 5 years), Return on Assets, gross profitability, Gratham's quality score and dividend yield. Quality metrics have been mainly inspired by Novy-Marx (2014) and Lalwani et al. (2018), who found the best performing quality strategies being gross profitability and Grantham's score. In addition to being tested as stand-alone strategies, value and quality are also tested together by creating equally weighted portfolios based on both value and quality ratios, which is inspired by Novy-Marx (2014) and Lalwani et al. (2018), but also by Greenblatt (2006), given his highly popular "Magic Formula". Combining quality with value has not been thoroughly researched across different markets, and no such previous study exists based on the European stock market, which is analyzed in this thesis. Additionally, both Novy-Marx (2014) and Lalwani et al. (2018) combine the selected quality metrics only with price-to-book, i.e., one single value metric. On the other hand, this thesis aims to combine a set of value metrics with six different quality variables.

The thesis is organized in the following manner. The section titled "Foundations of active investing" offers a comprehensive overview of the theoretical framework behind active investing, including the efficient market hypothesis, risk-adjusted performance metrics and key models such as CAPM and Fama French factor models. The following session titled "Value investing" provides a brief history of this strategy, after which literature related to the key value investing ratios is presented. Then, some key drivers behind the value premium are presented, in addition to more recent criticism of value investing. Moving on to the section titled "Quality investing", a number of definitions of what quality investing is, including the ones by Novy-Marx (2014), are outlined; furthermore, the performance of some quality strategies is reported from previous literature. The section titled "Combining value with quality investing" includes the analysis of performance of some strategies attempting to include both value and quality factors, including those by Novy-Marx (2014) and Lalwani & Chakraborty (2018). Going into the empirical part of the thesis, the section titled "Data and methodology" outlines the data sample selection process and the selected financial variables, together with the description of methodology. The following section titled "Empirical results and discussion" presents the key results of the research, both for the standalone value and quality portfolios, as well as for those combining both strategies. Finally, main findings are summarized, and key conclusions are drawn from the research in the section titled "Conclusion".

2 - FOUNDATIONS OF ACTIVE INVESTING

2.1 - Efficient market theory and its implications

Eugene Fama conducted extensive research on the efficient market theory, defining a market where all available information is fully reflected in share prices as "efficient" (Fama, 1970). According to Fama, the three conditions for efficiency in markets are: absence of transaction costs, all information is available to all investors, and these investors come to the same conclusions by interpreting the available information. This premise is supported by market equilibrium conditions, according to which all the stock trading activities are characterized by a Net Present Value equal to zero. The reason is that the stock market already prices in all the future cash flows, discounted with a rate that appropriately reflects risks. Hence, Jensen (1978) claimed that in an efficient market it is impossible to consistently generate a risk-adjusted positive return, net of all costs, meaning that long-term investors cannot beat the market. This perspective serves as the foundation for passive investment, which follows a market-weighted index or portfolio.

Fama (1970) articulated the efficient market hypothesis (EMH) in three forms: weak, semi-strong and strong form. He concluded that academic findings support the weak and semi-strong form. In the weak form, future stock price movements cannot be anticipated by thoroughly analyzing historical prices, as this information is already reflected in current prices. This entails that it is impossible to generate abnormal returns via technical analysis. In the semi-strong form, the current prices also reflect all the public information related to the business, e.g., guidance on future earnings. This implies that not even fundamental analysis is able to produce outlier returns. Lastly, in the strong form, prices also reflect private information. As a result, even insiders who have access to confidential information that could affect the share price, cannot generate outlier returns.

The implications of the EMH, according to Fama, are that it is not only useless to examine historical data but also annual reports and other publicly available information about the company, or even insider information; all information is already reflected in the share price (Fama, 1970). Since Fama's definition, empirical research and theoretical justification greatly bolstered the EMH up until the mid-1980s. For instance, Jensen (1978) asserted that the EMH has the strongest empirical foundation of any economics proposition. Its main implication is that passive form of investing has became more and more popular (Szyszka (2007)).

From a theoretical perspective, the efficient market hypothesis is strictly connected to the random walk theory. Malkiel Burton (1973), a leading proponent of EMH, demonstrated that market prices are random, hence investors are not able to predict them by looking at past data. As a consequence, applying fundamental or technical analysis to time the market is useless and will simply lead to underperformance. As a consequence, according to Malkiel, investors would be better off buying and holding an index fund.

2.2 - Criticism against the efficient market hypothesis

Efficient market hypothesis has also been heavily criticized, as there are numerous empirical studies that find patterns contradicting it. The expression "the most valuable commodity is information" is well-known on Wall Street. According to Grossman et al. (1980), gathering information pays off when markets are in equilibrium. This is where active investing begins, looking for mispriced securities in an effort to generate alpha. Since markets can occasionally be mispriced and positive alpha values can be found, active investors have therefore the potential to outperform markets over the long term. For instance, Thaler (1993) and Shiller (2000) came to the conclusion that market prices are not as efficient as commonly believed and that behavior psychology has significant influence on market sentiment. Malkiel (2003) also investigated the efficient market hypothesis and came to the conclusion that there are market anomalies and that there is evidence of some degree of price predictability. Behavioral finance supporters might argue that market anomalies are due to the irrationality of investors in reacting to market developments (Szyszka (2007). According to behavioral finance proponents, there are a variety of situations where investors' actions result in violations of the EMH. For instance, research by Kahneman and Tversky (1973) found that people frequently overemphasize recent developments in comparison to the bigger picture of a phenomenon. Depending on how recent events might play out, this is likely to manifest as too extreme reactions in either direction. This effect could explain the reason why shares with already high P/E ratios might go even higher as recent developments drive up too much future earnings expectations, while the contrary occurs for shares with low P/E ratios (Debondt & Thaler 1990).

Although supporters of the efficient market hypothesis claim that it is impossible to outperform the market in the long run, there is increasing research pointing out about how certain value investing strategies result in higher returns. Basu (1977), Fama and French (1992), Chan and Lakonishok (1991) and several others have found evidence on value premium in their studies. Additionally, well-known investors like Warren Buffett, Joel Greenblatt, and Seth Klarman have managed to consistently outperform the market over multiple decades. If the markets were fully efficient, this should not be possible.

Additional anomalies contradicting the Efficient Market Hypothesis could be found by testing its three forms: weak, semi-strong and strong form. Starting from the weak form efficiency, finding patterns in the stock return data enables to test it, by analyzing the serial correlation of stock prices. For instance, Jegadeesh and Titman (1993) found that a stock's recent performance is likely to persist (momentum effect). On the other hand, the reversal effect (supported by empirical evidence by Chopra et al. (1992) and Debondt et al., (1995)) implies that the market is likely to overreact to certain developments. Both momentum and reversal effects condradict the Efficient Market Hypothesis.

Numerous studies have examined fundamental analysis and asked whether using information that is readily available to the public can improve investment performance in order to test the semi-strong form of market efficiency (Bodie, 2014). Several papers have identified market anomalies. For instance, there is the small-firm-in-January effect, i.e., a seasonal increase in stock prices especially for small firms during the month of January, as well as book-to-market, and price-to-earnings anomalies. Furthermore, Buffett argues that the value investors' outperformance is not random or due to luck, which implies the invalidity of the semi-strong form.

Lastly, strong form efficiency is harder to test, as data about investment strategies based on private information, the use of which is illegal, is hard to obtain. However, arguably the main reason for which it is illegal is related to the ability to generate an unfair private gain by using such information. Jaffe (1974) was able to identify patterns according to which share prices increase following massive buys by insiders, and vice versa.

Overall, there are many anomalies found in the finance literature. Those related to value and quality investing are examined in greater detail in the relative chapters.

2.3 - Risk-adjusted performance metrics

As William Sharpe (1964) introduced the capital market line, he pointed out the fundamental assumption in financial markets, namely the fact that a higher rate of return implies higher risk. Due to this, no one can systematically outperform the market without bearing more risk.

Multiple risk-adjusted return ratios exist for assessing portfolio performance. The Sharpe ratio is the most prevalent among them, and it is calculated by dividing the excess return of an asset by its standard deviation (Bodie et al., 2014). A higher Sharpe ratio implies a better risk-adjusted performance.

Treynor (1965) introduced a comparable metric (the Treynor ratio) that differs in its choice of risk measure, incorporating the beta coefficient (which measures the sensitivity of an asset to overall market movements) instead of the standard deviation. On the other hand, Jensen's Alpha (1978) evaluates portfolio performance by comparing the return of the asset to what is predicted by the capital asset pricing model.

Additionally, the Sortino ratio and the Modigliani-Modigliani ratio are two other well-known risk-adjusted performance ratios. Sortino ratio is a variant of the Sharpe ratio that takes downside risk into account, as any returns below a set target are penalized.

2.4 - Pricing securities in an efficient market

2.4.1 - Capital Asset Pricing Model

The capital asset pricing model (CAPM) is the first and perhaps the most renowned pricing model in finance, its major strength being its ability to clearly show the fundamental relationship between return and risk.

Sharpe (1964) introduced the following formula defining the expected return of a financial asset as the sum of the risk-free rate and the excepted market risk premium (which subtracts the risk-free rate from market return), multiplied by the asset's beta:

$$E(R_i) = R_f + \beta_i * E(R_m - R_f)$$

The asset's beta is calculated by dividing the covariance between the asset's and the market's return, by the market's variance:

$$\beta_i = \frac{\mathrm{Cov}\ (R_i, R_m)}{\mathrm{Var}\ (R_{m)})}$$

Jensen's alpha is a method introduced in 1967 by Michael Jensen to assess a portfolio's risk-adjusted-performance. It is based on the CAPM, according to which higher returns lead to higher risk, and is interpreted so that positive values imply a better return relative to the risk level. A value equal to zero implies that the returns are equal to those expected by the CAPM, while negative values indicate weaker than expected performance. The formula for calculating Jensen's alpha is the following (Jensen, 1967):

$$\alpha_i = R_i - R_f - \beta_i * (R_m - R_f)$$

The CAPM model has also received significant criticism. For instance, it was discovered that returns are consistently higher for stocks with small market capitalization than their large market capitalization counterparties, which is not predicted by the CAPM. Additionally, value stocks—those with low P/B or P/E ratios— tend to have higher returns than predicted by the CAPM. Furthermore, the study by Fama and Macbeth (1973) revealed that although there is some qualitative evidence supporting the validity of CAPM, there is a lack of quantitative support.

2.4.2 - Fama French Factor Models

Considering that CAPM is a single-factor model, it has undergone numerous extensions (Bodie et al., 2014). Multifactor models incorporate a number of systematic components of security risk in an effort to increase CAPM model's explanatory power.

The size and value factors were first introduced by Fama and French (1992), and they were then used in a factor-based model (Fama and French, 1993). Fama-French 3-factor model relates the return of a security to its correlation with three portfolios, each representing a factor, according to the following formula:

$$R_i = \alpha_i + \beta_1 * MKT + \beta_2 * SMB + \beta_3 * HML + \varepsilon_i$$

where α is the intercept, MKT is the return of the market portfolio, SMB ("Small Minus Big") represents the size premium, i.e., the excess return of the portfolio with stocks having low market cap over the one with large cap stocks, HML ("High Minus Low") represents the value premium, i.e., the excess return of the value portfolio over the growth portfolio, $\beta 1$, $\beta 2$, $\beta 3$ are the loadings on the factors. The additional size and value risk factors improve the model's explanatory as well as predictive power when compared with CAPM, which has only the market factor (Fama and French, 1993).

Carhart (1997) added the momentum factor to the model. Then, Fama and French (2015) introduced a five-factor model, which includes the market, size, value, profitability and investment factors:

$$R_i = \alpha_i + \beta_1 * MKT + \beta_2 * SMB + \beta_3 * HML + \beta_4 * RMW + \beta_5 * CMA + \varepsilon_i$$

Asness et al. (2013) developed the quality-minus-junk factor, which is meant to include safe, profitable and growing companies. The authors showed the ability of such factor to earn significant risk-adjusted returns both in the US and globally. This is arguably due to a less than proportional effect of quality on price, as high-quality stocks (those with high profitability, growth and safety) have on average higher prices, although not by a large margin, which attributes to them a higher risk-adjusted return (Asness et al., 2013). Interestingly, Frazzini et al. (2018) demonstrated that by including a betting-against-beta and a quality-minus-junk factor, Buffett's alpha becomes statistically insignificant. This could imply that the additional returns achieved by Berkshire could be attributed to Buffett's inclination towards high-quality stocks.

3 - VALUE INVESTING

Investors who do not believe in market efficiency are prevalent in financial markets. As a matter of fact, nearly every active investor attempts to include his own viewpoints in the investment process. In 1995, passive investments represented only 3% of total assets under management in mutual and exchange-traded funds. However, the share reached 14% in 2005 and was already 37% in December 2017 (Anadu et al., 2018), and Bloomberg claimed that passive overtook active around August 2018, with a share of about 54%. Despite the recent shift from active to passive investing, the former is still a very popular investing style. This implies that either the efficient market theory is incorrect or active investors are not rational.

3.1 - A brief history of value investing

Value Investors do not fully believe in market efficiency. Indeed, according to Arnold (2009), investors should try to select undervalued stocks that therefore have a high potential to create value, which in this case implies a relatively high capital gain. Everything began with Graham and Dodd (1934), who are considered pioneers with respect to value investing theories. In their Security Analysis book, Graham refers to the stock market as a voting machine where both retail investors and investment practitioners can express their opinions by buying and selling stocks, particularly in the short term. According to Graham, decisions are a combination of emotions and reason. Market factors, which are only speculative, can be characterized as technical, manipulative and psychological. On the other side, intrinsic value factors, over which an investment approach should be based, include earnings, cash flows dividends, leverage, etc. Finally, future value factors sit between investments and speculation, including management performance, competitive positioning of the business, etc.. All those factors combined tend to establish the share price (Graham and Dodd, 1934).

Graham and Dodd (1934) advocated going beyond basic fundamental metrics to better understand the true value of the underlying securities and identify those which are underpriced. They emphasize that relying solely on simple fundamental metrics is not sufficient for analysts to make informed investment decisions, but further research is needed to establish a rational basis for investment decisions.

The Graham and Dodd era of value investing is based on some key principles. First, financial securities tend to have an underlying fundamental value that can be measured fairly accurately and is comparatively stable (Graham and Dodd, 1934). As a result of market fluctuations, the financial security's intrinsic value may differ from its current market value. Some factors which the intrinsic value relies on, include dividends, earnings, assets, and future prospects.

Another crucial concept in value investing is the margin of safety, which is the difference between its intrinsic value and its current price (Graham and Dodd, 1934). The lower the security’s price compared to its intrinsic value, the higher is the margin of safety. This is ultimately due to having to deal with a very irrational player, namely Mr. Market, who bases his investment decisions on the current mental state, hence making market prices significantly fluctuate and influencing the aforementioned margin of safety. Lastly, another principle advocated by Graham and Dodd (1934) is related to the concept of diversification, according to which it is recommended for a securities portfolio to encompass a variety of stocks in order to mitigate risk.

Over the following approximately 50 years, the value approach to investing remained dominant, albeit with a number of modifications and adaptations. The general perception of value investing changed in the 1980s as pricing multiples gained popularity as a result of the development of financial databases, which in turn raised consumer awareness of market anomalies. The first comprehensive stock market database created by the Center for Research in Security Prices (CRSP) in 1960 played a significant role in this regard (Kok et al., 2016). In the 1980s, a significant number of anomalies, including those related to a number of value multiples, such as the P/E, P/B and P/CF ratios, emerged from the CRSP database (Fama, 1970). By the 1990s, the era of formula-based value investing had begun, the investing decisions being based on straightforward accounting ratios. This trend was further advanced by authors like Fama and French, who found strong correlations between value ratios and future stock returns. However, recent research has concluded that strategies based on formulaic value investing are losing their effectiveness across a number of markets (Asness et al., 2015; Kok et al., 2016; Lev et al., 2019).

Despite extensive research on value investing in the academic literature, there is no agreement yet on the reasons why value investing could generate superior returns (Davydov, 2017). A possible argument is the one supported by Fama and French (1992) and Kapadia (2011), which claims that the value premium of the selected companies is simply due to their higher level of fundamental risk. An alternative view argues that value premiums result instead from investors' irrational behavior, as they may tend to judge too positively or negatively a given security compared to others for a number of possible reasons; this view is supported by Campbell et al. (2008) and Lakonishok et al. (1994). This might be due to investors trying to project the past performance of a business over an excessively long investment horizon or simply overreacting to recent developments. On the other hand, some stocks may be undervalued due to insufficient attention of market participants, and therefore create opportunities for value investing.

3.2 - Value investing multiples/ratios

Overall, both academic research and strategies adopted by practitioners have evolved relatively little since the pioneering work by Graham. Interestingly, also providers of value indices all use very similar ratios for constructing them (Chee et al., 2013). For instance, S&P uses a weighted combination of P/B, trailing dividend yield, trailing P/Sales and trailing P/CF ratios. Russell adopts the P/B ratio as well, as also does Dow Jones, which uses a weighted average of P/B, trailing P/E, P/E (next year's consensus forecast) and dividend yield ratios (Chee et al., 2013). In most of these ratios, the numerator represents the market price, and is divided by some sort of metric intended to capture the security's intrinsic value; here, academics and practitioners still follow Graham's guidance of estimating intrinsic value by means of either book value or proxies of earnings power. In most of the aforementioned metrics, a lower ratio translates into a higher relative value, while the opposite is true for ratios like the dividend yield.

3.2.1 - P/E

The price-to-earnings ratio (P/E) evaluates a security's market value in relation to its earnings. The ratio indicates how much the market is willing to pay for a stock based on its actual or projected earnings (Bodie, 2014). Furthermore, the P/E ratio partly reflects the expected growth opportunities a business might have (Bodie, 2014). A high P/E ratio (which typically identifies growth stocks) means that the cost for a given level of current earnings is relatively high, while the opposite applies to a low P/E ratio (which is typically associated with value stocks) (Fama and French, 1997). P/E ratio therefore indicates the relative (to the earnings) price of the stock, including in a single metric lot of information about the underlying company. However, using the P/E ratio involves several risks to be aware of, which can potentially mispresent the value of a company. For instance, there is the risk of earnings per share being manipulated by the companies, which themselves calculate this accounting metric. Another major drawback of this metric is that it bases a company's earnings on past performance, which may not reflect its future prospects, or projected future performance, which in turn depends on the perception of the market. Furthermore, inflation could affect how investors perceive the companies’ future cash flows, on which the valuation of stocks is often based; specifically, the effect of higher inflation on future growth is likely to be negative, which would probably decrease the company’s stock price (Aga and Kocaman, 2006). Finally, P/E ratios depend heavily on factors other than the company’s ability to deliver good business results: these include, for instance, market conditions and the industry in which the company operates, as they tend to differ a lot in terms of growth rates, hence P/E ratios (for instance, biotechnology businesses tend to have high P/E, while financial institutions lower ones).

Related Literature

Numerous research papers have demonstrated the benefits from incorporating the P/E ratio in the decision-making process for investments, as it’s able to show the stock's relative price. The first evidence of the price-to-earnings anomaly was found by Nicholson (1960), who investigated 100 US stocks from 1939 to 1959 with holding periods ranging from 3 to 20 years. The finding in all holding periods was that the portfolio with lowest P/E had higher returns compared to the highest one. Nicholson's article, however, omitted any risk-adjusted return metrics.

Risk-adjusted excess returns were first reported by Basu (1977). His findings showed that the two portfolios with low P/E ratios produced average annual returns of 13.5% and 16.3%, while those generated by the two portfolios with high P/E ratios, were only 9.3–9.5%. Importantly, Basu also stated that the returns decreased monotonically when moving from low to high P/E portfolios. The excess returns were statistically significant at a 5% confidence level, while also exceeding CAPM’s implied returns.

Furthermore, Sharpe ratios for low P/E portfolios were higher, giving further proof for the P/E anomaly (Basu, 1983).

Cook and Rozeff (1984) analyzed the P/E anomaly in the NYSE over the 1964-1981 period. This was after Banz (1981) and Reinganum (1981) concluded that the P/E anomaly is irrelevant as it is the company size that explains the excess returns. On the other hand, Cook and Rozeff (1984) claimed that the P/E anomaly was significant, and the company size was another factor in explaining the excess returns, arguing that Reinganum (1981) made wrong conclusions with respect to the P/E anomaly due to pitfalls in the methodology of his research.

The P/E anomaly has also been investigated in other markets. For instance, Chan et al. (1991) conducted a study in the Japanese market from 1971 to 1988 and did not find any evidence of the P/E anomaly (even though P/B and P/CF anomalies were evident). On the other hand, Dhatt et al. (1999) focused on small capitalization stocks within the Russell 2000 index from 1979 to 1999, and according to their results, low P/E stocks had higher returns than their high P/E counterparties. However, the P/E ratio underperformed the P/Sales and P/B ratios (Dhat et al., 1999). Evidence of the P/E anomaly was found also in the German market. Artmann et al. (2012), examining 955 stocks listed on the Frankfurt Stock Exchange in the 1963-2006 time period, found that both P/E and P/B were significant at explaining excess returns, while the company size was not (Artmann et al., 2012). Bauman et al. (1998) conducted a similar study for companies from 21 developed countries from 1986 to 1990, and found out that, although this did not happen every single year, portfolios with low P/E stocks generally outperformed by a wide margin those with high P/E. They argued that this was due to investors overreacting to historical performance while neglecting the concept of mean-reversion (Bauman et al., 1998).

Fama and French conducted extensive research on a number of value anomalies. They opted for not including the P/E ratio in their 3-factor model as in their opinion the P/E anomaly is already captured by size and value factors (Fama and French, 1992). On the contrary, Artmann et al. (2012) argued that the 3-factor model had insufficient explanatory power in the German market over the period 1963-2006, and that on the other hand returns were better explained by replacing the size factor with the P/E factor.

Interestingly, Anderson and Brooks (2006) conducted research from 1975 to 2003 on companies within the London Stock Exchange, including earnings from the previous one to eight years in the P/E ratio calculation. According to their results, lowest P/E portfolios generated excess returns over those with high P/E, and importantly P/E ratios calculated using earnings from the previous eight years were much more effective at explaining returns than those calculated on the basis of the previous year's earnings only. Sharpe ratios of low P/E portfolios were compelling, while annual returns were in the 21.1-28.9% range, depending on the number of years used to calculate the earnings (Anderson et al., 2006).

More recently, research conducted by Athanassakos (2011) over the 1985-2006 period on stocks from AMEX, NASDAQ and NYSE, found that stocks with low P/E generated higher returns compared to their high P/E counterparties. Interestingly, the value portfolios, i.e., composed by low P/E stocks, declined less than growth portfolios, i.e., composed by high P/E stocks, during bearish markets (Athanassakos, 2011). Additionally, Fama and French extended their previous research (1998) to the 21st century. In particular, they examined the P/E, P/B and P/CF ratios for stocks across 23 countries in North America, Europe, Japan and Asia Pacific region. They found that over the period from November 1989 to March 2001, every market experienced a value premium (Fama and French, 2012).

3.2.2 - P/B

The market price of a share divided by its book value is known as the price-to-book ratio (Bodie, 2014). A higher ratio indicates a higher expected revenue generation by the company given a certain level of assets (Bodie, 2014). Even though P/B and P/E ratios are arguably similar, P/B could be seen as more useful in sectors where book value plays a key role for revenue generation, such as banking (Mladjenovic, 2009). As the P/B ratio can be viewed as a "floor" supporting the market price, companies with low P/B ratios can be considered "safer investments." In other words, as the company always has the option to sell or liquidate its assets, the argument is that the market price is not likely to fall below the book value. As a consequence, P/B ratios lower than one typically indicate that a stock may be deeply undervalued. This measure is subject to some limitations as well. A low P/B ratio may be a sign that a business has significant financial issues. Furthermore, this measure can be distorted in a number of ways, as it does not account for recent write-offs, share buybacks, or acquisitions, nor does it consider whether the company pays dividends or not. P/B ratio generally does not work well for businesses that have a high proportion of intangible assets and a low proportion of fixed assets.

Related Literature

The P/B anomaly was first researched in the US markets by Rosenberg, Reid and Lanstein (1985) over the period 1980-1984. The B/P anomaly was present and significant, and the simple strategy consisting of buying stocks with high while selling those with low B/P, generated excess returns (Rosenberg et al., 1985). Fama and French (1992) also conducted research on the US markets but with a longer time frame (from 1963 to 1990). The conclusion was that the strongest explanatory power was held by the B/P ratio, arguing that this was at least partly due to higher risk; this is specifically related to the bankruptcy risk held by stocks with a low P/B ratio, which are often highly leveraged (Fama and French, 1992).

Kothari et al. (1995) argued that survivorship bias is one key reason for the P/B anomaly’s existence. According to their findings, the P/B ratio did not exhibit a significant relation to stock returs in the time period from 1927 to 1990. However, the companies characterized by low P/B ratios tended to have significant earnings increases (Kothari et al., 1995). Furthermore, Davis (1994) conducted a research from 1940 to 1963 with no survivorship bias, showing that P/B ratio had relevant explanatory power over future returns. The low P/B quintile generated an excess return over high P/B quintile of 6.8% on average (Davis, 1994). Similar results were also found by Chan, Jegadeesh and Lakonishok (1995).

The P/B anomaly was researched also outside the US. For instance, research by Capaul et al. (1993) showed that in the 1981-1992 period low P/B ratio stocks generated excess risk-adjusted returns in the European, US and Japanese markets. Specifically, Sharpe ratios were higher for value portfolios, and the annual spread with growth portfolios being in the 1.35-6.41% range (Capaul et al., 1993). According to the research conducted by Bird and Whitaker (2003) on companies in the UK, Germany, France, Italy, Netherlands, Switzerland and Spain over the years 1990-2002, P/B ratio was the best at generating high returns, compared to P/E, P/Sales and the dividend yield. Similarly, also Bauman, Conover and Miller (1998) found that the largest excess returns were generated by P/B ratio compared to P/E, P/CF and dividend yield.

Fama and French investigated the rationale behind the P/B anomaly, arguing that its existence is due to companies with low P/B significantly accelerating their growth rate following the portfolios formation (Fama and

French, 1992), as the vastly different earnings growth rates of high and low P/B stocks tend to converge over time.

Another potential reason behind the P/B anomaly is related to research and analyst coverage. In this regard, Griffin and Lemmon (2002) claimed that P/B has the highest relevance in those companies which are small and are not extensively covered by analysts, finding that the average annual return of such stocks was 16.49% against the -2.64% for those having low P/B but high market capitalization and analyst coverage (Griffin and Lemmon, 2002).

Trecartin (2001) found that stocks' 10-year returns were correlated with low P/B ratios, the correlation being statistically significant. However, this study, which analyzed stocks from NYSE, Amex and NASDAQ in the 1963-1997 period, also showed that in case of short investment periods, portfolios with low P/B could not outperform those with high P/B (Trecartin, 2001).

More recently, Gerakos and Linnainmaa (2018) researched the P/B anomaly in NYSE, Amex and NASDAQ from 1963 to 2016, arguing that changes in company size is a key factor for explaining the excess return of low P/B stocks. Accordingly, when accounting for changes in equity's market value, the P/B ratio no longer had significant explanatory power over stock returns (Gerakos and Linnainmaa, 2018).

Lastly, an extremely meaningful research is the one conducted by Ball et al. (2020) over stocks listed on NYSE, Amex and NASDAQ in the 1964-2017 period. According to it, the equity book value includes diverse sets information about the stock returns', hence it would be reasonable to divide it into two parts: contributed capital and retained earnings. The authors found that the retained earnings component had a much higher explanatory power of stock returns. As a consequence, retained earnings component being an effective proxy for future earnings yield, is a key reason for the P/B anomaly existence.

3.2.3 - P/CF

The price-to-cash-flow ratio (P/CF) relates the stock price to operating cash flow on a per share basis. According to Bodie (2014), this metric is particularly useful for assessing companies which have positive cash flows but are not yet profitable, as they have high non-cash expenses. It has been claimed that P/CF is preferable to P/E ratio because it is harder to manipulate; specifically, accounting metric such as depreciation and amortization can to some extent be manipulated by the management (Bodie et al., 2014). Cash flow, representing the amount of cash actually generated by the company, can arguably be seen as more reliable compared to earnings, which instead can potentially be manipulated.

Related Literature

Wilson (1986) conducted a research over 462 companies from 1981 to 1982, investigating the relationship between businesses' cash flows and stock returns. Specifically, he analyzed the difference between cash generated from business operations and earnings (i.e., total accruals), finding that cash flow had a much larger influence on stock returns compared to earnings (Wilson, 1986). On the other hand, according to analysis by Bernard and Stober (1989) over the 1977-1984 period, cash flow did not have a significant effect on stock returns around the earnings release date. They argued that the effect of cash flows was already priced at that point by means of other channels, while others criticized the used model, which was thought to be too simplistic for being able to the effect of cash flows on price (Bernard and Stober, 1989).

Lakonishok et al. (1994) examined P/E, P/B, P/CF and sales growth in the US markets over the 1963-1990 period, noticing that value stocks overall had higher excess returns than growth ones, as value stocks were able to improve their financial performance over time, while growth stocks, despite the fast-paced growth assumed by the market, were not. Specifically, out of all analyzed ratios, low P/CF portfolios achieved the highest average annual returns (20.1%, against a 5.6% average return for high P/CF portfolios) with a holding period of 5 years. Furthermore, their research also proved a lower volatility among value stocks (Lakonishok et al., 1994). A similar study was conducted by Chan et al. (1991) on the Japanese market in the 1971-1988 time period. The highest explanatory power on stock returns was found in the P/B and P/CF ratios, although between these two, returns based on P/B ratio were slightly higher, with a 0.21% monthly difference compared to P/CF (Chan et al, 1991).

Dhatt, Kim and Mukhreji (2004) performed a study on the value anomaly in the US markets from 1980 to 1998, investigating ratios such as P/E, P/B, P/CF and P/Sales and forming portfolios based on these financial ratios. Overall, in accordance with previous literature, value portfolios outperformed their growth counterparties, the best results in terms of risk-return tradeoff being achieved by the low P/CF portfolio, with an excess return of 6.6% per year (Dhatt et al., 2004). Similarly, a study by Desai, Rajglopal and Venkatachalam (2004) also discovered a significant P/CF anomaly in the US markets from 1980 to 1998, with the low P/CF portfolio generating an average annual return of 15.3% (Desai et al., 2004).

Dissanaike et al. (2010) analyzed stocks from the LSE from 1987 to 2001, investigating the performance of portfolios constructed on the basis of value investing ratios such as P/E, P/B and P/CF ratios, in addition to the Ohlson model and the residual income model. Interestingly, the simple investment strategy based on P/CF had a very similar predicting power over future earnings to the much more complex Ohlson and residual income models, which aim to predict future earnings and their mean reversion. The returns achieved by low P/CF portfolios ranged between 8.6-14.42% (Dissanaike and Lim, 2010). P/CF ratio had the most powerful explanatory power over stock returns (compared to P/E, P/B, momentum, size and leverage factors) also according to a study by Hou et al. (2011) considering the 1981-2003 period (Hou et al., 2011).

