

The price of sustainability on the Swedish market

A study of ESG restrictions on value weighted portfolios

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Abstract

In this paper, we evaluate value weighted portfolios with ESG constraints on the Swedish stock market from 2009 to 2013. Most studies within this area have not been able to show significant difference in performance between ethical and conventional portfolios. Observing the four restricted portfolios we created in this study we cannot prove a significant difference when comparing their risk adjusted return. However, we are able to show that market capitalization and sector classification does have an impact on ESG ratings. Our results imply that investing according to ESG principles may not have an impact on risk adjusted return.

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1 INTRODUCTION

1.1 Background and previous research

When talking about social responsible (SR) investments there are three main areas; Environmental (E), Social (S) and Governance (G). These are non-financial measures which tell us how well a company is handling issues that can affect the environment and society in a negative way. The European Federation of Financial Analysts Societies (2011) has defined different areas for which they have KPI (Key performance indicators), such as energy efficiency, staff turnover and corruption. KPI's can be used for evaluating companies from an ESG perspective. In the financial markets, investing with social responsibility has been embraced by a large number of investors. Since 2006 the number of signatories investing according to United Nations Principles for Responsible Investments (2013) have gone from about 100 to over 1200 with almost 35 trillion US\$ assets under management. These signatories are stationed all over the world, with Swedish participants such as AP, Folksam, Ratos and SPA.

When using different ESG criteria, investors need to decide in which companies to invest. According to their goals, they need to remove companies from their portfolios which are not fulfilling these requirements. A screening process is thereby made, and only companies that fit the investment profile is available for asset allocation. There are three common ways of screening. First, the most frequently used way of screening is to avoid investing in companies using a negative SR criterion. The second way of screening is to seek out companies to invest in using a positive SR criterion. The third and final approach is when investors do invest in companies that are morally wrong but using their influence to make them change (Kinder and Domini, 1997).

But can SR investments gain excess returns compared to non-constrained investments? A lot of studies have been within this area, and a great number compare SR mutual funds with conventional mutual funds. Hamilton, Jo and Statman (1993) found no difference in return and performance for 17 U.S. ethical funds compared to the regular fund benchmark during the 1980's. However, no statistically significant results were found. They also found that SR characteristics are not priced by the market; SR factors does not have any effect on the companies' cost of capital or their expected returns. This result was confirmed by Statman (2000) when performing a similar study by the years 1990-1998. Furthermore, Statman found that during this

time period the underlying Domini Social Index¹ performed better than the S&P 500. Sauer (1997), who did not take transaction costs, management fees or investment policy into consideration, found that social responsibility screenings does not necessarily have a negative impact on investment performance. Therefore, both these studies indicate that investors can choose to invest in social responsible funds with no loss in performance.

One problem with the above mentioned studies is they have not taken fund managers skills into consideration, something that mutual funds' performance could depend heavily on. Older studies, beginning with Jensen (1968) have shown that actively mutual funds do not outperform their underlying market on average, even if the measure is with or without management expenses. More recent studies focus on the minority of funds who outperform their benchmark. A study by Hendricks et al. (1993) confirms that there is some evidence to the fact that there are consistent superior funds, named "hot hands" as well consistent underperforming funds, "icy hands", and that a strategy of selecting the top performing funds based on the last year result can significantly outperform the average mutual fund. According to Jegadeesh and Titman (1993) this one year momentum can be explained by the buy-the-winners and sell-the-losers transactions which will move prices away from their long-run values; the losing portfolio shows a higher return 8 to 20 months after the formation date than the winning portfolio. To eliminate these management errors, as well as other non-quantified aspects such unknown portfolio holdings and methods of screening, this has not analyzed SR mutual fund's performance against conventional mutual funds. Instead our focus was on the underlying market.

Previous research about investing according to ESG principles has come to different and vague results. For citing Kurtz (2005): "Practitioners of SR investing's have delivered acceptable results for their clients. But what is past is past". According to this citation, there are still questions on SR investments that need to be answered.

