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Performance of a Trading Strategy Based on Changes in Capital Structure

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ABSTRACT
Capital structure is a widely discussed topic in the financial literature. Previous research is mixed regarding changes in capital structure and its impact on return on equities. It is well documented in the literature that investors should invest in well-diversified index funds as they give the best risk-adjusted return. More recent studies shows that investors can increase their risk-adjusted return from active strategies where the investors concentrate their portfolio by analysis of companies and the market, see for example Fjesme (2019, 2020). In this article we examine whether a trading strategy that buys companies that reduce the debt ratio and short sells companies that increase the debt ratio can beat the market at Oslo Stock Exchange. This is done by constructing portfolios based on data for all companies listed on the Oslo Stock Exchange from January 2002 until November 2020. We document that it is possible to beat the market by following the strategy when adjusting for risk and the strategy generates up to 11.61% annual risk-adjusted excess return.

1. INTRODUCTION

Capital structure is an important topic as it affects company's operations. Changes in leverage ratio affect companies' taxation, risk, cost of capital, investment opportunities and company value. This creates interest among investors when they choose their investment opportunities. The topic has been studied regularly in the financial literature. Modigliani and Miller (1958) are the first major contributors to literature with their irrelevance theory where they argue that companies cannot create value by balancing the capital structure. Traditional portfolio theory claims that investors optimize risk-adjusted returns by holding the market portfolio (Markowitz, 1952).

In this thesis, we examine whether a trading strategy that are buying companies which reduce the debt ratio and short selling companies that increase the debt ratio is a strategy that can perform better than the market portfolio for the Oslo Stock Exchange. We collect all company-specific data for the stocks listed at the Oslo Stock Exchange from Eikon Datastream over the period from January 2002 until November 2020. There are 201 stocks in our dataset, and we construct portfolios based on their changes in financial leverage. Specifically, when a company reduces its debt ratio by 5% or more, we include the company in our portfolio by buying shares, and when a company increases its debt ratio by 5% or more, we short sell shares in the company. We construct both an equal-weighted portfolio where the weights of the shares in the portfolio are equal, and a value-weighted portfolio where the weights are distributed based on company size. We measure the performance from the constructed portfolios against the value weighted index of all shares on Oslo Stock Exchange. We calculate some well-known risk-adjusted performance measures and compare the results with the market portfolio. Further we follow Cai and Zhang (2011) and regress monthly portfolio returns over the risk-free rate on traditional risk factors (RM-RF, SMB, HML, MOM).

We find that the equal-weighted portfolio performs better than the value-weighted portfolio. Apart from risk, the market portfolio yields a higher monthly average return than both of our portfolios. Our main findings are that the equal-weighted portfolio gives significant risk-adjusted abnormal return. By performing regressions with monthly portfolio returns over risk-free interest rate on traditional risk factors, the equal-weighted portfolio generates up to 11.61% annual risk-adjusted excess return.

We conclude that the trading strategy provides risk-adjusted excess returns compared to the market portfolio when the investor equals the shares in the portfolio.

Our most important contribution to the literature is that we show that a trading strategy based on changes in capital structure can beat the market on the Oslo Stock Exchange when we adjust for risk. Masulis (1980, 1983) and Cornett and Travlos (1989) find positive correlations between an increase in the debt ratio and equity returns. Cai and Zhang (2011) and Huang and Chan (2013) shows that increased financial leverage has a negative impact on equity returns. We contribute to the literature by documenting a positive risk-adjusted excess return by buying shares in companies that reduce the debt ratio and short selling companies that increase the debt ratio for listed companies on the Oslo Stock Exchange when equilibrating the shares in the portfolio.

2. THEORY

2.1 Capital Structure Theory

There are several theories that address the relationship between capital structure and company value. Modigliani and Miller (1958) show in their first proposition that capital structure has no effect on the value of companies given the assumption of perfect capital markets. A change in leverage will thus not affect the expected return on total assets.

Modigliani and Miller (1958) show in their second proposition that the expected return on equity and debt will change with a change in leverage. Increased leverage leads to an increased expected return on equity, but the required rate of return also increases correspondingly so that the present value of expected cash flows to equity is independent of leverage.

Myers (1984) describes the static trade-off theory, which is based on a world with imperfections. The static trade-off theory assumes that companies can find an optimal capital structure by balancing the tax advantage of debt and expected bankruptcy costs related to debt. Companies value will thus be affected by gearing through these two effects.

Fischer et al., (1989) further develops the dynamic trade-off theory which builds on the static trade-off theory but considers that it is expensive to issue securities. Companies will actively change leverage when the deviation from the optimal capital structure is large enough so that the benefit of changing leverage is greater than the costs of issuing new securities.

The market timing theory articulated by Baker and Wurgler (2002) implies that decisions regarding the choice of funding sources is a result of market conditions that exist at the financing time. Debt is preferred when it is low-priced relative to equity and vice versa.

The pecking order theory developed by Myers (1984) suggests that the company's management prefers certain sources of financing over others as a result of asymmetric information between management and the financial market. Companies' capital structure is a result of decisions made over time based on these priorities.

The signaling theory of capital structure modelled by Ross (1977) signify that companies can use debt as a way of signaling that the management has information which indicates that the investments will generate enough cash flow to at least cover the debt obligations. Using debt as a way of financing is believed to send a credible market signal as it commits the company to debt obligations that must be covered. This signal should therefore affect the market value of companies as it affects the future expectations.

Jensen (1986) argues that free cash flow is a source of agency costs. Debt, on the other hand, leads to obligations that have a disciplining effect on management thereby leading to lower agency costs.

Myers' (1977) debt overhang theory considers the effect debt can have on future investments. Real options such as growth opportunities can count for a huge part of a company's market value. Such real options depend on the future investment decisions. The future investment decision is related to financing according to the debt overhang theory. Risky debt or highly leverage firms can lead to higher required rate of return for the equity holders relative to the overall required rate of return for the firm, leading to forgoing positive net present value investment, and thus less value of these real options.