More recently, P/CF performance was also investigated in emerging markets, delivering some contradictory results if compared to the literature covering developed markets. Akhtar and Rashid (2015) found that over the period 2004-2011 in Pakistan markets, while the P/B and P/Sales ratios had a positive relationship with returns, this was not the case for P/E and P/CF, which affected returns in a negative way (Akhtar and Rashid, 2015). In the Egyptian markets, Mostafa (2016) found that cash flows were even worse than earnings in predicting stock returns from 2002 to 2008, although this might be due to the high volatility and low trustworthiness of cash flows as an accounting metric in Egyptian markets (Mostafa, 2016).

3.2.4 - Dividend yield

Dividend yield (expressed as a percentage) measures the amount of dividends paid out by a company, divided by its share price. Dividend payments are a way of distributing profits made by a company via its business activities, to its shareholders. Dividend yields can vary a lot between different companies, as they are not obliged by any means to pay dividends every year; options other than returning money to shareholders, would be paying off debt, reinvesting in growth opportunities or adding to cash reserves. In this sense, the amount of dividends being paid is a strategic decision for a company, as another option would be to allocate the accumulated profits to investments, which could grow the company’s future earnings. It could be argued that paying out high dividends signals that the company does not believe in its ability to successfully reinvest in its current business with high enough expected return (Barclay et al. 1995). On the other hand, another view is that cash is actually distributed as dividends only if the business is profitable, so the dividend yield has the advantage of being less erratic as the businesses that distribute dividends are typically more established, mature, and consistent dividend payers. However, a high dividend yield may also signal that the company is currently undervalued or is trying in this way to attract new investors (Aono et al., 2009). Modigliani and Miller (1961) claimed that dividends have no significant effect on the company's stock price, demonstrating this by showing in their paper that investors can reinvest their dividends in the company if they think it paid too much of dividends. On the other hand, if they are not satisfied with the little amount of dividends paid by the company, investors can sell part of their shares and receive a virtual dividend. Nevertheless, Modigliani and Miller (1961) pointed out that such theory about dividend irrelevance works only in an ideal market. Another key idea is that dividends tend to be more predictable than capital gains, as the management arguably has greater control of the dividend policy rather than capital gains, which are heavily reliant on market sentiment. Hence investors might see the dividends as less risky compared to capital gains. On the other hand, according to the dividend signaling theory, management signals key messages to shareholders via dividends. This theory distinguishes between "good" and "bad" firms, arguing that good companies are able to stand out from the bad ones in the eyes of investors from by paying out an amount of dividends that would be too big for bad companies being able to match it (Ogden et al. 2003). Another important factor which highlights the relevance of dividends is that they might solve important conflicts between actors (arising from fundamentally different interests), thus improving the company's overall performance. For instance, the self-interest of managers (willing to increase the size of the company, which would likely lead to higher salaries and other benefits) can make shareholders worried about the company's future. Therefore, a solution could be to offer directly to shareholders part of the cash flow generated by the business (Ogden et al. 2003).

Related literature

Black and Scholes (1973) did not find a strong relation between dividend yield and stock returns. Specifically, in their study, portfolios with high dividend yield did not translate into higher returns. Hence, Black and Scholes argued that dividend yield is not a metric significantly affecting returns, hence it could be ignored. An exception, however, could be whenever investors might have a taxational reason for pursuing stocks with either high or low dividend yield (Black and Scholes, 1973).

Another research, conducted by Huang et al. (2014) in the Greater China region, studied an investment strategy (Dogs strategy) based on dividend yield. Positive abnormal returns were observed under the three-factor model for stocks with the highest dividend yields, which also overperformed the Chinese MSCI Golden Dragon index from 2003 to 2009.

On the other hand, Aono et al. (2009) showed that in Japan, only when excluding economic downturns and considering autocorrelation in returns, the dividend yield was effective in predicting stock returns, hence the relationship was weak.

3.2.5 - EV/EBITDA

The EV/EBITDA multiple puts into relation a firm’s Enterprise Value to its Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA) and is heavily used by industry practitioners as a key tool for stock valuation and investment decision-making. Its key strength is given by its ability to account for differences in capital structure (compared to P/E) and also in its investment needs (which in turn imply a lower/higher depreciation and amortization). This makes it extremely useful when comparing companies in different industries and growth stages. In essence, it is supposed to capture the true economic profitability of a business. Furthermore, the conceptual idea behind the EV/EBITDA multiple is not distant from the one behind the P/CF multiple, as EBITDA, by adding back non-cash expenses such as depreciation and amortization, serves as a proxy of a company’s cash flows. However, this could also be an important flaw of this multiple, as it does not account at all for capital expenditures, which could a be key financial metric for a number of capital-intensive industries.

Related Literature

A number of different studies have demonstrated EV/EBITDA multiple’s ability to identify undervalued stocks. Perhaps the clearest example of this multiple’s efficiency in doing so is provided by the research conducted by Gray and Vogel (2012), while similar results were found also by Loughran and Wellman (2010). Specifically, the two authors found that in the US stock market over the 1971-2010 time period, an annually rebalanced equal-weight portfolio of low EV/EBITDA stocks generated an annual return equal to 17.66% per year. Such an incredibly high return, while generating a 2.91% annual alpha (against the Fama French 3-factor model), has outperformed more popular metrics such as P/E (also in its forward version) and P/B, which showed no evidence of significant alpha after controlling for market, size and value factors.

3.2.6 - EV/EBIT

Similar to the EV/EBITDA ratio, the EV/EBIT ratio instead does include depreciation and appreciation (Chan and Lui, 2011). At the numerator, the enterprise value is a measure of the company's overall value. At the denominator, Earnings Before Interest and Taxes (EBIT) is a metric used to evaluate a company's performance without taking into account the costs of its capital structure and fiscal obligations. While the EV/EBITDA multiple can provide stronger insights future on profit growth, EV/EBIT is arguably a better metric to represent the true financial strength of a business, as EBIT includes all the operating expenses incurred by the business.

Related Literature

Arguably the most popular piece of financial literature highlighting the importance of EV/EBITDA in selecting undervalued stocks is "The Little Book That Beats the Market" by Joel Greenblatt (2006). Specifically, the magic formula proposed in this book is made up by the earnings yield, calculated as EBIT/EV, combined with the return on invested capital (ROIC). Such a combination is meant to ensure that investors are "buying good companies only at bargain prices" (Greenblatt 2006), and it generated an annual return equal to 15.2% in the period 1988–2009, against the average market (S&P500) return of 9.5%.

3.3 - Literature about value investing strategies based on historical multiples

As it may be inferred for the previous paragraphs, the existence of a value premium is well supported by prior literature. The first researcher to discover that value stocks outperform the market by examining the P/E ratio was Basu (1977). According to his research, between 1956 and 1971, stocks with low P/E outperformed their high P/E counterparties in the American stock market. The value factor included by Fama and French (1993) in their three-factor model showed that stocks with low P/B ratios (value stocks) outperformed those with high ones (growth stocks).

In their study of the P/CF, P/B, and P/E ratios in the Japanese market, Chan et al. (1991) concluded that these strategies might generate excess returns. Fama and French (1992, 1997) and Lakonishok et al. (1994) discovered that the American stock market exhibits a significant value premium, and that low P/CF, P/B and P/E stocks generate higher returns compared to their counterparties with high ratios. The authors also claim that financial distress is related to such value premium.

Additionally, by building portfolios based on P/E, P/B, P/CF ratios and on the dividend yield, Fama and French (1998) were able to measure value premiums in thirteen major stock markets between 1975 and 1995. In Australia, Italy, Hong Kong, and Germany, the highest value premium (P/CF) was also statistically significant. The P/B ratio had the largest value premium in Switzerland, Belgium, Singapore, Japan, the UK and the US. Sweden and the Netherlands had the highest value premiums based on the P/E criterion. Only France had the highest value premium with the dividend yield criterion.

3.4 - Criticism of value investing

Value investing has faced some criticism, although the number of studies doing so is not large. For instance, Asness et al. (2015) identified a number of value investing facts and fictions that required further investigation. According to Asness et al. (2015), value can be measured in a variety of ways, but a composite of variables is the most effective way to do so. The authors also noted, by examining P/B, P/E, P/CF, and P/Div as measures of value, that there are periods when all value measures perform better or worse than each other in different decades. It remains true, though, that cheap assets perform better than expensive ones no matter how you define value. However, they also found that value standalone is surprisingly weak among large cap stocks. While no single measure of value is clearly superior to all others, the best results are typically achieved by averaging multiple ratios (Asness et al., 2015). The fictions that Asness et al. (2015) attempted to clarify include, among others, the misconceptions that that value is simply a form of compensation for higher risk, and that value investing works only in concentrated portfolios.

The term "value investing" has been criticized by Kok et al. (2016) as it is associated with investment strategies that rely on ratios of common fundamental metrics (like P/B and P/E), which do not accurately reflect the financial asset's intrinsic value. The study also discovered that there is little proof that these two straightforward metrics, (P/B and P/E) prevail over others in U.S. equity markets. Furthermore, it should be mentioned that these simple methods repeatedly reveal businesses with temporarily inflated accounting numbers. These strategies could be combined with some other metrics such as profitability and momentum, to help detect these distortions. Overall, the common approach of identifying a security's relative value based on these ratios, ignores a number of extremely relevant attributes, such as the timing and risk of future cash flows, the liquidity of the investment, etc. (Chee et al., 2013). Already Graham and Dodd (1934) acknowledged the presence of such issues, suggesting either to make relative value comparisons only across investments with similar characteristics or to incorporate an appropriate "margin of safety" for those more risky and illiquid securities.

In a related study, Lev and Srivastava (2019) examined the P/B and P/E ratios and came to the conclusion that, according to their data analysis, value investing has been unprofitable in the United States for almost 30 years, starting from the dot-com bubble in the 1990s, which elevated the valuations of glamour companies. Then, the first part of the 2000s saw a brief resurgence of value, given the burst of the tech bubble (Nasdaq fell by 55% in 2000), which determined the move by investors from the collapsing tech to the more stable value stocks. However, this was just a brief resurgence in 2000-2006, as value continued to have bad performance thereafter. During the financial crisis of 2007, mean reversion in value investing began to slow down. Mean reversion is the tendency for a security's price to move towards its long-term average over a specific time period. The dramatic decline in bank lending during the financial crisis is

one potential explanation for the underwhelming performance of value stocks. Value firms have faced operational challenges and decreased profitability since the financial crisis (Lev et al., 2019). The fundamental economic developments and systematic accounting misidentifications, specifically in the accounting for intangibles, were the main contributors to the underperformance of value stocks relative to growth stocks. Specifically, book value mismeasurement is increasingly due to the immediate expensing in the income statement of all investments in internally generated intangible assets, including R&D, brand development, IT, etc. Such expensing makes both the earnings and book value (via retained earnings) smaller, inflating therefore the corresponding P/E and P/B ratios. Moreover, this effect is amplified by the fact that the investment rate in intangibles is much higher compared to tangible assets, and the gap is increasing. For instance, in the US it was double already in 2017, the annual investments in intangibles surpassing $2 trillion (Lev et al., 2019).
A similar deteriorating performance of value investing has been detected also in the Japanese market, known for its stable returns arising from value investing (Kudoh et al., 2018). Although the Japanese market delivered an average value excess return of 3-5% per annum throughout the 1988-2017 study period, the concerning fact is that for the 2011-2017 period the excess return was 0.3% for P/B and negative for P/E, which is similar to what other studies found in the US and European markets. This may signal that the market environment has significantly changed (Kudoh et al., 2018).

Spyrou and Kassimatis (2009) studied the performance of the HML factor in twelve European markets over the period 1982-2005, and found that, although the annualized HML returns were positive and statistically significant, such performance is driven by few years. Indeed, the HML return is statistically significant in only 36% of the years, during which the average return was 2.24% (for 64% of the years it was only 0.54%). Similarly, Piotroski (2000) argued that the excess returns of low P/B portfolios are to be attributed to a very strong performance by few firms, as only 44% of low P/B stocks generated positive risk-adjusted 2-years returns.

Interestingly, Schwert (2002) demonstrated that many of the most popular anomalies are not statistically significant against relevant pricing models. The weekend effect, the small-firm-turn-of-the-year effect, and the ability to predict stock market returns using factors like the inflation rate, for instance, have all demonstrated fading anomalies. Similar to this, Linnainmaa and Roberts (2018) come to the conclusion that data snooping is most likely the cause of the majority of accounting-based return anomalies. According to their sample results, most anomalies' average returns and Sharpe ratios are on the decline, while their volatility and correlations with other anomalies are rising. Value premiums are therefore generally small and statistically insignificant.

Fama and French (2020) concluded that although value stocks in the US market generate average returns higher than the market in the 1963-2019 period, value premiums are much larger in the 1963-1991 period than in the following 1991-2019 period, decreasing from 0.36% to 0.05% per month (Fama and French, 2019). This does not allow however the authors to reject the hypothesis that expected value premiums are equal to zero in the second time period. On the other hand, it cannot be claimed either that value premium are the same in the two time periods (Fama and French, 2020).

Another study investigating the decline of value investing is the one conducted by Israel, Laursen and Richardson (2020). Among the possible drivers, it lists the boom in share buybacks, which have arguably changed the nature of companies’ book values, thus making B/P ratio less meaningful, and the fact that value investing strategies are known by everybody, hence are simply too naïve to work (Israel et al., 2020).

3.5 - What is the value premium driven by?

Value has consistently outperformed growth for a number of decades. However, on what causes the value premium (namely, the spread in returns of stocks with low and high valuation) to exist, there are different views.

According to Fama and French (1993), it can be explained by risk premiums, i.e., a form of compensation for risk missed by the CAPM. In other words, the higher returns can be attributed to the higher fundamental risk, which value investors are willing to bear. A similar argument is that the value premium is due to the higher financial distress risk inherent in value firms. Indeed, B/MV indicates the company's degree of distress risk, as value firms, i.e., those with high B/MV, are likely to have high financial leverage and issues with earnings (Fama and French ,1992; Chen and Zhang, 1998).

Lakoniskok et al. (1994) provide the opposing explanation for why the value premium exists, arguing that markets are not sufficiently efficient. They found that stock analysts routinely forecast incorrectly and project historical performance too far into the future, making stocks with poor past performance under-priced while those with good past performance over-priced. The performance then changes drastically once markets become aware of this. La Porta (1996) came to the same conclusion, namely that companies with lower expected growth rates perform better than those with higher expected growth rates.

In line with these reasons, Cassella et al. (2020) found that the magnitude of the value premium is conditional on aggregate market-wide misvaluation. Specifically, over the 1968-2018 study period, the value premium per month was 3.42% following market-wide under- valuation, while being just 1.70% following market-wide overvaluation; on the contrary, when the aggregate market is priced correctly, the value premium was close to being non-existent. This is mainly due to a good (poor) performance of value (growth) stocks going from appropriate valuation to market-wide undervaluation (overvaluation) (Cassella et al., 2020).

Overall, behavioral finance is arguably the main driver of mispricing in securities. Specifically, this is due to the fact that investors often tend to base their investment decision exclusively on past performance, thus overlooking fundamental analysis and behaving irrationally. According to this reasoning and to Graham, the superiority of value investing lies in the fact that it buys neglected stocks at discount and sells overestimated ones (Teti et al., 2019).

4 - QUALITY INVESTING

The 1930s saw the emergence of quality investing as Graham (1934), who can be seen as the value investing father, early recognized quality characteristics in stocks, categorizing them as either high or low quality and arguing for buying high quality compared to buying cheap (Lalwani et al., 2018). Nevertheless, unlike strategies such as value, growth, momentum, etc., quality investing is not yet a well-defined term, as there is no precise definition of what quality represents. As an illustration, it has been said that quality stocks can be recognized "when you see them. (Novy-Marx, 2014)" While some researchers base their definition of quality stocks on financial metrics, others connect "quality" to non-financial ones like sustainable business practices.

The definition of quality stocks provided by Novy-Marx (2014) serves as the basis for this thesis. First, different definitions of quality investing are investigated. Second, a closer look is taken at Novy-Marx's definition of quality investing. Finally, the performance of a number of quality investing strategies is shown.

4.1 - Definitions of quality investing

The term "quality investing" has been defined in a number of different ways. According to Damodaran (2005), investors can associate quality investing with factors like corporate governance, credit ratings, ethical concerns, or financial strength. High ROE, consistent earnings, and low debt, according to some researchers, are indicators of quality (Grantham, 2004). Quality can also be described as "the opposite of junk," which means that it does not have a high level of leverage, experience cyclical profitability, and have not irregular earnings (Piotroski, 2000). However, those criticizing the use of traditional financial metrics argue that the key success drivers in many industries are increasingly intangible assets (e.g., intellectual capital), which do not compare on the financial statements and therefore require an in-depth analysis of the company’s products or services, market positioning, business model, among others (Lalwani et al., 2018). Moreover, it has been proved that non-financial measures, are in fact helpful in predicting future performance.

Despite this, there are many quantitative definitions of quality investing which are much more practical to test, thus this thesis will be consistent with Marx's (2014) definition, in addition to a number of other quantitative quality measures.

4.2 - Novy-Marx’s seven quality measures

Novy-Marx (2014) argued that buying high quality without overpaying is related to value investing as much as buying average quality at a discount, hence quality investing can be seen as “an alternative implementation of value” (Novy-Marx, 2014).

Traditional value strategies seek to acquire assets at a discount, whereas quality strategies seek to acquire those assets that are characterized by exceptional productivity. While the pitfall of value investing strategies is that they are of low-quality, quality strategies are on the other hand typically more expensive. Marx selected gross profitability, Graham’s G-score, Grantham’s quality score, Piotroski's F-score, Greenblatt's ROIC, Sloan's accruals, and defensive equity strategies as the seven core quality metrics (Novy-Marx, 2014).

Gross profitability has the same level of explanatory power as conventional value investing metrics (such as the P/B ratio), according to Novy-Marx (2014). This metric is calculated as the difference between revenue and total cost of goods sold, scaled by assets.

Long believed that profitability should be a good predictor of returns (as the share price should reflect future payouts expectations), financial economists have been perplexed by ROE's poor performance in doing so (Novy-Marx, 2014). Novy-Marx (2013) argues that gross profitability is a better metric than ROE in predicting future returns, being a better proxy for true economic profitability. Specifically, this is mainly due to the potential accounting tricks that might be used to manipulate earnings, and to the fact that several forms of investment (such as R&D and human capital development), while increasing future expected profitability, do lower net income (but do not impact gross margins). Overall, gross profitability provides an immediate insight, which makes it unnecessary to look any further down the income statement as accounting tricks can be used to manipulate the lower numbers (Novy-Marx, 2014).

According to Grantham (2004), quality businesses are those that have low earnings volatility, little debt, and high profitability, as outlined in "The Case for Quality—The Danger of Junk" (2004). The Grantham quality score is therefore calculated by averaging the ranks of return on equity (ROE), the inverse of ROE volatility, and assets-to-book value. ROE is in turn calculated by dividing net income by shareholders' equity book value, while the standard deviation of ROE over the previous five years is used to calculate the volatility of ROE (Lalwani et al., 2018). Interestingly, Grantham's key criteria of low leverage, high profitability, and low earnings volatility, have been highly influential for the construction of important quality indices. For instance, MSCI Quality Indices are based on Grantham's basic principles, which also make up half of the score adopted by Russell in constructing their Defensive Indexes; two of Grantham's criteria (high ROE and low leverage) also serve as the foundation for the Dow Jones Quality Index.

Greenblatt (2006) published a book titled "Little Book That Beats the Market", which has had a high influence on value investors, by making them focus on quality in addition to value (Novy-Marx, 2014). In this book, he proposed a magic formula, which logic is clearly to combine value with quality, i.e., buying high-quality businesses at low prices. Specifically, the formula is made up by the earnings yield (EBIT/EV), combined with the return on invested capital (ROIC). While the EBIT/EV ratio is a value metric, ROIC is a metric for profitability, expressing it as a percentage of invested capital and assessing the efficiency with which a business converts capital into profits. As a consequence, ROIC is used by Novy-Marx as one of the quality metrics. Such a combination is meant to ensure that investors are "buying good companies only at bargain prices" (Greenblatt 2006), and it generated an annual return of 15.2% in the period 1988–2009, against the average market (S&P500) return equal to 9.5%. Its ability to consistently beat the market is the main reason why Greenblatt (2006) called this technique as the "magic formula".

Graham is arguably best known for merely value metrics, such as P/E and P/B, although he advocated for buying high quality businesses cheaply, instead of merely focusing on cheap stocks. This means that Graham was equally concerned with the quality and value aspects, claiming that both a minimum of quality (measured in terms of the company's past performance and its financial position) and quantity (in terms of value per dollar of price) have to be obtained (Graham 1973). Specifically, Graham adopted seven different criteria in screening stocks: the first five are meant to identify quality firms, while the last two ensure that the investor does not overpay them.

These Graham's original quality criteria have been used by Novy-Marx to create a trading strategy by means of the so-called Graham G-score (Novy-Marx, 2014). It is measured on a scale of one to five and consists of five variables. Specifically, single points are earned if long-term debt is below net current assets, there is a ten-year history of positive earnings, and dividends and buybacks have been positive over the previous ten years. Higher quality firms should be detected by a higher G-score.

Before a company's financial statements are published, adjustments that must be made are referred to as accruals. Accruals are either unrealized revenues or expenses which have already been incurred but not yet reflected in the accounts. Sloan (1996) proposed a metric called Sloan's accruals, which is calculated by dividing the company’s discretionary accruals (the difference between net income, i.e., accounting earnings, and operating cash flow, i.e., cash earnings) by its total assets. The biggest supporter for integrating earnings quality into value strategies has probably been BlackRock, hiring Sloan in 2006 for his expertise in this field and publishing a related paper titled “Global Return Premiums on Earnings Quality, Value, and Size” (Kozlov et al., 2012).

Piotroski (2000) created another accounting-based metric that accounts for firm quality. Nine binary variables make up Piotroski's score, each one indicating either a strength or a weakness. The portfolios are then built using the list of companies with the highest F-score rankings. Such metric includes Grantham’s quality, Sloan’s earnings quality, fundamental momentum and the equity issuance anomaly (Novy-Marx, 2014).

Profitability is measured by four variables, which are net income, return on assets (ROA), operating cash flow (CFO), and operating cash flow being greater than net income (quality of earnings). To assess a firm's liquidity, three variables are created, accounting for the changes in the firm's long-term debt levels, changes in its current ratio, and the issuance of equity. The final two factors gauge the firm's operational efficiency: these are the gross margin and the asset turnover ratio, which is given by the division of revenues by total assets.

Interestingly, Piotroski’s F-score is widely available on stock screeners and commonly adopted by professional money managers (Novy-Marx, 2014). For instance, this is the primary screen used by Societe General when constructing its Global Quality Income Index, while it is combined with Greenblatt’s magic formula by Morgan Stanley.

Finally, defensive equity strategies are often considered quality strategies as they promise equity like returns but with lower volatility and smaller drawdowns, being able to mitigate market risk without sacrificing absolute performance (Novy-Marx, 2014). This is possible by selecting stocks with low volatility and market betas. Indeed, market betas, while outperforming in down markets, are only weakly correlated with average returns (Frazzini and Pedersen, 2013), while low volatility stocks generally outperform high volatility ones (Baker, 2010).

4.3 - Why were the seven fundamental quality metrics chosen?

In this chapter, some arguments are provided in favor of each of the seven quality metrics outlined by Novy-Marx (2014).

Starting from Graham's quality criteria, these arguably represented the first attempt to distinguish quality and value stocks. Grantham's quality score represents the basis over which the MSCI quality indices are constructed. Piotroski's F-score serves as a screening tool for Societe General when creating its Global Quality Index. Sloan's accruals is applied for incorporating earnings quality into investment strategies by Blackrock, the biggest asset manager in the world. Investors are increasingly encouraged to consider capital productivity thanks to Greenblatt's ROIC. Gross profitability, while having the same explanatory power on predicting future returns as conventional value metrics, is a more straightforward one; in addition, portfolios based on gross profitability are negatively correlated with value, which means that while generating high average returns, they also represent an important hedge for value investors. Lastly, the defensive equity strategies, while looking different compared to other selected quality metrics as they tilt towards value, are included by Novy-Marx mainly because they select stocks by using additional themes that are common to other quality strategies, hence have relevant quality characteristics.

4.4 - Quality investing strategies performance

Novy-Marx conducted an empirical evaluation of the seven core quality strategies. Despite the fact that only gross profitability produced statistically significant excess returns when considering long/short strategies, all high-quality strategies generated some abnormal returns, and had significant alphas (against the Fama French 3-factor model). When examining the spanning tests, together with gross profitability, also Grantham’s quality score yields encouraging outcomes. Last but not least, a better risk-return relationship is produced when quality and value are combined. Novy-Marx (2014) will be further investigated in one of the following paragraphs.

The seven fundamental quality metrics were also studied by Hanson and Dhanuka (2015) in the US market. According to their study's findings, only ROIC produced statistically significant outperforming results. The authors argue that the most compelling explanation is that the explanatory power of most accounting metrics has been arbitraged away over time.

Lalwani and Chakraborty (2018) examined the performance of four quality metrics in India between 2001 and 2016: the Magic Formula, Piotroski's F-score, gross profitability, and Grantham's quality score. Findings imply that after controlling for size, value, and momentum, gross profitability and Grantham’s quality score produced superior results. Piotroski's F-score performed the worst, while Magic Formula also underperformed the market.

Cheong et al. (2019) investigated the performance of strategies based on F-score and gross profitability in Asian stock markets in the 2000-2016 period. In the cross-sectional regressions, F-score and gross profitability both yielded highly significant positive results. Finally, financial institutions are purchasing more higher-quality stocks compared to lower-quality ones.

Significant evidence of such pattern can be found in institutions that are actively managed.

Gallagher et al. (2013) analysed the performance of high-quality stocks in American mutual fund owners' portfolios from 2000 to 2009. They found out that a stock's quality is negatively correlated with its volatility and positively correlated with its market capitalization. The highest-quality stocks outperformed the market in a statistically significant manner, while their low-quality counterparties did underperform. The study was further expanded into the Australian market, with small stocks, micro stocks, and large stocks all delivering positive alphas (Gallagher et al., 2013).

5 - COMBINING VALUE WITH QUALITY INVESTING

Value and quality are quite similar concepts, conceptually. Indeed, as already mentioned, quality can be considered an alternative implementation of value (Novy-Marx, 2014). Indeed Warren Buffett, arguably the most successful value investor, claimed that it would be much better to buy an exceptional business without overpaying than to buy at a high discount an average business. Accordingly, Frazzini et al. (2012) showed that the performance of stocks held by Berkshire Hathaway can largely be explained by the strategy consisting of buying high quality businesses.

On the other hand, however, value and quality can be seen as highly dissimilar, considering the actual stocks held by these two strategies, as value strategies are typically short quality (value companies tend to be lower quality), while quality strategies are short value (quality stocks tend to be expensive). This is a particularly relevant point, as it makes each of these two strategies perform well precisely when the other underperforms, which in turn makes them particularly attractive to run together (Novy-Marx, 2014).

5.1 - Performance of strategies combining value with quality

There hasn't been a lot of research on combining value and quality. The focus of relevant earlier academic literature was often on combining the P/B value ratio with a quality metric.

While Piotroski (2000) originally investigated investing strategies based on the F-score as a standalone factor, Piotroski and So (2012) combined value (low P/B) and quality (high F-score) criteria. The authors showed that strategies trading jointly on valuation and quality are able to generate a superior performance. Interestingly, they also claimed that the companies benefitting the most from such combination are small caps with a low share turnover and few (if any) analysts following the business.

Greenblatt's (2006, 2010) "Magic Formula" can be seen as combining both quality and value investing, with ROIC serving as the quality component and EBIT to EV multiple as the value investing component. Investors can outperform the market, according to Greenblatt, by employing a formula that systematically looks for good companies at prices below intrinsic value. The formula has undergone extensive testing and has consistently produced encouraging outcomes.

The following paragraphs refer to the two papers that include the most relevant analysis for the empirical part of this thesis.

5.2 - Novy-Marx (2013)

This is arguably the first paper clearly defining and testing (in the US markets) the performance of quality investing by dividing it into seven fundamental quality metrics: gross profitability, Graham's G-score, Grantham's quality score, Piotroski's F-score, Greenblatt's ROIC, Sloan's accruals, and defensive equity strategies.

Data and methodology

The sample considered in this study included both financial and non-financial companies in a time period between 1963 and 2013. The stocks were ranked against the seven-quality metrics, and quality portfolios were formed by including the top 30% quality stocks. Portfolios were rebalanced every year in June and the quality metrics were based on accounting data from the previous year's financial statements. In addition to long-only strategies, also long-short (i.e., buying the top 30% while shorting the bottom 30%) ones were tested.

Firstly, excess returns were examined. Secondly, the seven strategies was tested against the Fama French three-factor model. Thirdly, the strategies were compared to each other by means of spanning tests. Lastly, long-only portfolios based on quality metrics were combined with the P/B value metric.

Results

In terms of excess returns, the best performance (2.70% per annum) was achieved by gross profitability, followed by F-score and ROIC, with annual excess returns of respectively 2.24% and 2.17%. On the other hand, defensive investor (-1.55%), Grantham's quality score (-0.55%) and Graham's G-score (-0.08%) were the worst performing strategies.

Compared to the three-factor model, long/short portfolios based on gross profitability (5.21%), F-score (4.33%), ROIC (4.66%) and Grantham's quality score (4.84%) all resulted in statistically significant alphas. All the strategies tilted towards large cap stocks and had negative loadings on the market factor, while gross profitability, Grantham's quality score, Graham's G-score and F-score tilted towards growth stocks.

Coming to spanning tests, these were done for testing whether the seven quality strategies were able to result in significant alphas when compared to each other. Only Grantham's quality score and gross profitability produced significant positive alphas, while all the other strategies generated some positive abnormal returns, yet these were statistically insignificant.

Examining long-only portfolios, Marx noted that although all seven quality strategies generated positive alphas against CAPM, ranging from 0.03% to 1.44% per annum, gross profitability was the only strategy producing statistically significant results at 5% confidence level. On the other hand, all quality strategies, except for the earnings quality and defensive strategy, did generate highly significant alphas against the three-factor model.

Lastly, combining (i.e., using both rankings when selecting stocks) quality strategies with the value P/B metric, yielded higher results than using valuation alone for ROIC, Piotroski's F-score and gross profitability (almost 2% improvement) when considering large caps. When considering Sharpe ratio and CAPM information ratio, there was an improved risk-adjusted performance when combining value with quality, except for earnings quality. On the other hand, for small caps, where traditional value already generated great performance over the sample (5.35% CAPM alpha), only combining it with gross profitability generated a higher excess return (12.3% vs 11.7% per year). Despite this, all joint strategies, except for those with ROIC and earnings quality, had better risk-adjusted performance than traditional value.

5.3 - Lalwani & Chakraborty (2018)

This study examined quality investing in the Indian stock market, following a thorough selection of which quality metrics to use and why. The chosen metrics are Grantham's quality score, magic formula, Piotroski's F-score and gross profitability.

Data and methodology

The sample was made of non-financial companies within the BSE-500 index between 2001 and 2016, and long-only equally weighted portfolios were constructed on October 1st and then rebalanced every year. The top 30% was picked when considering Grantham quality score, gross profitability and Magic Formula, while stocks scoring above seven were selected for Piotroski's F-score; on the other hand, due to unavailability of data, Graham's G-score and earnings quality were ignored in this paper.

