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Summary

The focus on socially responsible investments (SRI) has been increasing the last years, as an alternative to the traditional approach of investing. The acronym ESG categorizes SRI into three categories: Environmental, Social and Governance. Previous research has shown that by implementing ESG into the investment decision, the investor can achieve higher risk-adjusted returns on their investment.

The thesis objective is to uncover the effects of ESG by constructing a multi-factor model with ESG-integration, as an alternative to the traditional framework of asset pricing theory. By implementing our own screening and assessment strategy of ESG-factors, we will try to examine the effects in the Nordic market.

Introduction

This thesis' objective is to uncover the effect integration of ESG-factors in an investment strategy has on the risk-adjusted return. We will scrutinize large datasets and look at how individual ESG-exposures, as opposed to pre-analysed ESG-scores presented by rating agencies, affect performance from a style investor's perspective. Taking ESG into consideration in a smart beta strategy may improve, weaken or have no significant effect on risk-adjusted returns. As the market for ESG investing is still developing and rapidly growing, the importance of finding potentially undiscovered anomalies is crucial. Consequently, this leads us to the research question: "Is it possible to achieve higher risk-adjusted return by integrating ESG into a multi-factor model?"

From our examination of ESG-exposure's impact on risk-adjusted return, three different hypotheses exist. With the presentation of each hypothesis, theoretical explanations and empirical evidence are provided. As previous research papers' findings vary, we will elaborate more on each side's arguments, and with our own conclusion plausibly provide some insight in the discussion.

Hypothesis 1: "Integrating ESG in a factor-model reduce your risk-adjusted returns."

This hypothesis, held by the opposition of ESG investing, has its roots in modern portfolio theory which emphasize on the lost diversification effect smart beta strategies have in general. Namely, a focus on a limited number of factors will effectively constrain the investment opportunity, leading to a lower diversification, and thus reduce the risk-adjusted return of a portfolio. In practice, the argument means that the cost of being a sustainable company exceeds the benefits of "doing good", resulting in weakened results for the investors.

Hypothesis 2: "Integrating ESG in a factor-model increase your risk-adjusted returns."

In this case, the investment strategy is thought to beat the market even with traditional financial measures. Typically, the supporters of this view believe that the long-term perspective of ESG investing will outperform the market over time. An argument is that the screening process excludes companies in possession of certain risks which will make them future non-performers, and that this will more than compensate for the loss of diversification. Another explanation points to the possibility that investors generally underestimate the value of being sustainable, effectively under-pricing the companies.

Hypothesis 3: "Integrating ESG in a factor-model neither reduce, nor increase your risk-adjusted returns."

This scenario may have various possible explanations, consisting of combination of the above mentioned arguments. For instance, the cost and benefit for a company to focus on sustainability may be exactly the same. In addition, statistical inference can show to be invalid to draw a conclusion one way or the other, typically as a result of negligible differences in the results.

Investors' concerns nowadays seem to exceed the traditional focus on investment return. We are observing a trend where socially responsible investments increase in popularity among investors. The consumers through media are more socially aware of the firms they are involved with, as a result setting higher requirements to the investors. Topics such as carbon footprint, labour working rights, gender equality, to name a few, have been receiving a lot of attention in the media. Consequently, the investors have adopted an alternative investment approach to reflect upon and to take into consideration.

The new perspective of many investors falls under the category ethical investments, also named Socially Responsible investing (SRI)[1]. The United Nations Principles for Responsible investing states that this approach: "recognizes that the generation of long-term sustainable returns is dependent on stable, well-functioning and well-governed social, environmental and economic systems[2]." The vast popularity on the topic is leading to a large amount of investors to construct their portfolios this way and is the fastest growing segment in finance[3]. We now find numerous mutual funds, rating agencies and different sustainability indexes. For example, Morningstar sustainability rating and MSCI ESG indexes. By the increase in popularity, so has its complexity. The multitude of intertwined terms, and their frequent misuse, complexifies the investment space. This itself result in a need for clarification, to grasp and structuralize a sufficient strategy.