2.2 Modern Portfolio Theory

The efficient market hypothesis (EMH) addresses the question of whether share prices fully reflect all available information. In general, an efficient stock market is a market where stock prices always reflect fundamental information about companies (Degutis & Novickytė, 2014). According to Fama (1970), markets can be characterized by weak, semi-strong or strong form of market efficiency: *Weak form of market efficiency* claims that the price of a share reflects all previously available information. This implies that an investor will not achieve excess returns by studying past prices. *Semi-strong form of market efficiency* states that the stock prices reflect all the past information as well as the current information that is available to the general public. This form of market efficiency assumes that it is not possible to obtain a competitive advantage from publicly available information. *Strong form of market efficiency* states that all information in the market is reflected in the share prices. This also includes information that is not publicly available such as inside information. If the stock market has either a semi-strong or strong form of efficiency, active management would be completely unnecessary because the time and energy that the investor spends analyzing companies is needless as stock prices already reflect this information. On the other hand, the analyzes and search for incorrectly priced shares makes the market more efficient. When investors identify undervalued companies, the underlying stock will achieve increased demand which will lead the price to increase until it reaches a fair price.

According to Malkiel (2003) the efficient market hypothesis is associated with the idea of a “random walk”. He explains the random walk as a term to characterize a price series where all subsequent price changes represent random departures from previous prices. A random walk will be the natural result of prices that always reflect all current information. In fact, if stock price movements were predictable, it would be a judgmental proof of stock market inefficiency, because the ability to predict prices would indicate that all available information was not already reflected in stock prices (Bodie et al., 2008).

If the EMH holds, it will not be possible to achieve risk-adjusted returns without luck or randomness. Nevertheless, there are several deviations from this assumption that weakens the validity of the hypothesis. A departure from the hypothesis is that investors do not always react correctly in line with the new information that becomes available. Investors may overreact by buying companies where the shares have increased in value or selling shares which has fallen in value (DeBondt & Thaler, 1985). Such overreactions in the market can cause stock prices to move away from their fair value. In such situations, rational investors will act countercyclically to get the price back to what they believe is fair value. This phenomenon implies price reversal and that a trading strategy where investors buy losers and sell winners can provide excess returns.

Another departure from EMH is anomalies. One of the most important anomalies with respect to the EMH is the so-called size or small-firm effect (Bodie et al., 2008). It says that smaller companies provide higher risk-adjusted returns compared to large companies. Other known anomalies include the relationship between P/E and P/B multiples and expected returns, the profitability of momentum strategies, in addition to the January effect (Bodie et al., 2008). All these anomalies have one thing in common, they deviate from EMH because they can be exploited by following relatively easy trading strategies. On the other hand, it can be argued that anomalies are in line with an efficient market due to the risk and transaction costs that the investor undertakes.

Markowitz (1952, 1959) and Tobin (1958) theoretically explain that holding the market portfolio will optimize risk-adjusted returns for investors. In contrast, Van Nieuwerburgh and Veldkamp (2009, 2010) shows theoretically how investors can take advantage of learning about assets prior to investing. Rational investors will optimize their portfolios by information learning and investing where they have greater international information.

2.3 Previous Findings

Many studies have empirically investigated how efficient the stock markets are and whether analysis of companies can provide risk-adjusted excess returns. DeBondt and Thaler (1985) studies overreactions in the US stock market in the period 1926 to 1982. They find that winners and loser for a period of 36 months tend to reverse over the subsequent 36-month period. This means that investors overreact to new information that leads stock prices away from fair value before reversing later. In contrast, Chan (1988) finds no risk adjusted excess return for the investment strategy where investors buy losers and sell winners. By risk-adjusting the returns, he finds that on average, the strategy gives excess returns, but that excess return is likely to be a normal compensation for the risk in the strategy, which is consistent with EMH.

Fjesme (2020) finds empirically that experienced retail investors increase returns from portfolio concentration on Oslo Stock Exchange while inexperienced investors reduce returns form concentration. Fjesme (2020) argues that investors who are closer to the Norwegian market culturally or geographically have greater learning capacity than other investors and that higher learning capacity investors can benefit from becoming internationally informed. He also finds that investors with a better cultural understanding of the market can increase risk-adjusted returns from active management and that investors with higher learning capacity can reduce diversification and increase portfolio returns on Oslo Stock Exchange (Fjesme, 2019).

There is also extensive research on how changes in the capital structure affects the return of companies' shareholders. Masulis (1980, 1983) finds that announcements of changes in the capital structure of companies listed on the NYSE and ASE that result in an increase (decrease) in financial leverage are associated with a positive (negative) abnormal return for the companies' shareholders.

Cornet and Travlos (1989) examine public announcements of "pure" exchange offers (EOs) for companies listed on the NYSE or AMEX in the period 1973 to 1983. By replacing equity with debt, they find significantly positive abnormal returns for the companies' shareholders. In the opposite case, where debt is exchanged for equity, they find evidence of a significantly negative abnormal return for the companies' shareholders. They also find evidence that by replacing equity with debt, non-convertible debtors get normal returns and convertible debtholders get significantly positive abnormal returns. By replacing debt with equity, they find that both non-convertible and convertible debtors experience significant losses.

Cai and Zhang (2011) empirically study the effect leverage change has on stock prices and future investments, where leverage is measured using accounting data. They confirm a significantly negative effect on companies' market prices when increasing the financial leverage ratio. The findings are also consistent with Myers (1997) debt overhang theory as firms with an increase in leverage ratio tends to have less future investment.

Huang and Chan (2013) show that the long-term equity return of listed Taiwanese companies after an increase in debt may underperform the industry average in some cases, and only companies with a small degree of financial risk will experience significant positive long-term equity returns after increasing their debt ratio. They also find evidence that firms with independent directors, with a CEO serving as the chairperson of the board, that are controlled by a family, or with low-growth opportunities will be more likely to experience a better long-term stock performance following an increase in debt.

Rajkumar (2014) finds that an increased debt ratio is negatively related to financial performance (net profit, ROE, ROCE) for John Keells Holdings (Siri Lanka's largest listed company) for the period 2006-2012. At the same time, they find that financial leverage has a significant effect on the financial performance of the company over the period.