Risk-adjusted performance of such portfolios, investigated by means of the Sharpe ratio, was compared to passive investing. Additionally, regressions of portfolio returns were made against the CAPM and Carhart's four factor model.

Results

Grantham quality score, gross profitability and Piotroski's F-score all outperformed the market portfolio, respectively by 4.43%, 4.38% and 2.20% annually, while the Magic Formula underperformed it by 0.82%.

When considering risk-adjusted returns, computed by means of Sharpe ratio, the biggest excess returns were generated by F-score, Grantham quality, gross profitability and magic formula, respectively 14.98%, 14.72%, 8.59% and 8.50%.

Testing portfolio returns against CAPM and Carhart's four factor model yielded positive and statistically significant alphas for gross profitability (0.51% against CAPM, 0.42% against Carhart's four factor model), positive but not statistically significant alpha for F-score, and negative yet insignificant alpha for the magic formula.

Interestingly, to test the robustness of the aforementioned results, the time period was divided into three sub-periods: 2001-2005, 2005-2010 and 2011- 2015. By doing so, the authors were able to find out that Grantham's quality score had a significant loading on the momentum, hence it performed well in bull markets, while gross profitability performed well in both bull and bear markets.

Lastly, the previously analysed quality strategies were combined with a value criterion, namely the P/B ratio, similarly to Novy-Marx (2014). By doing so, the performance generally decreased, with the exception of the magic formula. For instance, Grantham's quality portfolio passed from 4.43% to 3.34%, while gross profitability passed from 4.38% to 2.21%. To compare the performance of portfolios combining quality and value with quality-only portfolios, the authors conducted spanning tests, which showed no significant gain arising from shifting from a strategy based on quality-only to a quality-value one. Overall, the findings indicated that switching from quality investing strategies to a mix of value and quality did not significantly improve performance.

6 - DATA AND METHODOLOGY

6.1 - Data sample selection process

To represent the European stock market, constituents of the STOXX Europe 600 index are considered in this thesis. STOXX Europe 600 is an index of European stocks, designed by STOXX Ltd. (part of Qontigo) and introduced in 1998. This index serves as underlying for a great number of products, including ETFs, futures, options and structured products. The components are fixed in number (600) and represent almost 90% of the free-float market capitalization of the European stock market (not limited to the Eurozone). Thus, STOXX Europe 600 can be considered to be adequately representative of the European stock market. Specifically, it includes large, mid and small capitalization companies across 17 European countries: the United Kingdom (composing 23.3% of the index), France (18.2%), Switzerland (14.6%), Germany (12.7%), Netherlands (6.8%), Sweden (4.6%), Denmark (4.5%), Italy (4.4%), Spain (3.9%), Finland (1.7%), Austria, Belgium, Ireland, Luxembourg, Norway, Poland and Portugal (Stoxx, 2023). On the other hand, the ten sectors with the highest weight within the STOXX Europe 600 index are healthcare (15.4%), industrials (13.1%), banks (8.7%), food, beverage & tobacco (7.5%), technology (7.4%), consumer goods (7.1%), energy (6.1%), insurance (5.1%), utilities (3.9%), construction & materials (3.6%).

The time period for this study is from June 2001 to June 2023. The stocks included in the index have been retrieved from Refinitiv Datastream. Specifically, the constituents of the STOXX Europe 600 index were updated on a yearly basis, also considering that the actual composition of such index is reviewed four times a year (in March, June, September and December). All active, and inactive (dead) public companies within the STOXX 600 were part of the initial sample, in order to avoid survivorship bias, the presence of which could deliver over-optimistic results given that the sample consists only of winners. On the other hand, for the sake of simplicity, companies that were delisted in a given yearly holding period are excluded, as this is typically due to acquisitions by other companies, which generally occurs at a premium over the stock price. Financial companies (firms with one digit SIC codes of 6) are excluded from the sample, as the interpretation of their financial statements is considerably different, hence many accounting ratios could not be meaningful (Lalwani et al., 2018). Companies with missing data are excluded, as are also the ones with negative ROIC, ROA, ROE, gross income, EBIT, EBITDA, FCF; this is to exclude loss-making companies. Lastly, in order to exclude those companies that are more likely to go bankrupt, another selection criteria was to have a Debt/Equity ratio smaller than 3x. Following all the aforementioned exclusions, the number of stocks considered in a single year was within the 184-351 range, with an average of 275.

6.2 - Selected financial variables

A number of financial variables were retrieved from Refinitiv DataStream on a yearly basis. Below are the Datastream codes for these variables.

Datastream codes	
ROIC	WC08376
ROIC (5-years)	WC08380
ROA	WC08326
ROE	WC08301
ROE (5 years)	WC08305
Dividend Yield	DY
Market Cap	WC08001
EV	WC18100
Total Assets	WC02999
D/E	WC08231
Common shares outstanding	WC05301
Gross Income	WC01100
EBIT	WC18191
EBITDA	WC18198
FCF per share	WC05507

EPS	WC05202
BV per share	WC05476
TBV per share	WC05486
Price (Year end)	WC05001
Price (May close)	W05035
Return Index	RI

6.2.1 - Value metrics

Value metrics that have been chosen for this thesis are P/E, P/B, P/CF, EV/EBIT, EV/EBITDA. P/B is arguably the most popular value investing metric in the whole finance literature and is also the one associated with quality metrics by Novy-Marx (2014) and Lalwani et al. (2018). P/E is another widely used value ratio in previous research. EV/EBIT is an appealing ratio as EBIT (i.e., operating profit) cannot be manipulated to the same extent as net income (which is used in P/E). Finally, EV/EBITDA and P/CF were chosen as what arguably matters most for investors is the company's ability to generate cash, which can then be either reinvested in the business (organic growth), used to fund acquisitions (inorganic growth) or given back to shareholders (via dividends and/or share buybacks); EBITDA is a proxy for operating cash flows (as it adds back depreciation & amortization, which are non-monetary expenses), while Free Cash Flow takes accounts for the cash flow generated by operating activities and the cash needed to fund capital expenditure as well as acquisitions.

6.2.2 - Quality metrics

Quality metrics that have been chosen for this thesis are ROA, ROIC, ROIC (5-years average), Dividend yield, Gross profitability, Grantham's quality score. Gross profitability and Grantham's quality score are inspired by Novy-Marx (2014), as they have been the most prominent quality metrics in this study. ROIC was also among the quality metrics analyzed by Novy-Marx (2014) and is part of Greenblatt's Magic Formula (together with EV/EBIT, which is amongst the value metrics chosen for this thesis). Including also the 5-year average ROIC is an attempt to account for outliers, i.e., those years in which ROIC could have been extremely high/low compared to the historical trend. While gross profitability measures gross profit in relation to revenues and ROIC measures operating profit (after tax) in relation to invested capital, ROA measures a firm's overall profitability in relation to assets, i.e., how efficient is the business in using its assets to generate net profits (bottom line of the income statement). Finally, dividend yield was chosen as a quality rather than value metric due to the dividend signaling theory (Ogden et al. 2003).

In addition to ROIC, gross profitability and Grantham's quality score, Novy-Marx (2014) also used the following quality metrics: Graham's G-score, Piotroski's F-score, Sloan's accruals and defensive equity strategy. Graham's G-score and Piotroski's F-score were excluded as they are binary variables, while this thesis aims to focus on simple metrics against which it is possible to rank stocks. Sloan's accruals are excluded as Novy-Marx (2014) concluded that it should not be classified as a quality strategy. Lastly, defensive equity strategy is excluded as this thesis aims to select only financial indicators that are based on company fundamentals.

While all other selected quality metrics were directly taken from Datastream, gross profitability and Grantham's quality score required some manual calculations. Specifically, gross profitability is given by the ratio between gross income and total asset, while Grantham's quality score is calculated by averaging ROE, the inverse of ROE volatility (5 years are considered) and the ratio of total assets over book equity.

6.3 - Portfolio formation

Portfolios are formed on the first day of June of each year, starting from 2001, and are based on financial variables from the most recent annual financial statements (i.e., those related to the previous year). The exception is when it comes to the numerators (i.e., market capitalization and enterprise value) of value ratios, which are calculated by using the most recent share price (i.e., end-of-May share price). Such an approach aims to eliminate (or greatly reduce) the risk of look-ahead bias, which refers to a situation in which data that was not available at the time being analyzed, is incorrectly used in a study. The portfolios are rebalanced every year, which entails that the holding period is one year. This, together with the portfolio rebalancing date being between May and July, is common in this kind of research (Fama and French (1992), Novy-Marx (2014)).

The created portfolios are long-only, equally weighted and include the top 30 percentile stocks (portfolios are made of 82 stocks on average) ranked based on the five value metrics and six quality metrics; in case of value metrics, the lower the ratio, the higher the ranking, while for quality metrics, the higher the ratio/score, the higher the ranking. This entails that eleven different ranking are formed each year. In addition to these, portfolios of both value and quality are also constructed, for each of the available combinations (e.g., EV/EBIT combined with ROIC), which are 30 (5x6) in total. The ranking of the given combination is simply given by the average of the ranking based on the selected value metric (e.g., EV/EBIT) and the ranking based on the selected quality metric (e.g., ROIC). While some studies, including Lalwani et al., 2018, operate via a 50/50 portfolio of pure value and pure quality, Novy-Marx (2014) showed that a combination of value and quality (i.e., selecting stocks that look attractive from both perspectives, as this thesis does) is more effective because it is able to achieve larger exposures to both quality and value factors.

6.4 - Methodology

Following portfolios formation, Total Return Index data are retrieved from Refinitiv Datastream on a monthly basis for all selected companies in each year. The same data is retrieved also for the benchmark index, namely the STOXX Europe 600. This approach has a couple of main benefits: the first is that it makes unnecessary to retrieve data related to both share prices and dividends, and then calculate the total return, and even more importantly it is perfectly consistent in quantifying returns for both the selected portfolios and the benchmark index against which performance will be evaluated. Calculating the monthly return requires simply to take the difference between the Total Return Index (TRI) of a given month and the previous month and divide it by the TRI of the previous month, as shown in the following formula:

$$R(t) = \frac{TRI(t) - TRI(t-1)}{TRI(t-1)}$$

Then, to calculate the monthly return of the given portfolio, it is only necessary to take the average of its constituents' monthly returns, as all portfolios are equally weighted. Returns for periods greater than one month (e.g., one year) are calculated by compounding the monthly returns as follows:

$$R(n) = \big(1 + R(t)\big) * \big(1 + R(t+1)\big) * \dots * (1 + R(t+n))$$

where n is the number of months that lie in the period for which returns are to be calculated (e.g., n equals 12 when calculating a yearly return).

For the sake of simplicity and given the more theoretical approach of this thesis, all returns are calculated without accounting for transaction costs. Furthermore, Novy-Marx (2014) claims that trading costs are typically modest, especially for quality strategies (around 0.5% per year for strategies focused on large capitalization stocks), which exhibit a low turnover of stocks from year to year given that quality is highly persistent.

First, the performance of portfolios based on both value and quality strategies stand-alone are compared with a benchmark, namely the STOXX Europe 600, from which the sample was extracted according to the aforementioned criteria. In addition to absolute returns, it is important to consider the risk-adjusted performance, which is done by means of the Sharpe and Sortino ratios. Despite arguably being the most popular risk-adjusted performance metric, the Sharpe ratio has been criticized as it tends to penalize extremely high positive returns. On the other hand, the Sortino ratio is able to correct for such drawdowns, hence it is used in this thesis.

Then, returns of the different portfolios are analyzed by quantifying the respective alphas generated by regressing portfolios returns against the Fama French five factors. The reason behind this analysis is that several successful trading strategies are simply different expressions of the size and value anomalies. As also Novy-Marx (2014) does, this thesis aims to find out whether the investigated value and quality strategies are able to generate significant excess returns even after controlling for the returns that an investor could have produced by trading on these basic anomalies. The crucial test is that for a strategy (be it value or quality or even a combination) to be truly innovative and profitable, its returns have to be able to generate α against the Fama French 5-factor model, as per the following formula:

$$R(i) - R(f) = \alpha + \beta 1 * \left(R(m) - R(f)\right) + \beta 2 * SMB + \beta 3 * HML + \beta 4 * RMW + \beta 5 * CMA + \varepsilon$$

Where R(i) is the return of a given portfolio, R(f) is the return of the risk-free asset, SMB is the Small Minus Big factor, HML is the High Minus Low factor, RMW is the Robust Minus Weak factor and CMA is the investment pattern factor, β1, β2, β3, β4, β5 represent the loading on the five factors, and α is the portion of the excess return achieved by the portfolio which is not explained by the model.

The factor data for the model has been obtained directly from the Kenneth French online library; the European factors were picked. The only adjustment made is to build the market factor (R(m) – R(f)) manually, namely by computing the returns of the STOXX Europe 600 index out of the Total Return Index retrieved from Refinitiv Datastream, and subtracting R(f), which on the other hand is taken from the Kenneth French online library, as is the rest of factor data. This adjustment is meant to better link the returns of the given portfolio to the benchmark from which the sample was built in first place.

The same type of analysis (excess returns, risk-adjusted performance, regressions against Fama French 5-factor model) is done for the combined value-quality portfolios. Furthermore, correlations between the returns of different stand-alone portfolios are examined, to find out which combinations are likely to benefit most from diversification. Lastly, spanning tests similar to those in Novy-Marx (2014) are conducted in order to compare the performance of value-quality portfolios with their value-only counterparts (the same applies to quality-only portfolios). Specifically, the returns from a given combination strategy are regressed on the Fama French 5-factors and on the returns from a strategy based on the value metric only, viewed as an explanatory strategy. For instance, a spanning test for P/E would be conducted by running the following regression:

$$R(P/E, Quality) = \alpha + \beta 1 * (R(m) - R(f)) + \beta 2 * SMB + \beta 3 * HML + +\beta 4 * RMW + \beta 5 * CMA + \beta 6 * R(P/E) + \varepsilon$$

7 - EMPIRICAL RESULTS AND DISCUSSION

7.1 - Value and Quality standalone portfolios

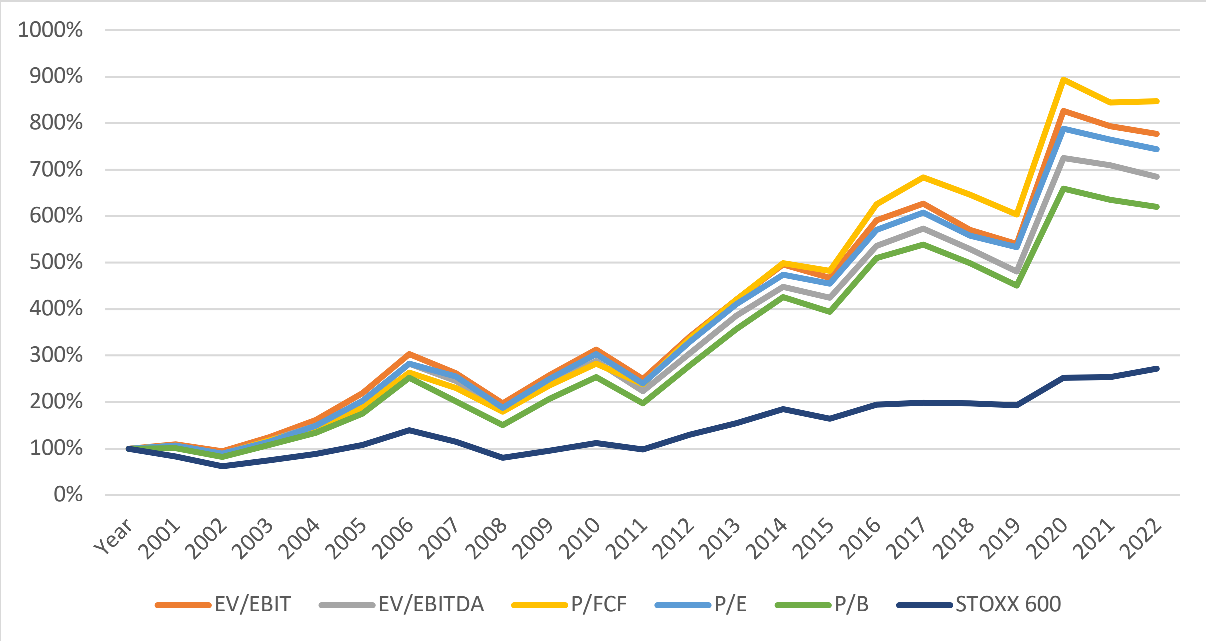
Table 1 shows the descriptive statistics for value portfolios. The mean, median, maximum and minimum value are expressed as annual returns (including dividends) and are calculated by compounding the monthly returns of the given year. CAGR is computed based on the yearly returns (including dividends). Standard deviation is computed based on monthly returns and then annualized.

Table 1: Value portfolios performance

Year	EV/EBIT	EV/EBITDA	P/FCF	P/E	P/B	STOXX 600
2001	9.7%	6.4%	6.5%	6.2%	1.5%	-17.0%
2002	-14.2%	-16.7%	-17.6%	-16.2%	-19.2%	-25.4%
2003	32.5%	32.5%	33.1%	29.5%	31.7%	21.0%
2004	29.6%	27.3%	23.6%	29.7%	23.9%	18.5%
2005	35.7%	32.9%	30.9%	35.2%	30.7%	21.5%
2006	38.5%	42.4%	39.2%	40.0%	43.9%	28.9%
2007	-13.8%	-13.5%	-12.3%	-10.1%	-20.2%	-17.5%
2008	-24.9%	-24.6%	-22.1%	-26.4%	-25.3%	-29.8%
2009	30.8%	29.6%	31.2%	33.3%	37.7%	18.5%
2010	21.6%	20.4%	20.1%	21.5%	22.9%	17.5%
2011	-20.3%	-22.4%	-15.4%	-21.0%	-22.5%	-12.2%
2012	36.4%	36.4%	40.7%	37.2%	41.7%	31.7%
2013	23.8%	26.7%	24.8%	25.0%	27.9%	19.5%
2014	18.0%	15.7%	18.7%	15.4%	19.5%	19.7%
2015	-5.8%	-5.1%	-3.1%	-4.2%	-7.3%	-11.1%
2016	26.6%	26.4%	29.7%	25.3%	29.1%	17.8%
2017	6.1%	6.8%	9.1%	6.7%	5.7%	2.1%
2018	-9.1%	-7.5%	-5.3%	-8.3%	-7.5%	-0.8%
2019	-5.3%	-9.2%	-6.6%	-4.5%	-9.7%	-1.8%
2020	53.0%	50.8%	48.0%	48.0%	46.5%	30.6%
2021	-4.0%	-2.1%	-5.5%	-3.0%	-3.6%	0.6%
2022	-2.0%	-3.5%	0.4%	-2.6%	-2.5%	7.2%
Average	11.9%	11.4%	12.2%	11.7%	11.1%	6.3%
CAGR	9.8%	9.1%	10.2%	9.6%	8.6%	4.6%
Min	-24.9%	-24.6%	-22.1%	-26.4%	-25.3%	-29.8%
Max	53.0%	50.8%	48.0%	48.0%	46.5%	31.7%
Median	13.8%	11.2%	13.9%	11.0%	12.6%	12.3%
Standard Deviation	18.8%	19.0%	18.2%	18.5%	19.4%	16.1%
Sharpe Ratio	0.54	0.51	0.58	0.53	0.48	0.28
Sortino Ratio	0.70	0.66	0.75	0.68	0.62	0.36
Average drawdown	-10.5%	-11.6%	-9.5%	-10.5%	-13.8%	-14.5%
N. years with negative returns	9	9	8	9	9	8

The findings show that all portfolios have positive and higher than benchmark's (STOXX Europe 600) annual mean returns. P/FCF has the highest mean return (12.2%), followed by EV/EBIT (11.9%), P/E (11.7%) and EV/EBITDA (11.4%), while the lowest is P/B (11.1%), still almost 5% higher than the benchmark (6.3%). It can be noted that the median returns are generally higher than their average counterparties, the most significant gain being the one made by the benchmark (12.3% median); P/FCF remains the highest (13.9%), closely followed by EV/EBIT (13.8%). This is arguably due to the fact that the distribution of returns is skewed towards the left tail (downside). This is reflected in a relatively high volatility (average standard deviation equal to 18.8% vs 16.1% for the benchmark) and importantly into a CAGR which is 2.0-2.5% below the average returns. This is not surprising, given that CAGR highly suffers negative returns as to recover them it needs a more than proportionate positive outperformance. Anyway, all strategies significantly outperform STOXX Europe 600 in terms of CAGR (8.6-10.2% vs 4.6%). Passing to risk-adjusted performance, we have a substantial outperformance of all value strategies (the highest is again P/FCF with 0.58 Sharpe ratio, while the lowest is P/B with 0.48) against the benchmark (0.28). The difference gets even larger when considering the Sortino ratio (0.62-0.75 for the value strategies vs 0.36 for STOXX Europe 600). This is due to a higher volatility of drawdowns for the benchmark, which has also a higher average drawdown (-14.5% vs -13.8% for P/B and -9.5-11.6% for other value portfolios). Lastly, the number of years with negative returns is slightly higher for the value strategies (8 years out of 22 for the benchmark and P/FCF, against 9 for all other portfolios). Overall, from this analysis the clear winner seems to be the portfolio based on the P/FCF ratio, with the best performance in terms of highest average and median return, CAGR, Sharpe and Sortino ratio, and lowest average drawdown. Over the 2001-2023 period it managed to outperform the benchmark in 17 out of 22 years. For P/FCF, as it can be seen in Figure 1, the total compound return for the 22-years period is 848%, while the other value strategies range between 620% and 774%, and STOXX Europe 600 did only 272%. Interestingly, all value strategies share an extremely similar pattern over the investment period, while the benchmark's one is also in line but less accentuated.

Figure 1: Value portfolios - Compound performance



Importantly, as it can be seen from Table 2, P/FCF is the only portfolio able to generate significant excess returns even after controlling for the returns that an investor could have produced by trading on the five Fama-French anomalies. Indeed, its alpha (3.26% annualized) is the only one significant at 5% confidence level. Loadings on the factors tend to be positive and significant for the market, size, value and profitability factors.

Table 2: Value portfolios – Regressions against 5-FF model

	EV/EBIT	EV/EBITDA	P/FCF	P/E	P/B
α	1.79	1.62	3.26**	1.66	2.00
β (STOXX-Rf)	1.07***	1.1***	1.08***	1.06***	1.12***
β (SMB)	0.42***	0.39***	0.44***	0.4***	0.44***
β (HML)	0.5***	0.43***	0.24***	0.48***	0.35***
β (RMW)	0.43***	0.33***	0.24***	0.42***	0.14
β (CMA)	-0.13	-0.01	0.07	-0.10	0.04

Lastly, spanning tests (for which monthly alphas are reported in Table 3) confirm the superiority of P/FCF over other value strategies, as it is able to generate significant (at 5% confidence level) excess returns even accounting for both the Fama-French factors and all the other value strategies (taken one at a time).

Table 3: Value portfolios – Spanning tests

	Explanatory strategy (x)				
Test strategy (y)	**EV/EBIT**	**EV/EBITDA**	**P/FCF**	**P/E**	**P/B**
EV/EBIT		0.01978	-0.08599	0.01744	0.01256
EV/EBITDA	-0.001312		-0.09323	0.007933	-0.00573
P/FCF	0.14819**	0.15782***		0.16042**	0.13898**
P/E	-0.0002224	0.01143	-0.08413		0.0002157
P/B	0.03903	0.04185	-0.06945	0.04398	

Similarly, Table 4 shows the descriptive statistics for the selected quality portfolios.

Table 4: Quality portfolios performance

Year	ROIC (5y avg)	ROIC	ROA	Gross Profitability	Grantham's Quality Score	Dividend Yield	STOXX 600
2001	-11.1%	-5.5%	-6.7%	-2.9%	-7.5%	14.0%	-17.0%
2002	-16.7%	-12.9%	-15.6%	-15.5%	-20.9%	-12.0%	-25.4%
2003	25.7%	25.2%	26.4%	29.2%	28.8%	28.9%	21.0%
2004	18.7%	22.7%	18.8%	17.1%	23.0%	22.8%	18.5%
2005	26.3%	33.8%	30.5%	24.3%	32.6%	28.2%	21.5%
2006	33.4%	36.4%	36.0%	36.1%	33.9%	40.5%	28.9%
2007	-9.4%	-7.0%	-11.4%	-15.5%	-12.2%	-18.0%	-17.5%
2008	-20.8%	-24.3%	-23.2%	-17.7%	-24.5%	-19.6%	-29.8%
2009	28.0%	26.8%	27.8%	29.5%	28.6%	30.3%	18.5%
2010	21.8%	23.3%	24.1%	19.6%	23.4%	17.4%	17.5%
2011	-9.9%	-6.8%	-5.8%	-7.7%	-7.6%	-20.9%	-12.2%
2012	30.5%	31.6%	31.4%	36.3%	33.8%	38.3%	31.7%
2013	16.2%	17.3%	15.4%	18.9%	19.3%	26.3%	19.5%
2014	15.7%	16.5%	18.4%	18.9%	18.2%	14.2%	19.7%
2015	-2.8%	-1.0%	-1.3%	0.5%	0.7%	-7.1%	-11.1%
2016	22.8%	22.3%	20.8%	25.6%	22.4%	24.2%	17.8%
2017	6.6%	8.6%	10.5%	12.2%	4.6%	1.3%	2.1%
2018	0.2%	-0.9%	1.5%	-0.8%	0.6%	-3.3%	-0.8%
2019	13.4%	13.0%	16.4%	9.3%	10.7%	-6.7%	-1.8%
2020	35.9%	39.3%	39.1%	43.2%	36.0%	37.6%	30.6%
2021	-12.7%	-10.8%	-9.8%	-13.1%	-9.9%	-1.7%	0.6%
2022	9.1%	7.0%	5.3%	9.3%	6.2%	1.0%	7.2%
Average	10.0%	11.6%	11.3%	11.7%	10.9%	10.7%	6.3%
CAGR	8.6%	10.1%	9.8%	10.2%	9.3%	8.9%	4.6%
Min	-20.8%	-24.3%	-23.2%	-17.7%	-24.5%	-20.9%	-29.8%
Max	35.9%	39.3%	39.1%	43.2%	36.0%	40.5%	31.7%
Median	14.6%	14.8%	15.9%	14.6%	14.4%	14.1%	12.3%
Standard Deviation	16.9%	16.5%	16.3%	16.0%	16.4%	16.7%	16.1%
Sharpe Ratio	0.52	0.61	0.61	0.63	0.57	0.54	0.28
Sortino Ratio	0.69	0.78	0.80	0.84	0.74	0.68	0.36
Average drawdown	-7.1%	-5.7%	-5.8%	-6.3%	-7.6%	-9.2%	-14.5%
N. years with negative returns	7	8	7	7	6	8	8

All quality portfolios have positive and higher than benchmark's (STOXX Europe 600) annual average returns, the highest being Gross Profitability (11.7%) and the lowest ROIC 5y average (10.0%). However, the range for quality (10.0-11.7%) is slightly lower than value (11.1-12.2%), while both are clearly higher than the benchmark (6.3%). It can be noted that the median returns are significantly higher than their average counterparties, the most significant gain being again the one made by the benchmark (12.3% median); in terms of median return, ROA is the highest (15.9%). This is arguably due to the fact that the distribution of returns is skewed towards the left tail (downside). This is reflected into a CAGR that is lower than the average returns, although the jump is smaller for quality (1.4-

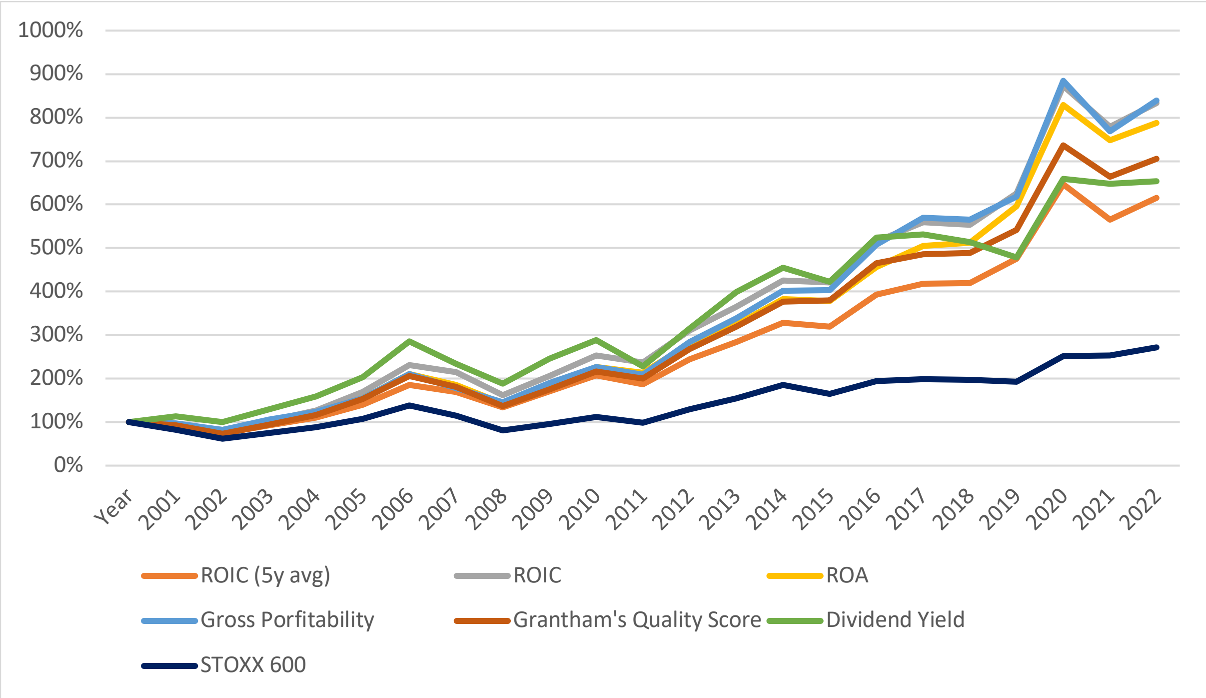
1.8%) than for value (2.0-2.5%). Given that CAGR highly suffers negative returns, this might mean that downside risk is generally lower for the selected quality strategies. As a proof, the average drawdown is significantly lower (-6.9% average for quality vs -11.2% for value, both lower than the benchmark's -14.5%) and also the number of years with negative returns (7.17y average for quality vs 8.8y for value and 8y for STOXX Europe 600). Compound returns are around double compared to the benchmark (4.6%), the highest being Gross Profitability (10.2%), closely followed by ROIC (10.1%) and the lowest being ROIC 5y (8.6%). Volatility for quality portfolios is slightly higher than the benchmark's (16.1%) but lower than for their value counterparties (16.0-16.9% for quality vs 18.2-19.4% for value).

Passing to risk-adjusted performance, we have again a substantial outperformance of all quality strategies (the highest is again Gross Profitability for both metrics, with 0.63 Sharpe ratio and 0.84 Sortino ratio, while the lowest is ROIC 5y respectively with 0.52 and 0.69) against the benchmark (0.28 Sharpe ratio and 0.36 Sortino ratio). Quality portfolios outperform their value counterparties in terms of risk-adjusted performance (average Sharpe ratio 0.58 vs 0.53, average Sortino ratio 0.75 vs 0.68). This is mainly due to a lower overall and downside volatility.

