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Enhanced value and profitability premium

Evidence from the U.S. market

School of Accounting and Finance
Master's Thesis in Finance
Master's Degree Programme in Finance

Vaasa 2022

UNIVERSITY OF VAASA
School of Accounting and Finance
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Title of the Thesis: Enhanced value and profitability premium: Evidence from the U.S. markets
Degree: Master of Science in Economics and Business Administration
Programme: Master's Degree Programme in Finance
Supervisor: Klaus Grobys
Year: 2022 **Pages:** 78

ABSTRACT:
Value and profitability premiums are market anomalies that challenge the efficient market hypothesis. Despite the extensive literature on value and profitability, the recently proposed investment strategy that combines value and profitability seems even more robust. This strand of literature suggests that value and profitability strategies are best used in combination with each other and that combining these two effects earns superior performance. Regardless of how attractive value and profitability are together, much uncertainty still exists about what combination of value and profitability earns the best performance.

This study investigates the performance of portfolios that combine value and profitability in the U.S. markets. The data encompasses stocks in the S&P 500 index over the sample period from 2000 to 2021. The main objective of this study is to determine whether profitable value stocks achieve higher risk-adjusted returns than unprofitable growth stocks. Moreover, our innovation for this study is to utilize the most recent research on value and profitability premium. Motivated by the recent literature, the profitability ratios used in this study are gross profitability (GP) and cash profitability (CP). Following the recent findings on value premium, this study uses retained earnings-to-market (RE/ME) and earnings before interest and taxes-to-enterprise value (EBIT/EV) ratios as proxies for value. To test different strategies, the aim is to find the portfolio that provides the best combination of value and profitability. Finally, the secondary objective is to assess how the performance of combination strategies compares against the traditional value and profitability portfolios.

The results show that portfolios that invest in profitable value stocks generate much higher risk-adjusted returns than portfolios that invest in unprofitable growth stocks in the S&P 500 index. Among combinations, the best overall performance is observed for the GP & RE/ME portfolio. The results for the GP & RE/ME portfolio are persistent and statistically significant across all asset pricing models used in this study. Moreover, the results show that the additional screen on profitability dramatically enhances the performance of traditional value strategies. The study finds that an additional screen on value improves the performance of traditional CP strategy but finds no evidence of improvement in the case of GP strategy. However, this study finds that combining profitability with value enhances the performance of traditional long-short portfolios, even in the case of GP strategy. Overall, these findings suggest that the strategy that goes long on profitable value and short on unprofitable growth earns the best performance.

KEYWORDS: value premium, profitability premium, magic formula, S&P 500, multi-factor investing

Vaasan yliopisto
Laskentatoimen ja rahoituksen yksikkö
Tekijä: Miikka Hankala
Tutkielman nimi: Enhanced value and profitability premium: Evidence from the U.S. markets
Tutkinto: Kauppatieteiden maisteri
Oppiaine: Rahoitus
Työn ohjaaja: Klaus Grobys
Vuosi: 2022 **Sivumäärä:** 78

TIIVISTELMÄ:

Arvo- ja kannattavuuspreemiot ovat markkina-anomalioita, jotka haastavat tehokkaiden markkinoiden hypoteesin. Arvo- ja kannattavuuspreemiot viittaavat ilmiöön, jonka mukaan matalan arvostuksen ja korkean kannattavuuden yhtiöt tuottavat korkeampia riskikorjattuja osaketuottoja kuin korkean arvostuksen ja matalan kannattavuuden yhtiöt. Laajasta emprisiisestä tutkimuksesta huolimatta aiempi kirjallisuus on keskittynyt pääosin tutkimaan arvo- ja kannattavuusstrategieoita erikseen. Uudempi kirjallisuus kuitenkin osoittaa, että arvo- ja kannattavuusstrategoita yhdistämällä voidaan saavuttaa korkeampia riskikorjattuja osaketuottoja. Empiirinen tutkimus ei ole kuitenkaan löytänyt konsensusta kysymykselle mitkä arvo- ja kannattavuusstrategiat toimivat parhaiten yhdessä.

Tämä tutkielma tutkii arvo- ja kannattavuusstrategioihin perustuvia yhdistelmästrategioita Yhdysvaltojen osakemarkkinoilla. Tutkielman aineisto koostuu S&P 500 -indeksin yhtiöstä ja se on kerätty vuosilta 2000-2021. Tutkielman tarkoitus on selvittää tuottavatko korkean kannattavuuden arvo-osakket parempia riskikorjattuja tuottoja kuin matalan kannattavuuden kasvuosakkeet. Tämä tulkielma erottuu aikaisemmasta kirjallisuudesta yhdistämällä uusimmat empriiset löydökset arvo- ja kannattavuuspreemioiden kirjallisuudesta. Tuoreimman kirjallisuuden motivoimana tässä tutkielmassa kannattavuusstrategioita edustavat bruttokannattavuus (GP) ja kassavirtapohjainen operatiivinen kannattavuus (CP). Arvostrategioita tässä tutkielmassa edustavat akateemiset RE/ME ja EBIT/EV -strategiat. Tutkielman ensisijaisena tarkoituksena on löytää kombinaatio, joka tuottaa parhaan mahdollisen yhdistelmän valituista arvo- ja kannattavuusstrategioista. Tutkielman toissijaisena tarkoituksena on verrata yhdistelmästrategioiden riskikorjattuja tuottoja perinteisten arvo- ja kannattavuusstrategioiden kanssa.

Tutkimuksen tulokset osoittavat, että kannattavat arvo-osakkeet tuottavat parempia riskikorjattuja kuin matalan kannattavuuden kasvuosakkeet S&P 500 -indeksissä. Yhdistelmästrategioista korkeimmat riskikorjatut tuotot havainnoitiin GP & RE/ME -strategialla. GP & RE/ME -strategian riskikorjatut ylituotot ovat positiivisia ja tilastollisesti merkitseviä kaikilla tämän tutkimuksen regressiomalleilla tarkasteltuna. Lisäksi tutkimus osoittaa, että yhdistelmästrategiat tuottavat korkeampia riskikorjattuja tuottoja kuin perinteiset arvostrategiat. Yhdistelmästrategoiden riskikorjatut tuotot ovat korkeampia kuin CP-strategian riskikorjatut tuotot, mutta matalampia kuin GP-strategialla. Siitä huolimatta markkinaneutraalit (long/short) yhdistelmästrategiat ansaitsevat korkeampia riskikorjattuja tuottoja kuin markkinaneutraali GP-strategia. Tuloksien perusteella voidaan todeta, että markkinaneutraali strategia, joka ostaa kannattavia arvo-osakkeita ja myy lyhyeksi matalan kannattavuuden kasvuosakkeita tuottaa parhaan riskikorjatun lopputuloksen.

AVAINSANAT: value premium, profitability premium, magic formula, S&P 500, multi-factor investing

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1 INTRODUCTION

Value and profitability premiums are well-documented market anomalies that challenge the efficient market hypothesis (EMH). The academic research on value premium is that cheap assets, on average, outperform expensive assets (see, e.g., Basu, 1977; Fama & French, 1992, 1993; Asness et al., 2015; Ball et al., 2020). In turn, the research on profitability premium is that profitable (productive) assets, on average, have higher expected returns than unprofitable (unproductive) assets (see, e.g., Novy-Marx, 2013; Ball et al., 2015, 2016). Thus, portfolios that invest in value stocks tend to be vastly different from those that invest in profitable stocks. While cheap stocks tend to be low in profitability, profitable firms tend to be expensively valued, suggesting that profitability and value strategies may capture these premium returns for different reasons.

Moreover, these premium returns do not come without concerns. The problem with value investing is that some stocks can be cheap for good reasons (i.e., value traps). In turn, the problem with profitable stocks is that good firms tend to be expensively valued, and investors often have to pay up on price. The intuition here suggests that an investor who can avoid these common traps may earn enhanced returns for her portfolio. Since controlling for profitability should increase the overall quality of value portfolios and vice versa, controlling for value should decrease the risk of overpaying; this study suggests that combining these two effects builds a better portfolio. For these reasons, it is of particular interest to understand whether firms that are both good and cheap are more lucrative investments than firms that are *just* good or cheap alone.

Considering the extensive literature on value and profitability premium, much confusion still exists about the performance of combining the two. In fact, given the magnitude of past evidence, surprisingly little attention has been paid to the possible synergies between value and profitability. However, this is not entirely virgin territory. Investment practitioners such as Warren Buffett and Joel Greenblatt have been known as strong proponents of the idea of buying better businesses at more reasonable prices. In academia, thus far, perhaps the most compelling interpretation is that by Novy-Marx (2014):

> *"Buying high quality assets without paying premium prices is just as much value investing as buying average quality assets at discount prices. Strategies that exploit the quality dimension of value are profitable on their own, and accounting for both dimensions of value by trading on combined quality and price signals yields dramatic performance improvements over traditional value strategies.'' (pp. 1)*

Moreover, subsequent literature has shown that traditional strategies may not work best alone but are better used in combination with other strategies. Since such strategies are often uncorrelated, they tend to improve and generate more stable and robust returns when combined. For instance, Asness et al. (1997) find that value is uncorrelated with momentum strategy, suggesting these two strategies are particularly powerful to run together. Whereas Novy-Marx (2013) finds that profitability is uncorrelated with value, offering a powerful hedge for value strategies. More subsequently, Asness et al. (2015) show that value is particularly attractive when combined with momentum and, more recently, profitability.

This study aims to fill this gap in the literature by examining the strategies that combine perhaps the two most potent forces in the asset pricing literature: value and profitability. Moreover, this study sheds light on the most recent research on value and profitability premium and investigates the effects of combining profitability and value on portfolio performance. Finally, by using the most recent value and profitability ratios, it is of particular interest to find the portfolio that offers the best combination of the two.

1.1 Purpose of the study

The purpose of this study is to investigate the effects of combining profitability and value on portfolio performance in U.S. markets using the stocks in the S&P 500 index. The main objective of the study is to assess the risk and return of portfolios that combine value and profitability. The idea of combining profitability with value is motivated mainly by the prior findings of Novy-Marx (2013, 2014), Asness et al. (2015), and Davydov et al. (2016), which show significant synergies between value and profitability strategies. This study contributes to the literature by examining the most recent research on profitability and value premium to test different variables to find the portfolio that provides the best combination of the two. Finally, it is of interest to test how well the combination of profitability and value compares against the traditional value and profitability portfolios.

Put differently, this study does not just look for stocks with the best value characteristics. It does not look for the most profitable stocks either. This study investigates the portfolio of profitable value stocks that rank, on average, highly on both profitability and value. The idea is that value and profitability factors are distinct and negatively correlated. Moreover, a firm that ranks highly on both value and profitability can be highly dissimilar to a firm that ranks highly on just one, value or profitability. Thus, this study tests whether combining these two effects builds a better portfolio.

In this study, two recently proposed profitability and two value factors outline the background against which we conduct the research. Following the findings of Novy-Marx (2013) on gross profitability (GP), Ball et al. (2016) on cash profitability (CP), as well as Ball et al. (2020) evidence on retained earning-to-market (RE/ME), this study investigates the most recent research on profitability and value strategies. In addition, due to strong interest among practitioners and recent evidence in the literature (see, e.g., Tikkanen & Äijö, 2018), this study employs the earnings before interest and taxes-to-enterprise value (EBIT/EV) ratio as an alternative proxy for the value factor. Moreover, this study mostly follows Novy-Marx (2013, 2014), Davydov et al. (2016), and Tikkanen and Äijö (2018) on assessing portfolio performance and the one by Davydov et al. (2016) on portfolio construction. As far as the author is aware, no previous studies have been conducted to combine gross profitability or cash profitability with a value strategy that uses retained earnings-to-market or EBIT-to-EV as a value signal in the U.S. markets.

Our innovation for this study is that all financial variables chosen for this study, to a certain degree, are related to a firm's profitability. Gross profitability and cash profitability, both of which scale profits by total asset, are designed to capture how much a company earns on its assets, focusing on capital productivity. In contrast, both RE/ME and EBIT/EV ratios are good proxies for earnings yield (e.g., Ball et al., 2020). RE/ME ratio, which contains information about past earnings, captures how much the market is willing to put value for the accumulated earnings a firm has generated and not distributed as dividends. EBIT/EV ratio, which scales operating profits by enterprise value, seeks to figure out how much a firm earns relative to its earning assets. Each gives us information about profitability, but in a slightly different way.

1.2 Research question and hypotheses

Thus far, most research on value and profitability premium has focused on value and profitability premium alone rather than examining the effects of combining profitability and value on portfolio performance. This notion outlines the background against which we conduct the research. With so many claims regarding the synergies, this study attempts to address the research question of whether profitable value stocks outperform unprofitable growth stocks in the U.S. markets.

More specifically, this study examines whether the claimed benefits of combining profitability and value apply to the stocks in the S&P 500 index. Thus, the first research hypothesis can be expressed as follows:

H1: The top 20% of firms based on a combination of profitability and value produce higher risk-adjusted returns than the bottom 20% of firms based on a combination of profitability and value.

In addition, it is of interest to test whether the additional screen on value improves the strategies built solely on profitability. Thus, the aim is to test how the performance of profitable value stocks compares against stocks that are just high profitability. Hence, the second research hypothesis can be formed as follows:

H2: Portfolios based on a combination of profitability and value produce higher risk-adjusted returns than portfolios based on profitability alone.

Lastly, this study aims to fill the gap in the literature to test whether value investors can improve their performance by controlling for profitability. Hence, the secondary consideration for value is to test how the performance of profitable value stocks compares against value stocks. The third research hypothesis can hence be formed as follows:

H3: Portfolios based on a combination of profitability and value produce higher risk-adjusted returns than portfolios based on value alone.

1.3 Structure of the study

The remainder of the study is organized as follows. The second chapter combines the most relevant literature on profitability and value premiums and studies that cover combination strategies. The third chapter lays out the theory of empirical research in this area of literature. The fourth chapter describes our data and the empirical methodology used in this study. The fifth chapter presents the empirical results and discusses the findings. Finally, the sixth chapter concludes and presents the ideas for further research.

2 LITERATURE REVIEW

This chapter provides a review of academic literature on profitability and value premiums, outlining the background against which we conduct the research. First, this chapter introduces the growing body of literature on profitability premium. Second, this chapter goes through the most recent research on value premium. Finally, this chapter reviews the literature on the alternative views of profitability and value investing by discussing the strategies that exploit multiple screens in stock selection. Thus, the objective is to highlight the academic research on the possible benefits of combining profitability and value in stock selection.

2.1 Prior research on profitability premium

Prior research has built a strong case for profitability premium to exist. Academic research on profitability premium, defined as a return difference between profitable and unprofitable stocks, dates back at least to Ball and Brown (1968). They find that earnings, defined as net income excluding extraordinary items, are positively related to the cross-section of expected returns in the U.S. markets. Since then, considerable research has been devoted to the relation between firm profitability and expected returns. Most recently, a firm's profitability has become one of the main building blocks of most recent asset pricing models (e.g., Fama & French, 2015, 2018).