2.4 Hypothesis

The literature written on capital structure indicates that capital structure in an imperfect market affects the company's value and thus its share price. This signifies that a strategy that involves buying or selling based on events related to capital structure can lead to positive or negative returns as these events affect companies' value. However, it is not entirely clear which strategy is best and how a change in capital structure affects share value, as the literature is not entirely unambiguous. Older empirical evidence shows that debt can have a positive effect on company value, while more recent research shows that increased financial leverage may have a negative impact on company values and financial performance. We choose to go ahead with a strategy where we are long in companies that reduce debt and short in companies that increase debt, as we have got the impression that this may be the best strategy in modern financial markets where companies are highly leveraged. It is also interesting to investigate further whether such a strategy will be able to provide a significantly positive risk-adjusted excess return, and in that regard, it is most relevant to compare the return of such a strategy with the market. In that way we get the opportunity to test whether it is possible to beat the market, which is difficult according to the literature in the field. This leads us to the following hypothesis:

A trading strategy that buys companies that reduce debt-ratio and short-sell companies that increase debt-ratio will be able to beat the market at Oslo Stock Exchange.

3. METHODOLOGY

3.1 Factor Models

We follow Eckbo and Ødegaard (2015) and analyze the relationship between the portfolio's return over the risk-free interest rate and traditional portfolio factors (RM-RF, SMB, HML). This is done by running regressions where the return over the risk-free interest rate is the dependent variable. Further we follow Cai and Zhang (2011) by also include Carhart four-factor model to analyze the momentum effect (PR1YR). When performing ordinary least squares

(OLS) regressions, there are several threats to internal validity we must beware of. We consider omitted variable bias by doing three different regressions where we add more variables into the regressions.

The analysis of the strategy is performed with the assumption that investors are risk averse in the form that they require compensation in the form of expected return when they take on risk in their investments. The total risk of an investor’s stock portfolio can be reduced by adding more stocks in the portfolio. By purchasing stocks from, for example, different companies, industries and regions, the investor will spread the risk, which is referred to as diversification. This assumption is in line with modern portfolio theory.

We choose to ignore transaction costs in this thesis, as these costs vary widely and because the factor variables taken from Ødegaard (2020) also exclude these costs. We therefore see limited benefit in including them in our analysis. In reality, these costs do have an impact on the portfolio's return, as they arise when the portfolios are rebalancing. Portfolios that include short sales carry higher costs than long-only portfolios because the investor in addition to commissions, also pays to borrow the asset. We also assume that short sales are unlimited in the form that there are no restrictions of short sales and that all shares on the Oslo Stock Exchange are available for short trading. This assumption is necessary to be able to implement and analyze the trading strategy.

Capital Asset Pricing Model (CAPM) published by William Sharpe (1964), John Lintner (1965) and Jan Mossin (1966) is one of the cornerstones of modern financial economics. CAPM build it main prediction on Markowitz’s (1959) work which is that the market portfolio is mean-variance efficient. CAPM measures equilibrium expected returns on risky assets ($E(r_i)$) by assuming that the only risk factor is the asset’s exposure to systematic risk. Equation (1) describes the CAPM model:

$$E(r_i) = r_f + \beta_i\left[E(r_m) - r_f\right] \qquad (1)$$

The-risk free rate (r_f) accounts for the time value of money. The market risk premium $\left[E(r_m) - r_f\right]$ is the expected excess return of the market and β measures the portfolios exposure to the systematic risk of the market. Beta could take any number, a positive beta indicates that the portfolio moves in the same direction as the market, meanwhile a negative beta indicates that the portfolio fluctuate in the opposite direction of the market and a beta equal to 0 indicates that the portfolio is uncorrelated with the market. The idea is that if you want to increase the expected return above the expected market return, the investor must increase the systematic risk (β). And conversely, if investors want to reduce the risk, the expected return will be reduced.

Jensen (1968) uses CAPM to evaluate whether a portfolio or stock generates risk-adjusted abnormal excess return as shown in equation (2). Jensen (1968) claims that the same model can be used to evaluate a portfolio's abnormal return by performing a regression of the term and use the intercept, named alpha, to evaluate the risk-adjusted performance of the risky asset:

$$r_i - r_f = \alpha_i + \beta_i[r_m - r_f] + \varepsilon_i \qquad (2)$$

A significantly positive alpha (α) indicates that the portfolio creates excess return above the market, and the opposite for a significantly negative alpha. CAPM is widely used because it is a simple calculation and because it assumes that rational investors hold a diversified portfolio, similar to the market portfolio. This is a simplification of reality and the fact that the model only considers the portfolio's exposure to systematic risk means that the model has some limitations.

Fama and French (1993) developed the Fama-French three-factor model which is built on CAPM and contains several risk factors. The model is described in equation (3), it includes the exposure to market risk (β_i), size risk (s_i) and value risk (h_i) as measures of systematic risk:

$$r_{it} - r_{ft} = \alpha_{it} + \beta_i(r_{mt} - r_{ft}) + s_i SMB_t + h_i HML_t + \varepsilon_{it} \qquad (3)$$

These two additional risk factors in equation (3) are included since Fama and French (1992) find that the average returns on stocks with small size are too high given their market beta and on the other hand the average returns on large firms are too low. SMB (small minus big) captures this effect by subtracting the average return of a portfolio consisting of firms with high market capitalization from the average return of a portfolio with low market capitalization firms. The value risk is included as they also empirically find that it has a role in explaining the cross-section of average returns. In the long-run, value firms with high book-to-market ratio outperforms growth firms with low book-to-market ratio (Stattman, 1980). HML (high minus low) captures this effect and is calculated by subtracting the average return of a portfolio consisting of value stocks from the average of a portfolio consisting of growth stocks. Bartholdy and Peare (2005) test the CAPM and three-factor model on companies listed at NYSE from 1970 to 1996 for a period of five years at a time and finds that the models perform poorly with 3% and 5% explanatory power of differences in returns, respectively.

Carhart (1997) builds further on the Fama-French three-factor model by including the exposure to momentum risk (p_i) as shown in equation (4):

$$r_{it} - r_{ft} = \alpha_{it} + \beta_i(r_{mt} - r_{ft}) + s_i SMB_t + h_i HML_t + p_i PR1YR_t + \varepsilon_{it} \qquad (4)$$

The momentum effect implies that there is a positive correlation between historical financial performance and future financial performance. PR1YR attempts to capture the momentum effect and is calculated by listing the eleven-month equal-weighted average returns lagged one month for the firms and then subtracting the highest 30% from the lowest 30%. A positive coefficient on the PR1YR parameter indicates that the assets have a positive momentum and vice versa if the coefficient is negative.