More recent studies on SR investment still have the same issue with finding significant results. Bauer et al. (2005) evaluated 103 ethical mutual funds from the US, German and UK market. Using the Carhart multi-factor model (Carhart 1997) they found no statistical significant difference between the ethical and conventional mutual funds, even if they controlled for size, momentum and book-to-market. One

¹A market cap weighted stock index of 400 companies provided by KLD research firm. The index contains only of companies with a high SR ratings.

interesting finding was that SR funds in UK and Germany tend to invest in small cap stocks, whereas US ethical funds invest more in large cap companies. Derwall et al. (2005) shows that a large cap “eco-efficient”² portfolio outperforms on average a less “eco-efficient” portfolio over a nine year period. The study is also pointing out the issues with the transaction costs and management skills. Following a similar approach, Olsson (2007) compared different US stock portfolios’ as they were constructed by their level of Environmental risk according to industry ratings. By allocating the 30 % best companies in one portfolio and the 30 % worst companies in the other the given results indicated that none of the portfolios’ produced abnormal return. Herzel, Nicolosi and Stărică (2012) evaluated optimal portfolio decisions on the S&P 500 index with SR constraints based on E, S and G rankings provided by KLD. They used the Fama-French three factor model (Fama and French 1992) to estimate the covariance matrix and a neutral forecasting assumption for the expected returns with the same starting point as the Black-Litterman model (Black and Litterman 1992). They found that the loss in risk adjusted return was small despite a large impact on market capitalization. Another finding was that the percentage loss in market capitalization is higher than the percentage of companies removed. An explanation is that large cap companies have lately been raising more concerns within the ESG area.

Worth noticing is that most studies are conducted on the US market. This is not unexpected since the US market is one of the most developed markets in the world. In 2012 the NYSE and NASDAQ accounted for 33 % of the world’s market capitalization. Our study will instead focus on the Swedish market, which is highly-developed³, however many times smaller. For domestic investors, the Swedish market is interesting from an evaluation perspective since Swedes have a great proportion of “home bias” when investing; during the period 1998-2012 almost 90 % of the household’s savings involved investments in companies listed on the Swedish stock market (The Swedish Investment Fund Association, 2013).

There is, however, also a critique against the term SR investments. Milton Friedman (1970) argued that the only responsibility a company has is to increase its profits. Thinking “socially responsible” could limit the shareholder wealth, which was against the basis of business enterprise. The foundation of the stock market is such that it is

²“Eco-efficiency” is, according to Innovest Strategic Value Advisors rating database, a concept of how the economic value of company adds relative to the waste when creating value.

³USA was ranked as the 2nd most developed market in the Financial Development Index at the World Economic Forum (2012) while Sweden was ranked at a 10th place.

impossible for one person to make an impact. If an investor does not buy a certain asset for ethical reasons, someone else will buy it instead. Another problem is that these ethical funds want to make the same profits as other funds. Perhaps you will have to accept lower returns in order to make a real difference, which is unrealistic if you believe investors to be perfectly competitive (Sandberg 2013).

Another problem comes from the fact that it is hard to determine whether a company is ethical or not. Bigger companies might have more resources to improve their ESG ratings than smaller ones. A study made by Svensk Handel (2012) shows that 91 % of the largest companies within the commerce sector are working with issues regarding corporate social responsibility. However, only 50 % of the smallest companies are working with these questions. Folksam (2013) states in their sustainability report that Swedish large cap companies have higher SR requirements compared to small- and midcap companies. Reasons for that is the higher market capitalization, a more diverse ownership and higher volume of business. This results in higher ESG ratings for large cap companies. This report also mentioned the difference between sectors: Sectors with e.g. high environmental impact tends to display more information, which leads to a better ranking.

1.2 Problem formulation

This study tried to determine what the effects might be for investors if they choose to invest using ESG restrictions⁴. We created different portfolios with different levels of restrictions and we used a non-restricted portfolio as our benchmark. Thereafter we used different measurements for comparison among the portfolios. Therefore, the thesis statement is:

- Does ESG restriction on your portfolio lead to lower risk adjusted return?