Subsequent research has revealed a strong relation between several P&L items and expected stock returns. First, Lakonishok et al. (1994) show that cash flows, measured as earnings plus depreciation, better explain stock returns than earnings alone. Further, Haugen and Baker (1996) document that a high return on equity (ROE) is positively associated with expected stock returns. Sloan (1996) reports that firms with low accounting accruals outperform those with high accruals, suggesting that there exists an accruals anomaly. Moreover, some costs seen as investments to provide future cash flows tend to predict stock returns. For instance, Chan et al. (2001) find that research and development (R&D) activity and advertising expenditures are positively associated with expected returns. In turn, Eisfeldt and Papanikolaou (2013) discover that spending on the development of organizational capital, defined as selling, general, and administrative (SGA) expenditures, has a strong and positive relation with expected stock returns.

The most recent research on profitability premium shows that the profitability factor is different from the value factor in number of respects. Novy-Marx (2013) illustrates this point clearly as he shows that profitability factors scale profits by assets instead of price. Further, he explains that it is not inexpensive assets (profitability scaled by price) but productive assets (profitability scaled by assets) that drive profitability premium. In other words, the intuition says that productive assets have become dominant not because of what they own but rather because of the value they create. This interpretation also distinguishes from earlier studies (e.g., Ball & Brown, 1964; Lakonishok et al., 1994) that scale profits by price, thus being value investing strategies. Furthermore, Ball et al. (2015) conclude that the book value of total assets is among the best deflator at capturing the profitability premium.

Arguably the most known paper in the literature on profitability premium is that of Novy-Marx (2013). The study reports that gross profitability, measured as gross profits to total assets, better captures the excess returns emanating from profitability. More interestingly, the evidence shows that gross profitability has approximately the same predictive power in the cross-section of average returns as the book-to-market ratio. Over the period from 1962 to 2010, firms that score high on gross profitability significantly outperform those with low gross profitability, despite commanding much higher valuation ratios. Further, the findings that show gross profitability predicts higher subsequent returns than any other measure of profitability, such as bottom-line earnings and cash flows, being among the most robust variable in predicting future returns.

More specifically, since gross profit is a top-line measure of profitability, Novy-Marx (2013) clarifies that gross profitability is the least manipulated accounting measure of true economic profitability, thus providing useful information on assets' productivity. In other words, Novy-Marx (2013) explains that gross profits are less likely to be manipulated by investments treated as expenses that may produce lower earnings and a false view of true economic profitability. Moreover, a firm with higher revenue and lower production costs compared to peers can easily have lower accounting earnings, albeit having significantly higher true economic profitability. To illustrate, spending on SG&A and R&D may increase a firm's competitive advantage in the future but produce lower earnings. Moreover, capital expenditures may boost a firm's scale of operations but also reduce free cash flows.

Motivated by Novy-Marx's (2013) findings, a growing body of literature has revealed similar results regarding the profitability effect. Kenchington et al. (2019) find that mutual funds with substantial loadings on gross profitability have produced significantly higher risk-adjusted returns than other mutual funds, despite experiencing much higher volatility. Further, the study shows that mutual funds that trade on gross profitability continue to outperform even after controlling for size, value, and momentum. This suggests that the outperformance of funds that trade on gross profitability is rather attributable to managerial skill than reward for strategies built on other well-known market anomalies. Furthermore, they show that gross profitability premium is particularly strong among firms with lower analyst coverage and high limits to arbitrage, indicating that profitability premium stems from mispricing rather than risk.

Jiang et al. (2018) examine the profitability premium in the Chinese stock markets over the sample period from 2001 to 2014. They obtain broadly consistent results for gross profitability (GP), return on assets (ROA), and return on equity (ROE), suggesting that profitable firms have produced significantly higher returns than their less profitable peers. They also provide an alternative explanation for profitability premium by suggesting that high returns of profitable firms are driven by risk rather than mispricing. Consistent with the q-theory of investment, they find that profitability premium is significantly higher among firms with low investment frictions, given the positive investment rates.

Novy-Marx (2013) intuitively states that the higher the income statement goes, the cleaner things get. In contrast, Ball et al. (2015) suggest that operating profitability, calculated as operating profits to total assets, is a far better way to extract information from accounting variables and expected returns. They note that operating profitability better matches current sales and expenses since it accounts for SG&A expenditures that contribute to current sales. They examine the performance of different profitability variables in the U.S. markets using the data from 1963 to 2014. According to findings, operating profitability outperforms both gross profitability and earnings in predicting the cross-section of average returns. Moreover, they find that operating profitability is highly persistent, predicting subsequent returns as far as ten years ahead.

A follow-up study by Ball et al. (2016) investigates the U.S. markets from 1963 to 2014 and provides new evidence on profitability premium. They show that cash-based operating profitability (cash profitability), as measured by operating profitability excluding accounting accruals, better captures the returns generated by firms with high profitability and low accruals. Further, the study shows that firms with high operating profitability and low accruals earn significantly higher returns than those with low operating profitability and high accruals. Interestingly, the findings indicate that cash profitability provides a much more vital link to expected returns than either operating profitability or accruals alone while also experiencing much lower volatility.

These findings are rather easy to reconcile with prior literature as expected returns tend to decrease in accruals but increase in profitability (see, e.g., Sloan, 1996). Moreover, Ball et al. (2016) explain that operating profitability can broadly be defined as having two dimensions: the cash component of profitability and the accounting accruals. Furthermore, their empirical evidence suggests that profitability premium is far less robust among firms that are profitable solely due to high accruals than among the firms with low accruals, as they tend to be less profitable on a cash basis. In fact, the findings show that any increase in profitability that is solely driven by accruals has hardly any relation to the cross-section of expected returns.

Furthermore, profitability has been a significant contributor to the development of asset pricing models, despite being somewhat counterintuitive as a risk factor. First, Fama and French (2015) add operating profitability into the five-factor model as a new factor to capture excess returns emanating from profitability. Subsequently, Fama and French (2018) test how operating profitability and cash profitability interact with other variables believed to be important determinants of expected stock returns. In line with Ball et al. (2016), the study of Fama and French (2018) reports that cash profitability, defined as operating profits to book equity, offers higher predictive power than operating profitability when combined with the other risk factors.

2.2 Prior research on value premium

Value premium, defined as a return difference between value and growth stocks, is perhaps the most well-known market anomaly in academic literature. The concept of value dates back at least to Graham and Dodd (1934), who advocated buying undervalued assets to earn superior results. Thereafter, the concept of value has evolved and attracted a great deal of attention from both academia and practitioners. However, the underlying idea of value remains intact, implying that value investors buy cheap assets and sell expensive assets. Moreover, practitioners typically define *value* as an investing style that uses fundamental analysis to buy stocks that sell at or below their perceived intrinsic value. While there is no single formula to identify the intrinsic value of a stock, investors commonly use simple valuation metrics such as book-to-market (B/M) or earnings-to-price (E/P) ratios in valuing stocks.

To get a more systematic approach, the academic version of value investing relies on simple valuation ratios. First, Basu (1977) finds that low P/E stocks produced higher returns than high P/E stocks in the U.S. markets from 1957 to 1971. Fama and French (1992) show that the future returns of high B/M stocks are higher than those of low B/M stocks, using the data from the U.S. market from 1962 to 1989. Later, Fama and French (1993) propose the three-factor model, adding value and size factors to the traditional Capital Asset Pricing Model (CAPM). Their findings suggest that a return difference between high B/M (value) and low B/M (growth) stocks can explain a great degree of variation in stock returns not captured by the traditional CAPM.

The subsequent research on value premium consists of several different financial measures to identify value. Chan et al. (1991) find that value stocks outperform growth stocks by studying the cash flow-to-price (CF/P), book-to-market (B/M), and earnings-to-price (E/P) ratios in the Japanese market. Later, Lakonishok et al. (1994) find that high CF/P stocks earned higher returns than low CF/P stocks in the U.S. markets from 1963 to 1990. Besides the value premium existence in the U.S. markets, Fama and French (1998) performed a study in the international markets to examine the performance of several different value metrics from 1975 through 1995. While they show that value premium is a global phenomenon, they also show that a high dividend-to-price (D/P) ratio is associated with higher future returns. Moreover, Cochrane (2011) discusses the relation between expected stock returns and underlying discount rates. The study confirms that low (high) prices relative to current dividends forecast higher (lower) future stock returns.

Instead of valuing companies based on the market value of equity, enterprise value (EV) is an alternative measure to identify the value of a business. Enterprise value takes into account both the market value of equity and debt financing, thus being a strongly preferred metric to determine the purchase price of a business, especially in the field of corporate finance. Loughran and Wellman (2011) study the EV/EBITDA strategy in the U.S. markets from 1963 to 2009. Their findings were that low EV/EBITDA stocks provided higher returns than high EV/EBITDA stocks during the sample period. Furthermore, Walkshäusl and Lobe (2015) re-examined the EV/EBITDA strategy with international data from 1981 to 2010. Consistent with Loughram and Wellman (2011), their findings show that statistically and economically significant value premium exists in both emerging and developed markets.

Motivated by Greenblatt (2010), the valuation measure based on EBIT/EV ratio has gained attention from both academia and practitioners. The strategy based on EBIT/EV, defined as operating earnings (EBIT) to enterprise value (EV), is a useful measure as it seeks to tell how much a business earns relative to the purchase price of the business. Davydov et al. (2016) studied the EBIT/EV strategy, among other value strategies, in the Finnish stock market in the period between 1991 and 2013. They find that EBIT/EV strategy provided single the highest returns, even after controlling for risk, and more than any other value strategy investigated. Tikkanen and Äijö (2018) performed a study in the European stock markets in which they compare different value strategies. Again, their findings report that EBIT/EV strategy produces higher returns than any other traditional value strategy. Moreover, both studies show that EBIT/EV strategy works particularly well when value is combined with other strategies, such as profitability or financial strength.

Regardless of the extensive evidence on value premium, much confusion still exists about the performance of value strategies. First, Fama and French (1996) find that the excess returns of portfolios formed on earnings to price (E/P) and cash flow to price (CF/P) are much lower after controlling for size and book-to-market. More recently, Asness et al. (2015) and Fama and French (2016) find that the relation between B/M and expected stock returns has been relatively weak, especially in the post-1990 period. However, Asness et al. (2015) stress that value premium has not disappeared, but the definition of value may have changed. They note that value can be measured in several different ways, and none of the strategies is optimal at all times. They argue that a value portfolio that mixes different valuation ratios provides better and less volatile performance.

Ball et al. (2020) study the retained earnings-to-market (RE/ME) ratio in the U.S. and developed markets from 1989 to 2016. The study's key findings show that RE/ME ratio predicts the cross-section of average returns in both the U.S. and developed markets.

The regression results show that retained earnings-to-market provides a stronger link to expected returns than book-to-market, with *t*-values of 4.39 and 3.17, respectively. Moreover, they show that once both RE/ME and B/M are included in the same regression, book-to-market is no longer statistically significant. This suggests that the information in RE/ME subsumes the information in B/M, as the t-values are 4.60 and 0.69, respectively. In fact, they find that B/M predicts returns only because the book value of equity contains information about retained earnings. Furthermore, their study reveals that RE/ME predicts higher future earnings, while E/P predicts lower future earnings.

These findings are interesting to reconcile with Kyosev et al. (2020). They show that quality premium, a return difference between high-quality and low-quality stocks, is primarily driven by earnings growth. Since past earnings tend to predict future earnings, Ball et al. (2020) argue that RE/ME also provides a good proxy for underlying earnings yield, much better than either B/M or E/P. They explain that the book equity of a firm consists of two main components: retained earnings and contributed capital. While they show that retained earnings, which refers to accumulated earnings less dividend payments, contain important information about expected returns, contributed capital has hardly any relation to expected returns. Therefore, they conclude that value investors are better off if they tilt their value bets on RE/ME.

2.3 Prior research on combination strategies

This subchapter reviews the literature on profitability and value factors when used in combination with other factors. Up to now, prior literature has investigated a variety of approaches to explain the profitability and value premium. However, surprisingly little attention has been paid to factors that might amplify the premium returns. This is somewhat odd since many strategies are uncorrelated and tend to offer the most when combined with other strategies. This is exemplified in the work undertaken by Asness et al. (2015), which investigates value strategies and states that:

> *"Clearly, value does not work best alone. Far from it. Combining it with other economically intuitive and empirically strong factors, such as profitability and momentum, builds the best portfolio.'' (pp. 40)*

This quote gives us an exciting ground to explore more in detail the studies that have found synergies between profitability and value and perhaps how these strategies have performed with other empirically proven and alpha-generating investment strategies.

Several studies have revealed that profitability enhances value strategies. This is evident in the case of Novy-Marx (2013), who investigates the relation between gross profitability and the book-to-market in both U.S. and international data. His findings show that gross profitability is largely a growth strategy, being uncorrelated with value, and thus provides an excellent hedge for value strategies. Moreover, the study finds that the performance of book-to-market improves dramatically when controlling for gross profitability, and vice versa, the performance of gross profitability enhances rather substantially when controlling for book-to-market. The study uses double sorts on gross profitability and book-to-market, showing that profitable value stocks dramatically outperform unprofitable growth stocks. The 50/50 combination of profitability and value produces a much higher Sharpe ratio than either gross profitability or book-to-market alone and nearly 2.5 higher than that observed for the market.

A subsequent study by Novy-Marx (2014) considers strategies that combine quality and value investing. The study examines several quality investing strategies combined with the book-to-market ratio in the U.S. markets from 1963 to 2013. The study finds that profitable value, a strategy based on the combination of gross profitability and book-to-market, constantly outperforms other strategies that combine quality and value. Moreover, the study tests both long-only and long-short strategies and two different combining techniques. When running gross profitability and book-to-market side-by-side in the large-cap universe, a long-only portfolio based on profitable value produces an excess return of 9.20% per year, higher than the 7.50% produced by the book-to-market. In the small-cap universe, long-only profitable value outperforms traditional value by producing excess returns of 12.3% versus 11.7% and CAPM alpha of 5.73% versus 5.31%, respectively. Overall, the findings suggest that combining gross profitability and book-to-market improves the strategies that trade on profitability or value alone.

Asness et al. (2015) show that the use of profitability enhances the performance of value strategies. They advocate that the use of profitability helps to clean up value in searching for the most underpriced assets with the best prospects to deliver higher future returns. They study a 60/40 combination of value (HML) and profitability (RMW) in the U.S. markets from 1963 to 2014. They find that the combination provides higher risk-adjusted returns than either stand-alone value or profitability. While the 60/40 combination of value and profitability earns the Sharpe ratio of 0.58, the traditional value and profitability yield only 0.46 and 0.42, respectively. Perhaps most interestingly, the 33/33/33 mix of value, momentum, and profitability earns even better performance, yielding the Sharpe ratio of 0.84, nearly two times higher than traditional value, over the same period.

Perhaps the most compelling idea of combining profitability and value measures is that of Greenblatt (2010), whose "magic formula" exploits enterprise value-to-operating earnings (EV/EBIT) as a value signal and return on invested capital (ROIC) as a profitability signal to form portfolios. Greenblatt's magic formula strategy yielded an impressive annual return of 30.8% in the period from 1988 to 2004, compared to 12.4% for the S&P500 (Greenblatt, 2010, pp. 59). More subsequently, Novy-Marx (2014) investigates the magic formula strategy, among other value and quality strategies, in the U.S. markets. Interestingly, although the magic formula outperforms the overall market, it underperforms the other quality and value combinations, such as the mix of gross profitability and book-to-market.