Abeysekera and Nimal (2017) find that the four-factor model performs better than the CAPM in all circumstances and does slightly better than the three-factor model in describing the variation in the cross-section of average stock returns at the Colombo Stock Exchange.

3.2 Risk-adjusted Performance Measures

We follow Arugaslan, Edwards and Samant (2017) and analyze monthly risk-adjusted performance of our portfolios based on some of the best-known risk-adjusted performance measures in the financial literature to compare portfolio performance. One of the most commonly used methods for analyzing risk-adjusted returns is the Sharpe ratio (SR). The measure is developed by Sharpe (1966) and measures the average return in excess of the risk-free rate per unit of volatility. It is calculated by dividing the excess return of a portfolio over the risk-free rate ($\overline{r_i} - \overline{r_f}$) by the standard deviation of the portfolio (SD_i), as shown in equation (5):

$$SR(r_p) = \frac{\overline{r_i} - \overline{r_f}}{\mathrm{SD}_i} \qquad (5)$$

The standard deviation does not distinguish between systematic risk and unsystematic risk. The Sharpe ratio also assume that the portfolio returns follow a normal distribution because of the standard deviation. In reality, this distribution is rarely the case. Skewed distributions with rare occurrences can result in inflated Sharpe ratios that do not address the whole story about the volatility of the portfolio.

Similar to the Sharpe ratio, the Treynor ratio (TR) also measures performance by excess return over the risk-free rate of return per unit of risk (Treynor, 1965). The difference between Sharpe ratio and Treynor ratio is shown in equation (6), where the Sharpe ratio uses the total risk in the denominator, while the Treynor ratio uses the systematic risk (β_i):

$$TR(r_p) = \frac{\overline{r_i} - \overline{r_f}}{\beta_i} \qquad (6)$$

Treynor ratio is based on comparing portfolios, assuming that portfolio managers are rational and "get rid" of unsystematic risk. Thus, the Treynor ratio may be an inaccurate measure if this assumption is not the case. In our case with few shares in the portfolio, unsystematic risk will incur. The more the portfolio deviates from the index we use to compare with, the more unsystematic risk it takes on. The ratio can also be criticized for not being applicable if the fund or portfolio has a negative beta as it attributes a negative performance to funds with a positive excess return.

Sharpe ratio and Treynor ratio does not differentiate between downside risk and upside risk and assumes that investors are indifferent between them (Chaudhry & Johnson, 2008). Rational investors will most likely not consider upside fluctuations as risk. The Sortino ratio (SO) ranks portfolios according to returns in excess of a target return or required rate of return, distributed only on downside risk (Sortino & Price, 1994).

Rollinger and Hoffman (2013) argues that the Sortino ratio is a better choice in many cases, especially if the distribution of returns does not follow a normal distribution, but is skewed, which often is the case for financial instruments. The model is explained in equation (7), and it says that investors decide a minimum target return (T) and subtract this from the average return on the asset, then dividing by the target downside deviation (TDD):

$$SO(r_p) = \frac{\bar{r_i} - T}{TDD} \qquad (7)$$

The target downside deviation is calculated as the root-mean-squared of the deviations of the realized returns underperformance from the target return.

Sharpe ratio, Treynor ratio and Sortino ratio are all measures investors can use to rank portfolios, but it is complicated to get a clear understanding of the interpretation of its numerical value. Graham and Harvey (1997) proposed an equivalent representation of the Sharpe ratio which later got popularized by Leah Modigliani and Franco Modigliani (1997), consequently known as the Modigliani-squared (M^2) measure. To compute M^2 we adjust the portfolio by mixing the risky investment with a risk-free position such that the adjusted portfolio (r_p^*) gets the same volatility as a comparable market index (r_m). If the portfolio has greater volatility than the market, one will include a long position in risk-free rate and if the portfolio has less volatility than the market, one will borrow money at risk-free rate and invest it in the portfolio. M^2 is then measured by subtracting the return of the adjusted portfolio (r_p^*) with the return of the market (r_m) as shown in equation (8):

$$M^2(r_p) = r_p^* - r_m \qquad (8)$$

Information ratio (IR) is another risk-adjusted performance measures. It takes the average excess return beyond the market portfolio per unit of volatility in excess return beyond the market portfolio (Goodwin, 1998). The excess return can be defined as *active return* and is the difference between the portfolio return and the return on the comparable index, volatility in excess return tells how closely the return on the portfolio and the index follow each other, popularly called «*Tracking Error*». Goodwin (1998) presents and explains the model as follows: If r_{pt} is the return on an active portfolio in period t and r_{mt} is the return on a benchmark portfolio in period t, then $\text{E}r_{pt}$, the excess return is the difference: $r_{pt} - r_{mt}$. $\overline{\text{E}r_{pt}}$ is the arithmetic average of excess returns over the historical period, or the active return. $\text{S}_{\text{E}r_{pt}}$ is the standard deviation of the excess returns, or tracking error, for the same period. We then divide the active return by the tracking error as shown in equation (9):

$$IR(r_p) = \frac{\overline{\text{E}r_{pt}}}{\text{S}_{\text{E}r_{pt}}} \qquad (9)$$

Information ratio does not say whether performance is due to the manager's skill or if it is explained by luck. IR cannot either tell whether the manager has performed well consistently, or whether it is due to extremely good performance in a single or few cases (Kidd, 2011).