Secondary, we also want to raise the following question:

- Using ESG investment decisions on the Swedish market, is there any market capitalization and sector bias in our portfolios?

⁴Investors assumes to be greedy and prefer less risk to higher for the same level of return, i.e. investors are risk averse. This is also known as the mean-variance criterion (Bodie, Kane, Marcus 2011)

Section 1 describes a theoretical background and the problem formulation. Section 2 includes the methodology and section 3 presents and analyzes the results. Finally, section 4 is a summary of the paper with conclusions and suggestions for further research within this area.

2 Method

This part describes the data used in this study, the estimation models used, the construction of portfolios, and the measures of performance for our comparing portfolios.

2.1 Data

The data set consists of stocks listed on the OMX Stockholm Large Cap between the years 2009 to 2013. This index is used because of the high liquidity as well as the probable large cap bias for the companies ESG ratings. Stocks that have been delisted or listed during this time period have been ignored, as well as companies with missing ESG ratings. That left us with 85 stocks over this five year period. The stock return is calculated on weekly basis as well as the market capitalization for each company. In other words, our portfolios were rebalanced once every week during this five year period according to their weights within the sample. Our return data is collected from Datastream and Bloomberg. For the risk free rate we used the 1 month Treasury bill retrieved from Sveriges Riksbank, also calculated on a weekly basis.

Our ESG data was retrieved from GES, which is a company that evaluates listed companies on their preparedness and performance on environmental and social risks. The evaluation is also a measure on how transparent the companies are with providing ESG information. Due to our agreement with GES we were not able to present the underlying data in this paper. GES have provided two aggregated scores for each company, one score for Human Rights (HR) and one for Environment (E), where the higher score is more preferable from an ESG perspective. These scores can be used to compare companies in different branches. We combined the HR and E scores for each company, since we wanted to observe the company's performance as a whole. In other words, a high HR score could therefore compensate a bad E score. This gave us a total company score (ESG) which we used for our portfolio evaluation. Since the ESG scores are revised yearly, our portfolios were rebalanced at the beginning of each year according to their aggregated score.

2.2 Portfolio construction

In theory, the portfolio risk equals the market risk as the number of assets goes to infinity. It is however argued about at which number of assets the nonsystematic risk becomes negligible. According to Statman (1987), at least 30 stocks are required for a borrowing investor and 40 stocks for a lending investor. On the other hand, Reilly and Brown (2011) argue that after the 18th stock, you have almost got the full diversification effect. However, if all investments are allocated in the same asset class portfolio diversification would not have been achieved.

For our portfolio construction, we performed a screening process to see how big a loss there is from excluding companies with a low ESG score from your portfolio, i.e. a negative SR criterion was used (Kinder and Domini, 1997). We constructed five different portfolios based on the levels of screening. We performed a screening at a 20 %, 50 %, 80 % and 90 % level and observed the effects on the risk adjusted return when removing these companies from the investment universe. Our fifth portfolio where constructed on a non-screening level.

Table I
Portfolio Strategies

Table I reports the five portfolio strategies used in this report. All companies are from OMXS Large Cap. The number of companies in each portfolio are determined by the level of screening.

| Strategy | No. of companies |
|-------------------|------------------|
| ALL, no screening | 85 |
| Best 80 % | 67 |
| Best 50 % | 43 |
| Best 20 % | 17 |
| Best 10 % | 9 |

When creating these five portfolios, no sector belongings or company size has been taken into consideration. The best 10 % and best 20 % portfolio consists of fewer stocks than needed for full diversification effect (Reilly and Brown 2011, Statman 1987). However, we considered these portfolios interesting from an evaluation perspective; if we could see a vanishing diversification effect with so few assets.