Overall, from this analysis the winner seems to be the portfolio based on the Gross Profitability ratio, with the best performance in terms of highest average return, CAGR, Sharpe and Sortino ratio; it is closely followed by the ROIC strategy for the main metrics.

Over the 2001-2023 period it managed to outperform the benchmark in 18 out of 22 years. For Gross Profitability, as it can be seen in Figure 2, the total compound return for the 22-years period is 840%, while the other quality strategies range between 616% and 833%, and STOXX Europe 600 did only 272%. Interestingly, all quality strategies share an extremely similar pattern over the investment period (this is very similar also to the value strategies' one), while the benchmark's one is also in line but less accentuated.

Figure 2: Quality portfolios - Compound performance



Compared to the value portfolios, where only P/FCF was able to generate significant (at 5% confidence level) alpha (3.26% annualized), we may note from Table 5 that all quality strategies except Dividend Yield have significant (at 1% confidence level) alphas, which also tend to be higher (4.5-5.8% range, the highest unsurprisingly being Gross Profitability). In terms of loadings on the five Fama-French factors, they are somewhat similar to the value portfolios for the market and size factor, while the big difference unsurprisingly is in the value factors, on which all the selected value portfolios have significant positive loadings, while the quality portfolios have (generally significant) negative loadings. The exception is again the Dividend Yield, which behaves more like a value strategy. Lastly, loadings on the profitability and investment pattern factors are more difficult to interpret, often being not significant.

Table 5: Quality portfolios – Regressions against 5-FF model

	ROIC (5y avg)	ROIC	ROA	Gross Profitability	Grantham's Quality Score	Dividend Yield
α	4.5***	4.57***	4.85***	5.8***	4.19***	1.67
***β* (STOXX-Rf)**	1***	0.97***	0.96***	0.98***	0.99***	0.99***
***β* (SMB)**	0.28***	0.37***	0.32***	0.31***	0.36***	0.34***
***β* (HML)**	-0.23***	-0.10	-0.17***	-0.31***	-0.12**	0.31***
***β* (RMW)**	-0.02	0.22***	0.18**	-0.04	0.11	0.36***
***β* (CMA)**	-0.19**	-0.26***	-0.23***	0.05	-0.13*	0.13

Spanning tests (monthly alphas are reported in Table 6) confirm the superiority of Gross Profitability over other quality strategies, as it is able to generate significant (at 1% confidence level) excess returns even accounting for both the Fama-French factors and all the other quality strategies (taken one at a time). Interestingly, the only significant alpha for all quality strategies (except for Gross Profitability) happens to be in regressions taking Dividend Yield as an explanatory strategy. Once again, this might imply that Dividend Yield portfolios should be marked as value instead of quality.

Table 6: Quality portfolios – Spanning tests

	Explanatory strategy (x)					
Test strategy (y)	**ROIC (5y avg)**	**ROIC**	**ROA**	**Gross Profitability**	**Grantham's Quality Score**	**Dividend Yield**
ROIC (5y avg)		0.02551	0.01464	-0.01031	0.05668	0.28938***
ROIC	0.07232		0.003878	0.01681	0.06512	0.30395***
ROA	0.09539*	0.03823		0.02927	0.096673*	0.32520***
Gross Profitability	0.20624***	0.18675***	0.16870***		0.20908***	0.40213***
Grantham's Quality Score	0.076986	0.0433	0.042264	0.023		0.26871***
Dividend Yield	-0.09832	-0.10157	-0.1161	-0.17352**	-0.12298	

Lastly, when looking at the correlation matrix (Table 7), unsurprisingly the value portfolios tend to have higher correlations with other value portfolios than with their quality counterparts, and vice versa. The exception is again the Dividend Yield Portfolio, which has an average correlation with other quality factors of 0.901, which is lower than the one with the value factors (0.980); this, together with other aforementioned anomalies, might imply an incorrect classification of Dividend Yield as a quality strategy. Importantly, almost all correlations are over 0.9, which could imply a limited diversification benefit arising from combining value with quality. For instance, for P/FCF, which was the best performing value strategy, the correlations with quality strategies ranges from 0.931 to 0.993, while the correlation between the best performing strategies (i.e., P/FCF and Gross Profitability) is as high as 0.96. Correlation of value and quality portfolios with the market (STOXX Europe 600) is within the 0.927-1 range, the lowest being with ROA and the highest with P/B.

Table 7: Value and Quality portfolios – Correlation matrix

	ROIC (5y avg)	ROIC	ROA	Gross Profitability	Grantham's Quality Score	Dividend Yield	EV/EBIT	EV/EBITDA	P/FCF	P/E	P/B	*STOXX 600 - RF*
ROIC (5y avg)	1											
ROIC	0.990	1										
ROA	0.992	0.993	1									
Gross Profitability	0.982	0.973	0.979	1								
Grantham's Quality Score	0.990	0.990	0.989	0.974	1							
Dividend Yield	0.889	0.903	0.889	0.921	0.906	1						
EV/EBIT	0.915	0.938	0.921	0.938	0.930	0.978	1					
EV/EBITDA	0.912	0.931	0.914	0.935	0.927	0.982	0.996	1				
P/FCF	0.931	0.943	0.932	0.960	0.944	0.979	0.990	0.993	1			
P/E	0.925	0.947	0.928	0.938	0.940	0.977	0.996	0.996	0.990	1		
P/B	0.929	0.936	0.927	0.952	0.942	0.985	0.985	0.991	0.993	0.988	1	
STOXX 600 - RF	0.929	0.936	0.927	0.952	0.942	0.985	0.985	0.991	0.993	0.988	1	1

7.2 - Combined Value-Quality portfolios

In this paragraph, a number of combinations of value with quality factors will be analyzed, similarly to the analysis made for standalone Value and

Quality portfolios. Specifically, the three best-performing (in terms of CAGR, Sharpe and Sortino ratios) value factors (namely, P/FCF, EV/EBIT and P/E) will be combined with all quality metrics (taken one at a time), while the tables summarizing the performance of all other combinations may be found in the appendix.

However, before doing that, similarly to those conducted for value and quality-only strategy, Table 8 is presented, which includes the (monthly) alphas generated by a number of spanning tests. These spanning tests have all the quality metrics as test strategies (y) and all value metrics as explanatory strategies (x), for a total of 30 combinations. They were done for testing whether the six quality strategies were able to generate significant alphas even accounting for both the Fama-French factors and the value strategies (taken one at a time). As a matter of fact, this was indeed the case, except for the strategy based on the Dividend Yield ratio. This means that the returns generated by quality portfolios are not sufficiently explained by Fama-French factors and by the value portfolios' returns, hence benefits from combining the two sets of strategies might potentially arise.

Table 8: Value-Quality combinations – Spanning tests

	Explanatory strategy (x)				
Test strategy (y)	**EV/EBIT**	**EV/EBITDA**	**P/FCF**	**P/E**	**P/B**
ROIC (5y avg)	0.28120***	0.29203***	0.206095***	0.29148***	0.28007***
ROIC	0.29482***	0.30837***	0.22951***	0.303881***	0.30387***
ROA	0.31953***	0.333200***	0.25307***	0.32736***	0.32715***
Gross Profitability	0.40760***	0.41790***	0.337456***	0.41617***	0.40083***
Grantham's Quality Score	0.26746***	0.27778***	0.20167***	0.27332***	0.27339***
Dividend Yield	0.03355	0.03867	-0.04105	0.03531	0.01954

Table 9 shows the descriptive statistics for the combinations between EV/EBIT (value metric) and all quality metrics (taken one at a time).

Table 9: EV/EBIT combined with Quality performance

Year	EV/EBIT	EV/EBIT + ROIC (5y avg)	EV/EBIT + ROIC	EV/EBIT + ROA	EV/EBIT + Gross Profitability	EV/EBIT + Grantham's Quality Score	EV/EBIT + Dividend Yield	STOXX 600
2001	9.7%	5.8%	5.0%	5.7%	7.9%	5.5%	11.7%	-17.0%
2002	-14.2%	-14.3%	-12.1%	-11.6%	-14.5%	-15.6%	-12.3%	-25.4%
2003	32.5%	31.7%	27.0%	27.5%	34.2%	31.8%	31.3%	21.0%
2004	29.6%	25.4%	25.0%	25.3%	23.0%	25.7%	27.3%	18.5%
2005	35.7%	33.0%	37.3%	35.1%	29.2%	33.3%	33.0%	21.5%
2006	38.5%	33.5%	36.1%	36.4%	35.9%	33.4%	38.6%	28.9%
2007	-13.8%	-8.0%	-5.5%	-6.9%	-11.6%	-7.2%	-17.9%	-17.5%
2008	-24.9%	-20.8%	-23.7%	-22.8%	-21.1%	-26.0%	-22.9%	-29.8%
2009	30.8%	30.8%	31.2%	28.5%	32.0%	31.1%	32.6%	18.5%
2010	21.6%	26.3%	22.5%	23.0%	22.2%	23.0%	21.4%	17.5%
2011	-20.3%	-14.0%	-12.9%	-14.7%	-13.5%	-14.4%	-19.9%	-12.2%
2012	36.4%	31.5%	33.4%	32.8%	37.4%	34.0%	35.9%	31.7%
2013	23.8%	17.9%	19.1%	19.8%	22.5%	22.8%	27.0%	19.5%
2014	18.0%	14.5%	17.0%	19.6%	16.6%	17.4%	16.1%	19.7%
2015	-5.8%	-5.1%	-4.0%	-2.5%	-1.8%	-2.3%	-5.5%	-11.1%
2016	26.6%	23.9%	23.9%	23.7%	25.6%	26.0%	25.5%	17.8%
2017	6.1%	4.6%	7.3%	9.0%	8.0%	5.7%	2.1%	2.1%
2018	-9.1%	-7.2%	-8.0%	-7.7%	-6.4%	-5.3%	-5.5%	-0.8%
2019	-5.3%	2.7%	1.2%	3.4%	0.2%	2.1%	-7.8%	-1.8%
2020	53.0%	42.8%	47.5%	43.4%	49.9%	44.7%	43.7%	30.6%
2021	-4.0%	-8.9%	-6.3%	-5.2%	-7.3%	-5.6%	-4.0%	0.6%
2022	-2.0%	2.5%	1.2%	1.2%	3.1%	1.6%	-0.9%	7.2%
Average	11.9%	11.3%	11.9%	12.0%	12.3%	11.9%	11.3%	6.3%
CAGR	9.8%	9.7%	10.2%	10.4%	10.6%	10.1%	9.3%	4.6%
Min	-24.9%	-20.8%	-23.7%	-22.8%	-21.1%	-26.0%	-22.9%	-29.8%
Max	53.0%	42.8%	47.5%	43.4%	49.9%	44.7%	43.7%	31.7%
Median	13.8%	10.1%	12.1%	14.3%	12.3%	11.5%	13.9%	12.3%
Standard Deviation	18.8%	17.5%	17.6%	17.1%	17.3%	17.3%	17.8%	16.1%
Sharpe Ratio	0.54	0.55	0.59	0.61	0.62	0.59	0.55	0.28
Sortino Ratio	0.70	0.72	0.74	0.77	0.78	0.74	0.68	0.36
Average drawdown	-10.5%	-7.6%	-7.5%	-7.1%	-7.6%	-7.9%	-10.0%	-14.5%
N. years with negative returns	9	7	7	7	7	7	9	8

Excluding the combination with Dividend Yield, there is a general improvement in performance by combining EV/EBIT with quality metrics. In terms of absolute performance, CAGR either remains almost equal (9.7% for EV/EBIT + ROIC 5y vs 9.8% for EV/EBIT only) or slightly increases (10.2% average, excluding Dividend Yield), the greatest being the combination with Gross Profitability (10.6% CAGR). A similar pattern can be found also for the risk-adjusted performance, as Sharpe ratio increases from 0.54 to an average of 0.58, and Sortino ratio from 0.70 to 0.74. For both ratios, the best performance is generated by the combination with Gross Profitability (0.62 Sharpe ratio and 0.78 Sortino ratio).

Table 10 shows the descriptive statistics for the combinations between P/FCF (value metric) and all quality metrics (taken one at a time).

Table 10: P/FCF combined with Quality performance

Year	P/FCF	P/FCF + ROIC 5y avg	P/FCF + ROIC	P/FCF + ROA	P/FCF + Gross Profitability	P/FCF + Grantham's Quality Score	P/FCF + Dividend Yield	STOXX 600
2001	6.5%	1.2%	6.3%	5.0%	5.5%	4.6%	10.4%	-17.0%
2002	-17.6%	-15.6%	-13.1%	-15.9%	-18.3%	-20.4%	-15.7%	-25.4%
2003	33.1%	31.3%	33.2%	31.8%	36.2%	32.4%	29.6%	21.0%
2004	23.6%	19.2%	23.2%	20.4%	23.4%	22.7%	24.9%	18.5%
2005	30.9%	31.0%	35.4%	32.8%	32.7%	30.9%	31.6%	21.5%
2006	39.2%	35.6%	34.8%	34.0%	35.9%	32.3%	39.5%	28.9%
2007	-12.3%	-11.5%	-8.1%	-11.9%	-15.4%	-9.0%	-19.1%	-17.5%
2008	-22.1%	-21.8%	-24.0%	-24.6%	-19.0%	-24.8%	-22.0%	-29.8%
2009	31.2%	29.0%	29.2%	29.9%	31.8%	29.2%	28.6%	18.5%
2010	20.1%	20.6%	20.7%	21.5%	19.0%	19.7%	18.0%	17.5%
2011	-15.4%	-13.8%	-12.4%	-10.4%	-11.0%	-14.1%	-18.5%	-12.2%
2012	40.7%	35.7%	37.8%	36.4%	42.9%	38.3%	41.5%	31.7%
2013	24.8%	20.6%	19.7%	18.3%	20.5%	22.5%	24.8%	19.5%
2014	18.7%	14.8%	20.9%	21.7%	18.4%	18.5%	17.5%	19.7%
2015	-3.1%	-4.1%	-0.3%	0.1%	-1.2%	-1.6%	-4.6%	-11.1%
2016	29.7%	21.5%	25.0%	24.2%	27.1%	26.0%	25.7%	17.8%
2017	9.1%	10.6%	12.3%	14.3%	10.1%	9.2%	5.3%	2.1%
2018	-5.3%	-5.5%	-4.6%	-1.8%	-3.0%	-3.4%	-5.9%	-0.8%
2019	-6.6%	2.5%	2.0%	5.1%	1.0%	-1.4%	-9.0%	-1.8%
2020	48.0%	45.0%	45.6%	44.6%	47.2%	41.2%	41.8%	30.6%
2021	-5.5%	-10.2%	-9.6%	-8.5%	-8.6%	-7.5%	-4.0%	0.6%
2022	0.4%	5.3%	3.9%	4.4%	1.1%	3.1%	1.7%	7.2%
Average	12.2%	11.0%	12.6%	12.3%	12.6%	11.3%	11.0%	6.3%
CAGR	10.2%	9.3%	10.9%	10.7%	10.7%	9.5%	9.0%	4.6%
Min	-22.1%	-21.8%	-24.0%	-24.6%	-19.0%	-24.8%	-22.0%	-29.8%
Max	48.0%	45.0%	45.6%	44.6%	47.2%	41.2%	41.8%	31.7%
Median	13.9%	12.7%	16.0%	16.3%	14.3%	13.9%	14.0%	12.3%
Standard Deviation	18.2%	17.9%	17.7%	17.2%	17.5%	17.5%	18.1%	16.1%
Sharpe Ratio	0.58	0.53	0.62	0.62	0.63	0.56	0.53	0.28
Sortino Ratio	0.75	0.66	0.78	0.79	0.81	0.70	0.66	0.36
Average drawdown	-9.5%	-8.6%	-6.8%	-6.8%	-7.7%	-8.8%	-10.5%	-14.5%
N. years with negative returns	8	7	7	6	7	8	8	8

Performance improves by combining P/FCF with ROIC, ROA and Gross Profitability, while it decreases in case of combinations with other quality factors. Specifically, the best absolute performance is obtained by P/FCF + ROIC (10.9% CAGR vs 10.2% for P/FCF only), while the best risk-adjusted performance is generated by combining P/FCF with Gross Profitability, namely the two best performing strategies when considered standalone: this combination has a 0.63 Sharpe ratio (vs 0.58 for P/FCF only) and a 0.81 Sortino ratio (vs 0.75 for P/FCF only).

Table 11 shows the descriptive statistics for the combinations between P/E (value metric) and all quality metrics (taken one at a time).

Table 11: P/E combined with Quality performance

Year	P/E	P/E + ROIC 5y avg	P/E + ROIC	P/E + ROA	P/E + Gross Profitability	P/E + Grantham's Quality Score	P/E + Dividend Yield	STOXX 600
2001	6.2%	5.7%	5.0%	3.6%	4.7%	3.7%	9.4%	-17.0%
2002	-16.2%	-16.3%	-12.9%	-12.3%	-16.4%	-16.7%	-14.3%	-25.4%
2003	29.5%	25.1%	29.1%	30.1%	32.3%	30.5%	29.5%	21.0%
2004	29.7%	25.2%	24.8%	24.5%	23.1%	27.4%	26.1%	18.5%
2005	35.2%	34.6%	36.2%	35.8%	30.8%	32.1%	32.3%	21.5%
2006	40.0%	35.6%	34.7%	34.9%	38.1%	34.1%	39.2%	28.9%
2007	-10.1%	-8.4%	-6.6%	-6.8%	-9.6%	-7.3%	-15.4%	-17.5%
2008	-26.4%	-22.2%	-23.8%	-22.2%	-21.2%	-24.9%	-23.2%	-29.8%
2009	33.3%	32.8%	30.4%	28.3%	34.7%	34.0%	31.2%	18.5%
2010	21.5%	24.2%	22.9%	23.0%	23.2%	22.7%	20.6%	17.5%
2011	-21.0%	-14.3%	-13.8%	-13.9%	-12.6%	-14.4%	-19.5%	-12.2%
2012	37.2%	31.5%	31.7%	33.9%	37.7%	33.6%	38.4%	31.7%
2013	25.0%	20.3%	20.2%	20.3%	20.8%	23.0%	26.1%	19.5%
2014	15.4%	15.3%	18.0%	19.3%	15.3%	19.3%	14.8%	19.7%
2015	-4.2%	-3.6%	-2.0%	-2.0%	-1.3%	-3.8%	-6.6%	-11.1%
2016	25.3%	23.1%	22.5%	24.0%	25.2%	23.8%	24.1%	17.8%
2017	6.7%	5.6%	8.3%	9.6%	8.5%	5.0%	2.8%	2.1%
2018	-8.3%	-4.3%	-5.6%	-5.9%	-5.7%	-5.5%	-5.3%	-0.8%
2019	-4.5%	4.9%	2.6%	3.6%	0.2%	3.4%	-7.2%	-1.8%
2020	48.0%	42.7%	46.2%	45.2%	48.2%	41.8%	42.6%	30.6%
2021	-3.0%	-9.7%	-5.6%	-4.7%	-8.3%	-5.0%	-3.4%	0.6%
2022	-2.6%	2.0%	1.4%	1.2%	2.2%	1.3%	-1.1%	7.2%
Average	11.7%	11.4%	12.0%	12.3%	12.3%	11.7%	11.0%	6.3%
CAGR	9.6%	9.7%	10.4%	10.7%	10.5%	10.0%	9.0%	4.6%
Min	-26.4%	-22.2%	-23.8%	-22.2%	-21.2%	-24.9%	-23.2%	-29.8%
Max	48.0%	42.7%	46.2%	45.2%	48.2%	41.8%	42.6%	31.7%
Median	11.0%	10.5%	13.1%	14.4%	11.9%	12.1%	12.1%	12.3%
Standard Deviation	18.5%	17.2%	17.1%	16.9%	17.3%	17.2%	17.6%	16.1%
Sharpe Ratio	0.53	0.57	0.60	0.63	0.61	0.58	0.53	0.28
Sortino Ratio	0.68	0.73	0.76	0.81	0.79	0.73	0.67	0.36
Average drawdown	-10.5%	-7.3%	-7.2%	-7.0%	-7.7%	-8.2%	-10.3%	-14.5%
N. years with negative returns	9	7	7	7	7	7	9	8

Excluding the combination with Dividend Yield, there is a general improvement in performance by combining P/E with quality metrics. In terms of absolute performance, CAGR either increases from 9.6% to a 10.2% average (excluding Dividend Yield), the greatest being the combination with ROA (10.7% CAGR), closely followed by the combinations with Gross Profitability (10.5%) and ROIC (10.4%). A similar pattern can be found also for the risk-adjusted performance, as Sharpe ratio increases from 0.53 to an average of 0.59, and Sortino ratio from 0.68 to 0.75. For both ratios, the best performance is generated by the combination with ROA (0.63 Sharpe ratio and 0.81 Sortino ratio), closely followed by the combination with Gross Profitability (0.61 Sharpe ratio and 0.79 Sortino ratio).

Lastly, when considering the regression of the portfolios generated by the combinations of the selected three value metrics (EV/EBIT, P/FCF and P/E) with all quality metrics (one at a time), alphas are positive and significant (at 5% confidence level), except for EV/EBIT + ROIC 5y and P/E + ROIC 5y, which are significant at 10% confidence level, and all the combinations with dividend yield (not significant even at 10% confidence level).

To summarize, the best performing value-only strategy is P/FCF (with 10.2% CAGR, 0.58 Sharpe ratio and 0.75 Sortino ratio), the best performing quality-only strategy is Gross Profitability (with 10.2% CAGR, 0.63 Sharpe ratio and 0.84 Sortino ratio), while the best performing quality-value combinations are EV/EBIT + Gross Profitability (with 10.6% CAGR, 0.62 Sharpe ratio and 0.78 Sortino ratio), P/FCF + ROIC (with 10.9% CAGR, 0.62 Sharpe ratio and 0.78 Sortino ratio), P/FCF + Gross Profitability (with 10.7% CAGR, 0.63 Sharpe ratio and 0.81 Sortino ratio) and P/E + ROA (with 10.7% CAGR, 0.63 Sharpe ratio and 0.81 Sortino ratio). Furthermore, the combinations tend to improve absolute and especially relative performance compared to value-only portfolios. This is arguably more due to a better risk-adjusted performance of Quality strategies (0.58 average Sharpe ratio and 0.75 average Sortino ratio, against respectively 0.53 and 0.68 for value) than to a diversification effect (as almost all correlations are significantly higher than 0.9).

8 - CONCLUSION

Several academic studies define “value stocks” as those being cheap relative to measures of capital in place. This is generally defined by lower market multiples of book value, earnings and other accounting metrics. Selecting stocks based on such criteria has revealed an incredibly profitable strategy over decades. However, recent academic literature has increasingly been reporting a fading value premium, especially in the US market, where such premium was detected in first place. This thesis has shown that this is not (yet) the case in the European stock market. Nevertheless, it might not last for a long time.

Accounting-based valuation, which aims to capture cheapness of stocks, is arguably only one part of value investing. As a matter of fact, a major issue with typical accounting indicators signaling value is that they focus only on comparing the current price of a stocks to its capital in place (e.g., sales, earnings, book value), missing therefore another key element in equity valuation, namely the growth opportunities. On the other hand, starting with Benjamin Graham, the most successful fundamental investors have always distinguished two key elements in value investing: (1) finding quality businesses and (2) not overpaying them. In other words, value investing consists of both cheapness (widely researched in the academic literature) and quality (much less researched topic).

These underlying concepts of cheapness and quality are incredibly helpful for understanding the investment approaches adopted by successful investors like Warren Buffett, Charlie Munger, Joel Greenblatt, Julian Robertson, etc. (Lee, 2014). An investor who successfully managed to identify specific quantitative criteria over which to base selection of stocks while accounting for both cheapness and quality, is Joel Greenblatt, an American academic and hedge fund manager. Together with Robert Goldstein he co-founded Gotham Capital, a hedge fund focused on special situation investing. For the ten years until they returned outside capital to investors in 1995, Greenblatt and Goldstein generated a yearly compounded average return before fees of around 40% (Lee, 2014). However, what Greenblatt is best known for is *"The Little Book that Beats the Market"* (2005). This book is the result of an attempt by Greenblatt to determine whether Warren Buffet's investing strategy could be somehow quantified. By studying Buffet's Chairman's (Berkshire Hathaway, Inc.) letters, a recurring theme: Buffet was not just looking at cheap stocks, but he was instead buying quality companies at reasonable prices ("It is far better to buy a wonderful company at a fair price than a fair company at a wonderful price" (Chairman's Letter, Berkshire Hathaway, Inc., Annual Report, 1989)). Greenblatt's idea was therefore to try creating a stock screen tool able to identify such wonderful businesses at reasonable prices. The results delivered by his strategy were so impressive that Greenblatt called it the "Magic Formula". In a nutshell, the Magic Formula attempts to select companies with consistently high Return on Invested Capital (ROIC) while also trading at low earnings yield (i.e., being cheap); the selection is therefore performed according to a ranking based on these two factors, namely Return on Invested Capital and Earnings Yield. Greenblatt's strategy has managed to select stocks consistently and significantly outperforming their peers over the past 50 years, as supported by the numerous tests (e.g., Gray and Carlisle, 2013), especially based on the US market (Lee, 2014). Interestingly, it applies concepts already introduced by Graham, as some of his criteria were five years of high and consistent growth, low P/E ratios, etc. This indicates that successful value investors do not only consider cheapness but also the quality of a company. This is what has mainly driven this thesis' attempt to combine value and quality investing in the European stock market. As discussed in the previous paragraph, a couple of key findings are that (1) quality portfolios have been superior to their value counterparties, especially from a risk-adjusted perspective, and (2) combining value with quality criteria clearly tends to improve both absolute and risk-adjusted performance with respect to value-only portfolios.

This is perfectly in line with the conclusion made by Asness et al. (2018) that high quality stocks (i.e., those with high profitability, growth, etc.) have on average a higher price, although not by a large margin, which makes them able to generate a higher risk-adjusted return. This in turn reinforces the need to combine cheapness with quality, by selecting firms with high Present Value of its expected Residual Income (PVRI) and which also trade at reasonable valuations. This is what the greatest investors try to do. For instance, Buffet's four key points are: (1) Only invest in a business you can understand, (2) which has a sustainable competitive advantage, (3) a high-quality management team, and (4) a significant "margin of safety" (Lee, 2014).

Assessing a firm's expected future residual income (PVRI) requires some form of fundamental analysis. This can be done by means of a number of fundamental performance indicators which are meant to indicate a firm's quality. This is what Graham arguably did when including low leverage, high liquidity and high growth rate as factors original stock screener. This is also the methodology adopted by the financial literature focusing on quality investing and on combining value with quality, including this thesis. However, in the end this is nothing more than identifying stocks with high PVRI, hence those more likely to generate high rates of return in the future. Another, perhaps more complete approach to do the same thing is by valuing businesses by means of a Discounted Cash Flow (DCF) analysis. Specifically, this would require assessing the ratio of fundamental DCF value to current market price (Cornell, 2021). This is arguably part of an attempt to include incredibly valuable businesses (which are therefore likely to generate high residual income and cash flow in the future) that could seem overvalued according to traditional value ratios. A clear instance of this actually happening is the exclusion of large technology companies such as the FAANGs (Facebook, Apple, Amazon, Netflix, Google) from the value portfolios. What happened is that the outperformance of growth portfolios compared to value ones since 2007 is largely attributable to these stocks, which have massively outperformed the market. The interesting thing is that at least some of the FAANGs at certain times during the last 15 years may well have been considered value stocks by means of the ratio between their fundamental DCF value and market price (Cornell, 2021). For instance, the five DCF valuations of Apple at different points in time posted by Professor Aswath Damodaran in his blog (Table 12), indicate that according to his own forecasts for Apple's future cash flows, Apple was a value stock early on, then it became fairly valued and finally it has lost its value status.

Table 12: Damodaran valuation of Apple over time

Date	DCF Value	Market price (split adj.)	Price/Value
Aug-15	32.5	27.5	85%
Feb-16	31.5	23.5	75%
Feb-17	32.3	32.6	101%
Sep-18	50.0	54.8	110%
Aug-20	84.9	115.7	136%

To conclude, the traditional way of estimating value in a stock, which is heavily based on accounting ratios like P/E and P/B, could have lost their edge in some markets (e.g., US market), while this is not (yet) the case for the European stock market, in which according to this thesis value portfolios generated higher returns than the broader market. However, quality investing seems more effective in generating high risk-adjusted performance, and combining value with quality helps increasing returns. A key point is therefore that cheapness and quality should not be seen as standalone concepts but rather as two sides of value investing, which implies buying high-quality stocks at reasonable prices. The way to combine these two sides adopted in this thesis is by applying both sets of criteria when selecting stocks, while another, arguably more complete, way of doing this is by running a full DCF analysis.

Further research could address some key limitations of this thesis. Specifically, three main areas of potential development are present. The first relates to a potential expansion of the research to other markets, expect for the US and India which have already been investigated by previous research. Second, a more complete set of value and quality metrics could be used to increase the robustness empirical findings. Third, this attempt to combine value and quality factors could be connected to the Discounted Cash Flow model, especially for determining if a high DCF valuation of a company is more likely to arise from a low current market valuation (value factor) of the stock or rather from the strong margins and cash flow generation by the underlying business (quality factor).