In addition, the more thorough analysis of ESG-factors is becoming increasingly popular. With such approach, the acronym ESG is divided into its respective components, where the environmental, social and governance exposures are measured and categorized for companies.[4] For example, under environmental factors, the investor's asses the company by carbon emissions, efficient use of resources and capitalizing on opportunities created by climate change regulations. Governance factors can be valued by corporate structure, gender quotas on boards and minimum wages. Lastly, examples of social indicators are treatment of employees, community relations and health benefits. The investors and organizations can apply the ESG-factors with ESG-integration through a screening of

[1] https://www.forbes.com/sites/feeonlyplanner/2013/04/24/socially-responsible-investing-what-you-need-to-know/#446de4eb3442
[2] http://roundhouse.ca/ethical-investing-what-it-means-and-why-its-important/
[3] https://www.forbes.com/sites/moneyshow/2017/08/16/socially-responsible-investing-earn-better-returns-from-good-companies/#629df24f623d
[4] http://lexicon.ft.com/Term?term=ESG

their portfolio. Based on their investment profile they can set thresholds, or limits, regarding the stocks they include. Most common methods applied is exclusion criteria, "best in class", and minimum value. Specifically, a screening of undesirable companies to exclude from investors portfolio has become commonplace

Many will argue that the advantages of Socially Responsible investments are that you can identify positive investment opportunities with long-term sustainable values. Further, it enables the investors to potentially avoid risky stocks, by excluding stocks with lower ESG-scores. For example, by excluding a company with low score on environmental emissions, the investor can avoid the future risk of negative media coverage of that company. The critics of socially responsible investments have always been that the investor is giving up higher returns, in favour of maintaining a sustainable investment profile. Mainly two substantial disadvantages have been stressed: First, the lack of diversification by removing stocks from the portfolio, consequently creating negative effects on the risk-adjusted returns. Second, the approach is generating higher costs by being more time-consuming, and may affect the returns negatively. [5]

Previous research

As a foundation for our thesis, we are going to use the approach by Dr. Andrij Fetsun and Dr. Dirk Söhnholz, from the research paper: "A Quantitative Approach to Responsible Investment: "Using ESG-Multifactor Models to Improve Equity Portfolios" (2014). They have studied how different ESG-factors can bring outperformance, by optimizing a weighted ESG-multifactor model. They also considered the effects ESG-factors have on risk, and if implementing ESG could lead to a risk reduction. The research is based on data from Sustainalytics, with ESG-scores for each company, with a total of 2,265 companies. Their screening process of the data was based on contructing a single ESG-score for each firm, by combining the ESG-scores from the different sub-factors. The score of the sub-factors was done by Sustainalytics, with a total of 148 different categories of ESG-measurements. The researches appleid their own weights of the factors: Enivormental, Social and Governance. Furthermore, after their screenings process they appleid a multi-factor model consisting of 5,7,10 of the most significant factors.

The result from their research indicates that by constructing an ESG optimized multi-factor model resulted in generating outperformance with statistical significance. However, they could not find any evidence of reduction in risk by implementing ESG.

[5] https://www.forbes.com/sites/advisor/2016/04/26/the-changing-face-of-socially-responsible-investing/#7c1e81da736a

Furthermore, we have looked at the research done by Jeff Dunn, Shaun Fitzgibbons and Lukasz Pomorski: "Assessing Risk through Environmental, Social and Governance Exposures" (2017). In the paper, they have been investigating the relationship between companies' ESG exposures and statistical risk of companies. Additionally, they considered the effect of ESG scores have on the future through prediction forecasts. The data is based on the MSCI ESG database, and they apply the Barra's GEM2L risk model to assess the risk of their adjusted ESG-scores (divided into five quintiles).

Consequently, by their research they have found clear support of hypothesis, that there is a strong correlation between risk and ESG exposure. Stocks with poor ESG exposure have volatility that is up to 10-15% higher than a stock with the high ESG exposure, and betas up to a 3% increase. The paper also describes findings that ESG may help to improve forecasts of future risk estimates, compared to traditional risk models.

The increase in popularity of ESG-integration is resulting into more focus on the research of the subject and implementation of an ESG investing strategy. On the other hand, there has not been a lot of research done on the Nordic markets. We will investigate the Nordic markets further, and see if we can find effects of ESG in this region. Previous research on the subject is also often based on data which has already been evaluated by rating agencies. We would like to see if we can find a method to identify, and rate our own data as a supplementary analysis. Furthermore, we will also implement our own screening strategy to find the optimal ESG selection.

Finally, we will try to construct an ESG multi-factor model, as an alternative to traditional asset price models.