2.3 Performance measurements

For portfolio evaluation we used two different risk measures. This is required for analyzing the results in a proper way. For each of the two ratios we compared them with the unrestricted portfolio. When evaluating portfolio performance with ESG constraints, single factor models are most frequently used than three and four factors models (Derwall et al, 2005), we took the majority perspective using a CAPM single-index model. This model's intercept gives the Jensen's alpha which is our first performance measurement,

$$\alpha_p = \bar{r}_p - [\bar{r}_f + \beta_p(\bar{r}_m - \bar{r}_f)] \quad (1)$$

where α_p is a measure of the portfolio performance, \bar{r}_p , relative to the market, $\beta_p(\bar{r}_m - \bar{r}_f)$ where β_p is the portfolio beta, \bar{r}_m is the return of the market and \bar{r}_f is the risk free rate (Jensen, 1968). In this study, the market is considered the unrestricted value weighted portfolio.

Our second performance measurement is the Sharpe ratio (Sharpe 1966). It is one of the most standardized measurements of performance since it measures the excess return, $\bar{r}_p - \bar{r}_f$, per unit of risk, σ_p ; the higher Sharpe ratio the better risk adjusted return is achieved.

$$Sharpe = \frac{\bar{r}_p - \bar{r}_f}{\sigma_p} \quad (2)$$

2.4 Evaluating market capitalization and sector bias

For analyzing if there is any market capitalization bias when using different levels of screening we performed a regression using average annual market capitalization and ESG scores for each year. We also performed a regression on average return and market capitalization to see if there is a small firm effect, which states that companies with a small market capitalization outperform larger companies (Fama and French 1992).

For observing potential sector bias using ESG constraints we performed a regression using dummy variables for each sector. The sectors were categorized according to

GICS⁵ which gave the following regression:

$$AverageESG = \alpha_i + \beta_1(Financial) + \beta_2(Cons.disc.) + \dots + \beta_9(Info.Tech) + \epsilon_i \quad (3)$$

The Energy sector was used as the benchmark sector. For each sector, the ESG ratings are averaged using all individual companies ESG rating within the sector. When evaluating the ESG ratings for a certain sector, the sector dummy is equal to 1 and all other sectors equal to 0. This gave us the following null hypothesis:

H0: The sectors have the same rating

Ha: At least one sector differs from another

2.5 Statistical test for the Sharpe ratio

In order to compare two different portfolios' Sharpe ratios we needed to ensure that they are statistically different from each other. To test for significance, we used the following test constructed by Lo (2002) to see whether the difference is statistically significant. Lo's test is a correction of previous test by Jobson & Korkie (1981).

If the returns are assumed to be I.I.D, the standard error for a Sharpe Ratio is:

$$Std.Error = SE(\widehat{SR}_i) = \sqrt{\frac{1 + \frac{1}{2}SR_i^2}{T}} \quad (4.1)$$

Consequently, the confidence interval can be written as follows, when using a 95 % confidence level, where the critical value is 1.96.

$$Conf.Interval : \widehat{SR}_t \pm 1.96 * SE(\widehat{SR}_i) \quad (4.2)$$

To see whether the difference between two Sharpe Ratios is statistically significant the following formula was used.

⁵GICS (Global Industry Classification Standard) is an industry classification. No companies within OMXS Large cap are classified under the sector Utilities, which leave this sector outside the test.

$$Z_{obs} = \frac{SR_j - SR_i}{SE(SR_i)} \quad (4.3)$$

This test gave the following hypotheses:

- H0: The Sharpe ratios for the portfolios are the same.
- Ha: The Sharpe ratios for the portfolios are not the same.

2.6 Empirical results and analysis

Figure 1
Portfolio return

Figure 1 shows the indexed return for each portfolio used in this study over a five year period. The portfolios are value weighted and rebalanced every week. The ALL portfolio consists of 85 companies and the other have been reduced according the screening level that have been used. In the Best 80 % portfolio for example, the 20 % worst rated companies are removed.