Alpha (α) describes the excess return for a portfolio relative to an index in the regression. Goodwin (1998) illustrates the relationship between IR and α from the single index regression model, we can set up the expression, provided that the manager maintains β = 1:

$$r_{it} - r_{ft} = \alpha + (r_{mt} - r_{ft}) + \epsilon_t \qquad (10)$$

which can be rearranged as:

$$(r_{it} - r_{ft}) - (r_{mt} - r_{ft}) = (r_{it} - r_{mt})$$

$$\text{E}r_{it} = \alpha + \epsilon_t \qquad (11)$$

Goodwin (1998) shows in equation (11) that the excess return over the market index is equal to the sum of alpha plus the residual risk (ϵ_t). Eckbo and Ødegaard (2015) claim like Goodwin (1998) that an active manager can only create excess returns by overweighting or underweighting individual securities relative to the benchmark index and at the same time maintaining the same level of market risk (β = 1). This also means that the portfolio acquires unsystematic risk, which will increase the portfolio's tracking error. The information ratio is then the risk-adjusted alpha, also called "appraisal ratio".

$$IR = \frac{\overline{r_i^e}}{\text{S}_{r_p^e}} = \frac{\alpha}{\omega} \qquad (12)$$

Equation (12) can be interpreted as that the information ratio measures the quality of the manager's information discounted by the residual risk. According to Eckbo and Ødegaard (2015), alpha is "punished" for the manager taking on unsystematic risk, because it can be diversified away. The more the manager deviates from the market index, the higher the excess return must be in order to maintain the information ratio.

4. DATA

4.1 Data and portfolio construction

The data used for the analysis runs over the period January 2002 until November 2020. Our data used to construct the portfolios are downloaded from Eikon Datastream. The dataset from Eikon Datastream consist of 201 stocks which is currently listed on Oslo Stock exchange (OSE). We have downloaded firm specific variables such as quarterly total liabilities, quarterly book value of total assets, monthly stock prices and monthly market capitalization for all stocks over the time period.

According to Fjesme (2020), Oslo Stock Exchange is comparable to other more well-known exchanges as the OSE is regulated under the European Union (EU) commission regulation of financial instruments. International investors have easy access to the exchange as a big part of the brokerage firms that provide trading on the OSE are non-Norwegian. Our results can therefore be generalized to other financial markets.

The market risk factors used in the regression analysis are downloaded from Ødegaard (2020). The market portfolio is the value weighted index of all stocks on OSE without including dividends. The estimate of risk-free rate is the forward looking one-month risk free rate estimated from government securities and Norwegian Interbank Offered Rate (NIBOR). Fama-French factors (SMB and HML) are as calculated by Fama and French (1998) only using Norwegian data. Carhart momentum factors (PR1YR) are as calculated by Carhart (1997) using Norwegian data.

Our portfolios consist of both long and short positions. The selection criteria in order to be included in the portfolio as a short position is to have a positive quarterly leverage change of 5% or more, and the selection criteria for the long positions is a negative quarterly leverage change of 5% or more. The quarterly leverage change is measured by the absolute change in leverage from the previous quarter, and leverage is measured by total liabilities divided by total assets reported. We use accounting data such that changes in leverage is linked to changes in accounting numbers and not to changes in market values. We use 5% or more absolute quarterly leverage change as the selection criteria as it is a significant change, and in order to get a big enough sample.

When a firm is qualified to be included in the portfolio, they are included in two quarters: the quarter where the change happens and the following quarter, where the monthly discrete market return is observed in both quarters. The reason for this is that we want to study the effect the leverage change has on the market returns, and that the change could happen at any time in a quarter and is often reported during the next quarter. We construct an equal-weighted portfolio and a value-weighted portfolio. The only difference between the equal-weighted portfolio and the value-weighted portfolio is the weights each stock is assigned. The value-weighted assigns monthly weights based on the market value of each firm relative to the total market value of the firms included in the portfolio each month, while the equal-weighted assigns equal weights to the stocks each month.

4.2 Descriptive Statistics

Table 1 shows that in our entire dataset, there are an average of 36 companies that qualify to be included in the portfolio per month with a standard deviation of 11 companies. The distribution between long and short positions is on average 46.5% against 53.5% in the EW portfolio, with a standard deviation of 8.3% per month. The distribution between long and short positions in the VW portfolio is 43.4% and 56.6%, but with a higher standard deviation of 20.9% per month.

Table 1: Portfolio Distributions

	Mean	St. Dev	Max	Min	No. of periods
Firms per month	36	11	70	10	227
Percent long EW	46,5%	8,3%	66,7%	18,8%	227
Percent short EW	53,5%	8,3%	81,3%	33,3%	227
Percent long VW	43,4%	20,9%	96,1%	8,4%	227
Percent short VW	56,6%	20,9%	91,6%	3,9%	227

Table 1 describes the number of companies in the portfolios per month in addition to the distribution of the portfolios between long and short positions (mean, standard deviation, maximum and minimum). There are a total of 201 companies listed on OSE in our sample period.

Table 2 present the descriptive statistics. Mean returns are calculated by the average monthly return over the sample period. Mean excess return is calculated by subtracting the risk-free rate of return from the monthly return in each period and then averaging the monthly excess return. From Table 2 we can see that the value-weighted market portfolio yields slightly higher average monthly return than the equal-weighted portfolio. The mean is higher than the median for both of our portfolios, which indicates that the distribution is positively skewed, while the mean is lower than the median for the market portfolio which indicates negatively skewed distribution. The standard deviation of the market portfolio is located between our two portfolios. The higher standard deviation in the value-weighted portfolio is consistent with the higher maximum and lower minimum returns we can see from Table 2.

Table 2: Descriptive Statistics

Portfolio	Mean return	Median	St. Dev	Mean excess return	Max return	Min return	No. of periods.
EW	0.96%	0.47%	4.07%	0.75%	28.48%	-14.51 %	227
VW	0.86%	0.58%	7.95%	0.66%	31.43%	-43.90%	227
Market	0.98%	1.31%	5.58%	0.77%	16.35%	-23.93%	227

Table 2 describes descriptive statistics for our two portfolios (EW and VW) and the value weighted market index for all shares at OSE (mean, median, standard deviation, mean excess return, maximum return and minimum return).

Figure 1 presents the historical return from January 2002 until November 2020. We cannot see a clear correlation between the three portfolios as they move quite independently. We can from Figure 1 see that the red line for the value-weighted portfolio is below both the market portfolio and the equal-weighted portfolio for almost the entire period and that the market portfolio and the equal-weighted portfolio alternates between who performs best. Even though the market portfolio has a higher average return, we can see from the figure that the equal-weighted portfolio gives the highest aggregate return at the end of the period. This can be explained by the distribution of the equal-weighted portfolio which has some very high monthly returns and limited negative monthly returns compared with the market portfolio, which has a positively effect on the compound interest. Relating this graph to our hypothesis, we do not get evidence to say that our portfolios perform better than the market portfolio.