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10 - APPENDIX

Table 13: EV/EBITDA combined with Quality performance

Year	EV/EBITDA	EV/EBITDA + ROIC 5y avg	EV/EBITDA + ROIC	EV/EBITDA + ROA	EV/EBITDA + Gross Profitability	EV/EBITDA + Grantham's Quality Score	EV/EBITDA + Dividend Yield	STOXX 600
2001	6.4%	7.2%	6.7%	4.3%	5.8%	3.3%	9.7%	-17.0%
2002	-16.7%	-16.3%	-13.4%	-14.5%	-17.0%	-19.0%	-13.4%	-25.4%
2003	32.5%	30.4%	29.8%	30.1%	31.4%	31.8%	32.2%	21.0%
2004	27.3%	24.8%	24.3%	25.1%	23.6%	26.6%	27.6%	18.5%
2005	32.9%	35.4%	38.0%	35.3%	30.6%	30.5%	31.3%	21.5%
2006	42.4%	38.9%	35.8%	36.6%	39.3%	37.2%	40.3%	28.9%
2007	-13.5%	-7.5%	-6.2%	-6.2%	-11.5%	-6.3%	-15.7%	-17.5%
2008	-24.6%	-22.6%	-23.6%	-22.8%	-22.0%	-25.6%	-24.2%	-29.8%
2009	29.6%	31.5%	30.4%	27.6%	32.7%	29.3%	30.7%	18.5%
2010	20.4%	20.1%	20.4%	20.9%	19.5%	21.2%	16.8%	17.5%
2011	-22.4%	-17.0%	-16.2%	-16.0%	-15.2%	-16.7%	-21.9%	-12.2%
2012	36.4%	29.9%	31.8%	32.6%	38.0%	33.3%	35.9%	31.7%
2013	26.7%	18.8%	20.0%	20.7%	21.9%	22.4%	26.7%	19.5%
2014	15.7%	13.1%	14.8%	16.8%	17.3%	17.3%	15.3%	19.7%
2015	-5.1%	-5.6%	-3.4%	-5.1%	-2.6%	-4.5%	-7.0%	-11.1%
2016	26.4%	24.8%	23.6%	25.1%	29.1%	25.0%	21.4%	17.8%
2017	6.8%	6.8%	8.0%	7.2%	8.7%	5.7%	2.6%	2.1%
2018	-7.5%	-7.6%	-7.9%	-6.7%	-7.7%	-6.9%	-5.4%	-0.8%
2019	-9.2%	3.3%	1.6%	1.7%	-1.6%	1.6%	-8.9%	-1.8%
2020	50.8%	43.8%	46.7%	47.1%	51.6%	43.5%	44.3%	30.6%
2021	-2.1%	-8.5%	-6.3%	-3.7%	-7.0%	-4.5%	-0.8%	0.6%
2022	-3.5%	2.4%	-0.4%	0.1%	2.0%	1.1%	-1.9%	7.2%
Average	11.4%	11.2%	11.6%	11.6%	12.1%	11.2%	10.7%	6.3%
CAGR	9.1%	9.4%	9.9%	10.0%	10.2%	9.4%	8.7%	4.6%
Min	-24.6%	-22.6%	-23.6%	-22.8%	-22.0%	-25.6%	-24.2%	-29.8%
Max	50.8%	43.8%	46.7%	47.1%	51.6%	43.5%	44.3%	31.7%
Median	11.2%	10.1%	11.4%	12.0%	13.0%	11.5%	12.5%	12.3%
Standard Deviation	19.0%	17.8%	17.6%	17.2%	17.8%	17.7%	17.7%	16.1%
Sharpe Ratio	0.51	0.54	0.57	0.58	0.59	0.54	0.51	0.28
Sortino Ratio	0.66	0.69	0.72	0.76	0.76	0.68	0.65	0.36
Average drawdown	-11.6%	-8.3%	-7.8%	-8.2%	-9.0%	-9.3%	-10.8%	-14.5%
N. years with negative returns	9	7	8	7	8	7	9	8

Table 14: P/B combined with Quality performance

Year	P/B	P/B + ROIC 5y avg	P/B + ROIC	P/B + ROA	P/B + Gross Profitability	P/B + Grantham's Quality Score	P/B + Dividend Yield	STOXX 600
2001	1.5%	1.7%	8.1%	7.9%	8.0%	3.2%	10.9%	-17.0%
2002	-19.2%	-15.8%	-14.0%	-13.8%	-18.5%	-19.4%	-14.8%	-25.4%
2003	31.7%	29.3%	28.3%	28.8%	34.1%	29.3%	29.8%	21.0%
2004	23.9%	25.2%	25.9%	25.7%	23.1%	26.0%	26.4%	18.5%
2005	30.7%	33.2%	37.0%	35.9%	31.6%	33.7%	31.8%	21.5%
2006	43.9%	38.7%	40.5%	37.9%	42.6%	35.7%	43.3%	28.9%
2007	-20.2%	-9.2%	-4.2%	-7.3%	-19.1%	-8.8%	-17.8%	-17.5%
2008	-25.3%	-23.5%	-26.6%	-27.0%	-21.6%	-27.4%	-25.9%	-29.8%
2009	37.7%	34.9%	32.2%	33.1%	37.1%	34.1%	37.3%	18.5%
2010	22.9%	22.2%	24.8%	21.0%	18.0%	22.0%	17.9%	17.5%
2011	-22.5%	-21.0%	-17.0%	-16.1%	-14.5%	-17.3%	-22.0%	-12.2%
2012	41.7%	35.7%	37.0%	36.1%	40.6%	37.3%	40.5%	31.7%
2013	27.9%	20.3%	22.4%	20.6%	22.5%	24.4%	28.3%	19.5%
2014	19.5%	14.7%	16.3%	20.3%	15.7%	17.4%	16.1%	19.7%
2015	-7.3%	-7.1%	-6.5%	-5.3%	-4.3%	-5.9%	-9.4%	-11.1%
2016	29.1%	24.8%	24.9%	26.1%	29.2%	26.0%	25.7%	17.8%
2017	5.7%	5.3%	9.2%	9.3%	6.0%	4.3%	4.4%	2.1%
2018	-7.5%	-7.7%	-8.3%	-7.8%	-6.0%	-7.1%	-6.1%	-0.8%
2019	-9.7%	0.2%	-1.1%	2.7%	-2.3%	-1.0%	-9.6%	-1.8%
2020	46.5%	50.5%	48.7%	48.1%	49.0%	41.6%	39.7%	30.6%
2021	-3.6%	-8.6%	-6.5%	-6.1%	-8.0%	-3.1%	-3.3%	0.6%
2022	-2.5%	-1.8%	-0.1%	2.8%	0.6%	-0.8%	-1.4%	7.2%
Average	11.1%	11.0%	12.3%	12.4%	12.0%	11.1%	11.0%	6.3%
CAGR	8.6%	9.0%	10.3%	10.5%	9.9%	9.1%	8.7%	4.6%
Min	-25.3%	-23.5%	-26.6%	-27.0%	-21.6%	-27.4%	-25.9%	-29.8%
Max	46.5%	50.5%	48.7%	48.1%	49.0%	41.6%	43.3%	31.7%
Median	12.6%	10.0%	12.7%	14.8%	11.9%	10.9%	13.5%	12.3%
Standard Deviation	19.4%	18.7%	18.4%	18.0%	18.1%	18.5%	18.3%	16.1%
Sharpe Ratio	0.48	0.50	0.57	0.59	0.57	0.52	0.51	0.28
Sortino Ratio	0.62	0.67	0.73	0.76	0.73	0.64	0.64	0.36
Average drawdown	-13.8%	-10.3%	-8.7%	-8.4%	-9.8%	-10.5%	-11.8%	-14.5%
N. years with negative returns	9	8	9	7	8	9	9	8

11 – INTRODUCTION

This part of the thesis, similarly to the previous one, is centered on the ability by investors to actively beat the stock market. As a matter of fact, history proves that this is something challenging to achieve, the vast majority of equity funds (both in Europe and the US) failing to generate any excess returns compared to the relative index, especially without incurring additional risk. For instance, 98% of the euro-denominated global equity funds underperformed the market (i.e., the S&P Global 1200 index) over the 2013-2023 period (SPIVA® Europe Mid-Year 2023). Such strong evidence is supported by the Efficient Market Hypothesis (EMH), according to which an investor cannot beat the market over the long term. On the other hand, however, the success of great investors of the likes of Warren Buffet challenges this whole paradigm. In this thesis I investigate whether two specific sets of active investing strategies, namely value and quality investing, and most importantly their combination, can beat the market.

Between these two strategies, value investing is arguably much more popular among academics and investment professionals, as it started in the 1930s with Graham and Dodd, who established a solid framework for value investing; it is essentially about selecting those securities that are selling below the levels justified by fundamentals, hence taking advantage of temporary market inefficiencies. Accordingly, securities priced below intrinsic value are expected to generate superior long-term returns, which is what Graham experienced already in the first half of the 20th century and other value investors as well as researchers (by means of back testing) did since then; therefore, solid evidence exists to support the statement that portfolios made of value stocks could be earning higher returns compared to a market index, especially in the US stock market. However, the more recently documented weakening performance of value investing in the US (e.g., Lev and Srivastava, 2019) may have led researchers and practitioners to explore other active investing strategies, including quality investing. This strategy consists in selecting stocks based on some fundamental "quality" characteristics, although currently there is no agreement on what exactly quality is, given its multiple definitions. Generally, a quality investor aims to select companies that are considered to be well-managed, financially stable, and have a history of consistent performance. Some common factors associated with quality investing may include financial strength (low levels of debt, sufficient cash reserves, etc.), high returns on capital, consistently growing earnings/dividends, transparent and accountable governance practices, the presence of a competitive advantage over peers (e.g., strong brand recognition, innovative products, dominant market position, etc.). Such qualities are likely to maintain the company's high profitability over the long term, weather economic downturns, limit the impacts by the entrance of new players into the market, etc., hence ultimately generating a stronger share price performance.

Similarly to the previous part on the European stock market, this thesis aims to combine value investing with quality investing, as this is arguably a proper match from a theoretical perspective, given that generally the downside of quality stocks is the significant premium they are priced at. The key difference between the two parts of the thesis is the market over which the empirical analysis is conducted: here, strategies based on selected value and quality metrics will be back tested in the Nordic stock market (Nasdaq OMX Nordic 120 Index being the benchmark) up to 2010. The selected value metrics are P/E, P/B, P/CF, EV/EBIT and EV/EBITDA, while the quality metrics are Return on Invested Capital (last year), Return on Invested Capital (last 5 years), Return on Assets, Gross Profitability, Gratham's Quality Score and Dividend Yield. In addition to being tested as stand-alone strategies, value and quality are tested together by creating equally weighted portfolios based on a combined ranking (i.e., one value metric and one quality metric), which is inspired by Novy-Marx (2014) and Lalwani et al. (2018), but also by Greenblatt (2006), given his highly popular “Magic Formula”. While combining value with quality has been analysed at European level (Bermejo et al., 2021), no such previous study exists based on the Nordic stock market.

There are a number of reasons making such analysis on the Nordic stock market meaningful. A key one is the high growth in the Nordic countries’ economies (Denmark, Sweden, Finland, Norway, Iceland) over the last few decades, coupled with a low-risk political environment. In this regard, a key question is whether this is sufficient to translate into strong and persistent returns, thus making the Nordic stock market no longer being considered a periphery market (i.e., perceived as not sufficiently safe by investors). As a matter of fact, results in this thesis show that Nordic value and quality portfolios outperform both the market and their European counterparties, the best performing metrics being P/FCF and EV/EBITDA for value, and Gross profitability and ROA for quality. Compared to Europe, the outperformance is at least partly arising from the superiority of the underlying index but could also be attributed to a different industry breakdown of the market, with a higher presence of healthcare and industrial businesses in the Nordics. On the other hand, risk-adjusted performance would also depend on the variability of returns, which could in turn be driven by two main factors: the higher political stability in the Nordic countries could be beneficial for lowering the standard deviation of returns, while the much lower starting sample size (120 vs 600) might on the other hand increase it. Again, results show that risk-adjusted performance is stronger for Nordic value/quality portfolios compared to the benchmark and to the European ones. Additionally, combining value with quality improves the performance of the former in terms of CAGR, Sortino ratio, etc., while also turning the alpha against the Fama French 5 factor model significant.

The thesis is organized in the following manner. The following section on literature review is in turn divided in three parts: value investing, quality investing and combining value with quality. In each of these, a brief summary of the given investing strategy is outlined before passing to the analysis of the relevant literature focusing on the Nordics (if available) or at international level, and finally comparing results with the European one as well as explaining the research gap this thesis aims to fill. Passing to the empirical part, the data sample selection process, the selected financial variables and a description of the methodology are outlined in the third section. The fourth section presents the key results of the research, both for the standalone value and quality portfolios, as well as for those combining both strategies; additionally, results are compared with those related to the previous part of this thesis focusing on the European stock market. Finally, key takeaways are highlighted in the Conclusion section.

12 – LITERATURE REVIEW

12.1 – Value Investing

Value investing arguably started with Graham and Dodd (1934), who are considered pioneers with respect to value investing theories. Interestingly, they advocated going beyond basic fundamental metrics to better understand the true value of the underlying securities and identify those which are undervalued. However, the general perception of value investing changed in the 1980s, when multiples gained popularity as a result of the development of financial databases, which in turn raised awareness of market anomalies, including those related to a number of value multiples, such as the P/E, P/B and P/CF ratios (Fama, 1970). By the 1990s, the era of formula-based value investing had begun, the investing decisions being mainly based on accounting ratios. This trend was further advanced by authors like Fama and French, who found strong correlations between value ratios and future stock returns (Fama & French, 1997). On the contrary, recent research has concluded that strategies based on formulaic value investing are losing their effectiveness across a number of markets (Asness et al., 2015; Kok et al., 2016; Lev et al., 2019).

In most of the value investing multiples, the numerator represents the market price, and is divided by a metric capturing the security's intrinsic value (typically book value or proxies of earnings power). In most of the value metrics, a lower ratio translates into a higher relative value, while the opposite is true for ratios like the dividend yield. Below is a brief overview of the main value investing multiples.

- **P/E**

  The price-to-earnings ratio evaluates a security's market value in relation to its earnings. The ratio indicates how much the market is willing to pay for a stock based on its actual or projected earnings (Bodie, 2014). A high P/E ratio (which typically identifies growth stocks) means that the cost for a given level of current/expected earnings is relatively high, while the opposite applies to a low P/E ratio (which is typically associated with value stocks) (Fama and French, 1997); in this way, the P/E ratio partly reflects the expected growth opportunities of a business (Bodie, 2014).

- **P/B**

  The market price of a share divided by its book value is known as the price-to-book ratio (Bodie, 2014). A higher ratio indicates a higher expected revenue generation given a certain level of assets held by the company (Bodie, 2014). Even though the P/B and P/E ratios are similar, P/B could arguably be more effective in sectors where book value is key for revenue generation, such as banking (Mladjenovic, 2009). Given that the P/B ratio can be viewed as a "floor" supporting the market price (being it unlikely for the market price to fall below the book value, considering the option by the company to sell or liquidate its assets), companies with low P/B could be considered "safer investments”.

- **P/CF**

  The price-to-cash-flow ratio (P/CF) relates the company’s stock price to its operating cash flow (per share). According to Bodie (2014), this metric is particularly useful for assessing companies that have positive cash flows but are not yet profitable, due to a high level of non-cash expenses. Additionally, the cash actually generated by the business can arguably be seen as a more reliable metric compared to earnings, which instead can potentially be manipulated.

- **Dividend yield**

  The dividend yield (expressed as a percentage) measures the dividends paid out by a company, divided by its share price. Dividend yields can vary a lot among companies and sectors, as paying regular dividends is not mandatory by any means. As a consequence, it is an important strategic decision, as another option for the business would be to allocate the accumulated profits to investments, which could grow its future earnings.

- **EV/EBITDA**

  The EV/EBITDA multiple puts into relation a firm's Enterprise Value to its Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA) and is heavily used by industry practitioners as a key tool for stock valuation and investment decision-making. Its key strength is the ability to account for differences in the company's capital structure (compared to P/E) and investment needs (which impact depreciation/amortization). This makes EV/EBITDA extremely useful when comparing companies in different industries and growth stages; in essence, it is supposed to capture the true economic profitability of a business. Interestingly, the conceptual idea behind the EV/EBITDA multiple is not distant from the one behind the P/CF multiple, as the EBITDA, by adding back non-cash expenses (depreciation and amortization), serves as a proxy of a company's cash flows.

- **EV/EBIT**

  The EV/EBIT ratio is a very similar metric to the aforementioned EV/EBITDA, except for the fact that it does include the effect of depreciation and appreciation. While the EV/EBITDA multiple can provide stronger insights future on profit growth, EV/EBIT is arguably a better metric to represent the true financial strength of a business, as EBIT includes all of its operating expenses, while disregarding its capital structure and fiscal obligations.

The existence of a value premium based on one or more of the above metrics is well supported by prior literature (e.g., Fama, 1970; Basu,1977; Athanassakos, 2011), both in the US and at international level. This is the case for both multiples such as P/B and P/E which have been researched for several decades, but also for more recently investigated metrics such as EV/EBIT and EV/EBITDA. In the following sub-paragraphs, the existing literature on value investing in the Nordics market is to be explored and results compared to the literature focused on the European stock market.

Pätäri, Leivo (2009)

Pätäri, Leivo (2009) is one of the few papers focusing on multiple value metrics (P/B, P/E, P/S, P/D, P/CF, EV/EBITDA) in a Nordic market (Finland: OMX Helsinki). Every year over the 1993-2008 period, stocks are ranked based on the aforementioned value ratios and accordingly divided into three equally weighted portfolios, the value portfolio being the one with lowest multiples. The main result of the study is the presence of the value premium in the Finnish market, with the average annual returns ranging from 15.64% (P/B) to 21.67% (P/D) against the market's 14.41%; moreover, such premium is not explained by the value portfolios' higher risk, as volatility is lower compared to the growth portfolios. Every performance selected metric agrees on the significant outperformance of P/D value portfolio over the market in the 15-year sample period, with a significant Jensen's alpha of 10.03% and an adjusted Sharpe ratio of 0.28 (vs the market's 0.16). Finally, this research found that the outperformance of value strategies is mostly attributed to the fact that the value portfolios experience on average a much less significant loss during bear markets (1.59% average monthly loss for value portfolios in this study vs 4.02% for the market and 4.76% for the growth portfolios).

Grobys, Huhta-Halkola (2018)

Grobys, Huhta-Halkola (2018) is a paper that explores the value and momentum investing strategies in the Nordic stock market (OMXH, OMXSPI, OSEBX and OMXC exchanges) over the 1993-2017 period. The P/B ratio is used to define value, which is represented by the third of stocks with lowest P/B values. The study found the presence of a value anomaly, as value stocks generated strong excess returns (2.05% average monthly return for the value portfolios and 1.25% for the zero-cost strategy, i.e., long value and short growth). However, the most important finding was that if only the top third of stocks by market capitalization was considered, returns were significantly lower (1.50% for value portfolios and 0.44% for value minus growth) and turned from statistically significant to not. Importantly, this could entail that the value premium in the Nordic market is at least partly driven by a size effect.

A study analysing the performance of value investing strategies in the European stock market (Dow Jones EuroStoxx Index being the benchmark) over a 15-year period (1997-2011) is Teti, Dallocchio, Tamburnotti (2019). An extremely relevant peculiarity of this study is related to the four different methodologies to define value/growth. The first one, the Global Quartile Method, simply sorts stocks and divides them in quartiles based on their P/B ratio. The second methodology, the Country-based Quartile Method, uses the same criteria but sorting is done on a country basis. The third method, PEBV (P/E and P/B) uses the two most renowned value metrics together (i.e., the sixty stocks with the lowest P/B, are split in two equal-size groups based on their P/E ratio). Finally, the Total Market Indicator method adds other two value metrics, i.e., P/FCF and the Dividend Yield, aiming to obtain in this way the "purest" value portfolios. The first key finding in Teti, Dallocchio, Tamburnotti (2019) is that whichever methodology is used, the performance of value is much stronger than growth, both from absolute and risk-adjusted perspective, the strongest performance being achieved by the Total Market Indicator methodology. In particular, the increase in performance when passing from the first to the last methodology (considering absolute returns) might suggest that adding relevant value metrics to investing strategies already based on another value metric is beneficial.

Confirming the superiority of value investing in Europe is also the study by Stagnol et al. (2021), which investigated the performance of the equity value factor (defined as Fama and French's HML factor) over the 2000-2020 period. According to this study, the monthly return of the HML portfolio is equal to 0.29% (c.3.5% annualized – higher than the 0.08% monthly return achieved in the US), although it was entirely driven the first decade (1.09% monthly return vs -0.39% over the second decade). The big difference in performance between the two decades could be at least partly attributed to a few macroeconomic factors, including interest rates (value tends to outperform with high interest rates and a steep yield curve), inflation (value is likely to outperform when inflation is high) and credit spreads (narrowing credit spreads tend to favour value).

While these two papers found strong evidence of a value premium in Europe, this seems not to be as robust in the Nordics, according to the aforementioned research. Indeed, the value anomaly found in Grobys, Huhta-Halkola (2018) was conditional on size (i.e., considering only the third of stocks with highest market capitalization, returns were lower and no longer statistically significant), and only the P/B ratio was tested, disregarding the other value metrics. On the other hand, the value anomaly reported in Pätäri, Leivo (2009) only applies to the Finnish stock market and refers to a time period only until 2008. As a consequence, this thesis aims to analyse the performance of the most popular value investing metrics across the entire Nordic stock market, aiming in this way to fill such gap in the existing literature.

12.2 – Quality Investing

Unlike value, quality does not represent yet a well-defined investing strategy, as there is no agreement on what defines quality. As an illustration, it has been said that quality stocks can be recognized "when you see them" (Novy-Marx, 2014). Similarly to the previous part of the thesis focusing on the European stock market, the definition of quality provided by Novy-Marx (2014) serves as the basis for the thesis.

Novy-Marx's seven quality measures

Novy-Marx selected gross profitability, Graham's G-score, Grantham's quality score, Piotroski's F-score, Greenblatt's ROIC, Sloan's accruals, and defensive equity strategies as core quality metrics (Novy-Marx, 2014).

- Gross profitability

  It is calculated as the difference between revenue and total cost of goods sold, scaled by assets. Gross profitability represents a simple yet meaningful quality metric due to its ability to highlight businesses with high operational efficiency, which is a key attribute for a quality company

- Grantham quality score

  It is calculated by averaging the ranks of return on equity (ROE), the inverse of ROE volatility, and assets-to-book value. ROE is in turn calculated by dividing net income by shareholders' equity book value, while the standard deviation of ROE over the previous five years is used to calculate the volatility of ROE (Lalwani et al., 2018). In this way, the Grantham quality score reflects profitability, stability, and efficiency of asset utilization, which are all proxies of quality.

- ROIC

  Greenblatt (2006) published the "Little Book That Beats the Market", in which he proposed a "Magic Formula", which logic is clearly to combine value with quality (i.e., buying high-quality businesses at low prices). The quality metric adopted by Greenblatt (2006) is the return on invested capital (ROIC), which expresses operating profit as a percentage of invested capital, hence assesses the efficiency with which a business converts capital into profits.

- Graham's G-score

  Graham adopted seven different criteria for screening stocks: five are meant to identify quality firms, while the last two ensure that the investor does not overpay them. The aforementioned five quality criteria have been used to create a trading strategy, namely the Graham G-score (Novy-Marx, 2014). Such score is measured on a scale of 1 to 5, and single points are earned when specific criteria are met (e.g., if long-term debt is below net current assets, in case of a ten-year history of positive earnings / dividends, etc.).

- Sloan's accruals

  Accruals are either unrealized revenues or expenses which have already been incurred but not yet reflected in the accounts. Sloan (1996) proposed a quality of earnings metric (Sloan's accruals) which is calculated by dividing the company's discretionary accruals (the difference between net income, i.e., accounting earnings, and operating cash flow, i.e., cash earnings) by its total assets. Essentially, a lower ratio entails a superior quality of earnings, given the higher proportion of accounting earnings coming from actual cash flows. On the other hand, high Sloan ratios may imply less reliable hence less sustainable earnings, given the large gap between net income (which could be manipulated by the company) and cash flows. In this way, Sloan's accrual was chosen by Novy-Marx as a quality metric.

- Piotroski's F-score

  Piotroski (2000) created another accounting-based metric that accounts for firm quality, namely the F-score, which is made of nine binary variables. Four variables measure profitability: net income, return on assets (ROA), operating cash flow (CFO), and operating cash flow being greater than net income (quality of earnings). Three variables assess the firm's liquidity: changes in the firm's long-term debt levels, changes in its current ratio, and the issuance of equity. The last two variables gauge the firm's operational efficiency: gross margin and asset turnover ratio (revenues divided by total assets).

- <u>Defensive equity strategies</u>
  These are often considered quality strategies as they promise equity-like returns although with lower volatility and drawdowns (Novy-Marx, 2014). Their ability to mitigate market risk without sacrificing absolute performance is possible by selecting stocks with low volatility and market betas. Indeed, market betas are only weakly correlated with average returns (Frazzini and Pedersen, 2013), while low volatility stocks generally outperform their high volatility counterparties (Baker, 2010).

Despite the different definitions used in multiple studies, the existence of a premium for a few quality metrics (e.g., gross profitability, ROIC) is supported by prior literature (e.g., Novy-Marx, 2014; Hanson and Dhanuka, 2015), in the US as well as in some other countries at international level. Furthermore, this has been confirmed also at European level, in the empirical analysis conducted in the previous part of the thesis. However, empirical research focusing on the quality premium in the Nordics is currently missing, hence this thesis aims to address such gap. In the following sub-paragraphs, the existing literature on quality investing (at international level) is to be explored, and then compared to the European one.

Novy-Marx (2014) conducted an empirical evaluation of the seven aforementioned quality strategies. Despite the fact that only gross profitability produced statistically significant excess returns when considering long/short strategies, all high-quality strategies generated some abnormal returns, and had significant alphas against the Fama French 3-factor model. When examining the spanning tests, also Grantham's quality score yields encouraging outcomes (being able to generate a statistically significant intercept). Finally, a better risk-return relationship is obtained when quality and value are combined.

The same seven quality metrics were also examined by Hanson and Dhanuka (2015) in the US market. According to this study, only ROIC produced statistically significant outperformance. The authors argue that the most compelling explanation is that the explanatory power of most accounting metrics has been arbitraged away over time.

Lalwani and Chakraborty (2018) examined the performance of four quality metrics (Magic Formula, Piotroski's F-score, gross profitability, and Grantham's quality score) in India between 2001 and 2016. Their findings imply that after controlling for size, value, and momentum, superior results (i.e., significant alphas) were obtained by gross profitability and Grantham's quality score.

Finally, Cheong et al. (2019) investigated the performance of strategies based on Piotroski's F-score and gross profitability in Asian stock markets over the 2000-2016 period. In the cross-sectional regressions, portfolios based on both metrics yielded highly significant positive results.

Unlike for value investing, in this case there is not much literature focusing on the Nordics context, but we can nevertheless look at the European context in order to get some insights. Although research on quality investing over the European stock market is not widespread, among the 24 countries included in the sample selected by Asness et al. (2018) (MSCI World Developed Index), 16 are European. The authors of this study developed the so-called Quality-Minus-Junk (QMJ) factor, which is meant to include safe (i.e., with low leverage, low ROE volatility, etc.), profitable (i.e., with high gross profitability / ROE / ROA, etc.) and growing (i.e., high growth in the aforementioned profitability metrics) businesses. The authors demonstrated the ability by the QMJ factor to earn significant risk-adjusted returns both in the US and internationally over the 1957-2016 period. This is arguably due to the fact that high-quality stocks (i.e., those with high profitability, growth and safety) have on average higher prices, although not by a large margin, which attributes to them a higher risk-adjusted return.

Overall, the analysed literature points at a strong quality premium (at least for a few metrics) at international level. This thesis aims to investigate whether the same applies also to the Nordic region.

12.3 – Combining Value Investing With Quality Investing

Value and quality are conceptually quite similar concepts, as quality can also be considered an alternative implementation of value (Novy-Marx, 2014). On the other hand, however, the two investing strategies can be seen as highly dissimilar, given that value strategies are typically short quality (i.e., value companies tend to be lower quality), while quality strategies tend to be short value (i.e., quality stocks tend to be expensive). This is an extremely relevant point, as theoretically it would make each of these two strategies perform well precisely when the other underperforms, which in turn makes them particularly attractive to run together (Novy-Marx, 2014).

Unlike for value and quality investing on a standalone basis, there hasn't been much research on combining these strategies. The focus of the few relevant papers is often on combining the P/B ratio with a quality metric. For instance, Piotroski and So (2012) combined P/B (a low ratio representing value) with the F-score (a high score representing quality), showing that strategies trading jointly on the value (i.e., low P/B) and quality (i.e., high F-score) factors are able to generate a superior performance compared to other combinations (e.g., low P/B & low F-score, mid P/B & high F-score, etc.).

Two key papers over which the empirical research conducted in this thesis is based, are Novy-Marx (2013), and Lalwani & Chakraborty (2018).
Novy-Marx (2013) is arguably the first paper clearly defining and testing (in the US markets, over the 1963-2013 period) the performance of quality investing. Moreover, it combines (i.e., uses both rankings when forming portfolios) quality strategies with the P/B ratio (value). Results show that for both large cap and small cap businesses, there is a significant improvement in risk-adjusted performance (i.e., Sharpe ratio and CAPM information ratio) compared to portfolios based solely on P/B (with the exception of combinations including earnings quality and ROIC). However, when it comes to alphas against the CAPM (which were significant for all portfolios, unlike those against the 3-factor Fama French model), only 3 out of the 7 combinations yielded an improvement over the P/B portfolio; P/B & gross profitability and P/B & Piotroski's F-score were the only two combinations improving the CAPM alpha for both large and small caps.
Lalwani & Chakraborty (2018) conducted a similar study in the Indian stock market, the chosen metrics being Grantham's quality score, magic formula, Piotroski's F-score and gross profitability. These were again combined with the P/B ratio. By doing so, however, absolute performance generally decreased (e.g., the average annual outperformance of the Grantham quality portfolio over the market has reduced to from 4.34% to 3.34% after combining with value), with the exception of the magic formula (turned from negative 0.82% to positive 0.95%). To compare the performance of portfolios combining quality and value with quality-only portfolios, the authors conducted spanning tests, which showed no significant gain arising from shifting from a strategy based on quality-only to a quality & value one.

Overall, the findings indicated that switching from quality investing strategies to a mix of value and quality did not materially improve the overall performance.

Unlike for value investing, in this case there is not much literature focusing on the Nordics context, but we can nevertheless look at the European context in order to get some insights. A paper analysing a combination of value and quality investing in the European stock market, is Bermejo et al. (2021). In this study, 600 European stocks with highest market capitalization are selected and analysed over the 1991-2019 period. P/B, P/E, EV/EBIT and EV/EBITDA ratios were the adopted value metrics, while Gross Profit over Total Assets (GPA), Return on Capital (ROC_Green) and Return on capital including intangible assets (ROC_Det) were used to define quality. For all metrics, findings show that the upper quintile outperforms the benchmark, and returns tend to increase when moving from the bottom to the upper quintile (the bottom quintile portfolio underperforming the benchmark). Moreover, mixed strategies deliver greater results than value-only; the best performing strategy is EV/EBITDA coupled with ROC_Green, with 12.2% CAGR and 4.5% FF3 alpha, albeit having a lower Sharpe ratio than EV/EBITDA standalone (0.74 vs 0.80). Finally, the spanning tests demonstrated that both mixed and iterative (i.e., screening for value first, then for quality and momentum) strategies generate positive alpha relative to the pure value portfolios.

To conclude, Novy-Marx (2013) and Bermejo et al. (2021) found strong improvements in risk-adjusted performance when combining value with quality investing in the US and European markets, while this was not the case for the Indian market in Lalwani & Chakraborty (2018); however, it has to be noted that, by having quality investing as a starting point (against which the performance of value & quality combinations is compared), Lalwani & Chakraborty (2018) is not fully comparable to the other papers.

13 – DATA AND METHODOLOGY

13.1 – Data sample selection process

The empirical analysis in this part of the thesis is conducted over the Nordic stock market, which if compared to the US as well as some European (e.g., German, French) stock exchanges, is relatively new (Grobys et al., 2018), hence less explored. The Nordics region is made of Denmark, Sweden, Finland, Norway and Iceland, although the Iceland stock market is the smallest one (considering market capitalization), hence often excluded from empirical research, which is done also in this thesis. Even though the Nordic stock markets are generally considered to be periphery markets, they have been developing (i.e., higher number of listed companies and market capitalization) massively since the 1990s, mainly driven by a strong economic growth by these countries. This growth has been benefitting from a solid low-risk environment, especially from a political perspective, which is one of the factors contributing most to the triple-A credit rating and the perceived risk of bonds being close to the US ones. As a consequence, despite starting as a periphery market, which implies a high volatility given that investors pull their funds away from such markets first compared to those they consider safer, the Nordic stock market is nowadays considered as more part of the European core. Such shift should theoretically mean a higher inflow of foreign capital, hence more robust performance in terms of returns.