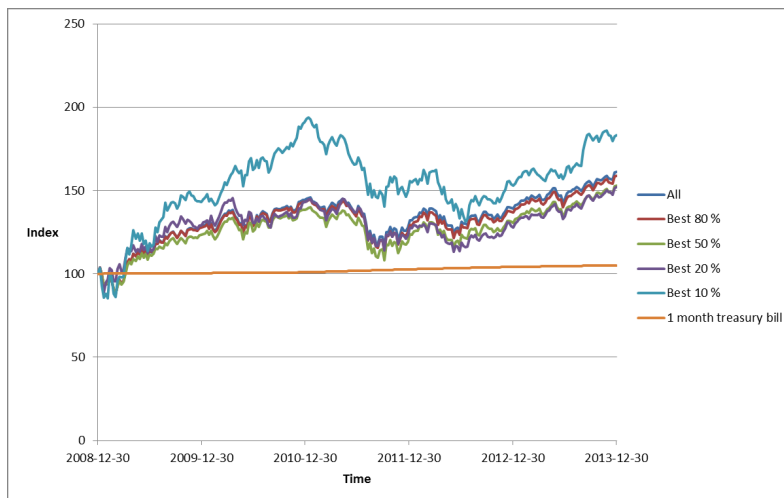


Table II
Summary statistics

Summary statistics for the above mentioned portfolios. The measurements are averaged over the years 2009-2013.

| Portfolio | Weekly return | Weekly std. dev. | Alpha | Beta | Sharpe |
|-----------|---------------|------------------|---------|--------|--------|
| ALL | 0.0022 | 0.0255 | 0 | 1 | 0.0844 |
| Best 80 % | 0.0021 | 0.0256 | -0.0001 | 1.0025 | 0.0806 |
| Best 50 % | 0.0018 | 0.0251 | -0.0003 | 0.9780 | 0.0732 |
| Best 20 % | 0.0018 | 0.0284 | -0.0004 | 1.0313 | 0.0634 |
| Best 10 % | 0.0029 | 0.0396 | 0.0001 | 1.3250 | 0.0754 |

As we see, the portfolios movements are very similar. This is confirmed by a correlation matrix (see Appendix 6.1). This is of course due to the fact that the unrestricted portfolio contains all the assets used in the restricted portfolios. When evaluating each portfolio's performance during this five year period, all restricted portfolios except the Best 10 % has a lower return than the index portfolio. The Best 10 % portfolio, however, has the highest return as well as the highest volatility. This result confirms Reilly's and Brown's (2011) that an 18 stock portfolio gives an almost full diversification effect; the Best 20 % consists of 17 stocks and closely track the index portfolio.

The regression for the beta- and alpha-values estimation shows that all the restricted portfolios have a beta close to 1, except for the Best 10 % which has a beta of 1.32. It is also the only portfolio with a positive Jensen's Alpha. This explains the higher return for this portfolio. However, none of the alphas are significant, which means that our restricted portfolio returns are not statistically different from the market portfolio.

The observed Sharpe ratios for this period show that in general, higher restrictions lead to a slightly lower risk adjusted return. The 10 % portfolio is again the exception, but it is not outperforming the index portfolio. To find if these results are significant, Lo's (2002) Sharpe ratio test gave the following results:

Table III

Sharpe ratio confidence intervals

Table III reports the confidence intervals for the restricted portfolios' Sharpe ratios. They are compared against the non restricted portfolio's Sharpe ratio of 0.0844. The test conducted is Lo's (2002) test for comparing Sharpe ratios.

| Portfolio | Lower critical value | Mean | Higher critical value | Standard Error |
|-----------|----------------------|------------|-----------------------|----------------|
| Best 80 % | -0.0409 | < 0.0844 < | 0.2021 | 0.06199 |
| Best 50 % | -0.0482 | < 0.0805 < | 0.1947 | 0.06198 |
| Best 20 % | -0.0580 | < 0.0732 < | 0.1849 | 0.06196 |
| Best 10 % | -0.0461 | < 0.0634 < | 0.1969 | 0.06198 |