Figure 1: Historical Return

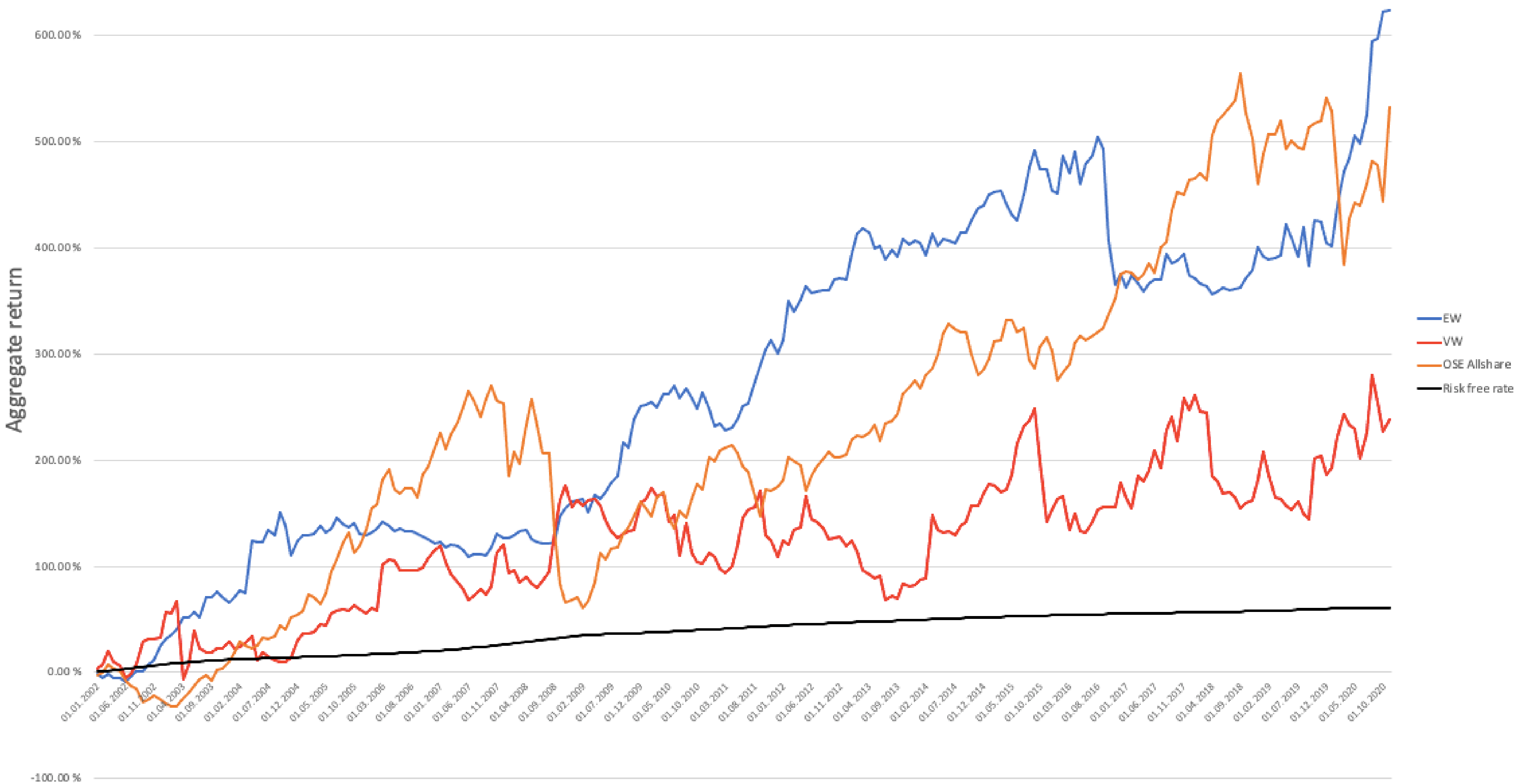

Figure 1 presents the historical return from January 2002 until November 2020. The black line represents the risk-free interest rate, the red line represents the value-weighted portfolio, the blue line represents the equal-weighted portfolio, and the orange line represents the value-weighted OSE "All share" index.

Table 3 describes the correlation between our complete portfolios, the separate portfolios, and the market portfolio. When splitting up the portfolios into long and short, the long- and short portfolios naturally have a negative correlation as they move quite in the opposite direction. An important remark is that the long portfolios correlate positive with the market portfolio and the short portfolios correlate negative with the market. This can capture the diversification effect of the composite portfolio as we are long and short in different stocks at the same time and the correlation between them is negative. The idea behind diversification is that the investor should not put all his eggs in one basket, so that the portfolio becomes less vulnerable to the risk in a single company. An important aspect is the correlation between the assets in the portfolio, that is how the assets move together. In order to achieve the diversification effect, the assets cannot be perfectly correlated. The risk that the investor can reduce by diversification is what we know as firm specific or unsystematic risk.

Table 3: Correlation Matrix

	Complete Portfolios		Separate Portfolios				Market
	EW	VW	EW Long	EW Short	VW Long	VW Short	Market portfolio
EW	1.000						
VW	0.234	1.000					
EW Long	0.313	-0.072	1.000				
EW Short	0.517	0.252	-0.651	1.000			
VW Long	0.055	0.477	0.577	-0.476	1.000		
VW Short	0.210	0.693	-0.550	0.663	-0.301	1.000	
Market portfolio	-0.136	-0.177	0.623	-0.668	0.437	-0.548	1.000

Table 3 descriptive the correlation between our complete portfolios, separate portfolios, and the market portfolio.

Table 4 shows the return on the factor variables over the 227 months from January 2002 until November 2020. RM-RF, SMB, HML and MOM are on average 1.39%, 0.29%, -0.20% and 1.12% respectively.