Davydov et al. (2016) investigate the magic formula strategy against traditional value investing strategies in the Finnish stock market using the sample from 1991 to 2013. They construct several value-profitability combinations by using several different value strategies in combination with ROIC. The innovation of this study is to construct portfolios based on their average rankings of profitability and value. Unambiguously, they show that the magic formula returned higher returns than the overall market producing statistically significant abnormal returns after controlling for the 4-factor model. Moreover, they propose an alternative magic formula, which is augmented by an additional value signal, cash-flow-to-price (CF/P). In fact, they show that the cash-flow augmented magic formula strategy produces a higher 4-factor alpha than any other value strategy over the sample period.

The evidence presented thus far supports the idea of synergies between value and profitability. Moreover, a considerable amount of research has been published on the other factors that also tend to work particularly well together with value and profitability. Frazzini et al. (2018) replicate the performance of Berkshire Hathaway from 1976 to 2017 in order to examine the factor exposures of the Buffett-style portfolio. The study documents that the success of Berkshire Hathaway emanates from the factor tilts toward safe, high-quality value stocks. These findings show that high excess returns of a Buffett-style portfolio are rewards for successfully implementing an investment strategy that owns high-quality securities at cheap valuations. These findings further illustrate that business quality (i.e., profitability) and valuation provide a lucrative combination for searching for higher expected returns.

Some studies have also shown factors that may amplify the profitability premium. Bouchad et al. (2019) argue that profitability premium is more pronounced for stocks with more persistent profits. Interestingly, they find that firms that are less subject to changes in cash flows produce much higher alphas than those with low cash flow persistency. Similarly, they report that profitability premium is more pronounced among stocks for which analysts are too slow to update expectations about future profits. Jiang et al. (2018) report that profitability premium is more pronounced for firms with low investment frictions, given the positive investment rates. They interpret that, given the positive investment, investors require higher expected returns for holding firms more sensitive to changes in profitability, demanding higher discount rates to offset uncertainty in high expected profitability. Moreover, firms with lower investment frictions are largely firms with low marginal costs of investment and hence less sensitive to changes in profitability. The findings of the paper are largely consistent with the q-theory of investments.

Furthermore, both value and profitability premiums are strongly related to firm size. Fama and French (1992, 1993) show that small value stocks generate much higher returns than big value stocks. Subsequent literature confirms that firm size and profitability exhibit the same phenomena. Asness et al. (2018) show that quality (measured by profitability, among others) helps clean up the relationship between size and expected returns. The results show that controlling for quality, a much stronger and more stable size premium emerges. Vice versa, controlling for size increases the returns for quality stocks.

The strong interaction between value and momentum strategies is widely recognized and one of the most pervasive phenomena in the asset pricing literature. First, Asness (1997) discovers a negative and economically meaningful correlation between momentum and value. In other words, the study finds that value stocks tend to be low in momentum while growth stocks tend to be high in momentum, suggesting that pairing momentum and value effects may offer diversification benefits. More subsequently, Asness et al. (2013) find a negative correlation between value and momentum across eight asset classes and markets, implying that the effect is a rather pervasive and global phenomenon. Most recently, Asness et al. (2015) show that momentum and value perform particularly well when combined with profitability, suggesting that there might be an additional reward for thoughtful investors.

Moreover, prior literature has shown that Pietroski's (2000) F-score can enhance value strategies. Tikkanen and Äijö (2018) study the impact of F-score screening on value strategies by covering ratios such as B/M, E/P, D/P, EV/EBIT, and EV/EBITDA in the European markets from 1992 to 2014. They form portfolios based on the top 20% of stocks based on each variable. They find that the Sortino and Sharpe ratios and Fama-French 5-factor alphas of value portfolios increase rather dramatically after F-score screening is applied.

Moreover, they show that the F-score also improves the performance of the gross profitability strategy, yet the return on gross profitability remains lower than those of value strategies. They observe the best performance for the portfolio that combines F-score screening with the EV/EBITDA strategy.

3 THEORETICAL FRAMEWORK

Market anomalies are return distortions that seem difficult to reconcile with traditional risk-based explanations and challenge the efficient market hypothesis. In order to better understand market anomalies, this chapter lays out the theory of efficient markets and standard academic methods for assessing portfolio performance. First, this chapter discusses the concepts of efficient markets. Next, this chapter introduces the evolution of asset pricing models. Finally, this chapter presents the traditional metrics for assessing the risk-adjusted performance.

3.1 Market efficiency

The theory of efficient markets is one of the main discussed puzzles of modern finance. The efficient market hypothesis of Fama (1970) refers to the concept, which states that the stock prices should reflect all available information available at a particular time. This implies that when price changes are independent, and returns are identically distributed, the direction of future price formation should be completely unpredictable. Moreover, when the financial markets are informationally efficient, stock prices should quickly adjust to the new information, implying that investors cannot earn abnormal returns by trading on it. (Fama, 1970.)

Fama (1970) states that the efficient market hypothesis (EMH) has three forms: weak, semi-strong, and strong. Weak-form EMH has it that the historical behavior of stock prices does not contain any helpful information about future price formation. This implies that, if weak-form EMH holds, stock prices fully reflect all historical price information, such as past prices and volume data, making the use of technical analysis rather useless. Semi-strong EMH holds that stock prices perfectly reflect all publicly available information, such as past prices, financial information, and other publicly known stock prospects. If semi-strong EMH holds, stocks instantly reflect all new information, and investors should not be able to earn abnormal returns by using fundamental analysis. In its strongest form, the EMH holds that the stock prices contain all available information, including all historical, publicly, and privately held information. If strong form EMH holds, the implication is that in addition to technical and fundamental analysis, investors should not be able to exploit private information to earn abnormal returns because all information is already fully embedded into prices. (Fama, 1970.)

3.2 Capital asset pricing model

The Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965) is arguably the first and most well-known asset pricing model for assessing the relationship between risk and return. CAPM is built on the foundation of the Modern Portfolio Theory (MPT) of Markowitz (1952), which suggests that investors demand higher expected returns for taking on additional risk. Thus, the MPT assumes that investors choose their portfolios such that the expected return is maximized for a given level of variance. These assumptions are rather easy to reconcile with the theory of CAPM but in a slightly different way.

According to CAPM, investors are predominantly concerned with the risk that cannot be eliminated away by diversification. Hence, the prediction of CAPM is that higher systematic risk (i.e., the risk that cannot be diversified away) should be compensated by higher expected returns. While the systematic risk of a stock is measured by a stock's beta (β), the CAPM predicts a positive relation between a stock's beta (β) and expected returns. Since the expected return of a stock increases linearly with its beta, a generally accepted formula for CAPM is described as:

$$\mathrm{E}(R_i) = R_f + \beta_i + [\, E(R_m) - R_f \,] \tag{1}$$

where $\mathrm{E}(R_i)$ is the expected return of portfolio i, R_f is the risk-free rate, β_i represents the beta coefficient of portfolio i, and $E(R_m)$ implies the expected return on the market portfolio. (Sharpe, 1964; Lintner, 1965; Black, 1972.)

Moreover, the CAPM assumes that the portfolio is mean-variance optimal when each stock's weight in the portfolio is proportional to its market beta. Each stock's beta represents its sensitivity to the market such that a beta greater than one ($\beta > 1$) implies a greater risk than the market in general. Vice versa, a beta coefficient less than one ($\beta < 1$) implies that the stock is less risky than the overall market and exhibits lower volatility. (Sharpe, 1964; Lintner, 1965.)

However, the CAPM has received much attention from critics on its simplicity and the assumptions it relies on. The CAMP assumptions include a belief that all market participants are rational, the expected returns are normally distributed, all investors are risk-averse, investors have similar expectations, all information is publicly available, all investors can lend and borrow at the risk-free rate, and there are no transactions costs, taxes, or other limitations in stock markets (Black, 1972). Subsequently, Black et al. (1972) show that the key assumptions of CAPM are biased and that the security market line for US stocks is too flat, in contrast to what the CAPM proposes. More recently, Frazzini and Pedersen (2014) show that low-beta stocks produce much higher risk-adjusted returns than the model predicts, and vice versa, high-beta stocks produce much lower risk-adjusted returns than expected by the CAPM.

3.3 Fama-French three-factor model

Due to empirical failures of CAPM, asset pricing literature has tended to focus on different factors for explaining abnormal returns. First, Fama and French (1992) find that market beta is not much of use for explaining rates of returns on stocks. Furthermore, they show that the returns are independent of the beta decile after controlling for the size factor. Moreover, they observe that book-to-market (B/M) and earnings-to-price (E/P) have significant information about expected stock returns. In fact, they observe a linear increase in returns in B/M deciles when portfolios are adjusted for size, suggesting that small value stocks produce much higher returns than big value stocks.

Fama-French (1993) three-factor model is an extension of CAPM that adds two new risk factors into the asset pricing model to capture excess returns emanating from size and value, not captured by the traditional CAPM. The model captures size by assigning firms based on their market capitalization so that it prefers small ones. Value factor, in turn, assigns stocks based on their B/M ratios. Hence, the Fama-French three-factor model is described as:

$$R_i - R_f = \alpha_i + \beta_i MKT_t + s_i SMB_t + h_i HML_t + \mathcal{E}_{it} \quad (2)$$

where, R_i is the return on portfolio i, R_f is the risk-free rate, α_i is the regression intercept, MKT is the excess return of the market portfolio, SMB is the excess return of the size factor (small minus big), HML is the excess return of the value factor (high book-to-market minus low book-to-market), β_i, s_i, h_i are the factor loadings, and $\mathcal{E}_{it}$ is the error term of the regression. (Fama and French, 1993.)

3.4 Carhart four-factor model

Perhaps the most puzzling factor in the asset pricing literature is momentum. Momentum of stocks implies the tendency of stocks that are getting better relatively recently (usually three to twelve months) to beat stocks that are getting worse. Jegadeesh and Titman (1993) find that past performance of stocks predicts future performance, suggesting that past winners tend to remain winning while past losers tend to remain losing in the markets over the near term. Moreover, these results are not particular to the momentum in stocks. Similar results hold for momentum strategies performed across different asset classes. Moskowitz et al. (2012) show that momentum strategies that trade on equity indices, currencies, bond futures, and commodities exhibit all the same phenomena.

Carhart (1997) contributes to asset pricing literature by introducing the four-factor model that adds momentum to the traditional three-factor model. WML factor, which stands for winner minus loser, describes the return difference between the winner and loser stocks. Hence, the enhanced model can now better capture the excess returns stemming from the winner stocks. The equation for the four-factor model is as follows:

$$R_i - R_f = \alpha_i + \beta_i MKT_t + s_i SMB_t + h_i HML_t + w_i WML_t + \mathcal{E}_{it} \quad (3)$$

where, WML is the excess return of the momentum factor (winner minus loser) and w_i is the factor loading for the momentum factor. (Carhart, 1997.)

3.5 Fama-French five-factor model

Subsequent asset pricing literature has discovered several different factors that have been able to produce abnormal returns (alpha) and that cannot be explained by the previous risk factors. For instance, Novy-Marx (2013) shows that profitability is positively related to expected returns. Titman et al. (2004) document a negative but statistically significant relation between investment and expected returns. These results suggest that firms with higher profitability and lower investment are associated with higher expected returns than firms with lower profitability and higher investment.

Fama and French (2015) propose an extension of the three-factor model that adds investment and profitability to complement the previous model. They find that adding profitability and investment into the model help explain the cross-section of average returns in the U.S. stock markets. More interestingly, they find HML factor becomes rather redundant when the model is adjusted for profitability and investment. The proposed five-factor model is described as follows:

$$R_i - R_f = \alpha_i + \beta_i MKT_t + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + \mathcal{E}_{it} \quad (4)$$

where, RMW is the excess return of the profitability factor (robust minus weak), CMA is the return of the investment factor (conservative minus aggressive), and r_i and c_i are the factor loadings for the profitability and investment factors, respectively. (Fama & French, 2015.)

3.6 Fama-French six-factor model

A follow-up study by Fama and French (2018) further examines the asset pricing models and presents their most recent innovation, the six-factor model. The six-factor model is an expansion of the five-factor model that adds a momentum factor to the previous model. Moreover, it is an enhanced version of the five-factor model that explores which profitability factor contributes the most. The six-factor model is described as follows:

$$R_i - R_f = \alpha_i + \beta_i MKT_t + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + u_i UMD_t + \mathcal{E}_{it} \quad (5)$$

where, the UMD which is the excess return of the momentum factor (up minus down). Otherwise, the model specification is identical to the previous five-factor model. (Fama & French, 2018.)

Fama and French (2018) rank asset pricing models by using the maximum squared Sharpe ratio, Sh^2(f). The study uses both nested and non-nested models to test how each factor contributes to the explanation of expected returns and which factors produce the highest Sh^2(f). The nested models used to test a factor's marginal contribution to Sh^2(f) include the traditional CAPM, the three-factor model, and the five-factor model. Moreover, additional tests for non-nested models compare identical six-factor models, except one includes operating profitability and the other cash profitability. In tests of asset pricing models, they use the U.S. data from 1963 to 2016.

The spanning regressions for nested models indicate that additional factors, including operating profitability, cash profitability, and momentum, all of which are important determinants of expected stock returns, contribute to models and increase the models'

Sh^2(f). Both operating profitability (RMWo) and cash profitability (RMWc) improve the models, yet cash profitability (t-stat 7.88) outperforms operating profitability (t-stat 4.01). While momentum (UMD) also produces a positive marginal contribution, the evidence suggests that the six-factor model dominates the previous models. Moreover, the results for the non-nested models show that the six-factor model that uses cash profitability instead of operating profitability is superior, producing the highest maximum squared Sharpe ratio. (Fama & French, 2018.)

3.7 Sharpe ratio

The relationship between risk and return is perhaps the most potent cornerstone of financial theory. Prior literature suggests that financial assets carrying higher risk should be priced lower than similar assets with less risk and hence have higher expected returns to compensate investors for holding those risky assets. Since investors require higher returns for taking on additional risk, the portfolio performance must be adjusted for the risk it endures.

Sharpe (1966) introduces the Sharpe ratio, which is now probably the most widely used measure for assessing the portfolio's risk-adjusted performance. Sharpe ratio, also referred to as the reward-to-variability ratio, compares the portfolio's excess return to the total risk of the portfolio. The Sharpe ratio measures risk as the standard deviation of the portfolio's excess return. Thus, the equation for the Sharpe ratio is as follows:

$$Sharpe\ ratio = \frac{R_p - R_f}{\sigma_p} \qquad (6)$$

where R_p is the monthly return of a portfolio, R_f is the monthly risk-free rate, and σ_p is the standard deviation of the portfolio's excess return. (Sharpe, 1966; 1994.)