The standard errors (SE) for the Sharpe ratios do not differ very much from each other. This is reasonable since all portfolios have the same number of observations. The confidence intervals for all portfolios cover the index Sharpe ratio of 0.0844. The z-test reveals that none of the portfolios Sharpe ratios are statistically significant from each other; the z-value furthest from zero is -0.34 which is insignificant. A lot of studies do have problem with statistical significance during performance evaluation, such as Hamilton, Jo and Statman (1993), Bauer et al. (2005) and Olsson (2007). For achieving significance using weekly data, this study would have needed 8755 observations which is equivalent to 168 years⁶. This result do not confirm Sauer's (1997) and Statman's (2000) indications that ESG restrictions do not necessarily have to affect portfolio performance. Since we had no statistical significance we cannot reject their studies. The results are confirmed by a regression using average return for each portfolio (see Appendix 6.3). The constrained portfolios return where constructed as dummy variables against the ALL portfolio return. The F-value for this test of 0.07 shows that joint significance does not exists.

⁶For calculations, see Appendix 6.2

Table IV

Loss in market capitalization for each portfolio

Table IV describes the loss in market capitalization when screening at a 20 %, 50 %, 80 % and 90 % level for the restricted portfolios.

| Portfolio | Loss in Market Capitalization |
|-----------|-------------------------------|
| Best 80 % | 10.43 % |
| Best 50 % | 21.13 % |
| Best 20 % | 69.61 % |
| Best 10 % | 89.79 % |

The loss in market capitalization differs among the used screening levels. When removing the worst rated companies, the percentage loss in market capitalization is less than the percentage of companies removed. This result is different from Herzl, Nicolosi and Stărică (2012) who found that the worst rated companies had a larger than average market capitalization. At a higher level of screening, the loss in market cap is approximately the same as the screening percentage. This means that for our study in general, the assets with lower market capitalization are the ones that have lower ratings. To confirm these results the following regression is made:

Figure 2

Regression market cap and ESG rating

Figure 2 shows the results of a regression, $AVE\ ESG = \beta_0 + \ln\ marketcap + \epsilon_i$, where $AVE\ ESG$ is the average ESG rating for the companies used in this study, β_0 is a constant, $\ln\ marketcap$ is the logarithmic average market cap for the companies and ϵ_i is the error term. The time period is 2009-2013.

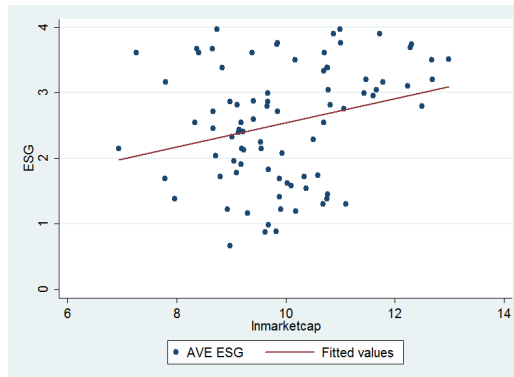


Table V

Regression market cap and ESG rating

Table V shows the results for the regression on market cap and ESG rating. The market capitalization is logarithmic due to a heteroscedastic problem. Since the t-value for market cap is 2.47 market cap have a significant impact on ESG ratings.

| | Coefficient | t-value |
|----------------|-------------|---------|
| ln(Market cap) | 0.1844 | 2.47 |
| Constant | 0.7010 | 0.94 |

Table V shows that a higher market cap is correlated with a higher ESG rating. It is statistically significant at a 5 % level. The market cap is logarithmic due to a problem with outliers, i.e. heteroscedastic (see appendix 6.4). These results is in line with the studies made by Svensk Handel (2012) and Folksam (2013), which discovered that larger companies have more resources to work with ESG questions which leads to a higher ESG ranking. This result implies that the ethical investor firstly should seek out companies with a high market capitalization to find companies with a high ESG rating.