Theory

To answer our research question: "Is it possible to achieve higher risk-adjusted return by integrating ESG into a multi-factor model?" We are going to apply the theory of multi-factor models to form a multi-factor model with ESG integration. Traditional asset pricing models does not fully capture the ESG effects in their models; hence we would construct a model which incorporates that. We will apply this approach to the traditional models: CAPM, Fama-French three-factor model and Carhart's factor model.

To evaluate the performance of our model, we are will use the traditional performance measures, and the risk-adjusted measures of Sharpe Ratio and Treynor's Measure.

Factor models

A factor model is a model where we can use variables to explain market phenomena or equilibrium asset prices. For instance, you can use a factor model to predicting the uncertainty in returns of a security from other variables. By introducing more than one variable into the computations, the model changes to a multi-factor model. In general a multi-factor model consists of one or more macroeconomic and firm-specific components (Bodie et al., 2014). A single-factor model is defined by:

$$R_i = E(R_i) + \beta_i F + \varepsilon_i$$

The common factor F is based on new information regarding macroeconomic variables, thus the expected value is zero. B_i is the firm's sensitivity to the common factor (also known as factor betas/factor loadings), and ε_i is the firm specific error term. Hence, the model states that the excess return is the macroeconomic exposure to the factor and its expected value. A multi-factor model would have more than one common factor. For instance, the firm is exposed to GDP (F). The GDP has an unexpected increase of 2% and the firms β_i is equal to 1,5. This would result in an increase in excess return of 3%.

CAPM;

The Capital Asset Pricing Model is single factor model for expected return developed by Sharpe (1964) and Lintner (1965). Their work is based on the Modern Portfolio Theory by Markowitz, thus only considering the market exposure of a given asset as an explanatory variable for the expected return (Bodie et al., 2014).

$$E[R_i] = R_f + \beta_{im}\big(E[R_m] - R_f\big)$$

Where:
R_i is the return of asset i
R_f is the return of the risk free asset
β_{im} is the beta of asset i with the market m
R_m is the return of the market portfolio

From the classical way to expressed CAPM above, one can see that the expected is the sum of risk free interest rate, and a stock's beta multiplied with the market risk premium. The beta measures the individual stock`s sensitivity to changes in market risk, and is calculated by the following formula:

$$\beta_{im} = \frac{Cov(R_i, R_m)}{Var(R_m)}$$

According to CAPM, the required expected return from investors has a linear relationship to a given assets covariance with the market portfolio. This means that inclusion of any other component than market portfolio or risk free rate, will hamper the risk-adjusted expected return.

The model also rests on many unrealistic assumptions (Arnold, 2005):

1. Aim to maximize economic utilities (Asset quantities are given and fixed).
2. Are rational and risk-averse.
3. Are broadly diversified across a range of investments.
4. Are price takers, i.e., they cannot influence prices.
5. Can lend and borrow unlimited amounts under the risk free rate of interest.
6. Trade without transaction or taxation costs.
7. Deal with securities that are all highly divisible into small parcels (All assets are perfectly divisible and liquid).
8. Have homogeneous expectations.
9. Assume all information is available at the same time to all investors.

APT:

The arbitrage pricing theory is an asset pricing model based on the idea that asset returns can be predicted by the relationship between one or more risk factors (Copeland et al., 2014).The APT model is based on the similar of intuition of the CAPM, but the application is more general. The model was introduced in 1976, by Steven Ross. The theory is based the assumptions of perfectly competitive and frictionless capital markets, homogeneous beliefs that the random returns of for the set of assets are governed by the linear k-factor model. Furthermore, the theory requires that there are sufficient securities to diversify away all unsystematic risk. Consequently, the APT enlightens how to take advantage of mispricing of assets when you are able to diversify away all unsystematic risk (Bodie et al., 2014). Example of an APT model:

$$R_i = E(R_i) + b_{i1}F_1 + \cdots + b_{ik}F_i + \in_i$$

Where R_i is the random return of the ith asset, $E(R_j)$ is the expected return and b_{ik} is the sensitivity to the asset. F_k is the returns common to all assets, and ϵ_i is a random zero mean noise term.

Fama-French three-factor model

One of the most popular approaches to specifying a firm's exposure to systematic risk is based on the paper by Fama and French: "Multifactor Explanations of Asset Pricing Anomalies" (1996). They constructed a three-factor model that captures systematic risk effects from macroeconomic factors, in critics of the CAPM which only contains the exposure to the market.

$$R_{it} = \alpha_i + \beta_{iM}R_{Mt} + \beta_{iSMB}\mathrm{SMB}_t + \beta_{iHML}\mathrm{HML}_t + e_{it}$$

- SMB = Small Minus Big. SMB is the return of a portfolio of small stocks in excess of the return on a portfolio of large stocks.
- HML = High Minus Low. HML is the return of a portfolio of stocks with a high book-to-market ratio in excess turn on a portfolio of stocks with a low book-to-market ratio.
- The model also captures the exposure to the market.