3.8 Sortino ratio

One of the shortcomings of the Sharpe ratio is that it penalizes for very high positive returns. Since sudden and big upside moves in stock prices can increase the portfolio's excess return, it simultaneously increases the portfolio's standard deviation and thus impacts the overall Sharpe ratio. Moreover, investors care more often about downside losses than upside gains and thus tend to be more focused on the portfolio's downside deviation. Thus, the Sortino ratio measures the portfolio's excess return against the downside risk it endures. Moreover, the Sortino ratio differs from the Sharpe ratio because it excludes positive returns and accounts only for the negative returns and the portfolio's downside deviation. (Sortino & van der Meer, 1991; Sortino & Price, 1994.)

Moreover, Sortino and van der Meer (1991) calculate the downside risk as the mean-root-square deviation below the minimum acceptable return. In this study, we are particularly concerned about the negative returns below the minimum acceptable returns. Thus, we describe the Sortino ratio as:

$$Sortino\ ratio\ = \frac{R_p - R_f}{\sqrt{\frac{1}{n}\sum R_{p<MAR}(R_p - MAR)^2}} \tag{7}$$

where R_p is the monthly return of a portfolio, R_f is the is the monthly risk-free rate, n is the number of observations, and MAR is the minimum acceptable return. (Sortino & van der Meer, 1991; Sortino & Price, 1994.)

4 DATA AND METHODOLOGY

This chapter introduces the data and methodology used in this study. The first part gives an overall description of the data employed in this study. The second part moves on to describe in detail the financial variables used in this study. Next, it presents the criteria for portfolio construction. Finally, the last part explains the methodology used in our empirical analysis.

4.1 Data

The initial sample of this study encompasses all active U.S. firms included in the S&P 500 market index. The monthly market data and accounting data for firms are retrieved from Refinitiv (Thomson Reuters) Eikon datastream. The monthly market data extends from January 2000 through December 2021. Following prior literature (see, e.g., Novy-Marx, 2013; Ball et al., 2020), portfolios are formed based on the accounting data from fiscal year *t-1* and merged with monthly excess returns of firms generated between June in fiscal year *t* and June in fiscal year *t+1*. Thus, the accounting data for firms is retrieved for the period from 1998 to 2020.

The monthly excess return for each stock is calculated from the total return of a stock less risk-free rate. Consistent with prior research, a risk-free rate used in this study is the U.S. one-month T-bill rate. The risk-free rates and necessary factor data for the regression analysis are obtained from Kenneth French's data library. Readily available U.S. risk factors consist of monthly excess returns for value, size, momentum, profitability, and investment factor. The market factor used in this study is constructed from the data of this study.

The sample consists of firms with a non-missing market value of equity, the book value of total assets, enterprise value, and all other income statement and balance sheet items needed to calculate gross profits, operating profits, accruals, and retained earnings. The financial variables chosen for this study are described in more detail in the following subchapter. The companies that do not have necessary accounting data for financial variables are excluded from this study. In addition, some firms might have ceased to exist, merged, or delisted during the sample period. Consistent with prior literature (see, e.g., Ball et al., 2020), financial companies are excluded from the sample due to differing interpretations of their financial statements. The data is also adjusted for any split.

The limitations of data and the availability of observations during the earlier periods are considered in several ways. Due to data availability, inactive firms are excluded from the sample. Since the sample covers only active firms, it is not free of survivorship bias. To mitigate survivorship bias, the market portfolio used in this study is the same as the data employed in this study. By conducting so, the market portfolio is also exposed to the same risk of survivorship bias to ensure a fair comparison of results.

Previous research has also dealt several different ways with illiquidity issues and other limits of arbitrage. Tikkanen and Äijö (2018) exclude the smallest 10% of companies to control for any biases stemming from small and illiquid stocks. Considering that S&P 500 constituent companies are widely regarded as stocks with large market capitalization, we decided not to exclude companies based on market capitalization in this study. In addition, we do not account for taxes nor transaction costs that may impact portfolio returns.

The final dataset encompasses 8470 company-year observations during the sample period. Albeit accounting data for firms is retrieved on a yearly basis, the excess returns for firms are calculated on a monthly basis. That is, each portfolio covers 264 monthly return observations over a 21-year period from January 2000 until the end of December 2021.

4.2 Financial ratios

This study ranks companies based on two factors: profitability and value. First, we define the financial variables chosen for this study. In the literature, these variables have been measured in several different ways. This study highlights the most recent research on profitability and value premium. Thus, the profitability ratios used in this study are gross profitability (GP) and cash profitability (CP). In addition, value variables chosen for this study are retained earnings-to-market (RE/ME) and earnings before interest and taxes-to-enterprise value (EBIT/EV). The financial variables chosen for this study are described in detail in this chapter.

4.2.1 Profitability variables

As explained earlier in chapter 2.1, the most recent profitability variables seek to find productive assets that tell us how efficiently a company is using its capital. More to the point, productive assets have become dominant not because of what they own but rather because of the value they create. Thus, the recent variables in the literature are constructed to tell how much economic profit a company generates per dollar of capital employed in the business. Hence, the one common trait for these variables is that they scale profits by assets.

Following Novy-Marx (2013), gross profitability is measured by calculating the ratio of gross profits to total assets. Gross profits are calculated as revenues minus the cost of goods sold. Thus, gross profits are designed simply to capture the top-line profitability of a business. Further, to derive the gross profitability ratio, gross profits are scaled down by the book value of total assets, in year $t-1$. Thus, the formula of gross profitability is described as follows:

$$\text{Gross profitability} = \frac{Revenue - Cost\ of\ goods\ sold\ (COGS)}{Total\ assets} \tag{8}$$

Following Ball et al. (2016), cash-based operating profitability (cash profitability) is calculated as the ratio of cash profits to total assets. Cash profitability is an enhanced metric for operating profitability, which converts operating profits to a cash basis by accounting for accruals. Following the original definition of operating profitability by Ball et al. (2015), the difference between gross profits and operating profits is operating expenses. Thus, operating profits can be measured as revenues minus cost of goods sold minus selling, general, and administrative (SG&A) expenses (excluding expenses on research and development). Hence, the formula for operating profits is expressed as follows:

$$Operating\ profits = Revenue - Cost\ of\ goods\ sold\ (COGS) - Selling, \\ general, and\ administrative\ (SG\&A)\ expenses \quad (9)$$

Accruals are, by definition, accounting items that can inflate the current year's profit but have not yet been converted into cash. Following Ball et al. (2016), accruals are calculated from the changes in balance sheet items on a year-to-year basis. Thus, the accruals component is defined as follows:

$$\text{Accuals} = -\Delta(Accounts\ receivable) - \Delta(Inventory) + \Delta(Prepaid\ expenses) \\ + \Delta(Deferred\ revenue) + \Delta(Accounts\ payable) \\ + \Delta(Accrued\ expenses) \quad (10)$$

According to Ball et al. (2016), cash profitability adjusts the operating profits with accruals. Further, these cash profits are scaled down by the book of total assets, in year $t-1$. Thus, the ratio of cash profitability is denoted as follows:

$$\text{Cash profitability} = \frac{Operating\ profits + Accruals\ adjustment}{Total\ assets} \quad (11)$$

4.2.2 Value variables

As discussed in chapter 1.2 and 2.2, our innovation for this study was to investigate profitability-based value factors. While the E/P ratio is commonly deemed as a traditional proxy for earnings yield, the prior literature has shown that EBIT/EV and RE/ME ratios better predict future returns and seem to be better proxies for earnings yield. Each metric gives us the same information but in a slightly different way. EBIT/EV ratio measures how much operating earnings a firm generates relative to its enterprise value. RE/ME ratio measures how much the market is willing to pay price for the accumulated earnings a firm has generated and not distributed as dividends.

Inspired by Ball et al. (2020), this study employs retained earnings-to-market as a proxy for the value factor. Retained earnings-to-market is used rather than the traditionally used book-to-market (B/M) or earnings-to-price (E/P) for several reasons. First, Ball et al. (2020) show that high RE/ME stocks are associated with higher future returns than high B/M stocks. Second, they find that B/M predicts returns only because the book value of equity contains information about retained earnings. Third, they find that RE/ME predicts higher future earnings and tends to be a better proxy for underlying earnings yield than E/P ratio.

Consistent with Ball et al. (2020), this study calculates RE/ME as the ratio of retained earnings to the market value of equity. Thus, we decompose the book value of equity in parts and use only retained earnings as the denominator. By dividing retained earnings by the market value of equity, in year $t-1$, the formula for RE/ME ratio can be denoted as follows:

$$\frac{RE}{ME} = \frac{Retained\ earnings}{Market\ value\ of\ equity} \tag{12}$$

Motivated by the original magic formula by Greenblatt (2010), the second profitability-based value variable chosen for this study is earnings before interest and taxes to enterprise value (EBIT/EV). EBIT/EV ratio serves as a proxy for value for several reasons. First, many companies are at least partially financed by debt, and thus enterprise value allows us to compare firms with different levels of debt. Thus, EBIT/EV ratio is also widely used valuation metric in corporate finance, as it measures how much a firm earns relative to the purchase price of the business. Moreover, the recent evidence in the literature by Tikkanen and Äijö (2018) shows that EBIT/EV ratio is single the best predictor of investment returns in the European stock market when compared to other value strategies.

Consistent with the previous literature, EBIT is simply calculated as earnings before interest and taxes. Enterprise value is defined as market capitalization plus preferred stock, minority interest, and total debt, minus cash. The formula for the EBIT/EV ratio is thus calculated as:

$$\frac{EBIT}{EV} = \frac{Earnings\ before\ interest\ and\ taxes}{Enterprise\ value} \tag{13}$$

4.3 Portfolio formation

To test the chosen variables and the combined performance of profitability and value, several different portfolios are constructed based on the financial variables used in this study. First, portfolios are formed as stand-alone strategies based on each value and profitability variable. Next, portfolios are constructed based on a combination of profitability and value. For combination strategies, GP and CP ratios are combined with RE/ME and EBIT/EV ratios to form two combinations based on each ratio. Finally, this study tests both high and low portfolios for each strategy.

Following previous literature (see, e.g., Novy-Marx, 2013; Ball et al., 2020), the holding period for each portfolio is one year, and the portfolios are formed on the last trading day of June each year. The portfolio formation is based on the latest financial information available, taken at the end of the previous year, $t-1$. The monthly excess returns for portfolios are calculated from the end of June in year t, and held for one year, until the end of next June in year $t + 1$. The monthly excess return of a stock is calculated as the monthly return minus the risk-free rate.

Consistent with previous literature (e.g., Tikkanen & Äijö, 2018), high portfolios are constructed for the top 20% of stocks based on each profitability and value variable. For comparison, low portfolios are constructed for the bottom 20% of stocks based on each variable. To test the combined performance of profitability and value, the combination portfolios are constructed based on the highest combined ranks of profitability and value. This methodology closely follows the one of Davydov et al. (2016), which mimics the underlying concept of the magic formula in portfolio formation. Hence, the combination portfolios are constructed based on equal weights as follows:

1. The first step ranks all firms based on the chosen profitability variable. The firm with the highest GP or CP ratio is assigned first place, and vice versa, the firm with the lowest GP or CP ratio is assigned last place.

2. The second step ranks firms based on the chosen value variable. Similarly, the firm with the highest RE/ME or EBIT/EV ratio is assigned first place, and vice versa, the firm with the lowest RE/ME or EBIT/EV is assigned last place.

3. The last step takes the average rankings of firms based on profitability and value variables. If a firm is assigned sixth based on the GP ratio and ninth based on the RE/ME ratio, its average ranking will be 7.5. Finally, portfolios are formed based on their average rankings.

4.4 Methodology

The methodology of this study extends the study of Novy-Marx (2014) and closely follows the one of Davydov et al. (2016) and Tikkanen and Äijö (2018). To test risk-adjusted implications of the strategies, the performance is tested with several methods. The traditional risk-adjusted metrics chosen for this study are the Sharpe ratio and Sortino ratios. The Sharpe ratio is tested mainly because it is widely accepted and perhaps the most used measure of risk-adjusted performance in the field of finance. Since the Sharpe ratio tends to penalize very high returns, the Sortino ratio is used in this study to test the downside risk of a portfolio. For the same reason, the worst monthly drawdowns are analyzed.

Furthermore, the abnormal returns of the portfolios are tested with asset pricing models. Fama and French (2015) show that asset pricing models are empirically reliable for testing whether portfolios produce abnormal returns. Therefore, the Ordinary Least Square (OLS) regressions are employed to test the excess returns of the portfolios. The regressions for portfolios are employed based on two asset pricing models, which are the Carhart (1997) 4-factor model and the Fama-French (2015) 5-factor model. This check confirms that the interpretations are not driven by a specific model.

The Sharpe ratio appears often in similar studies, and thus it is also used in this study. As covered in chapter 3., the Sharpe ratio takes the portfolio's excess return and compares it against the risk it endures. Risk is defined as the standard deviation of the portfolio's excess return. The Sharpe ratio is calculated as:

$$Sharpe\ ratio\ = \frac{R_p - R_f}{\sigma_p} \tag{6}$$

where, R_p is the monthly return of a portfolio, R_f is the monthly risk-free rate, and σ_p is the standard deviation of the portfolio's excess return.

In addition, the Sortino ratio is used in this study to address the fundamental problems of the Sharpe ratio. As covered in detail in chapter 3, the Sortino ratio divides the portfolio's excess return by the downside risk of the portfolio. The downside risk is captured by calculating the mean-root-square deviation below the minimum acceptable return.

This study uses the risk-free rate as the minimum acceptable return. Thus, the Sortino ratio is calculated as:

$$Sortino\ ratio\ = \frac{R_p - R_f}{\sqrt{\frac{1}{n}\sum R_{p<MAR}(R_p - MAR)^2}} \qquad (7)$$

where R_p is the monthly return of a portfolio, R_f is the is the monthly risk-free rate, n is the number of observations, and MAR is the minimum acceptable return.

Consistent with previous literature, portfolios' excess returns are tested using the asset pricing models. Following Davydov et al. (2016), Carhart's (1997) 4-factor model is used to test whether the potential outperformance of the combinations, profitability, and value portfolios can be explained by the risk factors. In 4-factor regressions, the market, size, value, and momentum factors are used as independent variables of the regressions. As covered in chapter 3, the 4-factor alpha is estimated with the following time-series regression:

$$R_i - R_f = \alpha_i + \beta_i MKT_t + s_i SMB_t + h_i HML_t + w_i WML_t + \mathcal{E}_{it} \qquad (3)$$

where, R_i is the return on portfolio i, R_f is the risk-free rate, α_i is the regression intercept, MKT is the excess return of the market portfolio, SMB is the excess return of the size factor (small minus big), HML is the excess return of the value factor (high book-to-market minus low book-to-market), WML_t is the return on the momentum factor, β_i, s_i, h_i, w_i are the factor loadings, and $\mathcal{E}_{it}$ is the error term of the regression.

Following Tikkanen and Äijö (2018), the Fama-French (2015) 5-factor model is used to test whether the risk factors can explain the potential abnormal returns. As covered in chapter 3, the 5-factor model excludes the momentum factor and incorporates two new factors into the model to test the abnormal returns emanating from profitability and investment not captured by the original 3-factor model. The 5-factor alpha is estimated with the following time-series regression:

$$R_i - R_f = \alpha_i + \beta_i MKT_t + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + \mathcal{E}_{it} \qquad (4)$$

where, RMW is the excess return of the profitability factor (robust minus weak), CMA is the return of the investment factor (conservative minus aggressive), and r_i and c_i are the factor loadings for the profitability and investment factors, respectively.