To represent the Nordics stock market, constituents of the Nasdaq OMX Nordic 120 index are selected in this thesis. Nasdaq OMX Nordic 120 is an index of Nordic stocks, designed by Nasdaq and introduced in 2010. This index serves as underlying for a number of products, including ETFs, futures, options and structured products. The components are fixed in number (120) and represent the 120 largest and most traded stocks listed on the most popular Nordics stock exchanges: Nasdaq Copenhagen A/S, Nasdaq Stockholm AB, Nasdaq Helsinki Ltd., and Oslo Bors. Thus, Nasdaq OMX Nordic 120 can be considered to be adequately representative of the Nordics stock market. The sector breakdown for the Nasdaq OMX Nordic 120 index is as follows: Healthcare (29.7%), Industrials (24.6%), Financials (17.7%), Energy (6.1%), Basic Materials (5.5%), Telecommunications (4.1%), Consumer Discretionary (4.0%), Consumer Staples (3.9%), Technology (2.1%), Real Estate (1.3%) and Utilities (1.2%).

The time period for this study is from June 2010 to June 2023. The stocks included in the index have been retrieved from Refinitiv Datastream; the constituents of the Nasdaq OMX Nordic 120 index were updated on a yearly basis. All active, and inactive (dead) public companies within the Nasdaq OMX Nordic 120 were part of the initial sample, in order to avoid survivorship bias, the presence of which could deliver over-optimistic results given that the sample consists only of winners. On the other hand, for the sake of simplicity, companies that were delisted in a given yearly holding period are excluded, as this is typically due to acquisitions by other companies, which generally occurs at a premium over the stock price. Financial companies (firms with one digit SIC codes of 6) are excluded from the sample, as the interpretation of their financial statements is considerably different, hence many accounting ratios could not be meaningful (Lalwani et al., 2018). Companies with missing data are excluded, as are also the ones with negative ROIC, ROA, ROE, gross income, EBIT, EBITDA, FCF; this is to exclude loss-making companies. Lastly, in order to exclude those companies that are more likely to go bankrupt, another selection criteria was to have a Debt/Equity ratio smaller than 3x. It is worth mentioning that some of the restrictions put in place are common across previous literature (e.g., excluding financial companies is also present in Grobys et al., 2018, and Bermejo et al., 2021) while others are not. Among the latter ones, excluding companies with negative ROIC, ROA, ROE, gross income, EBIT, EBITDA, FCF is meant to come up with an extremely robust pool of stocks to then rank based on the selected metrics. For instance, when analysing value investing strategies, it is important to include only include profit-making, cashflow-positive and solid (i.e., D/E < 3x) companies so that it is already in a way a combination of value and quality, even though the final pool of stocks will then be ranked only based on a value metric. The reasoning is that there is arguably little current value in a company not generating profit / cashflow / being in financial distress, as its potential strong stock price performance is entirely dependent on future growth expectations, which in turns makes it closer to growth rather than value investing. It has to be noted, however, that this is a strong distinctive point of this thesis compared to the papers analysed in the Literature Review section; as a consequence, results are likely to be nont fully comparable.

Following all the aforementioned exclusions, the number of stocks was within the 52-75 range, with an average of 60 per year.

13.2 – Selected financial variables

A number of financial variables were retrieved from Refinitiv DataStream on a yearly basis. These are either the selected value / quality metrics used for ranking the stocks in the sample, or financials needed to compute one or more of the below metrics (DataStream codes are in the appendix).

Value metrics

Value metrics that have been chosen for this thesis are P/E, P/B, P/CF, EV/EBIT, EV/EBITDA, in line with the previous part of the thesis. P/E and P/B are arguably the most popular value investing metrics, the latter also being the one combined with quality metrics by Novy-Marx (2014) and Lalwani et al. (2018). EV/EBIT is an appealing ratio as operating profit cannot be manipulated to the same extent as net income. Finally, EV/EBITDA and P/CF were chosen as what arguably matters most for investors is the company’s ability to generate cash, which can then be either reinvested in the business (organic growth), used to fund acquisitions (inorganic growth) or given back to shareholders (via dividends and/or share buybacks); EBITDA is a proxy for operating cash flows (as it adds back depreciation & amortization, which are non-monetary expenses), while Free Cash Flow takes accounts for the cash flow generated by operating activities and the cash needed to fund capital expenditure as well as acquisitions.

Quality metrics

Quality metrics that have been chosen for this thesis are ROA, ROIC, ROIC (5-years average), Dividend yield, Gross profitability, Grantham's quality score, in line with the previous part of the thesis. Gross profitability and Grantham's quality score are inspired by Novy-Marx (2014), as they have been the most prominent quality metrics in this study. ROIC was also among the quality metrics analyzed by Novy-Marx (2014) and is part of Greenblatt's Magic Formula (together with EV/EBIT, which is amongst the value metrics chosen for this thesis). Including also the 5-year average ROIC is an attempt to account for outliers, i.e., those years in which ROIC could have been extremely high/low compared to the historical trend. While gross profitability measures gross profit in relation to revenues and ROIC measures operating profit (after tax) in relation to invested capital, ROA measures a firm's overall profitability in relation to assets, i.e., how efficient is the business in using its assets to generate net profits (bottom line of the income statement). Finally, dividend yield was chosen as a quality rather than value metric due to the reasoning according to which a strong and consistent dividend policy could represent a positive indicator of the company's financial health. Indeed, a company being able to pay out a generous dividend (especially if on a consistent basis) suggests that the company is managing its capital effectively and has confidence in its future earnings prospects.

While all other selected quality metrics were directly taken from Datastream, gross profitability and Grantham's quality score required some manual calculations. Specifically, gross profitability is given by the ratio between gross income and total asset, while Grantham's quality score is calculated by averaging ROE, the inverse of ROE volatility (5 years are considered) and the ratio of total assets over book equity.

13.3 – Portfolio formation

Portfolios are formed on the first day of June of each year, starting from 2010, and are based on financial variables from the most recent annual financial statements (i.e., those related to the previous year). The exception is when it comes to the numerators (i.e., market capitalization and enterprise value) of value ratios, which are calculated by using the most recent share price (i.e., end-of-May share price). Such an approach aims to eliminate (or greatly reduce) the risk of look-ahead bias, which refers to a situation in which data that was not available at the time being analyzed, is incorrectly used in a study. The portfolios are rebalanced every year, which entails that the holding period is one year. This, together with the portfolio rebalancing date being between May and July, is common in this kind of research (Fama and French (1992), Novy-Marx (2014)).

The created portfolios are long-only, equally weighted and include the top 30 percentile stocks (this is a common practice across the relevant literature: e.g., Novy-Marx, 2014 and Lalwani & Chakraborty, 2018) ranked based on the five value metrics and six quality metrics (portfolios are made of 18 stocks on average); in case of value metrics, the lower the ratio, the higher the ranking, while for quality metrics, the higher the ratio/score, the higher the ranking. This entails that eleven different ranking are formed each year. In addition to these, portfolios of both value and quality are also constructed, for each of the available combinations (e.g., EV/EBIT combined with ROIC), which are 30 (5x6) in total. The ranking of the given combination is simply given by the average of the ranking based on the selected value metric (e.g., EV/EBIT) and the ranking based on the selected quality metric (e.g., ROIC). While some studies, including Lalwani et al., 2018, operate via a 50/50 portfolio of pure value and pure quality, Novy-Marx (2014) showed that a combination of value and quality (i.e., selecting stocks that look attractive from both perspectives, as this thesis does) is more effective because it is able to achieve larger exposures to both quality and value factors.

13.4 – Methodology

Following portfolios formation, Total Return Index data are retrieved from Refinitiv Datastream on a monthly basis for all selected companies in each year. The same data is retrieved also for the benchmark index, namely the Nasdaq OMX Nordic 120. This approach has a couple of main benefits: the first is that it makes unnecessary to retrieve data related to both share prices and dividends, and then calculate the total return, and even more importantly it is perfectly consistent in quantifying returns for both the selected portfolios and the benchmark index against which performance will be evaluated. Calculating the monthly return requires simply to take the difference between the Total Return Index (TRI) of a given month and the previous month and divide it by the TRI of the previous month, as shown in the following formula:

$$R(t) = \frac{TRI(t) - TRI(t-1)}{TRI(t-1)}$$

Then, to calculate the monthly return of the given portfolio, it is only necessary to take the average of its constituents' monthly returns, as all portfolios are equally weighted. Returns for periods greater than one month (e.g., one year) are calculated by compounding the monthly returns as follows:

$$R(n) = \big(1 + R(t)\big) * \big(1 + R(t+1)\big) * \ldots * (1 + R(t+n))$$

where n is the number of months that lie in the period for which returns are to be calculated (e.g., n equals 12 when calculating a yearly return).
For the sake of simplicity and given the more theoretical approach of this thesis, all returns are calculated without accounting for transaction costs.

First, the performance of portfolios based on both value and quality strategies stand-alone are compared with a benchmark, namely the Nasdaq OMX Nordic 120, from which the sample was extracted according to the aforementioned criteria. In addition to absolute returns, it is important to consider the risk-adjusted performance, which is done by means of the Sharpe and Sortino ratios. Despite arguably being the most popular risk-adjusted performance metric, the Sharpe ratio has been criticized as it tends to penalize extremely high positive returns. On the other hand, the Sortino ratio is able to correct for such drawdowns, hence it is used in this thesis. Then, returns of the different portfolios are analyzed by quantifying the respective alphas generated by regressing portfolios returns against the Fama French five factors. The reason behind this analysis is that several successful trading strategies are simply different expressions of the size and value anomalies, while this thesis aims to find out whether the investigated value and quality strategies are able to generate significant excess returns even after controlling for the returns that an investor could have produced by trading on these basic anomalies. The crucial test is that for a strategy (be it value or quality or even a combination) to be truly innovative and profitable, its returns have to be able to generate α against the Fama French 5-factor model, as per the following formula:

$$R_{i,t} - R_{f,t} = \alpha + \beta_{i,m}(R_{m,t} - R_{f,t}) + \beta_{i,s}SMB_t + \beta_{i,h}HML_t + \beta_{i,r}RMW_t + \beta_{i,c}CMA_t + \varepsilon_{i,t}$$

Where $R_{i,t}$ is the monthly return of a given portfolio (e.g., P/E, ROA, etc.), $R_{m,t}$ is the monthly return of the market (Nasdaq OMX Nordic 120 index), $R_{f,t}$ is the monthly return of the risk-free asset, SMB is the Small Minus Big factor, HML is the High Minus Low factor, RMW is the Robust Minus Weak factor and CMA is the investment pattern factor, $\beta_{i,m}$, $\beta_{i,s}$, $\beta_{i,h}$, $\beta_{i,r}$, $\beta_{i,c}$ represent the loading on the five factors, and α is the portion of the excess return achieved by the portfolio which is not explained by the model.

The factor data for the model has been obtained directly from the Kenneth French online library; the European factors were picked, as factors for the Nordics stock market are not available (Swedish ones are available and a robustness check considering those is performed). The only adjustment made is to build the market factor manually, namely by computing the returns of the Nasdaq OMX Nordic 120 index out of the Total Return Index retrieved from Refinitiv Datastream, and subtracting R(f), which on the other hand is taken from the Kenneth French online library, as is the rest of factor data. This adjustment is meant to better link the returns of the given portfolio to the benchmark from which the sample was built in first place.

The same type of analysis (excess returns, risk-adjusted performance, regressions against Fama French 5-factor model) is done for the combined value-quality portfolios. It is important to note that such combined portfolios are made by combining the two best performing value investing strategies with all the quality metrics (one at a time). This is in line with Novy-Marx (2013) and Piotroski et al. (2012) and is done to reflect the higher popularity of value investing, which is therefore more likely to be the starting point (being the preferred investment style of several investors) by investors, who however might consider adding quality criteria to their stock selection process.

Furthermore, correlations between the returns of different stand-alone portfolios are examined, to find out which combinations are likely to benefit most from the diversification effect. Lastly, spanning tests similar to those in Novy-Marx (2013) are conducted in order to compare the performance of value-quality portfolios with their value-only counterparts (the same applies to quality-only portfolios). Specifically, the returns from a given combination strategy are regressed on the Fama French 5-factors and on the returns from a strategy based on the value metric only, viewed as an explanatory strategy. For instance, a spanning test for P/E would be conducted by running the following regression:

$$R_{i1,t} - R_{f,t} = \alpha + \beta_{i1,m}(R_{m,t} - R_{f,t}) + \beta_{i1,s}SMB_t + \beta_{i1,h}HML_t + \beta_{i1,r}RMW_t + \beta_{i1,c}CMA_t + \beta_{i1,v} R_{i,t} + \varepsilon_{i1,t}$$

Where $R_{i1,t}$ is the monthly return of a given combination portfolio (e.g., P/E & ROIC), $R_{i,t}$ is the monthly return of the corresponding value-only portfolio (P/E, in this example), $\beta_{i1,v}$ is the loading on the return of the corresponding value-only portfolio, and every other variable is as previously defined for the standard Fama-French regression.

14 – EMPIRICAL RESULTS AND DISCUSSION

14.1 – Summary Statistics

Value portfolios

Table 1 shows the descriptive statistics for value portfolios. The mean, median, maximum and minimum value are expressed as annual returns (including dividends) and are calculated by compounding the monthly returns of the given year. CAGR is computed based on the yearly returns (including dividends). Standard deviation is computed based on monthly returns and then annualized.

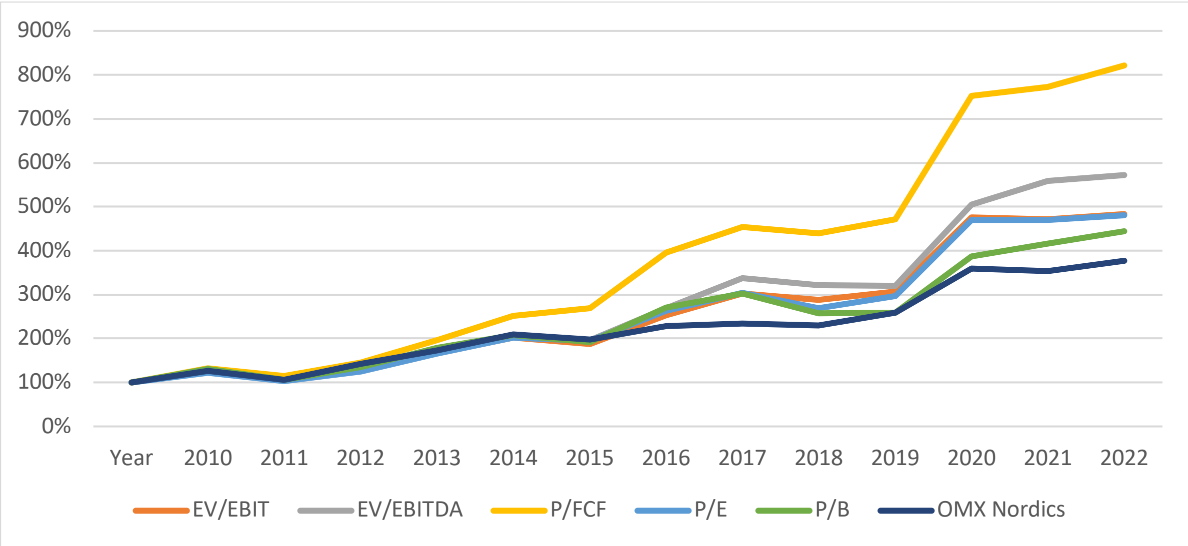
Table 1: Value portfolios performance

Year	EV/EBIT	EV/EBITDA	P/FCF	P/E	P/B	OMX Nordics
2010	27.2%	27.0%	31.8%	22.6%	31.1%	25.8%
2011	-13.8%	-13.7%	-13.0%	-15.4%	-19.1%	-15.8%
2012	21.7%	20.0%	26.3%	19.9%	27.8%	34.6%
2013	25.6%	29.4%	35.7%	33.0%	32.2%	21.0%
2014	20.6%	18.8%	27.8%	21.7%	16.3%	21.3%
2015	-7.5%	-3.1%	7.0%	-3.5%	-7.8%	-5.6%
2016	35.1%	37.3%	47.2%	35.3%	40.5%	15.1%
2017	20.0%	25.2%	14.8%	15.5%	12.0%	2.8%
2018	-5.1%	-4.7%	-3.0%	-11.7%	-14.6%	-1.9%
2019	6.6%	-0.4%	7.0%	10.2%	0.5%	12.4%
2020	55.0%	58.1%	60.0%	58.9%	49.2%	39.4%
2021	-1.0%	10.5%	2.6%	0.0%	7.6%	-1.9%
2022	2.7%	2.4%	6.3%	2.2%	6.6%	6.7%
Average	14.4%	15.9%	19.3%	14.5%	14.0%	11.9%
CAGR	14.0%	15.6%	19.2%	14.0%	13.2%	11.7%
Min	-13.8%	-13.7%	-13.0%	-15.4%	-19.1%	-15.8%
Max	55.0%	58.1%	60.0%	58.9%	49.2%	39.4%
Median	20.0%	18.8%	14.8%	15.5%	12.0%	12.4%
Standard Deviation	17.4%	17.1%	18.4%	17.3%	18.4%	15.6%
Sharpe Ratio	0.79	0.88	0.97	0.79	0.71	0.70
Sortino Ratio	1.04	1.12	1.28	1.08	0.93	1.00
Average drawdown	-6.9%	-5.5%	-8.0%	-7.6%	-13.8%	-6.3%
N. years with negative returns	4	4	2	4	3	4

The findings show that all portfolios have positive and higher than benchmark's (Nasdaq OMX Nordic 120) annual mean returns. P/FCF has the highest mean return (19.3%), followed by EV/EBITDA (15.9%), P/E

(14.5%) and EV/EBIT (14.4%), while the lowest is P/B (14.0%), still almost 2% higher than the benchmark (11.9%). It can be noted that the median returns are generally higher than their average counterparties as it is not really influenced by the negative returns, the most significant gain being the one made by EV/EBIT (20.0% median); the exceptions are P/FCF (decreases from 19.3% to 14.8%) and P/B (decreases from 14.0% to 12.0%), which are the two strategies having the fewest years with negative returns. This is reflected in a relatively high volatility (average standard deviation equal to 17.7% vs 15.6% for the benchmark) and importantly into a CAGR which is 0.1-0.8% below the average returns. This is not surprising, given that CAGR highly suffers negative returns as to recover them it needs a more than proportionate positive outperformance. However, this effect is much less significant compared to the entire European stock market, where the CAGR was 2.0-2.5% lower than the average returns; this is arguably due to the much higher average drawdown in years with negative returns (-11.2% vs the Nordic's -8.5%). Anyway, all strategies significantly outperform Nasdaq OMX Nordic 120 in terms of CAGR (13.2-19.2% vs 11.7%). Passing to risk-adjusted performance, we have a substantial outperformance of all value strategies (the highest is again P/FCF with 0.97 Sharpe ratio, while the lowest is P/B with 0.71) against the benchmark (0.70). However, the difference gets smaller on average when considering the Sortino ratio (0.93-1.28 for the value strategies vs 1.00 for OMX Nordic 120). This is arguably due to a relatively lower volatility of drawdowns for the benchmark, which has also a lower average drawdown (-6.3% vs -5.5% for EV/EBITDA and -6.9-13.8% for other value portfolios). Lastly, the number of years with negative returns is either the same (4 years out of 12) as the benchmark or even lower for the value strategies (e.g., 3 years for P/B and only 2 years for P/FCF). Overall, from this analysis the clear winner seems to be the portfolio based on the P/FCF ratio, with the best performance in terms of highest average return, CAGR, Sharpe and Sortino ratio. Over the 2010-2023 period it managed to outperform the benchmark in 9 out of 12 years. For P/FCF, as it can be seen in Figure 1, the total compound return for the 12-years period is 821%, while the other value strategies range between 444% and 572%, and OMX Nordic 120 did 377%. Interestingly, all value strategies share an extremely similar pattern over the investment period, while the benchmark's one is also in line but less accentuated.

Figure 1: Value portfolios - Compound performance



Quality portfolios

Similarly, Table 2 shows the descriptive statistics for the selected quality portfolios.

Table 2: Quality portfolios performance

Year	ROIC (5y avg)	ROIC	ROA	Gross Profitability	Grantham's Quality Score	Dividend Yield	OMX Nordics
2010	27.0%	24.2%	27.7%	26.6%	29.1%	19.9%	25.8%
2011	-11.3%	-0.7%	-3.2%	2.1%	-9.0%	-12.5%	-15.8%
2012	26.9%	26.3%	28.0%	29.5%	27.2%	26.7%	34.6%
2013	28.2%	30.9%	41.2%	44.2%	32.4%	31.4%	21.0%
2014	30.5%	26.7%	36.8%	23.6%	30.9%	19.4%	21.3%
2015	1.0%	4.5%	6.4%	9.3%	4.0%	0.0%	-5.6%
2016	18.4%	19.8%	16.5%	21.9%	22.5%	35.3%	15.1%
2017	16.5%	14.6%	25.0%	21.8%	17.0%	15.0%	2.8%
2018	6.3%	4.5%	1.6%	1.2%	5.4%	-5.5%	-1.9%
2019	36.0%	33.3%	33.5%	35.9%	32.7%	0.9%	12.4%
2020	40.5%	42.0%	39.7%	45.8%	42.1%	47.4%	39.4%
2021	-3.7%	-6.5%	-3.8%	-8.0%	0.5%	-2.8%	-1.9%
2022	12.6%	9.6%	11.5%	6.5%	4.5%	5.1%	6.7%
Average	17.6%	17.6%	20.1%	20.0%	18.4%	13.9%	11.9%
CAGR	18.1%	18.3%	20.8%	20.6%	19.0%	13.7%	11.7%
Min	-11.3%	-6.5%	-3.8%	-8.0%	-9.0%	-12.5%	-15.8%
Max	40.5%	42.0%	41.2%	45.8%	42.1%	47.4%	39.4%
Median	18.4%	19.8%	25.0%	21.9%	22.5%	15.0%	12.4%
Standard Deviation	15.1%	15.2%	15.2%	15.3%	15.0%	15.2%	15.6%
Sharpe Ratio	1.06	1.07	1.20	1.18	1.10	0.85	0.70
Sortino Ratio	1.61	1.56	1.81	1.82	1.66	1.13	1.00
Average drawdown	-7.5%	-3.6%	-3.5%	-8.0%	-9.0%	-5.2%	-6.3%
N. years with negative returns	2	2	2	1	1	4	4

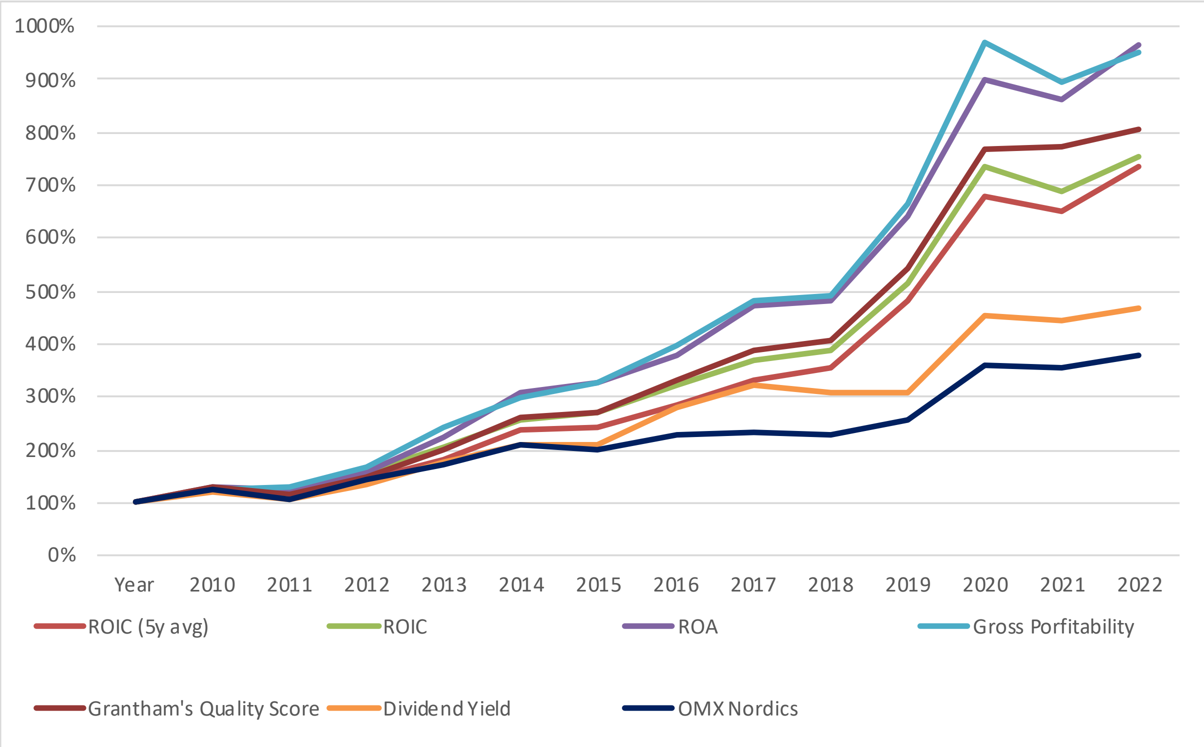
All quality portfolios have positive and higher than benchmark’s annual average returns, the highest ones being ROA (20.1%) and Gross Profitability (20.0%) and the lowest being Dividend Yield (13.9%). Average returns are on average higher for the quality portfolios compared to the aforementioned value counterparties (17.9% vs 15.6%), both being clearly higher than the benchmark (11.9%). It can be noted that the median returns are significantly higher than their average counterparties, the most significant gain being the one made by the ROA strategy (25.0% median), which is again the highest. This is arguably due to the fact that the distribution of returns is skewed towards the left tail (downside). However, the CAGR is higher than the average returns (average jump of 0.5%). Given that CAGR highly suffers negative returns, this might mean that downside risk is much lower for the selected quality strategies than for the value ones. To prove this, both the average drawdown is lower (-6.1% vs -8.4%) and especially the average number of years with negative returns is lower (2 vs 3.4 years) than for value strategies. Compound returns are much higher than the benchmark (11.7%), the highest being ROA (20.8%), closely followed by Gross profitability (20.6%) and the lowest being Dividend Yield (13.7%). Volatility for quality portfolios is slightly lower than the benchmark's (15.6%) and significantly lower than for their value counterparties (15.0-15.3% for quality vs 17.1-18.4% for value).

Passing to risk-adjusted performance, we have again a substantial outperformance of all quality strategies (the highest ones are again ROA, with the highest Sharpe ratio of 1.20 and Gross Profitability, with the highest Sortino ratio of 1.82, while clearly the lowest is Dividend Yield, with 0.85 Sharpe ratio and 1.13 Sortino ratio) against the benchmark (0.70 Sharpe ratio and 1.00 Sortino ratio). Quality portfolios outperform their value counterparties in terms of risk-adjusted performance (average Sharpe ratio 1.08 vs 0.83, average Sortino ratio 1.60 vs 1.09). This is mainly due to a lower overall and especially downside volatility.

Overall, from this analysis the two winners seem to be the portfolios based on the ROA and Gross Profitability ratios, with the best performance in terms of highest average return, CAGR, median, Sharpe and Sortino ratio; the other strategies perform quite close to each other, except for the dividend yield, which is a clear outliner (its main metrics are closer to the benchmark than to the rest of the peers).

Over the 2010-2023 period, ROA and Gross Profitability managed to outperform the benchmark in respectively 12 and 11 out of 12 years. As it can be seen in Figure 2, the total compound return for the 12-years period is 962% for ROA and 951% for Gross Profitability (vs the highest value performer's 821%), while the other quality strategies range between 735% and 806% if excluding the Dividend Yield's 465%, and Nasdaq OMX Nordic 120 did only 377%. Interestingly, all quality strategies share an extremely similar pattern over the investment period (this is very similar also to the value strategies' one), while the benchmark's one is also in line but less accentuated.

Figure 2: Quality portfolios - Compound performance



Combined value and quality portfolios

Before starting to explore the combination of value and quality investing, it might be insightful to analyse the correlations between each value and quality portfolio. This is an important step in order to form some preliminary expectations related to the eventual success of each combination. Indeed, if the correlation between two given strategies (e.g., P/FCF and gross profitability) is low enough (the ideal case would be to have negative correlation, although it is quite impractical when analysing returns of portfolios formed starting from the same market), they are likely to benefit from diversification effects; this could translate into lower volatility, hence stronger risk-adjusted performance for the combined portfolio.

The correlation matrix (Table 3) shows the correlation between each possible pair of value/quality investing strategies. Specifically, correlations are computed from the time series of (simple) monthly returns (over the whole 2010-2023 period) of portfolios based on each pair of selected metrics (e.g., the correlation between P/E and ROA is computed from the time series of monthly returns over the 2010-2023 period for the portfolio based on P/E ranking and the portfolio based on ROA ranking). Unsurprisingly, value portfolios tend to have higher correlations with other value portfolios than with their quality counterparts, and vice versa. The exception is the Dividend Yield Portfolio, which has an average correlation with other quality factors of 0.847, which is lower than the one with the value factors (0.918); this might imply an incorrect classification of Dividend Yield as a quality strategy.

Importantly, correlations are quite high, (ranging from 0.784 to 0.931) which could imply a limited diversification benefit arising from combining value with quality. For instance, for P/FCF, which was the best performing value strategy, the correlations with quality strategies ranges from 0.826 to 0.944, while the correlation between the best performing strategies (i.e., ROA and Gross Profitability) being on the lower end of the range (respectively 0.855 and 0.826). Correlation of value and quality portfolios with the market (STOXX Europe 600) is within the 0.857-0.914 range, the lowest being Gross Profitability and the highest ROIC (5y average).

Table 3: Value and Quality portfolios – Correlation matrix

	ROIC5	ROIC	ROA	GMARGIN	QSCORE	DYIELD	EVTOEBIT	EVTOEBITDA	PTOFCF	PE	PB	*OMX - RF*
ROIC5	1											
ROIC	0.965	1										
ROA	0.955	0.975	1									
GMARGIN	0.906	0.932	0.937	1								
QSCORE	0.953	0.962	0.956	0.905	1							
DYIELD	0.856	0.866	0.835	0.812	0.864	1						
EVTOEBIT	0.865	0.882	0.851	0.812	0.880	0.929	1					
EVTOEBITDA	0.844	0.857	0.831	0.784	0.860	0.929	0.974	1				
PTOFCF	0.870	0.882	0.855	0.826	0.880	0.903	0.940	0.944	1			
PE	0.865	0.885	0.856	0.800	0.888	0.931	0.979	0.975	0.942	1		
PB	0.834	0.849	0.824	0.785	0.851	0.929	0.950	0.966	0.953	0.959	1	
OMX - RF	0.914	0.911	0.884	0.857	0.891	0.889	0.898	0.881	0.895	0.891	0.900	1

A number of combinations of value with quality factors are to be analyzed, similarly to the analysis made for standalone Value and Quality portfolios. It is important to specify that in this thesis, combining a value metric with a quality metric entails averaging the two rankings (e.g., the combined P/FCF & ROA ranking of a stock ranked 5^{th} for P/FCF and 6^{th} for ROA is 5.5) and building the top 30 percentile portfolio based on such combined ranking. In this way, the two best-performing (in terms of CAGR, Sharpe and Sortino ratios) value factors (namely, P/FCF and EV/EBITDA) will be combined with all quality metrics (taken one at a time), while the tables summarizing the performance of all the other combinations may be found in the appendix.