For analyzing how ratings vary among different sectors we performed a regression. The companies are categorized according to the GICS , and the ESG score for each sector is the average score for the companies in said sector:

Table VI
Regression Sector ESG ratings

Table VI shows a dummy variable test between the sectors used in this study and ESG rating, see equation 3. The Energy sector is omitted since it is used as the benchmark sector. Each sectors ESG rating is based on the average company ESG rating for companies within the sector over the time period 2009-2013.

| Sector | Coefficient | Std. Err. | t | P> t | F(8,76) | Prob>F |
|------------------|-------------|-----------|------|-------|---------|--------|
| Financial | 0.4383 | 0.8219 | 0.53 | 0.595 | 3.56 | 0.0015 |
| Consumer disc. | 1.1327 | 0.8481 | 1.34 | 0.186 | | |
| Consumer staples | 1.1266 | 0.8601 | 1.31 | 0.194 | | |
| Health Care | 0.6220 | 0.8996 | 0.74 | 0.464 | | |
| Energy | 0 | Omitted | - | - | | |
| Industrials | 1.3766 | 0.8235 | 1.67 | 0.099 | | |
| Telecom | 0.2925 | 0.8996 | 0.33 | 0.746 | | |
| Material | 1.6008 | 0.8438 | 1.90 | 0.062 | | |
| Information tech | 1.3823 | 0.8691 | 1.59 | 0.116 | | |
| Constant | 1.536 | 0.8046 | 1.91 | 0.060 | | |

The sectors are compared against the Energy sector which works as the benchmark group. Since the F value is significant, we can reject the null hypothesis that there is no difference in rating between sectors, which confirms the report by Folksam (2013). However, their report argues that sectors with high impact on a certain area would give higher ratings, while this study shows different results, e.g. the rating of the Energy sector. The Energy sector has the lowest ranking, but according to Folksams (2013) argumentation, their ranking should have been higher due to probable high environmental effects. One possible explanation to this result is the aggregated E and HR scores used in this study, where a high HR score can compensate a low E score. However, this explanation holds for most sectors. Low rated companies in sectors such as Financial and Telecom are assumed to work less with ESG issues, especially environmental questions, compared to the Industrial, Information Technology and Material sector, which have a higher ESG rating.

Figure 3

Regression average return and market cap

Figure 3 is a regression, $Average\ return = \beta_0 + \ln\ marketcap + \epsilon_i$, where $Average\ return$ is the averaged yearly return for the companies used in this study, β_0 is a constant, $\ln\ marketcap$ is the logarithmic average market cap for the companies and ϵ_i is the error term. The time period is 2009-2013.

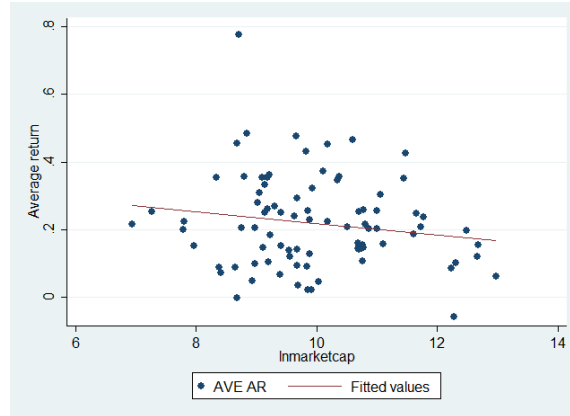


Table VII

Regression Average return and market cap

Table VII shows the results for the regression on average yearly market cap and average yearly return over the time period 2009-2013. The market capitalization is logarithmic due to a heteroscedastic problem.

| | Coefficient | t |
|----------------|-------------|-------|
| ln(Market cap) | -0.0173 | -1.50 |
| Constant | 0.3907 | 3.37 |

In a regression with return as the dependent variable, and market cap as the independent variables, we see that it has a negative effect on returns. This indicates that there might be a small firm effect (Fama and French 1992). However, the result is not statistically significant.