Table 4: Factor Return

Variable	Mean Return	St. Dev	Max Return	Min Return	No. of Periods.
RM-RF	0.77%	5.61%	16.31%	-24.45%	227
SMB	0.29%	3.80%	11.45%	-12.89%	227
HML	-0.20%	4.49%	13.95%	-19.64%	227
MOM	1.12%	4.34%	12.05%	-16.09%	227

Table 4 describes descriptive statistics for the factor variables used in the regression analysis.

5. EMPIRICAL FINDINGS

It is not enough to compare returns to explain whether active portfolios performs better or worse than the market. We must also consider risk in order to compare portfolio performance to the market performance. To analyze the portfolio performance, we will look at several risk-adjusted performance indicators.

The hypothesis predicts that a trading strategy where investors buy companies that reduce debt-ratio and short-sell companies that increase debt-ratio will beat the market at Oslo Stock Exchange.

Table 5 presents the Sharpe ratios for our portfolios and the market portfolio. It appears that the value-weighted portfolio has significantly higher standard deviations than the market portfolio while the equal-weighted portfolio has a lower standard deviation than the market. The low Sharpe ratio of the value-weighted portfolio is explained by the lower return and higher standard deviation compared to the market portfolio. According to the Sharpe ratio, the equal-weighted portfolio performs better than the market and the value-weighted portfolio performs worse than the market when we adjust for risk in form of standard deviation.

Table 5: Sharpe Ratio

Portfolio	Mean Excess Return	St. Dev	Sharpe Ratio
EW	0.75%	4.07%	0.18
VW	0.66%	7.95%	0.08
Market	0.77%	5.58%	0.14

Table 5 shows the Sharpe ratios, monthly average excess return divided by the standard deviation of the monthly return.

Table 6 shows that both portfolios have negative betas which leads to negative Treynor ratios even though the portfolios have positive excess return. This shows a clear limitation of the Treynor ratio as negative beta with negative excess return yields a better performance measure than with positive excess return, and it is therefore inappropriate to use this measure for our portfolios.

Table 6: Treynor Ratio

Portfolio	Mean Excess Return	Beta (β)	Treynor Ratio
EW	0.75%	-0.098	-0.077
VW	0.66%	-0.250	-0.026
Market	0.77%	1.000	0.008

Table 6 shows the betas of the monthly returns and the Treynor ratios, monthly average excess return divided by the beta of the monthly return.

Table 7 presents the Sortino ratios. We use required rate of return, T = 0% to only include negative returns in our calculations. In this way, we only capture downside risk. The equally weighted portfolio has the lowest downside deviation while the value weighted portfolio has the highest downside deviation. From Table 5 we can see that the difference in standard deviation between the equal-weighted portfolio and the market portfolio are 1.51%. When we now only look at downside risk, the difference in downside deviation between them is 3.04%. This can be explained by the fact that the portfolio has less downside risk than upside risk compared to the market. The equally weighted portfolio outperforms the market according to the Sortino ratio, while the value-weighted portfolio performs worse than the market.

Table 7: Sortino Ratio

Portfolio	Mean Return	Target Downside Deviation	Sortino Ratio
EW	0.96%	3.17%	0.30
VW	0.86%	7.63%	0.11
Market	0.98%	6.21%	0.16

Table 7 describes the target downside deviation and the Sortino ratio for both portfolios as well as the market portfolio.

Table 8 shows the portfolio weights as well as the M^2 measures for our portfolios. A positive M^2 means that the portfolio has achieved excess return relative to the comparable index. The equal-weighted portfolio has a risky investment above 1 which indicates that the portfolio has a lower standard deviation than the market index, and we must increase our exposure by borrowing at risk-free rate to achieve the same total risk as the market portfolio. The value-weighted portfolio has a risky investment below 1 which indicates that the portfolio has a standard deviation greater than the market portfolio and we must reduce our exposure by investing in risk-free rate. The value-weighted portfolio has a negative M^2 measure of -0.31% while the equal-weighted portfolio has a positive M^2 of 0.25%. We can interpret this as the equal-weighted portfolio provides excess return to the market of 0.25% when they now have the same volatility, while the value-weighted portfolio provides –0,31% less return compared to the market.

Table 8: M^2

Portfolio	Portfolio Weight	M^2
EW	1.37	0.25%
VW	0.70	-0.31%

Table 8 shows the weights invested in the portfolios and the M^2 results for both portfolios.

Table 9 presents the Information ratios of our portfolio. Similar to other performance indicators, it is difficult to say anything specific about what is a good measure of information ratio other than that you want as high a number as possible. A positive ratio indicates that the active return is positive. In our case, none of our portfolios have a positive active return. This can be interpreted as that the portfolios have performed worse than the market portfolio over time without taking risk into account. Tracking error explains how the portfolio fluctuates in relation to the market portfolio and is measured by standard deviations. The closer the value is to zero the closer the portfolio follows the benchmark. Our equal-weighted portfolio has a tracking error of 7.36% and the value-weighted portfolio has a tracking error of 10.50%. Both portfolios have negative IR. The ratio can be used to compare the two portfolios performance relative to the market benchmark, and it shows that the equal-weighted portfolio performs better than the value-weighted portfolio. The results in Tabel 9 also shows a weakness with the Information Ratio which is that the higher the tracking error the less negative the results will be in case of negative active return.

Table 9: Information Ratio

Portfolio	Active Return	Tracking Error	Information Ratio
EW	-0.02%	7.36%	-0.003
VW	-0.11%	10.50%	-0.010

Table 9 shows Active return (monthly returns in excess of the market portfolio), Tracking errors (standard deviation of monthly returns in excess of the market portfolio), and Information ratios (active return divided by the tracking error).

Table 10 presents our factor regressions. For each portfolio we run the following time-series regression:

$$r_{it} - r_f = \alpha_i + \beta_i F_t + \varepsilon_{it} \qquad (13)$$

Where r_{it} are the monthly portfolio return, r_f is the risk-free rate measured as the one-month interest rates for borrowing. F_t are the factor returns depending on the regression model including the market excess return (RM-RF), the size factor (SMB), the value factor (HML), and the momentum factor ($PR1YR$) and β_i is the portfolio's exposure to the risk factors. The results from Table 10 describe the alphas as well as the robust t-statistics for the corresponding alpha coefficient. The alphas from the regressions represent the risk-adjusted returns of the portfolios. The robust t-statistics for the corresponding alpha is used to measure weather the alphas are statistically different from zero, which is a clear strength of alpha as a performance measure compared to other risk-adjusted measures which does not take statistical significance into consideration.