Table 4 shows the descriptive statistics for the combinations between P/FCF (value metric) and all quality metrics (taken one at a time).

Table 4: P/FCF combined with Quality performance

Year	P/FCF	P/FCF + ROIC 5y avg	P/FCF + ROIC	P/FCF + ROA	P/FCF + Gross Profitability	P/FCF + Grantham's Quality Score	P/FCF + Dividend Yield	OMX Nordics
2010	31.8%	24.1%	27.5%	31.8%	24.2%	28.2%	20.8%	25.8%
2011	-13.0%	-6.1%	-5.1%	-3.2%	-3.1%	-7.8%	-8.3%	-15.8%
2012	26.3%	21.1%	27.3%	25.5%	27.3%	20.7%	28.2%	34.6%
2013	35.7%	37.9%	39.0%	37.2%	41.9%	38.0%	35.8%	21.0%
2014	27.8%	24.5%	30.7%	34.0%	32.3%	27.4%	25.1%	21.3%
2015	7.0%	12.1%	12.1%	12.7%	13.3%	11.3%	2.8%	-5.6%
2016	47.2%	28.8%	31.6%	29.9%	31.7%	36.1%	43.5%	15.1%
2017	14.8%	18.3%	26.4%	24.5%	15.9%	16.8%	11.8%	2.8%
2018	-3.0%	7.7%	2.9%	1.5%	8.7%	1.6%	-4.9%	-1.9%
2019	7.0%	31.2%	25.7%	27.2%	25.3%	25.3%	-1.0%	12.4%
2020	60.0%	59.3%	57.3%	52.1%	56.3%	56.1%	58.2%	39.4%
2021	2.6%	-5.3%	-1.2%	1.2%	-6.4%	0.4%	5.4%	-1.9%
2022	6.3%	7.5%	3.0%	4.6%	-0.8%	5.1%	1.0%	6.7%
Average	19.3%	20.1%	21.3%	21.5%	20.5%	19.9%	16.8%	11.9%
CAGR	19.2%	20.6%	22.0%	22.3%	21.0%	20.4%	16.6%	11.7%
Min	-13.0%	-6.1%	-5.1%	-3.2%	-6.4%	-7.8%	-8.3%	-15.8%
Max	60.0%	59.3%	57.3%	52.1%	56.3%	56.1%	58.2%	39.4%
Median	14.8%	21.1%	26.4%	25.5%	24.2%	20.7%	11.8%	12.4%
Standard Deviation	18.4%	17.1%	17.1%	17.3%	17.0%	17.1%	17.3%	15.6%
Sharpe Ratio	0.97	1.09	1.14	1.15	1.11	1.06	0.92	0.70
Sortino Ratio	1.28	1.58	1.67	1.68	1.60	1.49	1.21	1.00
Average drawdown	-8.0%	-5.7%	-3.2%	-3.2%	-3.4%	-7.8%	-4.7%	-6.3%
N. years with negative returns	2	2	2	1	3	1	3	4

Excluding the combination with Dividend Yield, there is a general improvement in performance by combining P/FCF with quality metrics. In terms of absolute performance, CAGR increases to an 21.2% average (excluding Dividend Yield) against the P/FCF's 19.2%, the greatest being the combination with ROA (22.3% CAGR), followed by the combination with ROIC (22.0%) and not the one with Gross Profitability (21.0%), which was the other best-performing quality strategy (with ROA); this is probably due to 3 years with negative returns for the combination with Gross Profitability, against 2 years for P/FCF standalone and the combination with ROIC. A similar pattern can be found also for the risk-adjusted performance, as Sharpe ratio slightly increases from 0.97 to an average of 1.08, and Sortino ratio from 1.28 to 1.54. For both ratios, the best performance is generated by the combination with ROA (1.15 Sharpe ratio and 1.68 Sortino ratio).

Table 5 shows the descriptive statistics for the combinations between EV/EBITDA (value metric) and all quality metrics (taken one at a time).

Table 5: EV/EBITDA combined with Quality performance

Year	EV/EBITDA	EV/EBITDA + ROIC 5y avg	EV/EBITDA + ROIC	EV/EBITDA + ROA	EV/EBITDA + Gross Profitability	EV/EBITDA + Grantham's Quality Score	EV/EBITDA + Dividend Yield	OMX Nordics
2010	27.0%	24.7%	24.0%	24.2%	23.8%	26.4%	25.8%	25.8%
2011	-13.7%	-10.0%	-11.7%	-11.7%	-6.6%	-14.4%	-13.2%	-15.8%
2012	20.0%	23.3%	24.2%	22.7%	28.4%	22.0%	20.9%	34.6%
2013	29.4%	25.8%	32.2%	32.2%	38.3%	29.3%	35.9%	21.0%
2014	18.8%	25.7%	25.4%	29.1%	23.7%	30.8%	19.3%	21.3%
2015	-3.1%	-2.1%	0.4%	-3.4%	-0.6%	-6.7%	-7.7%	-5.6%
2016	37.3%	37.7%	38.0%	34.5%	34.0%	38.4%	35.5%	15.1%
2017	25.2%	22.7%	27.2%	29.0%	27.8%	18.0%	18.3%	2.8%
2018	-4.7%	0.3%	-2.4%	-6.5%	-0.1%	-4.2%	-1.5%	-1.9%
2019	-0.4%	17.6%	16.9%	15.3%	9.3%	18.9%	-0.5%	12.4%
2020	58.1%	44.1%	44.4%	40.0%	51.1%	46.0%	56.7%	39.4%
2021	10.5%	-4.4%	1.9%	3.7%	-6.4%	6.6%	5.3%	-1.9%
2022	2.4%	4.7%	-2.1%	2.9%	-0.1%	2.7%	1.6%	6.7%
Average	15.9%	16.2%	16.8%	16.3%	17.1%	16.4%	15.1%	11.9%
CAGR	15.6%	16.4%	16.9%	16.4%	17.1%	16.4%	14.7%	11.7%
Min	-13.7%	-10.0%	-11.7%	-11.7%	-6.6%	-14.4%	-13.2%	-15.8%
Max	58.1%	44.1%	44.4%	40.0%	51.1%	46.0%	56.7%	39.4%
Median	18.8%	22.7%	24.0%	22.7%	23.7%	18.9%	18.3%	12.4%
Standard Deviation	17.1%	15.6%	15.8%	15.9%	14.8%	15.8%	16.0%	15.6%
Sharpe Ratio	0.88	0.98	1.00	0.96	1.08	0.97	0.89	0.70
Sortino Ratio	1.12	1.41	1.40	1.37	1.58	1.33	1.15	1.00
Average drawdown	-5.5%	-5.5%	-5.4%	-7.2%	-2.7%	-8.5%	-5.7%	-6.3%
N. years with negative returns	4	3	3	3	5	3	4	4

Again, compound performance improves by combining EV/EBITDA with all quality metrics except for the Dividend Yield. Specifically, both the best absolute and risk-adjusted performance is obtained by EV/EBITDA + Gross Profitability (17.1% CAGR vs 15.6% for EV/EBITDA only, 1.08 Sharpe ratio vs 0.88 for EV/EBITDA only, and 1.58 Sortino ratio vs 1.12 for EV/EBITDA only).

The findings from the above two tables suggest that combining the best-performing value strategies with quality strategies improves their already strong average and compound returns, while lowering volatility. This means that for an investor basing his/her investment decisions on one/a few value metrics, it would be beneficial to add some quality metric when selecting stocks.

Comparison with the European Stock Market

The same type of analysis on the European stock market (STOXX Europe 600 being the benchmark) has been done in the previous part of the thesis; as a consequence, I find it insightful to briefly compare their results. As a first point, the average returns of both value and quality strategies are higher for the Nordics stock market (15.6% average returns in the Nordics vs 11.7% in Europe for value strategies and 17.9% in the Nordics vs 11.0% in Europe for quality strategies); this is however largely driven by the Nordics benchmark beating the European one (11.9% vs 6.3%). It is further amplified when considering the CAGR (15.2% vs 9.5% for value and 18.4% vs 9.5% for quality); this can be explained by both fewer years with negative returns and lower average drawdown (8.4% vs 11.2% for value and 6.1% vs 6.9% for quality). Similarly, also adjusted performance is greater for the Nordics compared to Europe, again driven by a much stronger underlying index (0.70 vs 0.28 for Sharpe ratio and 1.00 vs 0.36 for Sortino ratio). It is worth noting, though, that the standard deviation is not significantly lower for the Nordics portfolios (17.7% vs 18.8% for value and 15.2% vs 16.5% for quality). This might be due to the much lower number of stocks within an average portfolio built to perform such analysis (18 stocks for an average value/quality portfolio in the Nordics vs 83 stocks in Europe), given the very different sizes of the two selected indices (120 stocks for the Nasdaq OMX Nordic 120 vs 600 for the STOXX Europe 600) and the fact that the methodology outlined in the previous section entails taking the top 30% of stocks, after screening for missing/negative data and financial companies. Another important reason for which the two studies are not fully comparable is that in the previous part of the thesis the analysis was conducted over the 2001-2023 period, while here it is conducted over the 2010-2023 period (due to Nordic stock market data unavailability on Refinitiv Datastream prior to 2010). The different time period does not seem to have a clear impact on the returns by the value/quality portfolios, although there is a significant jump in performance by the benchmark (the average return for the STOXX Europe 600 increasing from 6.3% when considering the full 2001-2023 period, to 9.3% when considering the 2010-2023 sub-period). Another interesting point is related to the difference between the average returns by the value/quality portfolios and the benchmark; such difference was higher for the European stock market when considering value portfolios (3.5% average difference against the benchmark for Nordics vs 4.8% for Europe), while this was the opposite when considering quality portfolios (6.7% average difference against the benchmark for Nordics vs 4.8% for Europe). Interestingly, the higher average difference for quality portfolios in the Nordics stock market could be attributed, among others, to a higher share of healthcare stocks (29.7% for the Nasdaq OMX Nordic 120 vs 15.4% for the STOXX Europe 600 index), which is in turn driven by the favourable startup and VC environment (e.g., Sweden, Denmark for healthcare specifically). The reasoning here is that when excluding loss-making healthcare companies (which could be the majority, especially for the early-stage startups) and ranking the remaining ones on quality metrics, the selected top 30% is made of truly best-in-class healthcare companies, which tend to have extremely strong share price returns (e.g., Novo Nordisk). The same could well apply to industrial companies as well (which are again more represented in the Nasdaq OMX Nordic 120 vs the STOXX Europe 600 index, with 24.6% vs 13.1%), given that while the majority of them tend to be of average / below-average quality (i.e., low returns on capital, for instance, compared to other sectors), the best-in-class ones do have excellent returns on capital, hence share price performance (e.g., Atlas Copco). This implies a higher difference in returns between the selected quality portfolios and the benchmark, therefore proving that the given quality metrics are effective in selecting best-in-class businesses.

Main Results

The first main finding of this section is that both value and quality portfolios do strongly outperform the benchmark: this happens both from an absolute (considering average/median total return and CAGR) as well as risk-adjusted perspective (i.e., Sharpe and Sortino ratio). Additionally, this is often coupled with a lower number of years with negative returns compared to the benchmark, which implies a greater degree of resilience to shocks by the selected businesses. This means that by simply selecting stocks based on an appropriate value/quality metric (after eliminating financial and loss-making companies), an investor would be able to achieve greater total and risk-adjusted returns than the broader market. However, selecting stocks based on a combined score taking into account both the ranking on a value metric and a ranking on a quality metric, improves performance relative to value-only portfolios but generally not relative to quality-only portfolios. This is explained by the high correlations between value and quality portfolios, which makes the diversification effect less relevant. As a consequence, the improvement experienced relative to the value-only portfolios is more due to the fact that value is combined with quality metrics that are able to generate significantly stronger performance, which is not the case when the starting point are the quality portfolios. However, there are a few exceptions to this pattern, i.e., value/quality combinations that are able to improve the performance of the relative quality-only portfolios. For instance, the best performing combinations, which are P/FCF & ROIC, P/FCF & ROA, are able to achieve that. These two combinations generated the strongest results in the Nordic stock market, with CAGRs of respectively 22.0% and 22.3%, only 1-2 years (out of 13) with negative returns, and an average drawdown of only 3.2% (vs the benchmark’s 6.3%). Investors selecting stocks based on these criteria would have generated a total return exceeding 1000% over the 2010-2022 period.

14.2 – Regressions

The key idea in all the proposed regressions is to use the t-test to assess whether the intercept (alpha) in the regression model is equal to zero, by setting the null hypothesis H0: alpha=0 and the alternative hypothesis H1: alpha≠0. The t-test is a common method for testing the significance of coefficients, and in this case, it helps determine whether there is a statistically significant difference between the estimated intercept and zero.

The standard errors reported in the regression tables are based on the assumption of homoscedasticity, i.e., the variance of the errors being constant across all levels of the independent variables. The decision to use standard errors aligned with this assumption reflects the stability observed in the spread of residuals across various levels of the Fama-French factors. Furthermore, the QQ plots of residuals were analysed, and indicated symmetric patterns, therefore providing additional support for the assumption of homoscedasticity.

Value portfolios

As it can be seen from Table 6, none of the alphas generated by the tested value strategies was significant at 5% confidence level (at 10%, only P/FCF was significant), meaning that none of the strategies was able to generate significant excess returns after controlling for the returns that an investor could have produced by trading on the five Fama-French anomalies. Indeed, loadings on the factors tend to be positive and significant for the market, value and profitability factors. This arguably means that the excess returns generated by the aforementioned strategies, although considerable, are almost totally explained by the above factors. This is proven also by the high R squared values (over 0.80).

Table 6: Value portfolios – Regressions against 5-FF model

	EVTOEBIT	EVTOEBITDA	PTOFCF	PE	PB
`OMX - RF`	**0.952*****	**0.943*****	**1.038*****	**0.949*****	**1.057*****
(std. error)	(0.042)	(0.044)	(0.045)	(0.043)	(0.043)
SMB	**0.146**	**0.166**	**0.334*****	**0.126**	**0.154**
(std. error)	(0.107)	(0.113)	(0.116)	(0.112)	(0.112)
HML	**0.508*****	**0.489*****	**0.345****	**0.436*****	**0.403*****
(std. error)	(0.124)	(0.131)	(0.134)	(0.130)	(0.129)
RMW	**0.496*****	**0.587*****	**0.557*****	**0.433****	**0.495*****
(std. error)	(0.178)	(0.188)	(0.193)	(0.186)	(0.186)
CMA	**-0.275**	**-0.006**	**0.066**	**-0.185**	**0.179**
(std. error)	(0.182)	(0.192)	(0.197)	(0.190)	(0.190)
Intercept	**0.158**	**0.254**	**0.380***	**0.173**	**0.03**
(std. error)	(0.179)	(0.189)	(0.193)	(0.187)	(0.186)
Observations	155	155	155	155	155
R^2	0.83	0.806	0.823	0.812	0.836
Adjusted R^2	0.824	0.799	0.817	0.806	0.831
Residual Std. Error	2.102 (df = 149)	2.215 (df = 149)	2.271 (df = 149)	2.195 (df = 149)	2.189 (df = 149)
F Statistic	145.420*** (df = 5; 149)	123.721*** (df = 5; 149)	138.322*** (df = 5; 149)	128.843*** (df = 5; 149)	152.041*** (df = 5; 149)
Note:	*p<0.1; **p<0.05; ***p<0.01				

Quality portfolios

Compared to the value portfolios, where only P/FCF was able to generate significant (at 10% confidence level) alpha, we may note from Table 7 that all quality strategies except Dividend Yield have significant (at 1% confidence level) alphas, which also tend to be higher (5.7-7.9% annualized range if excluding the Dividend Yield’s 2.3%, the highest ones unsurprisingly being ROA and Gross Profitability). In terms of loadings on the five Fama-French factors, unlike for the value strategies (which had positive significant loadings on the market, value and profitability factors), here we may note that the only two factors with significant loadings are the market one and the investment (CMA) one. The exception is again the Dividend Yield, which behaves more like a value strategy, having a significant loading on the profitability factor as well.

Table 7: Quality portfolios – Regressions against 5-FF model

	ROIC5	ROIC	ROA	GMARGIN	QSCORE	DYIELD
`OMX - RF`	**0.857*****	**0.864*****	**0.828*****	**0.821*****	**0.833*****	**0.851*****
(std. error)	(0.033)	(0.033)	(0.037)	(0.041)	(0.037)	(0.038)
SMB	**-0.028**	**0.043**	**-0.035**	**0.244****	**0.053**	**0.09**
(std. error)	(0.084)	(0.085)	(0.096)	(0.105)	(0.096)	(0.098)
HML	**-0.111**	**-0.051**	**-0.025**	**-0.095**	**-0.062**	**0.361*****
(std. error)	(0.097)	(0.098)	(0.111)	(0.122)	(0.112)	(0.114)
RMW	**-0.108**	**0.176**	**0.22**	**0.256**	**0.051**	**0.472*****
(std. error)	(0.140)	(0.141)	(0.159)	(0.175)	(0.160)	(0.164)
CMA	**-0.394*****	**-0.293****	**-0.383****	**-0.224**	**-0.278***	**0.05**
(std. error)	(0.143)	(0.144)	(0.163)	(0.179)	(0.164)	(0.167)
Intercept	**0.552*****	**0.477*****	**0.659*****	**0.629*****	**0.565*****	**0.19**
(std. error)	(0.140)	(0.142)	(0.160)	(0.176)	(0.161)	(0.164)
Observations	155	155	155	155	155	155
R^2	0.863	0.862	0.822	0.789	0.815	0.812
Adjusted R^2	0.858	0.857	0.816	0.782	0.809	0.805
Residual Std. Error	1.647 (df = 149)	1.662 (df = 149)	1.878 (df = 149)	2.067 (df = 149)	1.891 (df = 149)	1.932 (df = 149)
F Statistic	187.325*** (df = 5; 149)	186.096*** (df = 5; 149)	137.897*** (df = 5; 149)	111.593*** (df = 5; 149)	131.713*** (df = 5; 149)	128.489*** (df = 5; 149)
Note:	*p<0.1; **p<0.05; ***p<0.01					

Combined value and quality portfolios

Lastly, when considering the regsression of the portfolios generated by the combinations of the selected two value metrics (P/FCF and EV/EBITDA) with all quality metrics (one at a time), alphas are positive and significant (at 5% confidence level), except for the combinations with dividend yield (not significant even at 10% confidence level). This is an important result, given that combining the best-performing value strategy with any selected quality strategy, turns the alpha from negative to positive. However, alphas for the combinations are all lower than those for the selected standalone value metrics (P/FCF and EV/EBITDA). This could imply that by combining more than one metric makes the returns more similar to those obtained by the Fama French factors; indeed, R squared is higher for the combinations.

Table 8: P/FCF & Quality portfolios – Regressions against 5-FF model

	PTOFCF	ROIC5_PFCF	ROIC_PFCF	ROA_PFCF	GMARGIN_PFCF	QSCORE_PFCF	DYIELD_PFCF
\`OMX - RF\`	**1.038*****	**0.935*****	**0.941*****	**0.964*****	**0.936*****	**0.954*****	**0.970*****
(std. error)	(0.045)	(0.039)	(0.040)	(0.040)	(0.041)	(0.039)	(0.040)
SMB	**0.334*****	**0.263*****	**0.253****	**0.205****	**0.400*****	**0.252****	**0.327*****
(std. error)	(0.116)	(0.100)	(0.102)	(0.102)	(0.105)	(0.099)	(0.103)
HML	**0.345****	**0.248****	**0.241****	**0.225***	**0.125**	**0.226***	**0.529*****
(std. error)	(0.134)	(0.116)	(0.118)	(0.118)	(0.121)	(0.115)	(0.120)
RMW	**0.557*****	**0.404****	**0.449*****	**0.470*****	**0.491*****	**0.433*****	**0.911*****
(std. error)	(0.193)	(0.166)	(0.170)	(0.169)	(0.174)	(0.165)	(0.172)
CMA	**0.066**	**-0.446*****	**-0.377****	**-0.351****	**-0.224**	**-0.319***	**0.132**
(std. error)	(0.197)	(0.170)	(0.174)	(0.173)	(0.178)	(0.169)	(0.176)
Intercept	**0.380***	**0.541*****	**0.609*****	**0.611*****	**0.532*****	**0.489*****	**0.195**
(std. error)	(0.193)	(0.167)	(0.171)	(0.170)	(0.175)	(0.166)	(0.173)
Observations	155	155	155	155	155	155	155
R^2	0.823	0.846	0.841	0.846	0.831	0.849	0.84
Adjusted R^2	0.817	0.841	0.835	0.841	0.826	0.844	0.834
Residual Std. Error	2.271 (df = 149)	1.963 (df = 149)	2.002 (df = 149)	1.997 (df = 149)	2.052 (df = 149)	1.948 (df = 149)	2.031 (df = 149)
F Statistic	138.322*** (df = 5; 149)	164.175*** (df = 5; 149)	157.280*** (df = 5; 149)	163.709*** (df = 5; 149)	146.968*** (df = 5; 149)	167.814*** (df = 5; 149)	155.953*** (df = 5; 149)
Note:	*p<0.1; **p<0.05; ***p<0.01						

Table 9: EV/EBITDA & Quality portfolios – Regressions against 5-FF model

	EVTOEBITDA	ROIC5_EVEBITDA	ROIC_EVEBITDA	ROA_EVEBITDA	GMARGIN_EVEBITDA	QSCORE_EVEBITDA	DYIELD_EVEBITDA
\`OMX - RF\`	**0.943*****	**0.884*****	**0.873*****	**0.881*****	**0.832*****	**0.897*****	**0.893*****
(std. error)	(0.044)	(0.038)	(0.039)	(0.040)	(0.037)	(0.038)	(0.041)
SMB	**0.166**	**0.002**	**0.09**	**0.088**	**0.206****	**-0.036**	**0.09**
(std. error)	(0.113)	(0.097)	(0.100)	(0.103)	(0.095)	(0.097)	(0.104)
HML	**0.489*****	**0.194***	**0.281****	**0.308****	**0.223****	**0.196***	**0.434*****
(std. error)	(0.131)	(0.113)	(0.116)	(0.120)	(0.110)	(0.113)	(0.121)
RMW	**0.587*****	**0.291***	**0.376****	**0.441****	**0.441*****	**0.254**	**0.547*****
(std. error)	(0.188)	(0.162)	(0.166)	(0.172)	(0.158)	(0.162)	(0.174)
CMA	**-0.006**	**-0.169**	**-0.277**	**-0.194**	**-0.055**	**-0.159**	**0.058**
(std. error)	(0.192)	(0.165)	(0.170)	(0.176)	(0.162)	(0.166)	(0.178)
Intercept	**0.254**	**0.389****	**0.407****	**0.348****	**0.436*****	**0.392****	**0.253**
(std. error)	(0.189)	(0.163)	(0.167)	(0.173)	(0.159)	(0.163)	(0.174)
Observations	155	155	155	155	155	155	155
R^2	0.806	0.827	0.821	0.811	0.816	0.83	0.81
Adjusted R^2	0.799	0.821	0.815	0.805	0.81	0.824	0.804
Residual Std. Error	2.215 (df = 149)	1.908 (df = 149)	1.959 (df = 149)	2.029 (df = 149)	1.865 (df = 149)	1.912 (df = 149)	2.047 (df = 149)
F Statistic	123.721*** (df = 5; 149)	142.154*** (df = 5; 149)	136.810*** (df = 5; 149)	128.095*** (df = 5; 149)	132.316*** (df = 5; 149)	145.098*** (df = 5; 149)	127.277*** (df = 5; 149)
Note:	*p<0.1; **p<0.05; ***p<0.01						

Comparison with the European Stock Market

Results were quite similar in the analysis on the European stock market, meaning that alphas were not significant (except for P/FCF) for value strategies but significant for most quality metrics (except for the Dividend Yield). Among the value strategies, Nordics experienced a wider range of alphas, P/B having almost zero, while P/FCF had an alpha higher than 4.5% (annualised). Anyway, for both Europe and Nordics, the highest and the only significant value metric was P/FCF, hence results were quite similar. For quality portfolios, there is again a similar pattern, the dividend yield being the only metric not able to generate a significant intercept, while the others having more or less comparable alphas. The highest alpha in Europe was achieved by Gross profitability (5.8% annualized), while in the Nordics by ROA, followed by Gross profitability (respectively 7.9% and 7.6%); on average, alphas were significantly greater in the Nordics compared to Europe, mirroring the aforementioned stronger absolute and risk-adjusted performance. Finally, when considering combinations of value and quality investing, alphas are positive and significant also for the European stock market, except for EV/EBIT + ROIC 5y and P/E + ROIC 5y, (significant at 10% confidence level), and all the combinations with dividend yield. In contrast to the findings in the Nordic market, alphas were also generally higher in Europe, implying a higher portion of returns not explained by the Fama French factors, hence a higher degree of "uniqueness" by the strategies (i.e., the strategy has added value beyond what could be explained by the market, size and value factors).

Main Results

The results of this section reinforce the superiority of quality metrics over value metrics when it comes to ranking stocks and forming portfolios accordingly. Indeed, while the intercepts are not significant for the value portfolios, which means that their excess returns are almost totally explained by the Fama French factors, they are strongly significant for the quality portfolios, as well as for the value/quality combinations. As a consequence, while value strategies could be seen as replicating already heavily researched factors (testified by positive and significant loadings on the market, value and profitability factors), quality strategies as well as value-quality combinations are more innovative in this sense, being able to contribute to the existing literature with something unrelated to the existing factors.

14.2.1 - Robustness

Swedish FF3 factors

As aforementioned, the above regressions were against the European Fama French factors, given that they are not available for the Nordic market.

However, given the availability of the Fama French factors for Sweden (in the Swedish House of Finance Data Center), it could be meaningful to run a robustness check using them, while keeping the time series of excess returns by the OMX Nordics 120 index as the market factor. It has to be noted, however, that results will not be fully comparable to the above regressions for a couple of reasons: 1) only 3 factors were available for Sweden, 2) factors were available only until 2020.

Table 10: Value portfolios – Regressions against 5-FF model

	EVTOEBIT	EVTOEBITDA	PTOFCF	PE	PB
`OMX - RF`	**0.934*****	**0.926*****	**1.038*****	**0.965*****	**1.082*****
(std. error)	(0.046)	(0.048)	(0.056)	(0.051)	(0.050)
SMB	**-0.029**	**0.008**	**0.106**	**0.056**	**0.081**
(std. error)	(0.067)	(0.069)	(0.082)	(0.075)	(0.073)
HML	**-0.166****	**-0.169****	**-0.133**	**-0.154***	**-0.099**
(std. error)	(0.078)	(0.080)	(0.095)	(0.087)	(0.084)
Intercept	**0.313***	**0.437****	**0.640*****	**0.285**	**0.159**
(std. error)	(0.187)	(0.194)	(0.228)	(0.209)	(0.203)
Observations	114	114	114	114	114
R^2	0.79	0.775	0.76	0.764	0.814
Adjusted R^2	0.784	0.769	0.754	0.758	0.809
Residual Std. Error	1.956 (df = 110)	2.023 (df = 110)	2.382 (df = 110)	2.182 (df = 110)	2.116 (df = 110)
F Statistic	137.735*** (df = 3; 110)	126.541*** (df = 3; 110)	116.244*** (df = 3; 110)	118.757*** (df = 3; 110)	160.123*** (df = 3; 110)
Note:	*p<0.1; **p<0.05; ***p<0.01				

While none of the alphas generated by the value strategies was significant when using the European Fama French factors, Table 10 shows that when Swedish factors are used, the two best performing value strategies (i.e., P/FCF and EV/EBITDA) do generate significant intercepts. Interestingly, the HML coefficients (which were all positive and significant) become mainly insignificant (3 out of 5), which is surprising given the value nature of the selected metrics. Finally, adjusted R squared are lower (all higher or equal than 0.8 turns into the majority of them being lower), which might suggest that variability is explained better by European factors rather than the Swedish ones, even though the difference is not huge. This happens also to quality portfolios as well as to the value / quality combinations (Tables 19-20-21 in the Appendix). For these portfolios, alphas tend to be much higher with Swedish factors compared to the European ones. This, together with the adjusted R squared observation, might imply that the returns variability of the portfolios built according to the methodology adopted in this thesis, even though being made of Nordic businesses, is better explained by European factors, hence selected stocks inherently behave more closely to the European stocks rather than the Swedish ones. Another implication of this is that not all Nordic countries are closely comparable. Indeed, if we consider Table 11 with the correlations between the daily returns by the main indices (OMX Helsinki 25, a market cap weighted index of the 25 most-traded stocks on the Helsinki Stock Exchange; OMX Copenhagen 25, a market cap weighted index of the 25 largest and most traded shares on the NASDAQ Copenhagen stock exchange; OMX Stockholm 30, a market cap weighted index of the 30 most-traded stocks on the Nasdaq Stockholm stock exchange; Oslo Børs Benchmark Index, a market cap weighted index of the most traded and largest shares listed on Oslo Børs) of the Nordic countries (in the 2017-2023 time period, due to data constraints), the values are much lower than expected, meaning that the Nordic stocks do not tend to move in a similar way; this in turn implies that using Swedish factors for portfolios made of Nordic stocks might not be very accurate.

Table 11: Nordic countries' indices – Correlation matrix

	^OMXH25	*^OMXC25*	*^OMX*	*OSEBX.OL*
^OMXH25	1			
^OMXC25	0.0700555	1		
^OMX	0.85515298	0.06196448	1	
OSEBX.OL	-0.0469303	0.1248249	-0.047436	1

Regressions excluding Covid impact

Another way in which I found meaningful to test the robustness of results is by excluding the years following the outbreak of the Covid-19 pandemic (i.e., starting in January 2020), which made stocks crash and then greatly recover from its profound effects. As a matter of fact, previous results are valid also when excluding these years. Indeed, value portfolios alphas remain insignificant on the contrary of the quality ones. Interestingly, alphas tend to be even higher when excluding the pandemic years and the post-pandemic recover ones (Tables 22-23-24-25 in the Appendix).

14.3 – Spanning Tests

To compare the performance of value-quality portfolios with their value-only counterparts, spanning tests similar to those in Novy-Marx (2014) are conducted; by doing so, the objective is to determine whether combining value with quality generates any incremental ɑlpha for the value strategy. Returns from a test (value-quality) strategy are regressed on the Fama French five factors as well as returns from an explanatory (value-only) strategy. A positive (and significant) ɑlpha would imply that an investor trading only on value can gain by adding quality metrics in his strategy.

Value portfolios

Spanning tests (for which monthly alphas and standard errors are reported in Table 12) are in line with the regressions against the Fama French 5 factor model, P/FCF being the only value strategy able to generate some significant (even though mostly at 10% confidence level) excess returns when accounting for both the Fama-French factors and all the other value strategies (taken one at a time), except for the one based on EV/EBITDA.