In this study, the results mainly consider the risk-adjusted performance of high and low portfolios based on each strategy. However, in order to further elaborate on the difference between high and low portfolios, the statistical significance of the zero-cost strategies is also analyzed. The risk-adjusted spreads between high and low portfolios are considered by regressing the zero-cost strategy on the factor models. The study reports both 4-factor and 5-factor alpha spread for all strategies investigated.

5 EMPIRICAL RESULTS

This chapter goes through the empirical results of this study. First, the descriptive statistics of the sample are summarized. Second, the empirical results of the traditional profitability and value portfolios are analysed. Third, the empirical results of the combination strategies are presented. Finally, the last part discusses the results and compares the performance of different strategies in attempt to address the research question of whether profitable value stocks outperform unprofitable growth stocks in the U.S. markets.

In addition, the aim of this chapter is to examine whether the research hypotheses of this study hold true. First and foremost, it is of interest to test the combined performance of profitability and value. Considering the previous research on profitability and value premium, this study expects significant synergies between the two and that combining profitability and value strategies outperform their peers. In addition, it is investigated whether the combination strategies can outperform those solely built on profitability or value. The research hypotheses are presented in detail in chapter 1.2.

5.1 Descriptive statistics

In this section, descriptive statistics of the sample are summarized. First, the descriptive statistics are presented for the market portfolio. Second, the descriptive statistics of stand-alone strategies are analysed. The final part moves on to discuss the descriptive statistics of the combination strategies. To illustrate the performance of different strategies over the sample period, the cumulative monthly returns of portfolios are presented in Figure 1, 2, and 3.

Table 1 below presents the number of firms per year included in the final sample. The table reports the number of firms for each financial variable and the market portfolio. In total, the final sample for firms encompasses 8470 company-year observations over the sample period from 2000 to 2021. The number of firms in the sample varies due to data availability.

Table 1. The number of firms in the final sample

	Year																						
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
S&P 500	327	335	338	347	352	354	354	364	370	382	388	395	403	412	412	413	415	418	422	423	423	423	8470
EBIT/EV	314	320	325	327	336	342	344	351	360	366	372	380	381	395	399	406	404	407	412	416	419	423	8199
RE/ME	296	303	308	315	323	332	337	343	350	356	361	372	379	389	397	404	407	410	412	419	421	423	8057
GP	327	335	338	347	352	354	354	364	370	382	388	395	403	412	412	413	415	418	422	423	423	423	8470
CP	298	317	327	337	346	349	349	360	365	378	383	392	400	406	406	407	409	412	416	418	418	418	8311

Table 2 below presents the descriptive statistics for the market portfolio. In total, the market portfolio covers 264 monthly return observations over 21 years from January 2000 to December 2021. The mean annual return for the market portfolio is 8.23%. The median monthly return and standard deviation for the market are 1.2% and 4.3%, respectively, or 14.4% and 51.6% as annualized. The skewness of -1.084 and kurtosis of 4.500 for the market indicate that the distribution of monthly returns is slightly left-hand skewed and associated with thick tails. These indicate that fairly a high number of observations are in the tails rather than around the mean of the distribution.

Table 2. Descriptive statistics for market portfolio

S&P 500 market index	n	Mean (annual)	Median	Standard deviation	Skewness	Kurtosis
Panel A: All stocks						
S&P 500	264	8.23%	0.012	0.043	-1.084	4.500

Panel A presents descriptive statistics for the market portfolio. The sample period is from January 2000 to December 2021. The mean returns are calculated based on the monthly return time-series, but reported values are annualized. Median, standard deviation, skewness, and kurtosis statistics are reported based on the monthly returns.

Table 3 presents the descriptive statistics for the high and low stand-alone portfolios based on each variable. Consistent with prior research on profitability and value premiums, the results on Panel A and Panel B show that the high portfolios produce higher returns than low portfolios for all strategies investigated. The best performance of stand-alone strategies is observed in descending order for GP (14.00%), RE/ME (12.50%), CP (10.91%), and EBIT/EV (10.78%), all of which are ranked based on the top 20% of each variable. The worst performing strategies are GP (4.08%), CP (8.08%), RE/ME (8.17%), and EBIT/EV (8.82%), all of which are ranked based on the bottom 20% of each variable.

Table 3. Descriptive statistics for stand-alone strategies.

Stand-alone strategies	GP	CP	RE/ME	EBIT/EV
Panel A: High				
Mean (annual)	14.00%	10.91%	12.50%	10.78%
Standard deviation	0.045	0.042	0.051	0.051
Skewness	-0.550	-0.664	-0.982	-1.182
Kurtosis	1.610	1.577	4.080	4.612
n	264	264	264	264
Panel B: Low				
Mean (annual)	4.08%	8.08%	8.17%	8.82%
Standard deviation	0.054	0.057	0.059	0.064
Skewness	-1.144	-0.801	-0.763	-0.599
Kurtosis	4.844	2.258	3.116	1.705
n	264	264	264	264
Panel C: Variables				
Mean	0.329	0.083	0.144	0.059
Median	0.273	0.105	0.192	0.063
25th	0.163	0.060	0.055	0.040
75th	0.442	0.162	0.353	0.085

Panel A presents descriptive statistics for the top 20% of stocks based on each financial variable. The sample period is from January 2000 to December 2021. The mean returns are calculated based on the monthly return time-series, but reported values are annualized. Median, standard deviation, skewness, and kurtosis statistics are reported based on the monthly returns. Panel B reports descriptive statistics for the bottom 20% of stocks based on each financial variable. Panel C reports the mean, median, 25th percentile and 75th percentile of each financial variable.

While high value and profitability portfolios produce higher returns than low portfolios, they also exhibit much lower volatility. The standard deviation of monthly returns ranges from 4.2% to 5.1% (5.4% to 6.4%) between high (low) portfolios. Overall, closer inspection of results shows that value portfolios experience higher volatility than profitability, hence having a higher risk. The lowest monthly standard deviations are with high CP and GP strategies, 4.2% and 4.5%, respectively. Panel C of Table 3 reports the mean, median, 25th, and 75th percentile of the ratios for each financial variable used in the portfolio formation.

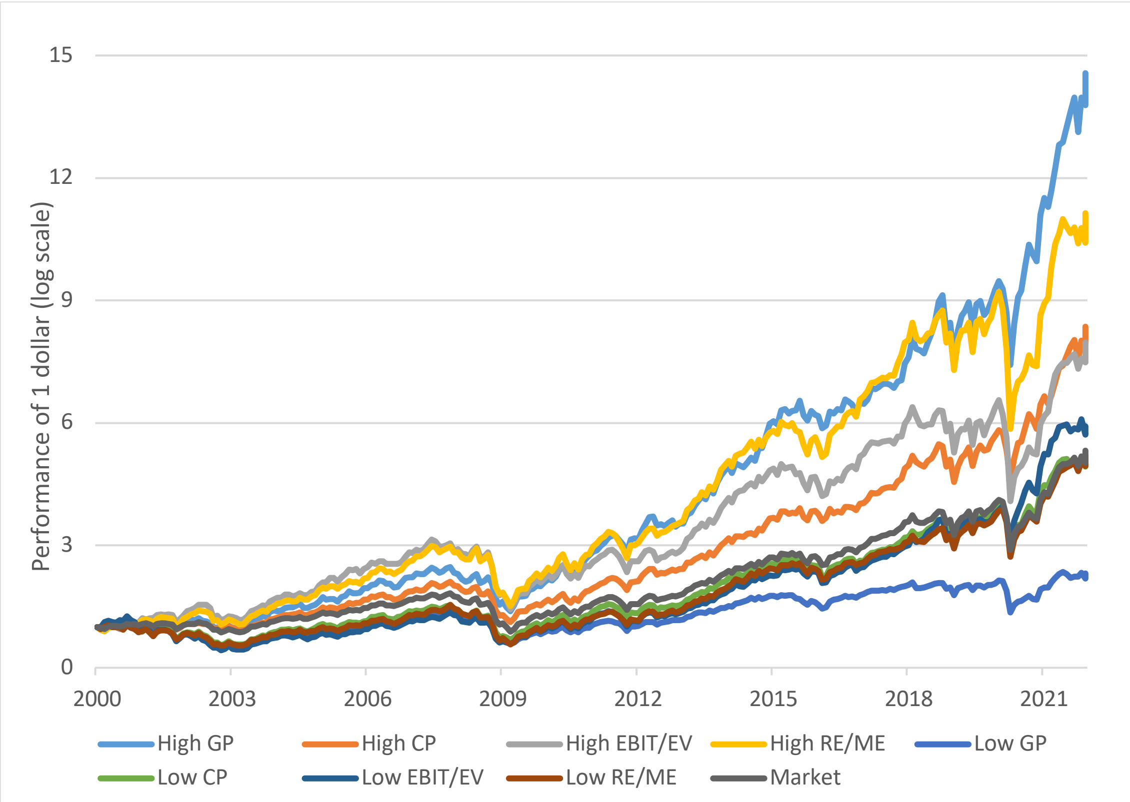

Figure 1. Performance of stand-alone strategies and the S&P 500 index

Figure 1 above presents the cumulative monthly returns for the high and low stand-alone portfolios based on each variable over 21 years. The figure illustrates that value and profitability portfolios outperform the market during the sample period. From the chart, it can be seen that by far the best performance is achieved by the GP strategy. In addition, except for the low EBIT/EV strategy, low portfolios underperform the market index during the sample period.

The descriptive statistics for combination strategies are presented in Table 4. Panel A and Panel B show that, for all investigated strategies, the high combinations of profitability and value outperformed the low combinations during the sample period. The highest compound annual growth rates are observed with high portfolios formed based on GP & RE/ME (13.34%), GP & EBIT/EV (13.16%), CP & EBIT/EV (12.12%), and CP & RE/ME (11.64%), all of which are higher than 8.23% observed on the market during the sample period. Correspondingly, the mean returns range from 4.59% (GP & RE/ME) to 7.43% (CP & RE/ME) among low portfolios, all of which are significantly lower than that of the market index.

Table 4. Descriptive statistics for combination strategies

Combination strategies	GP & EBIT/EV	CP & EBIT/EV	GP & RE/ME	CP & RE/ME
Panel A: Top 20%				
Mean (annual)	13.16%	12.12%	13.34%	11.64%
Standard deviation	0.046	0.045	0.045	0.044
Skewness	-0.703	-0.960	-0.722	-0.928
Kurtosis	2.046	3.585	2.205	3.862
n	264	264	264	264
Panel B: Bottom 20%				
Mean (annual)	4.67%	6.54%	4.59%	7.43%
Standard deviation	0.059	0.060	0.059	0.064
Skewness	-0.823	-0.781	-0.823	-0.759
Kurtosis	2.984	2.845	2.992	2.607
n	264	264	264	264

Panel A presents descriptive statistics for the top 20% of stocks based on combinations of profitability and value. The sample period is from January 2000 to December 2021. The mean returns are calculated based on the monthly return time-series, but reported values are annualized. Median, standard deviation, skewness, and kurtosis statistics are reported based on the monthly returns. Panel B reports descriptive statistics for the bottom 20% of stocks based on combinations of profitability and value.

Considering the standard deviation of combination strategies, Table 4 shows that high portfolios exhibit lower volatility than low portfolios. The standard deviation of monthly returns is ranging from 4.4% (CP & RE/ME) to 4.6% (GP & EBIT/EV) among high portfolios, while from 5.9% (GP & EBIT/EV) to 6.4% (CP & RE/ME) among low portfolios.

Figure 2 demonstrates the cumulative performance of combination strategies compared to the market portfolio. It is rather easy to conclude from this chart that high portfolios of profitable value produce substantially higher absolute returns than the overall market. While low portfolios underperform, unprofitable growth stocks tend not only to produce lower returns but also exhibit much higher volatility.

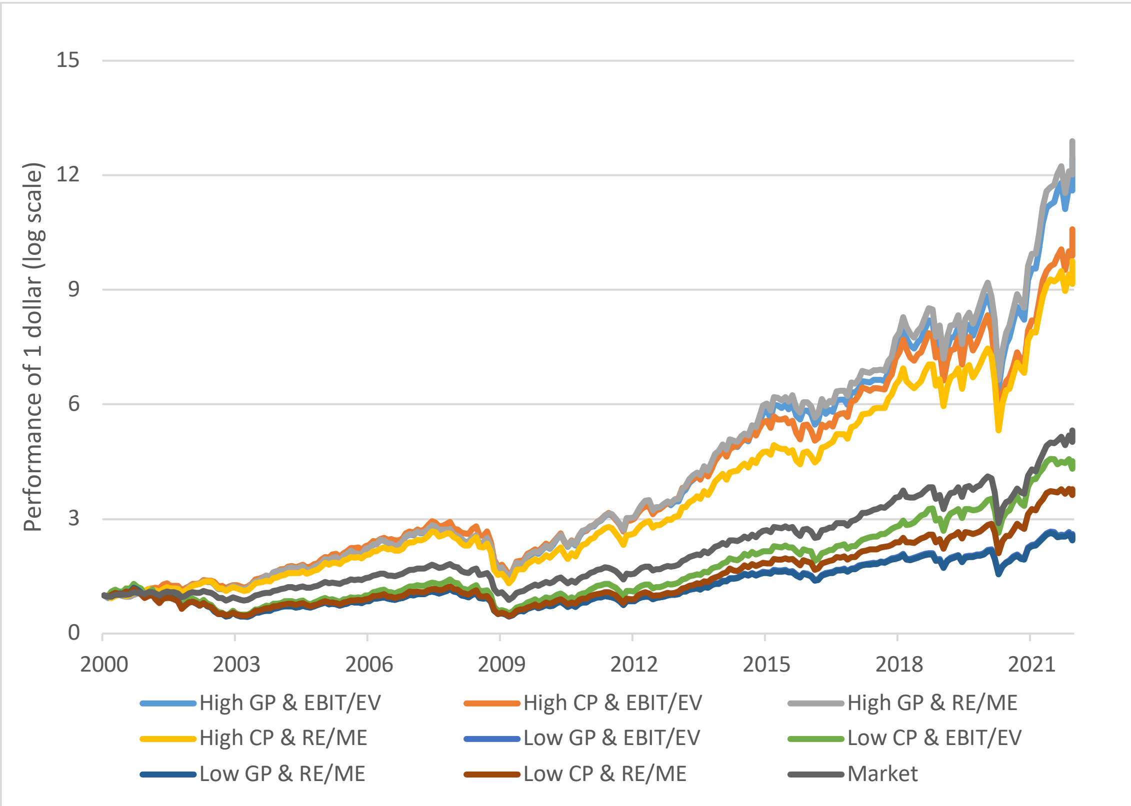

Figure 2. Performance of combination strategies and the S&P 500 index

When comparing combinations and stand-alone strategies, the highest compound annual growth rates are achieved by GP (14.00%), followed by the GP & RE/ME (13.34%), and GP & EBIT/EV (13.16%) strategies. More interestingly, the results show that combining profitability with value improves the absolute performance of CP, EBIT/EV, RE/ME strategies. Yet it seems not to be the case for GP. When running alone, GP is able to provide single the highest annual returns, albeit more volatile, than that of the broader market. Figure 3 illustrates the performance of combinations and stand-alone strategies based on high portfolios of each category.