The findings of Fama and French where that they found anomalies in the market, which explained excess return of stocks. The SMB captured the anomaly of size effects, where small stocks outperform large stocks. The HML seeks to identify the value effects of outperformance of value stocks versus growth stocks (Bodie et al., 2014).

Carhart Four-factor model

After the introduction of the research done by Fama and French, a fourth factor was added to the model by Mark Carhart (1997). The factor was a momentum factor, as was based on the research done by Jegadeesh and Titman (1993). They uncovered a tendency of performance patterns of stocks to persist over several months. Carhart found that what appeared to be an alpha of many mutual funds, could actually be explained by market momentum (Bodie et al., 2014). Carhart introduced the following four-factor model, with the momentum variable (MOM):

$$R_{it} = \alpha_i + \beta_{iM}R_{Mt} + \beta_{iSMB}SMB_t + \beta_{iHML}HML_t + \beta_{iMOM}MOM_t + e_{it}$$

Performance measures:

Sharpe-ratio:

The trade-off between reward (RP) and risk (SD) is given by the Sharpe ratio. The measure was introduced by William Sharpe (1994), and describes the relationship between the excess return of the market and the standard deviation of an asset or a portfolio (Bodie et al., 2014). The Sharpe ratio can be expressed in the following way:

$$Sharpe\ ratio = \frac{R_i - R_f}{\sigma_i}$$

- $R_i = Return\ on\ asset\ i$
- $R_f = return\ on\ risk\ free\ asset$
- $\sigma_i = Standard\ deviation\ of\ asset\ i$

Treynor Measure

Jack Treynor (1996) introduced a similar measure to the Sharp ratio. The Treynor measure gives excess return per unit of risk, but uses only the systematic risk component and not the total risk. The Treynor measure is defined by:

$$Treynor\ Measure = \frac{R_i - R_f}{\beta_i}$$

- $R_i = Return\ on\ asset\ i$
- $R_f = return\ on\ risk\ free\ asset$
- $\beta_i = Beta\ of\ asset\ i$

Jensen's Alpha

Jensen's alpha was introduced in 1968 by Michael Jensen. The approach of Jensen's alpha is to evaluate the risk-adjusted performance of mutual fund managers. The alpha is the excess return of a portfolio over the predicted return by CAPM (Bodie et al., 2014).

$Jensen's\ Alpha\ (\propto) = R_p - (R_f + \beta_p(R_m - R_f))$

- $R_p = Return\ on\ portfolio\ i$
- $R_m - R_f = Risk\ market\ premium$
- $\beta_{pi} = Beta\ of\ portfolio\ i$

Methodology

Our research started by looking at all individual stocks listed in the Nordic countries. One of our approaches is to, screen out undesirable stocks based on ESG-scores from the rating agencies. Thereafter, we will create a portfolio which equally weight the different ESG-ratings and compare its performance to the MSCI Nordic Countries Index. In addition, we will use the raw data from the agencies to construct our own factor model, which also will be compared to the abovementioned index. We will integrate ESG as an individual factor in our model, and try to enhance the classic factor models. To construct the explanatory variable "ESG" we will weight a vast number of measurable ESG indicators according to their relevance to the industry. We base our screening process on the indicators 'defined by The United Nations.

When we compare the performance we will use traditional measures which incorporate both risk and return. Namely, Sharpe Ratio, Treynor's Measure and Jensen's Alpha.

Data

We will use multiple sources to obtain the needed data for our thesis. By cross-referencing ESG-scores from several rating agencies, we will conduct our own rating. In addition we will assess the raw data for particularly interesting factors to use in our model. Suitable companies we have found are the following:

Bloomberg, Corporate Knights, DowJones Sustainability Index (RobeccoSAM), ISS, MSCI, RepRisk, Sustainalytics, Thomson REuters (Asset4)

As a benchmark for comparison, we will use the data from the The MSCI Nordic Countries Index. [6]

[6] https://www.msci.com/documents/10199/6bd9ad54-61be-4bdf-afcd-7465994bcb95

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