We examine whether the models contain autocorrelation as we want to see if the standard errors of the observations in the regressions are correlated and if the dataset contains momentum factors that affect our results. To check for autocorrelation, we have performed the Durbin-Watson test (Durbin & Watson, 1950), and we find no evidence of autocorrelation in our regressions. We use White's approach (White, 1980) to estimating standard errors that are robust to heteroskedasticity when regressing our models in Stata as we find evidence of heteroskedasticity when we perform Breusch-Pagan's test (Breusch & Pagan, 1979).

When splitting up the portfolios into long and short for the equal-weighted and value-weighted portfolio, Table 10 reports significantly positive alphas for the long equal-weighted portfolios. For the short equal-weighted portfolio, the alphas are not significantly different from zero. The alphas for the separate value-weighted portfolios are all positive except the short portfolio in the four-factor model, but none of the alphas are significantly different from zero. An interesting observation is that the short positions have negative betas while the long positions have positive betas, which indicates that a portfolio consisting of both long and short positions could hedge against systematic risk.

All the regressions for the equal-weighted complete portfolio generates strongly positive alphas which are significant at the 1% level. The results for the single index model, three-factor model and four-factor model are 0.82%, 0.90% and 0.92% respectively. The value-weighted complete portfolio has a positive alpha of 0.85% calculated with the single index model which are statistically significant at the 10% level. The 3- and 4-factor models are also positive but not significantly different from zero.

Table 10: Jensen’s Alpha, 3-factor model, and 4-factor model

	Complete Portfolios		Separate Portfolios			
	EW	VW	EW Long	EW Short	VW Long	VW Short
Single-index model	0.0082^{***}	0.0085^{*}	0.0063^{***}	-0.0002	0.0049	0.0014
	(3.03)	(1.66)	(2.69)	(-0.09)	(1.43)	(0.35)
3-factor	0.0090^{***}	0.0080	0.0050^{**}	0.0018	0.0032	0.0027
	(3.31)	(1.47)	(2.16)	(0.78)	(0.92)	(0.62)
4-factor	0.0092^{***}	0.0042	0.0066^{**}	0.0004	0.0031	-0.0011
	(3.21)	(0.65)	(2.41)	(0.16)	(0.86)	(-0.20)

Table 10 reports three different regressions in which the dependent variable is the returns of the different portfolios in excess of risk-free rate. The returns of the portfolios are both calculated equal- and value weighted. The numbers in Table 10 represent alpha (α). Robust t-statistics are in parentheses.
$H_0: \alpha = 0,\ H_1: \alpha \neq 0$. H_0 is rejected at $p < 5\%$. $\alpha_p \neq 0$ means that the portfolio generates abnormal returns. The significance level is indicated by: $*$: $p = 10\%$, $**$: $p = 5\%$, $***$: $p = 1\%$. A positive significant alpha means that the portfolio has generated excess returns beyond the market index.

The findings from the regressions are consistent with the results from the other risk-adjusted portfolio measures. The value-weighted portfolio does not have an alpha significantly different from zero at the 5% significance level and gets beaten by the market in the rest of the risk adjusted measures. The equal-weighted portfolio beats both the value-weighted portfolio and the market in every risk-adjusted measure included in the analysis and the alpha is significantly positive at the 1% significance level. The results of the equal-weighted portfolio are consistent with the hypothesis which states that a trading strategy that buys companies that reduce debt-ratio and short-sell companies that increase debt-ratio will be able to beat the market at Oslo stock exchange.

6. CONCLUSION

Capital Structure is one of the most central topics discussed in the field of corporate finance. It is well documented in the finance literature that firm value will be affected by changes in capital structure. However, how the capital structure is chosen, and which effect it has on company value is not entirely clear. Literature written on market efficiency makes it obvious that it is difficult but not impossible to beat the market. The ambiguity in the literature of capital structure and the challenges associated with beating the market led us to a hypothesis and approach that is unlike most of the empirical research articles written in the capital structure field.

In this paper, we investigate whether an active trading strategy that buys companies that reduce debt-ratio and short-sell companies that increase debt-ratio will be able to beat the market at Oslo Stock Exchange. Investigating 201 companies listed on Oslo Stock Exchange from January 2002 until November 2020. We find that an equal-weighted portfolio constructed based on the suggested trading strategy will obtain a significantly higher risk-adjusted return than the market at Oslo Stock Exchange. The trading strategy generates up to 11.61% annual risk-adjusted excess return in the period. Our conclusion is that it is possible to beat the market at Oslo Stock Exchange by buying companies that reduce debt-ratio and short-selling companies that increase debt-ratio.

The empirical implications of these findings suggest that companies should be careful with choices affecting capital structure and signals they send as the market picks it up. The empirical implication further suggest that investors can gain by analyzing the firms they invest in and should consider capital structure changes in their analysis, furthermore investors should be careful on how they weight their portfolio as it does affect the risk-adjusted return.

The theoretical implications of these findings suggests that future factor models should consider including leverage as a risk factor. The theoretical implications further suggest that it should be developed a measure like the Treynor ratio, that is appropriate to use to compare both negative and positive beta investments.

We contribute to the existing literature by showing that changes in capital structure does impact the market value of firms and that an active trading strategy based on capital structure changes is able to beat the market.

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APPENDIX

Table A1: Variable definitions

RM-RF	The value-weighted return on the market portfolio during the calendar month over the risk-free interest rate. Obtained from Ødegaard (2020).
SMB	(Small Minus Big) the average return of a portfolio consisting of firms with low market capitalization minus the average return of a portfolio consisting of firms with high market capitalization firms as described by Fama and French (1993). Obtained from Ødegaard (2020).
HML	(High Minus Low) the average return on a portfolio consisting of high value firms minus the average return on a portfolio consisting of growth firms as described by Fama and French (1993). Obtained from Ødegaard (2020).
PR1YR	(Momentum) the difference in the return on the winning portfolio and the losing portfolio as described by Carhart (1997). Obtained from Ødegaard (2020).