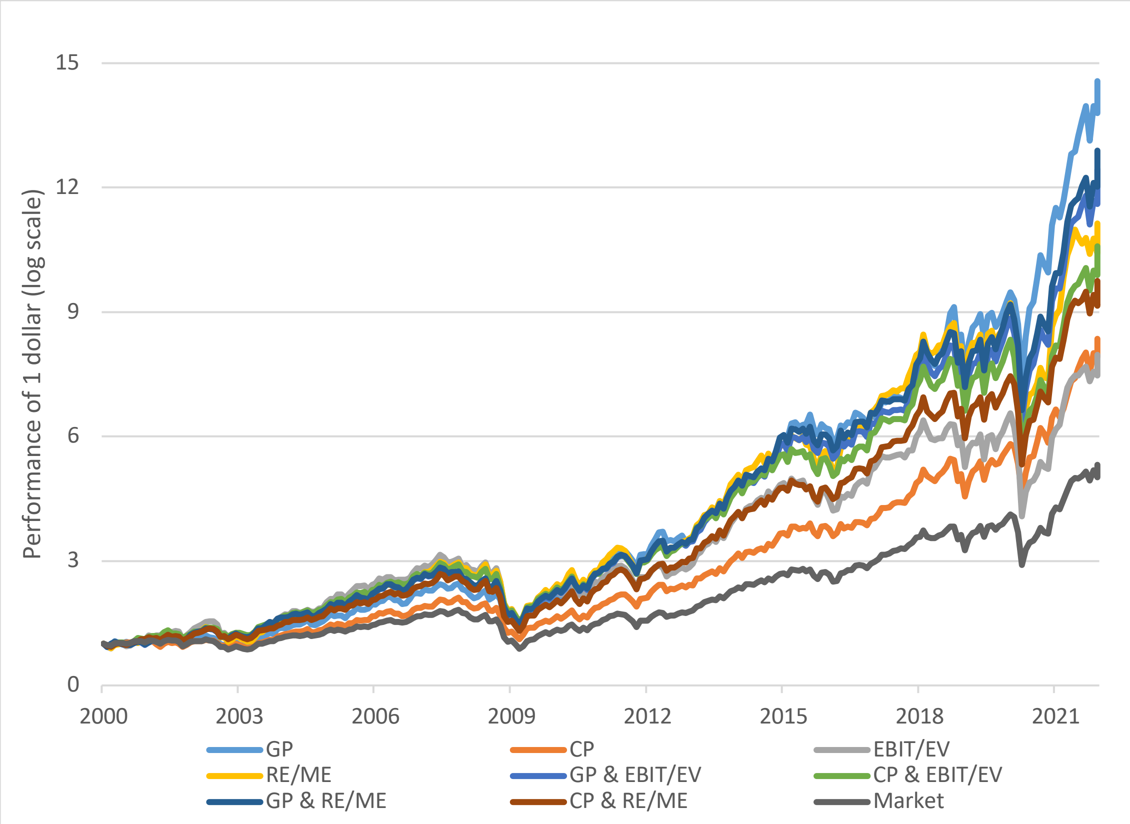

Figure 3. Stand-alone value and profitability versus combinations

5.2 Stand-alone profitability and value

This subsection analyses the risk-adjusted performance of stand-alone strategies and the market portfolio. The stand-alone strategies consist of high and low portfolios based on the top 20% and bottom 20% of stocks based on each ratio. The empirical analysis consists of several methods, including the analysis of performance ratios and regression results of each investigated portfolio. First, the annualized Sharpe and Sortino ratios of each strategy are analysed. Next, the annualized abnormal returns and factor loadings are analysed by using Carhart's (1997) 4-factor model and the Fama-French (2015) 5-factor model. The methodology is covered in detail in chapter 4.4.

Table 5 below shows the risk-adjusted performance measures for the market portfolio. During the sample period, the market portfolio's annualized Sharpe and Sortino ratios are 0.483 and 0.673, respectively. The maximum monthly drawdown observed for the S&P 500 is -21.57% over the sample period from January 2000 to December 2021.

Table 5. Risk adjusted performance measures for market portfolio

Risk-adjusted performance	Sharpe	Sortino	Max Drawdown
Panel A: Market portfolio			
S&P 500	0.483	0.673	-21.57%

Table 3 presents the market portfolio's annualized Sharpe ratio, Sortino ratio, and maximum monthly drawdown. The performance ratios are calculated based on the monthly return time-series during the sample period from January 2000 to December 2021.

Table 6 presents the risk-adjusted performance measures for the stand-alone value and profitability portfolios over the sample period from January 2000 to December 2021. The results clearly show that the Sharpe ratios for the high (low) portfolios are consistently higher (lower) than that for the broader market (0.483). The highest Sharpe ratio is obtained for the GP strategy (0.757), ahead of CP (0.631) and RE/ME (0.630) strategy, suggesting that profitability strategies tend to outperform value strategies when adjusting for risk. The Sharpe ratios for the low portfolios range between 0.222 (GP) and 0.256 (EBIT/EV). These findings are broadly consistent with prior literature; both profitability and value portfolios provide much higher risk-adjusted returns than unprofitable and growth portfolios.

Table 6 also reports the Sortino ratios for all portfolios based on value and profitability. Again, the high (low) value and profitability portfolios provide substantially higher (lower) Sortino ratios than 0.673 of the market portfolio. While the high GP portfolio has the highest Sortino ratio of 1.173, the high EBIT/EV strategy has the lowest of 0.744. Moreover, the low value portfolios have higher Sortino ratios than low profitability portfolios. Overall, these cases suggest that portfolios with high profitability produce greater returns with lower risk than value portfolios.

Table 6. Risk-adjusted performance measures for stand-alone strategies

Risk-adjusted performance measures	GP	CP	RE/ME	EBIT/EV
Panel A: High				
4-factor alpha	4.74%***	2.52%***	2.88%***	1.05%
t-stat	(3.475)	(3.004)	(3.291)	(0.959)
5-factor alpha	4.00%***	2.01%**	1.49%*	-0.57%
t-stat	(3.455)	(2.321)	(1.687)	(-0.532)
Sharpe	0.757	0.631	0.630	0.536
Sortino	1.173	0.935	0.906	0.744
Max drawdown	-19.20%	-17.47%	-25.05%	-27.63%
Panel B: Low				
4-factor alpha	-4.00%***	-3.74%***	-4.09%***	-2.97%*
t-stat	(-3.275)	(-2.873)	(-3.447)	(-1.757)
5-factor alpha	-2.85%**	-0.86%	-2.11%*	0.94%
t-stat	(-2.326)	(-0.719)	(-1.809)	(0.654)
Sharpe	0.222	0.228	0.232	0.256
Sortino	0.294	0.310	0.316	0.354
Max drawdown	-28.03%	-25.10%	-26.78%	-26.79%
Panel C: High-Low				
4-factor alpha spread	8.74%***	6.26%***	6.97%***	4.02%**
t-stat	(4.492)	(3.894)	(4.394)	(1.828)
5-factor alpha spread	6.85%***	2.87%*	3.60%**	-1.51
t-stat	(3.488)	(1.938)	(2.446)	(-0.836)

Panel A presents the risk-adjusted performance measures for the top 20% of stocks based on each financial variable. The table shows the annualized abnormal returns of Carhart (1997) 4-factor and the Fama-French (2015) 5-factor model and their t-statistics in parentheses. The Sharpe and Sortino ratios are calculated based on the monthly return time-series, but reported values are annualized. Maximum monthly drawdowns of each portfolio are also presented. Panel B reports the same key figures for low portfolios. Panel C presents the regression intercepts for the zero-cost strategies. *, **, and *** indicate the statistical significance at 10%, 5%, and 1% level, respectively. The sample period is from January 2000 to December 2021.

With regards to the maximum drawdowns of stand-alone strategies, Table 6 shows that the maximum monthly drawdowns range between -17.47% (-25.10%) and -27.63% (-28.03%) between the high (low) portfolios. The highest monthly drawdown for high portfolios is observed for the EBIT/EV strategy (-27.63%), followed by RE/ME (-25.05%), GP (-19.20%), and CP (-17.47%) strategies, suggesting that value portfolios tend to suffer worse drawdowns than profitability portfolios. As shown in Table 5, the worst monthly drawdown for the market is 21.57%, slightly higher than drawdowns of profitability portfolios but lower than those of value portfolios.

Table 6 also reports the annualized abnormal returns for each investigated portfolio. Except for the EBIT/EV strategy, high portfolios based on GP, CP, and RE/ME are all observed to have statistically significant and positive 4-factor and 5-factor alpha. Yet EBIT/EV strategy produces a positive 4-factor alpha of 1.05%; it is not statistically significant. While the GP strategy produces single the highest 4-factor alpha of 4.74%, it also has the highest 5-factor alpha of 4.00%. Regarding the low portfolios, the RE/ME strategy has the lowest 4-factor alpha of -4.09%. In the case of 5-factor regressions, the low GP strategy produces single the lowest abnormal returns, with a 5-factor alpha of -2.85%. More detailed 4-factor and 5-factor specifications are provided in Table 7 and 8.

Panel C of Table 6 presents the regression intercepts for long-short portfolios. The most significant 4-factor alpha for zero-cost strategies is observed for the GP strategy (8.74%), followed by RE/ME (6.79%) and CP strategies (6.26%), all of which are statistically significant at 1% level. The results are somewhat similar to 5-factor regressions; the most significant alphas are achieved by the GP portfolios (6.85%), followed by RE/ME (3.60%) and CP portfolios (2.87%). While the 5-factor alpha for the long-short GP portfolios is statistically significant at 1%, the RE/ME and CP strategies are statistically significant at 5% and 10% levels, respectively. The long-short EBIT/EV strategy has a positive and statistically significant 4-factor alpha at 5% level, but it appears to be negative and statistically insignificant when controlling for the 5-factor model. More specified interpretations for long-short strategies can be found in Table 9.

Table 7. The 4-factor model regression results for stand-alone strategies

4-factor model	GP	CP	RE/ME	EBIT/EV
Panel A: High				
Alpha	4.74%***	2.52%***	2.88%***	1.05%
	(4.225)	(3.004)	(3.291)	(0.959)
MKT	1.016***	0.978***	1.078***	1.107***
	(40.576)	(52.197)	(55.199)	(45.276)
SMB	0.045	-0.032	0.049**	0.002
	(1.466)	(-1.431)	(2.069)	(0.080)
HML	-0.176***	-0.189***	0.164***	0.258***
	(-6.014)	(-8.666)	(7.199)	(9.037)
WML	0.027	0.026*	-0.034**	0.032*
	(1.359)	(1.792)	(-2.172)	(1.664)
R^2	0.895	0.931	0.948	0.922
Panel B: Low				
Alpha	-4.00%***	-3.74%***	-4.09%***	-2.97%*
	(-3.275)	(-2.873)	(-3.447)	(-1.757)
MKT	1.132***	1.157***	1.243***	1.257***
	(41.485)	(39.746)	(46.855)	(33.346)
SMB	0.015	0.268***	0.153***	0.272***
	(0.458)	(7.544)	(4.718)	(5.912)
HML	-0.016	-0.373***	-0.265***	-0.533***
	(-0.529)	(-10.982)	(-8.551)	(-12.108)
WML	-0.072***	-0.100***	-0.090***	-0.137***
	(-3.326)	(-4.336)	(-4.279)	(-4.591)
R^2	0.909	0.909	0.928	0.879

The table reports the OLS regression results for Carhart's (1997) 4-factor model. Panel A presents the annualized abnormal returns (regression intercepts) and the factor loadings for the top 20% of stocks based on each financial variable. Panel B reports the results for low portfolios. R^2 indicates the goodness-of-fit. The t-statistics are in parentheses. *, **, and *** indicate the statistical significance at 10%, 5%, and 1% level, respectively. The sample period is from January 2000 to December 2021.

When investigating the 4-factor model specification in Table 7, Panel A shows that the high portfolios based on GP (4.74%), CP (2.52%), and RE/ME (2.88%) produce a positive and statistically significant alpha at 1% level. Yet the EBIT/EV strategy produces a positive 4-factor alpha of 1.05%; it is not statistically significant. The factor loadings show that the market risk (MKT) factor and value (HML) factor are the most significant contributors to the model, both of which are statistically significant at 1% level across regressions. The factor loading for the market risk varies between 0.978 (GP) and 1.107 (RE/ME), suggesting value portfolios tend to have slightly higher betas than profitability portfolios.

More interestingly, the HML factor loadings show that the high profitability portfolios have negative tilts of -0.176 (GP) and -0.189 (CP) towards value. This notion supports the thesis that profitability and value strategies are negatively correlated. Vice versa, both RE/ME and EBIT/EV high portfolios have positive HML loadings of 0.164 and 0.258, respectively, which is natural since both are deemed as value strategies. Moreover, all strategies seem to be positively associated with size, except for the CP strategy, which is negatively tilted towards SMB. In addition, RE/ME portfolio is negatively associated with the momentum factor, while others have positive tilts towards WML. This is consistent with the literature, as value strategies tend to be negatively correlated with momentum strategies. However, as with the EV/EBIT strategy, the value portfolio is positively associated with momentum, suggesting that EV/EBIT strategy is somewhat different from the typical value strategy.

On the question of low portfolios and the 4-factor model, Panel B of Table 7 shows that all investigated portfolios produce negative and statistically significant alphas over the sample period. The most negative alphas are observed for the low RE/ME (-4.09%), GP (-4.00%), and CP (-3.74%) strategies, all of which are statistically significant at a 1% level. The low EBIT/EV portfolio has a negative alpha of -2.97% with a statistical significance of 5%. The loadings on the market factor range between 1.132 and 1.257, implying that the low portfolios have higher exposure to the market risk than the high ones. Contrary to high portfolios, low portfolios are negatively associated with HML and WML factors, implying that these portfolios tend to own stocks with growth and poor momentum characteristics.

Table 8. The 5-factor model regression results for stand-alone strategies

5-factor model	GP	CP	RE/ME	EBIT/EV
Panel A: High				
Alpha	4.00%***	2.01%**	1.49%*	-0.57%
	(3.445)	(2.231)	(1.687)	(-0.532)
MKT	1.018***	0.978***	1.122***	1.121***
	(41.923)	(53.827)	(60.392)	(49.860)
SMB	0.095***	0.006	0.091***	0.114***
	(2.669)	(0.224)	(3.319)	(3.451)
HML	-0.248***	-0.229***	0.075**	0.138***
	(-6.369)	(-7.880)	(2.534)	(3.837)
RMW	0.108***	0.090***	0.122***	0.230***
	(2.648)	(2.945)	(3.910)	(6.052)
CMA	0.036	0.013	0.099**	0.054
	(0.629)	(0.229)	(2.247)	(1.015)
R^2	0.897	0.993	0.951	0.931
Panel B: Low				
Alpha	-2.85%**	-0.85%	-2.11%*	0.94%
	(-2.326)	(-0.719)	(-1.809)	(0.654)
MKT	1.150***	1.144***	1.237***	1.251***
	(44.775)	(45.745)	(50.430)	(41.298)
SMB	-0.119***	0.050	0.018	-0.061
	(-3.147)	(1.369)	(0.498)	(-1.362)
HML	0.072*	-0.186***	-0.104***	-0.288***
	(1.757)	(-4.655)	(-2.643)	(-5.923)
RMW	-0.249***	-0.441***	-0.285***	-0.657***
	(-5.731)	(-10.412)	(-6.896)	(-12.857)
CMA	0.060	-0.121**	-0.157***	-0.026
	(0.978)	(-2.033)	(-2.678)	(-0.370)
R^2	0.916	0.931	0.936	0.919

The table reports the OLS regression results for the Fama and French (2015) five-factor model. Panel A presents the annualized abnormal returns (regression intercepts) and the factor loadings for the top 20% of stocks based on each financial variable. Panel B reports the results for the low portfolios. R^2 indicates the goodness-of-fit. The t-statistics are in parentheses. *, **, and *** indicate the statistical significance at 10%, 5%, and 1% level, respectively. The sample period is from January 2000 to December 2021.