Table 12: Value portfolios – Spanning tests

	Explanatory strategy (x)				
Test strategy (y)	**EV/EBIT**	**EV/EBITDA**	**P/FCF**	**P/E**	**P/B**
EV/EBIT		**-0.051767**	**-0.08072**	**0.01159**	**0.1373**
		(0.089)	(0.134)	(0.084)	(0.124)
EV/EBITDA	**0.10843**		**0.10101**	**-0.01343**	**0.22890****
	(0.093)	(0.000)	(0.133)	(0.092)	(0.108)
P/FCF	**0.26472***	**0.1934**		**0.25579***	**0.35724*****
	(0.143)	(0.136)	(0.000)	(0.140)	(0.128)
P/E	**0.0269**	**-0.04694**	**-0.08346**		**0.14941**
	(0.088)	(0.091)	(0.136)	(0.000)	(0.116)
P/B	**-0.08952**	**-0.175657**	**-0.24552***	**-0.10564**	
	(0.129)	(0.108)	(0.125)	(0.116)	

Quality portfolios

Spanning tests (monthly alphas and standard errors are reported in Table 13) show that the most successful strategies in generating significant excess returns even after accounting for both the Fama-French factors and all the other quality strategies (taken one at a time) are ROA and ROIC (5y average), having significant (at 5% confidence level) alphas against respectively 4 and 3 (out of 5) quality metrics. This implies that the selected quality strategies, apart from generating significant excess returns, are also more differentiated among themselves compared to their value counterparties (if this was not the case, the alpha would not have been significant when including other quality strategies among the explanatory factors). Again, Dividend Yield seems to be an outlier as every other quality strategy, when regressed against the five factors and the Dividend Yield returns, generates a significant alpha; this means that Dividend Yield is not able to explain the returns of other quality strategies, perhaps because of its value rather than quality nature.

Table 13: Quality portfolios – Spanning tests

Test strategy (y)	Explanatory strategy (x): ROIC (5y avg)	ROIC	ROA	Gross Profitability	Grantham's Quality Score	Dividend Yield
ROIC (5y avg)		**0.19127****	**0.119321**	**0.28272****	**0.19475***	**0.49001*****
		(0.094)	(0.099)	(0.124)	(0.101)	(0.131)
ROIC	**0.05218**		**-0.020163**	**0.146082**	**0.087999**	**0.406597*****
	(0.096)		(0.078)	(0.112)	(0.092)	(0.129)
ROA	**0.18854***	**0.200040****		**0.25369****	**0.22525****	**0.59369*****
	(0.112)	(0.087)		(0.118)	(0.106)	(0.151)
Gross Profitability	**0.25795**	**0.24170***	**0.11494**		**0.28853***	**0.56389*****
	(0.157)	(0.139)	(0.131)		(0.153)	(0.168)
Grantham's Quality Score	**0.10631**	**0.14095**	**0.05264**	**0.24801***		**0.48140*****
	(0.117)	(0.104)	(0.108)	(0.140)		(0.145)
Dividend Yield	**-0.05513**	**-0.04704**	**-0.04922**	**0.001788**	**-0.07012**	
	(0.160)	(0.155)	(0.163)	(0.163)	(0.153)	

Combined value and quality portfolios

Table 14 includes the (monthly) alphas and standard errors generated by a number of spanning tests. These spanning tests have all the quality metrics as test strategies (y) and all value metrics as explanatory strategies (x), for a total of 30 combinations. They were done for testing whether the six quality strategies were able to generate significant alphas even accounting for both the Fama-French factors and the value strategies (taken one at a time). As a matter of fact, this was indeed the case, except for the strategy based on the Dividend Yield ratio. This means that the returns generated by quality portfolios are not sufficiently explained by Fama-French factors and by the value portfolios' returns, hence benefits from combining them with value metrics might potentially arise.

Table 14: Value-Quality combinations – Spanning tests

	Explanatory strategy (x)				
Test strategy (y)	**EV/EBIT**	**EV/EBITDA**	**P/FCF**	**P/E**	**P/B**
ROIC (5y avg)	0.50644***	0.48467***	0.44333***	0.50156***	0.54650***
	(0.131)	(0.132)	(0.131)	(0.130)	(0.137)
ROIC	0.418135***	0.396318***	0.351571***	0.409466***	0.469508***
	(0.126)	(0.129)	(0.128)	(0.122)	(0.135)
ROA	0.60451***	0.57959***	0.53489***	0.59500***	0.65170***
	(0.148)	(0.150)	(0.149)	(0.145)	(0.154)
Gross Profitability	0.58814***	0.57871***	0.52866***	0.59204***	0.62417***
	(0.171)	(0.174)	(0.171)	(0.172)	(0.174)
Grantham's Quality Score	0.49557***	0.46522***	0.41539***	0.483764***	0.55575***
	(0.141)	(0.144)	(0.144)	(0.136)	(0.150)
Dividend Yield	0.100594	0.0508772	0.03132	0.09306	0.174467
	(0.130)	(0.129)	(0.146)	(0.127)	(0.132)

Main Results

While no value strategy is able to generate significant (at 5% confidence level) excess returns when accounting for both the Fama-French factors and all the other value strategies (taken one at a time), and only ROA and ROIC (5y average) are able to do so when accounting for some of the other quality strategies (taken one at a time), the most important finding in this section is that quality strategies were able to generate significant alphas accounting for both the Fama-French factors and all the value strategies (taken one at a time). This is important in highlighting the potential benefits arising from combining the two sets of strategies.

14.4 – Summary of main results

To conclude, the combinations of value and quality tend to improve absolute and especially relative performance compared to value-only portfolios. However, this is arguably more due to a better risk-adjusted performance of Quality strategies (1.08 average Sharpe ratio and 1.60 average Sortino ratio, against respectively 0.83 and 1.09 for value), thanks, among others, to lower average number of years with negative returns (2 vs 3.4 years) than to a diversification effect (as almost all correlations are over 0.8). Additionally, Nordic portfolios do generate stronger returns (from both absolute and risk-adjusted standpoint) compared to their European counterparties, and this is due to both superior performance of the underlying index but also to a different industry breakdown, favouring the presence of a few healthcare and industrial champions driving strong performance (also given the lower number of companies compared to Europe). These factors drive a stronger quality than value premium in the Nordics, meaning that it is much more important to select the highest quality companies (which tend to have higher valuation) rather than focusing on a lower relative valuation; indeed, while combining value with quality improves portfolios performance, when we compare those same combined portfolios against the quality-only ones, this is not the case. Findings on the alphas (which are robust to excluding the Covid-19 years) by value portfolios not being significant are in line with previous literature on the Nordics, where there was no strong value premium, unlike in Europe. Similarly, this thesis confirms a strong quality premium, extending it to not previously analysed metrics such as Grantham’s quality score, and significant intercepts for the selected quality metrics as well as the value-quality combinations.

15 - CONCLUSION

To conclude, the combination of value and quality metrics has demonstrated effective in the Nordic stock market. Indeed, the analysis conducted in this thesis shows that portfolios formed by combining value and quality exhibit significant improvements in both absolute and relative performance when compared to portfolios relying solely on value metrics. Theoretically, the inclusion of a quality metric introduces an additional layer of scrutiny that goes beyond traditional value considerations, arguably refining the selection process; indeed, while value metrics identify stocks that may be undervalued, quality metrics identify companies with robust profitability and/or returns on capital, making in this way the evaluation of a company's intrinsic value more comprehensive. This is something that successful value investors have already been doing for a long time, by considering not only how cheap a business is trading at the moment of the investment, but also its intrinsic quality. For instance, Greenblatt's idea was to create a stock screen tool able to identify wonderful businesses at reasonable prices. Against common belief, also Warren Buffet does not just look at cheap stocks, but he instead buys quality companies at reasonable prices ("It is far better to buy a wonderful company at a fair price than a fair company at a wonderful price" (Chairman's Letter, Berkshire Hathaway, Inc., Annual Report, 1989)). Indeed, combining value with quality is arguably a proper match from a theoretical perspective, given that generally the downside of quality stocks is the significant premium they are priced at. Importantly, this is also confirmed by the results of regression analysis, as quality strategies were able to generate significant alphas when accounting for both the Fama-French factors and all the value strategies (taken one at a time). As a consequence, combining the two sets of strategies generated statistically significant alphas (while this was not the case for value-only portfolios), in this way introducing something new (i.e., not explained by the mostly researched Fama French factors) and therefore contributing to the existing literature. It is important to note, however, that all these results rely on systematically excluding any loss-making businesses, and that such combinations (except for the best performing ones such as P/FCF & ROIC and P/FCF & ROA) do not generally outperform the quality-only strategies, implying that the diversification effect is not great enough to compensate for the value's weaker performance. As a consequence, for an investor whose starting point is value investing, it would be beneficial to start considering quality metrics as well in the decision-making process, while for a quality investor combining his strategy with value investing is not likely to add much value.

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17 - APPENDIX

Table 15: Datastream codes for the selected financial metrics

Datastream codes	
ROIC	WC08376
ROIC (5-years)	WC08380
ROA	WC08326
ROE	WC08301
ROE (5 years)	WC08305
Dividend Yield	DY
Market Cap	WC08001
EV	WC18100
Total Assets	WC02999
D/E	WC08231
Common shares outstanding	WC05301
Gross Income	WC01100
EBIT	WC18191
EBITDA	WC18198
FCF per share	WC05507
EPS	WC05202
BV per share	WC05476
TBV per share	WC05486
Price (Year end)	WC05001
Price (May close)	W05035
Return Index	RI

Table 16: EV/EBIT combined with Quality performance

Year	EV/EBIT	EV/EBIT + ROIC (5y avg)	EV/EBIT + ROIC	EV/EBIT + ROA	EV/EBIT + Gross Profitability	EV/EBIT + Grantham's Quality Score	EV/EBIT + Dividend Yield	OMX Nordics
2010	27.2%	24.8%	26.2%	23.5%	27.7%	25.6%	26.2%	25.8%
2011	-13.8%	-11.8%	-10.9%	-9.4%	-8.5%	-12.5%	-13.2%	-15.8%
2012	21.7%	23.7%	24.8%	25.9%	27.4%	25.5%	25.1%	34.6%
2013	25.6%	21.8%	32.7%	30.9%	36.9%	29.0%	33.4%	21.0%
2014	20.6%	26.2%	30.9%	36.4%	35.3%	31.1%	21.9%	21.3%
2015	-7.5%	0.1%	2.1%	-0.9%	1.4%	0.6%	-9.2%	-5.6%
2016	35.1%	27.9%	31.0%	32.7%	29.9%	33.5%	32.4%	15.1%
2017	20.0%	24.4%	22.7%	29.0%	25.9%	19.5%	19.6%	2.8%
2018	-5.1%	1.3%	1.3%	-3.2%	-6.3%	-0.2%	-1.3%	-1.9%
2019	6.6%	18.0%	16.0%	16.3%	12.0%	16.8%	1.4%	12.4%
2020	55.0%	45.0%	43.7%	44.6%	51.7%	45.3%	61.7%	39.4%
2021	-1.0%	-3.0%	-2.2%	4.1%	-5.4%	0.0%	-0.4%	-1.9%
2022	2.7%	7.6%	3.1%	6.5%	1.8%	2.6%	4.7%	6.7%
Average	14.4%	15.8%	17.0%	18.2%	17.7%	16.7%	15.6%	11.9%
CAGR	14.0%	16.1%	17.3%	18.6%	17.6%	16.9%	15.1%	11.7%
Min	-13.8%	-11.8%	-10.9%	-9.4%	-8.5%	-12.5%	-13.2%	-15.8%
Max	55.0%	45.0%	43.7%	44.6%	51.7%	45.3%	61.7%	39.4%
Median	20.0%	21.8%	22.7%	23.5%	25.9%	19.5%	19.6%	12.4%
Standard Deviation	17.4%	15.6%	16.0%	15.8%	15.3%	16.1%	16.2%	15.6%
Sharpe Ratio	0.79	0.96	1.01	1.09	1.08	0.97	0.90	0.70
Sortino Ratio	1.04	1.35	1.44	1.55	1.52	1.39	1.16	1.00
Average drawdown	-6.9%	-7.4%	-6.5%	-4.5%	-6.7%	-4.2%	-6.0%	-6.3%
N. years with negative returns	4	2	2	3	3	3	4	4

Table 17: P/E combined with Quality performance

Year	P/E	P/E + ROIC 5y avg	P/E + ROIC	P/E + ROA	P/E + Gross Profitability	P/E + Grantham's Quality Score	P/E + Dividend Yield	OMX Nordics
2010	22.6%	24.6%	25.4%	24.7%	29.1%	24.1%	25.0%	25.8%
2011	-15.4%	-11.2%	-8.7%	-10.1%	-10.1%	-12.6%	-9.0%	-15.8%
2012	19.9%	25.7%	28.5%	23.3%	27.6%	23.0%	21.2%	34.6%
2013	33.0%	29.6%	33.4%	33.0%	41.6%	29.0%	38.1%	21.0%
2014	21.7%	30.0%	30.4%	38.0%	36.7%	35.5%	22.3%	21.3%
2015	-3.5%	3.4%	5.7%	1.5%	2.2%	1.1%	-9.1%	-5.6%
2016	35.3%	26.8%	30.1%	30.4%	29.4%	35.0%	31.8%	15.1%
2017	15.5%	23.9%	22.9%	25.9%	26.8%	19.6%	18.7%	2.8%
2018	-11.7%	0.9%	-5.1%	-0.6%	4.4%	-2.7%	-6.8%	-1.9%
2019	10.2%	17.4%	14.8%	15.7%	10.4%	16.7%	7.4%	12.4%
2020	58.9%	42.3%	41.9%	42.8%	52.4%	43.9%	59.0%	39.4%
2021	0.0%	-3.4%	-2.5%	4.7%	-7.3%	0.5%	2.5%	-1.9%
2022	2.2%	4.5%	4.3%	3.9%	3.3%	0.7%	-0.9%	6.7%
Average	14.5%	16.5%	17.0%	17.9%	19.0%	16.4%	15.4%	11.9%
CAGR	14.0%	16.9%	17.3%	18.3%	19.0%	16.6%	15.0%	11.7%
Min	-15.4%	-11.2%	-8.7%	-10.1%	-10.1%	-12.6%	-9.1%	-15.8%
Max	58.9%	42.3%	41.9%	42.8%	52.4%	43.9%	59.0%	39.4%
Median	15.5%	23.9%	22.9%	23.3%	26.8%	19.6%	18.7%	12.4%
Standard Deviation	17.3%	15.6%	16.0%	16.2%	15.8%	16.4%	16.2%	15.6%
Sharpe Ratio	0.79	0.99	1.01	1.05	1.11	0.95	0.89	0.70
Sortino Ratio	1.08	1.38	1.43	1.55	1.59	1.32	1.15	1.00
Average drawdown	-7.6%	-7.3%	-5.4%	-5.3%	-8.7%	-7.6%	-6.5%	-6.3%
N. years with negative returns	4	2	3	2	2	2	4	4

Table 18: P/B combined with Quality performance

Year	P/B	P/B + ROIC 5y avg	P/B + ROIC	P/B + ROA	P/B + Gross Profitability	P/B + Grantham's Quality Score	P/B + Dividend Yield	OMX Nordics
2010	31.1%	26.0%	24.9%	26.8%	25.5%	25.9%	18.2%	25.8%
2011	-19.1%	-13.8%	-11.5%	-10.8%	-7.7%	-16.3%	-16.6%	-15.8%
2012	27.8%	26.7%	27.3%	27.0%	35.4%	21.1%	26.1%	34.6%
2013	32.2%	34.3%	40.3%	45.6%	41.8%	26.5%	32.0%	21.0%
2014	16.3%	18.8%	21.0%	26.9%	17.2%	28.6%	19.9%	21.3%
2015	-7.8%	-6.8%	-6.0%	-6.7%	-3.4%	-10.9%	-4.7%	-5.6%
2016	40.5%	36.3%	35.1%	35.9%	34.0%	43.8%	35.7%	15.1%
2017	12.0%	23.0%	27.8%	33.2%	18.0%	13.2%	22.2%	2.8%
2018	-14.6%	-0.1%	-7.1%	-13.7%	-2.4%	-2.5%	-10.0%	-1.9%
2019	0.5%	9.2%	13.7%	17.8%	-3.1%	15.3%	-0.2%	12.4%
2020	49.2%	56.3%	47.2%	47.0%	59.3%	50.3%	55.2%	39.4%
2021	7.6%	-4.2%	-1.4%	2.7%	-10.2%	-2.6%	5.3%	-1.9%
2022	6.6%	5.6%	4.5%	7.6%	6.9%	4.8%	5.2%	6.7%
Average	14.0%	16.3%	16.6%	18.4%	16.2%	15.2%	14.5%	11.9%
CAGR	13.2%	16.0%	16.4%	18.1%	15.7%	14.7%	14.0%	11.7%
Min	-19.1%	-13.8%	-11.5%	-13.7%	-10.2%	-16.3%	-16.6%	-15.8%
Max	49.2%	56.3%	47.2%	47.0%	59.3%	50.3%	55.2%	39.4%
Median	12.0%	18.8%	21.0%	26.8%	17.2%	15.3%	18.2%	12.4%
Standard Deviation	18.4%	17.5%	17.5%	17.3%	17.2%	17.5%	16.8%	15.6%
Sharpe Ratio	0.71	0.86	0.89	0.98	0.87	0.82	0.80	0.70
Sortino Ratio	0.93	1.23	1.25	1.41	1.16	1.16	1.02	1.00
Average drawdown	-13.8%	-6.2%	-6.5%	-10.4%	-5.4%	-8.0%	-7.9%	-6.3%
N. years with negative returns	3	4	4	3	5	4	4	4

Table 19: Quality portfolios – Regressions against 3-FF (Swedish) model

	ROIC5	ROIC	ROA	GMARGIN	QSCORE	DYIELD
\`OMX - RF\`	**0.874*****	**0.833*****	**0.804*****	**0.712*****	**0.843*****	**0.841*****
(std. error)	(0.041)	(0.041)	(0.047)	(0.049)	(0.045)	(0.043)
SMB	**0.013**	**0.016**	**0.001**	**0.120***	**0.039**	**0.047**
(std. error)	(0.060)	(0.060)	(0.068)	(0.071)	(0.066)	(0.063)
HML	**-0.154****	**-0.170****	**-0.227*****	**-0.093**	**-0.181****	**-0.153****
(std. error)	(0.070)	(0.070)	(0.079)	(0.082)	(0.077)	(0.073)
Intercept	**0.537*****	**0.641*****	**0.869*****	**0.932*****	**0.662*****	**0.402****
(std. error)	(0.169)	(0.168)	(0.191)	(0.198)	(0.185)	(0.175)
Observations	114	114	114	114	114	114
R^2	0.802	0.788	0.728	0.668	0.759	0.778
Adjusted R^2	0.797	0.783	0.721	0.659	0.752	0.772
Residual Std. Error	1.761 (df = 110)	1.751 (df = 110)	1.993 (df = 110)	2.063 (df = 110)	1.928 (df = 110)	1.826 (df = 110)
F Statistic	148.738*** (df = 3; 110)	136.671*** (df = 3; 110)	98.234*** (df = 3; 110)	73.689*** (df = 3; 110)	115.438*** (df = 3; 110)	128.556*** (df = 3; 110)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 20: P/FCF & Quality portfolios – Regressions against 3-FF (Swedish) model

	PTOFCF	ROIC5_PFCF	ROIC_PFCF	ROA_PFCF	GMARGIN_PFCF	QSCORE_PFCF	DYIELD_PFCF
`OMX - RF`	**1.038*****	**0.899*****	**0.931*****	**0.932*****	**0.841*****	**0.938*****	**0.903*****
(std. error)	(0.056)	(0.048)	(0.051)	(0.050)	(0.050)	(0.048)	(0.048)
SMB	**0.106**	**0.125***	**0.108**	**0.06**	**0.132***	**0.139***	**0.126***
(std. error)	(0.082)	(0.070)	(0.075)	(0.072)	(0.073)	(0.071)	(0.071)
HML	**-0.133**	**-0.157***	**-0.141**	**-0.184****	**-0.131**	**-0.142***	**-0.170****
(std. error)	(0.095)	(0.081)	(0.087)	(0.084)	(0.084)	(0.082)	(0.082)
Intercept	**0.640*****	**0.762*****	**0.926*****	**0.950*****	**0.958*****	**0.751*****	**0.601*****
(std. error)	(0.228)	(0.196)	(0.210)	(0.202)	(0.203)	(0.197)	(0.197)
Observations	114	114	114	114	114	114	114
R^2	0.76	0.764	0.751	0.764	0.727	0.777	0.763
Adjusted R^2	0.754	0.757	0.744	0.758	0.719	0.771	0.757
Residual Std. Error	2.382 (df = 110)	2.045 (df = 110)	2.189 (df = 110)	2.106 (df = 110)	2.115 (df = 110)	2.059 (df = 110)	2.054 (df = 110)
F Statistic	116.244*** (df = 3; 110)	118.569*** (df = 3; 110)	110.644*** (df = 3; 110)	118.739*** (df = 3; 110)	97.468*** (df = 3; 110)	127.760*** (df = 3; 110)	118.221*** (df = 3; 110)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 21: EV/EBITDA & Quality portfolios – Regressions against 3-FF (Swedish) model

	EVTOEBITDA	ROIC5_EVEBITDA	ROIC_EVEBITDA	ROA_EVEBITDA	GMARGIN_EVEBITDA	QSCORE_EVEBITDA	DYIELD_EVEBITDA
`OMX - RF`	**0.926*****	**0.875*****	**0.880*****	**0.859*****	**0.767*****	**0.902*****	**0.854*****
(std. error)	(0.048)	(0.043)	(0.045)	(0.045)	(0.041)	(0.043)	(0.046)
SMB	**0.008**	**-0.052**	**0.026**	**-0.017**	**-0.02**	**-0.017**	**-0.03**
(std. error)	(0.069)	(0.063)	(0.066)	(0.066)	(0.059)	(0.063)	(0.067)
HML	**-0.169****	**-0.167****	**-0.203*****	**-0.195****	**-0.085**	**-0.148****	**-0.152***
(std. error)	(0.080)	(0.073)	(0.076)	(0.077)	(0.069)	(0.073)	(0.078)
Intercept	**0.437****	**0.585*****	**0.636*****	**0.589*****	**0.774*****	**0.489*****	**0.440****
(std. error)	(0.194)	(0.177)	(0.183)	(0.185)	(0.165)	(0.177)	(0.188)
Observations	114	114	114	114	114	114	114
R^2	0.775	0.787	0.778	0.765	0.765	0.797	0.758
Adjusted R^2	0.769	0.781	0.771	0.759	0.759	0.792	0.751
Residual Std. Error	2.023 (df = 110)	1.846 (df = 110)	1.910 (df = 110)	1.929 (df = 110)	1.728 (df = 110)	1.848 (df = 110)	1.961 (df = 110)
F Statistic	126.541*** (df = 3; 110)	135.448*** (df = 3; 110)	128.149*** (df = 3; 110)	119.464*** (df = 3; 110)	119.473*** (df = 3; 110)	144.001*** (df = 3; 110)	114.639*** (df = 3; 110)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 22: Value portfolios – Regressions against 5-FF model (ex. Covid)

	EVTOEBIT	EVTOEBITDA	PTOFCF	PE	PB
`OMX - RF`	**0.914*****	**0.911*****	**1.068*****	**0.950*****	**1.085*****
(std. error)	(0.049)	(0.051)	(0.058)	(0.054)	(0.052)
SMB	**0.042**	**0.052**	**0.384****	**0.133**	**0.132**
(std. error)	(0.126)	(0.130)	(0.148)	(0.139)	(0.134)
HML	**0.302***	**0.346***	**0.223**	**0.439****	**0.407****
(std. error)	(0.174)	(0.179)	(0.204)	(0.191)	(0.184)
RMW	**0.411***	**0.492****	**0.546****	**0.560****	**0.631****
(std. error)	(0.230)	(0.237)	(0.270)	(0.252)	(0.244)
CMA	**-0.226**	**-0.129**	**-0.111**	**-0.267**	**-0.001**
(std. error)	(0.208)	(0.215)	(0.245)	(0.229)	(0.221)
Intercept	**0.22**	**0.317**	**0.383**	**0.145**	**-0.03**
(std. error)	(0.202)	(0.208)	(0.237)	(0.221)	(0.214)
Observations	115	115	115	115	115
R^2	0.79	0.777	0.777	0.772	0.82
Adjusted R^2	0.78	0.766	0.766	0.761	0.812
Residual Std. Error	1.970 (df = 109)	2.030 (df = 109)	2.314 (df = 109)	2.162 (df = 109)	2.091 (df = 109)
F Statistic	81.872*** (df = 5; 109)	75.818*** (df = 5; 109)	75.758*** (df = 5; 109)	73.632*** (df = 5; 109)	99.313*** (df = 5; 109)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 23: Quality portfolios – Regressions against 5-FF model (ex. Covid)

	ROIC5	ROIC	ROA	GMARGIN	QSCORE	DYIELD
\`OMX - RF\`	**0.851*****	**0.828*****	**0.780*****	**0.753*****	**0.834*****	**0.825*****
(std. error)	(0.042)	(0.043)	(0.050)	(0.049)	(0.047)	(0.046)
SMB	**0.065**	**0.096**	**0.016**	**0.277****	**0.152**	**0.011**
(std. error)	(0.108)	(0.109)	(0.127)	(0.125)	(0.121)	(0.118)
HML	**-0.099**	**-0.003**	**-0.034**	**-0.189**	**-0.013**	**0.283***
(std. error)	(0.149)	(0.151)	(0.174)	(0.172)	(0.167)	(0.163)
RMW	**-0.109**	**0.186**	**0.101**	**0.153**	**0.09**	**0.367***
(std. error)	(0.197)	(0.199)	(0.231)	(0.228)	(0.220)	(0.215)
CMA	**-0.483*****	**-0.307***	**-0.424****	**-0.051**	**-0.385***	**-0.052**
(std. error)	(0.179)	(0.181)	(0.209)	(0.207)	(0.200)	(0.195)
Intercept	**0.528*****	**0.531*****	**0.794*****	**0.738*****	**0.579*****	**0.318***
(std. error)	(0.173)	(0.175)	(0.202)	(0.200)	(0.193)	(0.189)
Observations	115	115	115	115	115	115
R^2	0.82	0.801	0.736	0.706	0.772	0.776
Adjusted R^2	0.812	0.792	0.724	0.692	0.762	0.766
Residual Std. Error	1.690 (df = 109)	1.708 (df = 109)	1.976 (df = 109)	1.954 (df = 109)	1.889 (df = 109)	1.847 (df = 109)
F Statistic	99.520*** (df = 5; 109)	88.018*** (df = 5; 109)	60.721*** (df = 5; 109)	52.320*** (df = 5; 109)	73.872*** (df = 5; 109)	75.495*** (df = 5; 109)
Note:	*p<0.1; **p<0.05; ***p<0.01					

Table 24: P/FCF & Quality portfolios – Regressions against 5-FF model (ex. Covid)

	PTOFCF	ROIC5_PFCF	ROIC_PFCF	ROA_PFCF	GMARGIN_PFCF	QSCORE_PFCF	DYIELD_PFCF
\`OMX - RF\`	**1.068*****	**0.909*****	**0.949*****	**0.940*****	**0.886*****	**0.956*****	**0.923*****
(std. error)	(0.058)	(0.049)	(0.051)	(0.050)	(0.049)	(0.049)	(0.050)
SMB	**0.384****	**0.313****	**0.354*****	**0.281****	**0.411*****	**0.356*****	**0.213***
(std. error)	(0.148)	(0.125)	(0.132)	(0.129)	(0.124)	(0.126)	(0.128)
HML	**0.223**	**0.089**	**0.142**	**0.073**	**-0.076**	**0.195**	**0.426****
(std. error)	(0.204)	(0.172)	(0.181)	(0.177)	(0.171)	(0.173)	(0.176)
RMW	**0.546****	**0.291**	**0.444***	**0.359**	**0.324**	**0.460****	**0.845*****
(std. error)	(0.270)	(0.228)	(0.239)	(0.235)	(0.226)	(0.229)	(0.233)
CMA	**-0.111**	**-0.413****	**-0.399***	**-0.357***	**-0.169**	**-0.344**	**0.028**
(std. error)	(0.245)	(0.207)	(0.217)	(0.213)	(0.205)	(0.208)	(0.212)
Intercept	**0.383**	**0.582*****	**0.688*****	**0.739*****	**0.697*****	**0.524****	**0.314**
(std. error)	(0.237)	(0.200)	(0.210)	(0.206)	(0.199)	(0.201)	(0.205)
Observations	115	115	115	115	115	115	115
R^2	0.777	0.787	0.784	0.787	0.773	0.799	0.779
Adjusted R^2	0.766	0.778	0.774	0.777	0.763	0.79	0.768
Residual Std. Error	2.314 (df = 109)	1.952 (df = 109)	2.052 (df = 109)	2.011 (df = 109)	1.939 (df = 109)	1.965 (df = 109)	2.000 (df = 109)
F Statistic	75.758*** (df = 5; 109)	80.752*** (df = 5; 109)	79.039*** (df = 5; 109)	80.559*** (df = 5; 109)	74.280*** (df = 5; 109)	86.834*** (df = 5; 109)	76.633*** (df = 5; 109)
Note:	*p<0.1; **p<0.05; ***p<0.01						

Table 25: EV/EBITDA & Quality portfolios – Regressions against 5-FF model (ex. Covid)

	EVTOEBITDA	ROIC5_EVEBITDA	ROIC_EVEBITDA	ROA_EVEBITDA	GMARGIN_EVEBITDA	QSCORE_EVEBITDA	DYIELD_EVEBITDA
\`OMX - RF\`	**0.911*****	**0.853*****	**0.863*****	**0.846*****	**0.777*****	**0.884*****	**0.828*****
(std. error)	(0.051)	(0.047)	(0.048)	(0.049)	(0.043)	(0.047)	(0.049)
SMB	**0.052**	**-0.046**	**0.103**	**0.094**	**0.137**	**0.004**	**-0.096**
(std. error)	(0.130)	(0.120)	(0.123)	(0.125)	(0.110)	(0.120)	(0.125)
HML	**0.346***	**0.145**	**0.279**	**0.236**	**0.115**	**0.266**	**0.348****
(std. error)	(0.179)	(0.166)	(0.169)	(0.172)	(0.151)	(0.165)	(0.172)
RMW	**0.492****	**0.272**	**0.460****	**0.398***	**0.328**	**0.389***	**0.423***
(std. error)	(0.237)	(0.219)	(0.224)	(0.228)	(0.200)	(0.218)	(0.227)
CMA	**-0.129**	**-0.172**	**-0.294**	**-0.216**	**-0.033**	**-0.132**	**0.023**
(std. error)	(0.215)	(0.199)	(0.203)	(0.207)	(0.181)	(0.197)	(0.206)
Intercept	**0.317**	**0.517*****	**0.489****	**0.468****	**0.638*****	**0.393****	**0.381***
(std. error)	(0.208)	(0.193)	(0.196)	(0.200)	(0.175)	(0.191)	(0.200)
Observations	115	115	115	115	115	115	115
R^2	0.777	0.782	0.778	0.763	0.772	0.795	0.763
Adjusted R^2	0.766	0.772	0.768	0.752	0.762	0.786	0.752
Residual Std. Error	2.030 (df = 109)	1.880 (df = 109)	1.919 (df = 109)	1.952 (df = 109)	1.712 (df = 109)	1.866 (df = 109)	1.949 (df = 109)
F Statistic	75.818*** (df = 5; 109)	78.159*** (df = 5; 109)	76.411*** (df = 5; 109)	70.127*** (df = 5; 109)	73.878*** (df = 5; 109)	84.744*** (df = 5; 109)	70.316*** (df = 5; 109)
Note:	*p<0.1; **p<0.05; ***p<0.01						