Regarding the 5-factor model specification, Panel A of Table 8 reports the annualized alphas and factor loadings for the high value and profitability portfolios. The results show that, even after adding two new factors, the regression alphas remain positive and statistically significant for all strategies, except for the EBIT/EV strategy. The high GP portfolio has the highest 5-factor alpha of 4.00%, with statistical significance at a 1% level. The CP and RE/ME strategies produce statistically significant alphas of 2.01% and 1.49%, respectively. Surprisingly, when controlling for the 5-factor model, the EBIT/EV strategy provides negative abnormal returns of -0.57%, yet that return is not statistically different from zero.

When examining the factor loadings of the 5-factor model for the high portfolios, the results show that the risk factors cannot fully explain the returns of stand-alone strategies. While the high RE/ME and high EBIT/EV portfolios have statistically significant and positive loadings for the HML factor, the GP and CP have statistically significant and negative loadings for the HML factor. More interestingly, the betas for the RMW factor indicate that all strategies have statistically significant and positive tilts toward profitability. This observation is worth noting since traditional value strategies tend to be negatively correlated with profitability (e.g., Novy-Marx, 2013). This may be explained by the fact that both EBIT/EV and RE/ME ratios are profitability-based value factors. Thus, the portfolios formed based on these factors may differ from traditional value portfolios.

Panel B of Table 8 presents the annualized alphas and factor loadings for the low stand-alone portfolios. The lowest alphas for the low portfolios are observed for the GP strategy (-2.85%), followed by RE/ME (-2.11%) and CP (-0.85%) strategy. Surprisingly, the low portfolio based on EBIT/EV strategy has a positive alpha, yet the result is not statistically different from zero. Moreover, low portfolios have higher exposures to the market risk factor than high portfolios. All investigated low portfolios also seem to be negatively associated with profitability, as they all have negative and statistically significant loading for the RMW factor at the 1% level.

Table 9. The regression results for long-short stand-alone portfolios

High-Low	GP	CP	RE/ME	EBIT/EV
Panel A: 4-factor model				
Alpha	8.74%***	6.27%***	6.97***	4.02*
	(4.492)	(3.894)	(4.394)	(1.828)
MKT	-0.116***	-0.178***	-0.164***	-0.149***
	(-2.671)	(-4.972)	(-4.647)	(-3.051)
SMB	0.029	-0.301***	-0.103**	-0.270***
	(0.556)	(-6.857)	(-2.391)	(-4.501)
HML	-0.159***	0.183***	0.429***	0.791***
	(-3.133)	(4.376)	(10.369)	(13.805)
WML	0.099***	0.127***	0.056**	0.170
	(2.872)	(4.447)	(2.006)	(4.356)
R^2	0.162	0.630	0.373	0.507
Panel B: 5-factor model				
Alpha	6.84%***	2.87%*	3.61%**	-1.51%
	(3.488)	(1.938)	(2.446)	(-0.836)
MKT	-0.131***	-0.166***	-0.113***	-0.129***
	(-3.196)	(-5.346)	(-3.676)	(-3.395)
SMB	0.215***	-0.044	0.073	0.175***
	(3.537)	(-0.972)	(1.598)	(3.128)
HML	-0.321***	-0.043	0.179***	0.426***
	(-4.851)	(-0.862)	(3.614)	(6.990)
RMW	0.357***	0.530***	0.408***	0.887***
	(5.135)	(10.112)	(7.808)	(13.826)
CMA	-0.023	0.134*	0.257***	0.081
	(-0.293)	(1.813)	(3.470)	(0.895)
R^2	0.216	0.532	0.502	0.692

The table reports the regression results for long-short strategies. Panel A presents the OLS regression results for Carhart's (1997) 4-factor model. Panel B presents the OLS regression results for the Fama and French (2015) five-factor model. R^2 indicates the goodness-of-fit. The t-statistics are in parentheses. *, **, and *** indicate the statistical significance at 10%, 5%, and 1% level, respectively. The sample period is from January 2000 to December 2021.

Table 9 above presents the 4 and 5-factor specifications for the zero-cost strategies. The results clearly indicate that the regression intercepts of high-low portfolios far exceed the regression intercepts observed for the high portfolios. Since the low portfolios drive this effect, the results suggest that these strategies are particularly useful for those who are willing to go short on low portfolios.

5.3 Combination of profitability and value

In this subsection, it is of interest to investigate the risk-adjusted performance of strategies that combine profitability and value. The portfolio formation for the different strategies is based on the highest combined ranks of profitability and value, which is detailly covered in chapter 5.3. The empirical analysis for the different strategies is conducted for both the top 20% (high portfolios) and bottom 20% (low portfolios) of stocks based on each combination. Consistent with the previous subchapter, the annualized Sharpe and Sortino ratios, as well as the worst monthly drawdowns, are firstly analysed. Finally, to test whether the potential outperformance can be explained by risk factors, the annualized abnormal returns and factor loadings are analysed by using Carhart's (1997) 4-factor model and the Fama-French (2015) 5-factor model. Finally, we also run the regression results for the zero-cost strategies to further elaborate on the performance difference between high and low portfolios.

Table 10 provides an overview of results for the combinations of profitability and value over the sample period from January 2000 to December 2021. When examining the Sharpe ratios, the results show that the high portfolios based on combinations provide much higher risk-adjusted returns than low portfolios. The highest Sharpe ratios are observed for the combinations based on GP & RE/ME (0.718) and GP & EBIT/EV (0.706), CP & EBIT/EV (0.671), and CP & RE/ME (0.652), all of which are higher than that observed for the broader market (0.483). In contrast, the Sharpe ratios of low portfolios are broadly lower than that of the broader market, varying between 0.076 (GP & RE/ME) and 0.162 (CP & RE/ME). These findings strongly support the first research hypothesis of this study.

Table 10. Risk-adjusted performance measures for combination strategies

Risk-adjusted performance measures	GP & EBIT/EV	CP & EBIT/EV	GP & RE/ME	CP & RE/ME
Panel A: High				
4-factor alpha	3.78%***	3.08%***	3.95%***	2.66%***
t-stat	(3.476)	(3.119)	(3.669)	(3.259)
5-factor alpha	3.17%***	1.52%	3.34%***	0.76%
t-stat	(2.810)	(1.576)	(2.990)	(1.019)
Sharpe	0.706	0.671	0.718	0.652
Sortino	1.065	0.977	1.084	0.946
Max drawdown	-19.24%	-22.23%	-19.24%	-21.74%
Panel B: Low				
4-factor alpha	-6.95%***	-4.69%***	-7.01%***	-5.49%***
t-stat	(-4.726)	(-2.986)	(-4.775)	(-3.979)
5-factor alpha	-4.22%***	-1.20%	-4.29%***	-2.80%**
t-stat	(-3.212)	(-0.902)	(-3.269)	(-2.160)
Sharpe	0.0798	0.201	0.076	0.162
Sortino	0.105	0.273	0.100	0.218
Max drawdown	-29.08%	-30.65%	-29.07%	-28.30%
Panel C: High-Low				
4-factor alpha spread	10.73%***	7.77%***	10.96%***	8.15%***
t-stat	(5.412)	(3.721)	(5.538)	(4.533)
5-factor alpha spread	7.39%***	2.72%	7.63%***	3.56%**
t-stat	(4.014)	(1.557)	(4.139)	(2.273)

Panel A presents the risk-adjusted performance measures for the top 20% of stocks based on each strategy. The table shows the annualized abnormal returns of Carhart (1997) 4-factor and the Fama-French (2015) 5-factor model and their t-statistics in parentheses. The Sharpe and Sortino ratios are calculated based on the monthly return time-series, but reported values are annualized. Maximum monthly drawdowns of each portfolio are also presented. Panel B reports the same key figures for low portfolios. Panel C presents the regression intercepts for the zero-cost strategies. *, **, and *** indicate the statistical significance at 10%, 5%, and 1% level, respectively. The sample period is from January 2000 to December 2021.

The Sortino ratios for the combination strategies are also reported in Table 10. Again, the results broadly suggest that the high (low) portfolios produce consistently higher (lower) risk-adjusted returns than 0.673 of the market. When considering the high portfolios, the highest Sortino ratio of 1.084 is observed for the GP & RE/ME combination, while the lowest is for the CP & RE/ME of 0.946. The Sortino ratios for the low portfolios vary between 0.100 (GP & RE/ME) and 0.218 (CP & RE/ME), which suggests that the highest spread between the Sortino ratios of high and low portfolios can be achieved by these two strategies.

Regarding the maximum monthly drawdowns of combination strategies, Table 10 shows that the portfolios formed on top combinations suffer much smaller drawdowns than the low portfolios. When combining value strategies with gross profitability, the observed drawdowns are lower than that observed for the market -21.57%. Overall, the maximum monthly drawdowns of high portfolios range between -19.24% (GP & EBIT/EV and GP & REME) and -22.23% (CP & EBIT/EV). In contrast, the maximum monthly drawdowns of low portfolios vary between -28.30% (CP & RE/ME) and -30.65% (CP & EBIT/EV). The results broadly suggest that gross profitability performs better with value strategies than cash profitability.

Broadly in line with the first research hypothesis of this study, the top (bottom) combinations provide positive (negative) abnormal returns after controlling for risk factors. For all strategies investigated, the regression intercepts are statistically significant at a 1% level after controlling for the 4-factor model. The highest 5-factor alphas are associated with high portfolios based on the GP & RE/ME strategy of 3.34% and GP & EBIT/EV strategy of 3.17%, both of which are statistically significant at a 1% level. The performance of low portfolios is inverse; GP & RE/ME and GP & EBIT/EV strategies provide statistically significant and single the lowest abnormal returns of -4.22% and -4.29% after controlling for the 5-factor model.

Furthermore, Panel C of Table 10 presents the regression intercepts for the zero-cost strategies. The results show that alphas observed for the long-short portfolios are consistently higher than alphas of either high or low portfolios. The 4-factor alphas are statistically significant at a 1% level for all zero-cost strategies investigated. The highest 5-factor alphas for long/short strategies are observed for the GP & RE/ME strategy of

7.63%, followed by GP & EBIT/EV of 7.39%. The regression results for long-short portfolios are covered in detail in Table 13.

Table 11. The 4-factor model regression results for combination strategies

4-factor model	GP & EBIT/EV	CP & EBIT/EV	GP & RE/ME	CP & RE/ME
Panel A: High				
Alpha	3.78%***	3.08%***	3.95%***	2.66%***
	(3.475)	(3.119)	(3.669)	(3.259)
MKT	0.995***	0.992***	0.991***	1.004***
	(40.973)	(44.978)	(41.229)	(55.051)
SMB	0.121***	-0.028	0.127***	-0.044**
	(4.095)	(-1.068)	(4.337)	(-1.972)
HML	-0.046	0.129***	-0.046*	0.112***
	(-1.631)	(5.012)	(-1.655)	(5.274)
WML	0.014	0.031*	0.013	0.034**
	(0.720)	(1.757)	(0.715)	(2.371)
R^2	0.903	0.917	0.904	0.942
Panel B: Low				
Alpha	-6.95%***	-4.69%***	-7.01%***	-5.49%***
	(-4.727)	(-2.986)	(-4.476)	(-3.979)
MKT	1.224***	1.279***	1.224***	1.262***
	(37.276)	(36.512)	(37.305)	(40.973)
SMB	0.138***	0.271***	0.137***	0.169***
	(3.437)	(6.338)	(3.422)	(4.479)
HML	-0.265***	-0.398***	-0.263***	-0.315***
	(-6.893)	(-9.738)	(-6.870)	(-8.750)
WML	-0.116***	-0.109***	-0.116***	-0.097***
	(-4.450)	(-3.919)	(-4.473)	(-3.984)
R^2	0.894	0.893	0.893	0.909

The table reports the OLS regression results for Carhart's (1997) 4-factor model. Panel A presents the annualized abnormal returns (regression intercepts) and the factor loadings for the top 20% of stocks based on each strategy. Panel B reports the results for low portfolios. R^2 indicates the goodness-of-fit. The t-statistics are in parentheses. *, **, and *** indicate the statistical significance at 10%, 5%, and 1% level, respectively. The sample period is from January 2000 to December 2021.

With regards to the 4-factor model specification, Table 11 shows that all four high (low) portfolios have a positive (negative) and statistically significant alpha at a 1% level. The two best performing combinations, GP & RE/ME and GP & EBIT/EV, produce the 4-factor alphas of 3.95% and 3.78%, respectively. In contrast, the alphas for the low GP & RE/ME and GP & EBIT/EV portfolios are -7.01% and -6.95%, respectively. This indicates rather substantial alpha spreads between high and low portfolios. Moreover, the results imply that the spreads are driven mostly by the negative returns earned by the low portfolios.

Moreover, the factor loadings show that the risk factors cannot fully explain the excess returns of combination strategies. Yet all eight portfolios are positively associated with the market risk factor; low portfolios tend to have consistently higher exposure to the MKT factor. The factor loadings on the value factor are somewhat mixed, while strategies that combine GP (CP) with value have negative (positive) tilts toward HML. Moreover, the top combinations tend to be positively associated with WML, while the low portfolios are negatively skewed toward momentum.

Table 12 presents the regression results obtained by the Fama-French 5-factor model. Overall, the findings comply rather well with the results obtained by the 4-factor model. The single highest abnormal return of 3.34% is achieved by the GP & RE/ME strategy. Moreover, high GP & EBIT/EV and GP & RE/ME portfolios have a positive and statistically significant alpha at a 1% level. Yet high CP & EBIT and CP & RE/ME portfolios have a positive alpha; they are not statistically different from zero. When investigating the goodness-of-fit of the regression models, the R-Squared measures constantly improve after new factors are incorporated into the model.

Regarding the low portfolios, strategies tend to exhibit the same phenomena. The low GP & RE/ME portfolio produces a negative and single the lowest alpha of -4.29%, followed by the low GP & EBIT/EV portfolio of -4.22%, both of which are statistically significant at 1% level. The low CP & RE/ME portfolio earns a negative alpha of -2.80% and is statistically significant at a 5% level. The low CP & EBIT portfolio, in turn, produces a negative alpha, but it is not statistically different from zero.

Table 12. The 5-factor model regression results for combination strategies

5-factor model	GP & EBIT/EV	CP & EBIT/EV	GP & RE/ME	CP & RE/ME
Panel A: High				
Alpha	3.17%***	1.53%	3.34%***	0.76%
	(2.810)	(1.577)	(2.990)	(1.019)
MKT	0.995***	1.011***	0.996***	1.034***
	(42.265)	(49.809)	(42.538)	(66.559)
SMB	0.161***	0.064**	0.164***	0.045**
	(4.634)	(2.155)	(4.748)	(1.987)
HML	-0.117***	0.012	-0.120***	-0.041*
	(-3.083)	(0.383)	(-3.204)	(-1.672)
RMW	0.084**	0.203***	0.078**	0.213***
	(2.122)	(5.929)	(1.995)	(8.109)
CMA	0.022	0.093*	0.034	0.189***
	(0.395)	(1.926)	(0.607)	(5.083)
R^2	0.904	0.926	0.905	0.955
Panel B: Low				
Alpha	-4.22%***	-1.20%	-4.29%***	-2.80%**
	(-3.212)	(-0.902)	(-3.327)	(-2.160)
MKT	1.237***	1.272***	1.237***	1.252***
	(44.903)	(45.416)	(44.945)	(45.979)
SMB	-0.132***	-0.033	-0.133***	-0.029
	(-3.255)	(-0.817)	(-3.282)	(-0.731)
HML	-0.090**	-0.205***	-0.088**	-0.121***
	(-2.034)	(-4.583)	(-2.013)	(-2.769)
RMW	-0.516***	-0.605***	-0.516***	-0.408***
	(-11.108)	(-12.846)	(-11.112)	(-8.890)
CMA	0.074	0.037	0.075	-0.119*
	(1.129)	(0.568)	(1.141)	(-1.839)
R^2	0.922	0.930	0.922	0.926

The table reports the OLS regression results for the Fama and French (2015) five-factor model. Panel A presents the annualized abnormal returns (regression intercepts) and the factor loadings for the top 20% of stocks based on each strategy. Panel B reports the results for the low portfolios. R^2 indicates the goodness-of-fit. The t-statistics are in parentheses. *, **, and *** indicate the statistical significance at 10%, 5%, and 1% level, respectively. The sample period is from January 2000 to December 2021.

Regarding the factor loadings of the 5-factor regressions in Table 12, all high and low portfolios have a positive and statistically significant relation to market risk at a 1% level. Two best performing strategies, the high portfolios formed based on GP & EBIT/EV and GP & RE/ME have a beta of less than one and significant alpha, which indicates that they have lower risk when adjusting for the market exposure. Vice versa, for the low portfolios, the beta for the market risk varies between 1.252 and 1.237, thus implying a higher risk relative to the market. Moreover, the high portfolios tend to have a positive tilt toward SMB, while low portfolios are negatively related to the size factor. The GP & EBIT/EV and GP & RE/ME strategies also tend to be negatively associated with HML, thus implying the value exposure does not drive the excess returns of combination strategies. High portfolios also have highly positive and statistically significant exposure to the RMW factor, implying that such portfolios tend to prefer stocks with high profitability. Vice versa, low portfolios have constantly negative and statistically significant loading on the RMW. A positive loading on CMA generally reflects that combination strategies tend to own stocks that invest more conservatively.

Table 13 presents the 4 and 5-factor model specification for the long-short portfolios. When the long/short portfolios are regressed on the factor models, the results show that long/short portfolios earn significantly higher alphas than long-only portfolios. The table shows that GP & RE/ME strategy earns the best performance as the 4-factor and 5-factor alphas for long/short portfolios are 10.79% and 7.63%, respectively. Moreover, the long/short strategies formed on GP & RE/ME and GP & EBIT/EV portfolios have both statistically significant 5-factor alphas at a 1% level, as the t-stats are 5.54 and 5.41, respectively. The 5-factor alpha for the long/short CP & RE/ME portfolio is statistically significant at the 5% level. The long/short CP & EBIT/EV strategy has a statistically significant 4-factor alpha, but the 5-factor alpha is not statistically different from zero.

Moreover, a closer inspection of the results shows that alphas earned by the long/short combination strategies exceed those of stand-alone strategies. For instance, the 5-factor alphas for long/short GP & RE/ME and GP & EBIT/EV portfolios are 7.63% and 7.39%, respectively, higher than the 6.85% earned by the stand-alone GP strategy. Taken together, the results broadly suggests that unconstrained investors can earn significant performance improvements by accounting for both the long and short legs of the strategies. The results obtained for the long/short strategies also support the second research hypothesis of this study.

Table 13. The regression results for long-short combination strategies

High-Low	GP & EBIT/EV	CP & EBIT/EV	GP & RE/ME	CP & RE/ME
Panel A: 4-factor model				
Alpha	10.73%***	7.77%****	10.97%***	8.15%***
	(5.412)	(3.721)	(5.538)	(4.533)
MKT	-0.229***	-0.286***	-0.232***	-0.259***
	(-5.177)	(-6.150)	(-5.257)	(-6.444)
SMB	-0.016	-0.300***	-0.009	-0.213***
	(-0.303)	(-5.270)	(-0.180)	(-4.333)
HML	0.218***	0.528***	0.216***	0.427***
	(4.218)	(9.693)	(4.197)	(9.109)
WML	0.130***	0.140***	0.130***	0.132***
	(3.696)	(3.778)	(3.708)	(4.134)
R^2	0.234	0.465	0.236	0.444
Panel B: 5-factor model				
Alpha	7.39%***	2.73%	7.63%***	3.560**
	(4.014)	(1.557)	(4.139)	(2.273)
MKT	-0.238***	-0.261***	-0.241***	-0.217***
	(-6.164)	(-7.096)	(-6.225)	(-6.605)
SMB	0.295***	0.098*	0.298***	0.075
	(5.162)	(1.811)	(5.213)	(1.547)
HML	-0.027	0.218***	-0.032	0.079
	(-0.436)	(3.691)	(-0.508)	(1.503)
RMW	0.601***	0.808***	0.595***	0.621***
	(9.228)	(13.028)	(9.120)	(11.208)
CMA	-0.052	0.056	-0.041	0.308***
	(-0.563)	(0.633)	(-0.444)	(3.931)
R^2	0.395	0.654	0.392	0.614

The table reports the regression results for long-short strategies. Panel A presents the OLS regression results for Carhart's (1997) 4-factor model. Panel B presents the OLS regression results for the Fama and French (2015) five-factor model. R^2 indicates the goodness-of-fit. The t-statistics are in parentheses. *, **, and *** indicate the statistical significance at 10%, 5%, and 1% level, respectively. The sample period is from January 2000 to December 2021.

5.4 Discussion

This subsection summarizes the results and discusses the key findings of this study. To review, our innovation for this study was to examine strategies that combine two widely recognized anomalies, value and profitability, in stock selection. We also consider the results of how well the combination of profitability and value compares against the traditional value and profitability portfolios. Thus, the empirical results are obtained for both traditional profitability and value strategies as well as the combinations of profitability and value.

When considering the first research hypothesis "*Top 20% of firms based on a combination of profitability and value produce higher risk-adjusted returns than bottom 20% of firms based on a combination of profitability and value",* the evidence from this study suggests that portfolios formed on the basis of the high combined score of profitability and value provide higher returns than low portfolios, even after adjusting for risk. Broadly in line with our expectations, the high combination portfolios produce constantly higher Sharpe and Sortino ratios and experience smaller drawdowns than low portfolios and the overall market. Moreover, high combination portfolios produce positive and significantly higher abnormal returns than low portfolios, and these returns cannot be explained by the risk factors. Furthermore, seemingly high alphas for zero-cost strategies imply that a strategy that goes long on profitable value and short on unprofitable growth can even magnify the performance of combination strategies. Taken together, the evidence from this study suggests that this study's first hypothesis can be accepted.

Regarding the best performing combinations, the high GP & RE/ME portfolio provides the best overall performance of all strategies investigated. To review, the GP & RE/ME strategy provides the highest Sharpe, Sortino, and the most significant 4-factor and 5-factor alphas while also experiencing smaller drawdowns than any other combination. For instance, the high GP & RE/ME portfolio has a Sharpe ratio of 0.72, which is 1.5 times the Sharpe ratio observed for the market, and more than 7 times higher than that of the low portfolio. Perhaps most interestingly, the results show that a long-short strategy offers even more compelling risk-adjusted returns. The strategy that goes long on high GP & RE/ME stocks and short on low GP & REME stocks produces a 5-factor alpha of 7.63%, more than double that of the long-only strategy.

With regards to the second research hypothesis "*Portfolios based on a combination of profitability and value produce higher risk-adjusted returns than portfolios based on profitability alone",* the empirical evidence on behalf of accepting or rejecting the hypothesis is somewhat mixed. The results clearly suggest that an additional screen on value enhances the performance of the CP strategy. When observing the risk-adjusted performance of top portfolios alone, the combinations of profitability and value outperform the traditional strategy of cash profitability but underperform the stand-alone gross profitability. Yet the high GP portfolio seems to outperform the combinations on almost all metrics, this is not the case for low portfolios. The low GP & RE/ME and GP & EBIT/EV portfolios have lower Sharpe and Sortino ratios, experience higher drawdowns and volatility, and produce significantly lower abnormal returns than the low GP portfolio.

Perhaps most notably, further investigation on the performance of combinations and stand-alone profitability shows that the long/short GP & RE/ME strategy produces higher 4-factor and 5-factor alphas than any other strategy. While the 5-factor alpha for the long/short GP & RE/ME strategy is 7.63%, the alpha for the long/short GP strategy is only 6.85%. This is merely because the low GP & RE/ME portfolio produces much lower abnormal returns than the low GP portfolio, as the 5-factor alphas for the low portfolios are -4.39% and -2.85%, respectively. Since the low portfolios drive this effect, it encourages further research on long-short strategies. However, it is not a primary objective of this study. Since combinations do not outperform on all metrics, we reject the second research hypothesis of this study.

Finally, when it comes to the third hypothesis *"Portfolios based on a combination of profitability and value produce higher risk-adjusted returns than portfolios based on value alone",* the empirical results suggest that value investors can improve their performance when controlling for profitability. That is, the risk-adjusted performance of high RE/ME and EBIT/EV portfolios improves rather dramatically when combined with GP or CP. Of all strategies investigated, the greatest improvement compared to the traditional strategy is observed for the EBIT/EV portfolio, suggesting that controlling for profitability is particularly useful for that strategy. When combined with GP, the Sharpe and Sortino ratios for the high EBIT/EV portfolio improve from 0.54 to 0.71 and from 0.74 to 1.07, respectively. Based on these results, we accept the third hypothesis of this study.

6 CONCLUSIONS

The aim of this study was to shed light on the most recent research on profitability and value premium and to investigate the effects of combining profitability and value on portfolio performance. Following the prior literature on profitability premium, this study used Novy-Marx's (2013) gross profitability (GP) and Ball et al. (2016) cash profitability (CP) as proxies for profitability. Moreover, following the previous findings on value premium, this study used Tikkanen and Äijö's (2018) operating earnings to enterprise value (EBIT/EV) and Ball et al. (2020) retained earnings to market (RE/ME) as proxies for value. This study mainly followed the studies by Novy-Marx (2013, 2014), Davydov et al. (2016), and Tikkanen and Äijö (2018) on assessing the portfolio performance of combination strategies and the one by Davydov et al. (2016) on portfolio construction.

In this investigation, the purpose was to assess the performance of portfolios that combine profitability and value. More specifically, this study investigated the combination of profitability and value in the U.S. markets using the stocks included in the S&P 500 index over the sample period from 2000 to 2021. The main goal was to find the portfolio that provides the best combination of profitability and value. The secondary objective was to investigate how well the combination of profitability and value compares against the traditional value and profitability portfolios. Thus, the empirical results were obtained for both traditional profitability and value strategies as well as the combinations of profitability and value. As described above, the traditional value and profitability portfolios were classified as GP, CP, EBIT/EV, and RE/ME, and combinations as GP & EBIT/EV, GP & RE/ME, CP & EBIT/EV, and CP & RE/ME. The results were obtained for both the top 20% and bottom 20% of firms based on each strategy. Moreover, the OLS regression results were also obtained for long/short portfolios to further assess the results.

With respect to the research question, the study finds that profitable value stocks have higher risk-adjusted returns than unprofitable growth stocks, and far superior to that of the overall market. Moreover, the study observes that profitable value stocks have much lower risk and experience much lower drawdowns than unprofitable growth stocks.

These findings are broadly in line with our base case of expectations and the prior literature (see e.g., Novy-Marx 2013, 2014; Asness et al., 2015; Davydov et. al., 2016; Tikkanen & Äijö, 2018). Among combinations, the best overall performance is observed for the high GP & RE/ME portfolio. Overall, these cases address the research question and support the view that the first hypothesis of this study can be accepted.

The second major finding of this study suggests that both traditional profitability and value portfolios perform rather well in the U.S. markets. All traditional value and profitability strategies generate higher Sharpe and Sortino ratios than the overall market. Moreover, except for the EBIT/EV strategy, all strategies have a positive and statistically significant alpha over the sample period. Overall, these results comply rather well with those observed in earlier studies (see, e.g., Novy-Marx, 2013; Ball et al., 2016; Ball et al., 2020). Moreover, the study finds that all combinations of profitability and value outperform stand-alone CP, EBIT/EV, and RE/ME strategies. However, the high GP portfolio appeared to be rather unaffected by value, hence outperforming the combination portfolios. Of all strategies investigated, the greatest improvement compared to the traditional strategy is observed for the EBIT/EV strategy, suggesting that controlling for profitability is particularly useful for that strategy.

Furthermore, this study finds that unprofitable growth stocks generate lower risk-adjusted returns than stocks with low profitability. The findings show that the low GP & RE/ME and GP & EBIT/EV portfolios have lower Sharpe and Sortino ratios, experience higher drawdowns and volatility, and generate much lower abnormal returns than the low GP portfolio. Moreover, the alpha spreads between profitable value and unprofitable growth portfolios are much higher than that of traditional value and profitability strategies. The 5-factor alphas for the long/short GP & RE/ME and GP strategies are 7.63% and 6.85%, respectively. Overall, these cases suggest that combining profitability with value enhances the performance of long-short profitability strategies. Thus, purely from a long/short perspective, the best performing strategy of this study is the long/short GP & RE/ME strategy.

To conclude, this study finds that portfolios that invest in profitable value stocks generate much higher risk-adjusted returns than portfolios that invest in unprofitable growth stocks in the U.S. markets. Second, the study shows that an additional screen on profitability dramatically enhances the performance of traditional value strategies. Moreover, this study finds that an additional screen on value improves the performance of traditional cash profitability but finds no evidence of improvement in the case of gross profitability. However, this study finds compelling evidence that combining profitability with value enhances the performance of traditional long-short portfolios, even in the case of GP strategy.

These results present great potential for further research to extent the ideas of profitability and value to assess the main drivers of these premium returns. Further studies need to be carried out to validate the performance of different long-short strategies. Alternatively, further study could assess the potential benefits of combining profitability and value with other empirically robust factors, such as momentum or low risk.

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