3 Conclusion

Previous studies made within the SR investment area both has come to different results, even if the studies are made on mutual funds or on portfolios with restrictions. This study took a similar approach using a screening process, but instead of looking at the world's largest markets, our focus was on the Swedish stock market. This study was not able to find any significance in risk adjusted return between the portfolios either. To find significance, a much longer time span would have been needed since the standard errors for the Sharpe ratios were too large. Regarding increased risk, there is no big difference in volatility unless for the Best 10 % portfolio. When screening at this level, we see an increased standard deviation. This is reasonable, since a lower number of stocks will increase the non-systematic risk. The advice for the risk averse investor is the same as always; make sure you have enough diversification in your portfolio.

This study also compared size and ESG rating. The loss in market capitalization when screening at different levels implies that bigger companies have higher ESG rating. Our result tells us that we have a large cap bias; large companies do have a better ESG-rating than smaller. Arguments for this could be that large companies have more resources and incitements for evolving in ESG strategies. We also found that the ESG rating does differ across different sectors. The reason for this might be that some sectors are considered dirtier, and therefore has to work harder with these issues, I.e. oil companies has to make sure they extract oil without spillage, and clothing companies has to make sure their employees get a salary that they are able to make a living on.

For the responsible investor this study have the following three conclusions: 1) We are not able to conclude any impact on the risk adjusted return by ESG screening, 2) Invest in large companies that disclose their work with ESG questions, 3) Avoid certain sectors but make sure you get enough diversification from the sectors you actually choose.

For further researchers, this area has a lot of unanswered questions, especially on small financial markets that often are neglected. For the Swedish market, a mean-optimization framework with ESG constraints would have been interesting from an investment view, as well as a deeper study on sectors individual ESG performance.

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5 Appendix

5.1 Correlation matrix

Table VIII

Correlation matrix for the five value weighted portfolios

Table VIII shows a correlation matrix for the five portfolios used in this study over the whole five year period.

| Portfolio | ALL | Best 80 % | Best 50 % | Best 20 % | Best 10 % |
|-----------|--------|-----------|-----------|-----------|-----------|
| ALL | 1 | | | | |
| Best 80 % | 0.9989 | 1 | | | |
| Best 50 % | 0.9945 | 0.9971 | 1 | | |
| Best 20 % | 0.9283 | 0.9300 | 0.9275 | 1 | |
| Best 10 % | 0.8538 | 0.8513 | 0.8415 | 0.8755 | 1 |

5.2 Calculation for number of observations required to obtain significance

$$Std.Error = SE(\widehat{SR}_i) = \sqrt{\frac{1 + \frac{1}{2}SR_i^2}{T}} \quad (5a)$$

$$0.0844 - 0.0634 = 0.0209 \quad (5b)$$

$$\frac{0.0209}{1.96} = 0.0107 \quad (5c)$$

$$\sqrt{\frac{1 + \frac{1}{2}0.073436^2}{T}} = 0.0107 \quad (5d)$$

$$T = 8755 \Rightarrow \frac{8755}{52} = 168years \quad (5e)$$

This means that weekly data from 168 years is needed for significance.

5.3 Regression with dummy variables for different portfolios

Table IX

Regression with dummy variables for the portfolios

Table IX reports the results from a regression using average return for each portfolio. The constrained portfolios, Best 80 %, Best 50 %, Best 20 % and Best 10 %, are constructed as dummy variables against the ALL portfolio (unconstrained). The coefficient is each restricted portfolios alpha value compared to the unrestricted. This regression gives an F-value of 0.07 which shows that joint significance does not exist.

| | Coefficient | t | F-value |
|-----------|-------------|-------|---------|
| Best 80 % | -0.0001 | -0.03 | 0.07 |
| Best 50 % | -0.0003 | -0.12 | |
| Best 20 % | -0.0004 | -0.14 | |
| Best 10 % | 0.0001 | 0.32 | |
| Constant | 0.0022 | 1.18 | |

5.4 Regression ESG and market cap (non logarithmic)

Figure 4

Regression ESG and market cap

Figure 4 shows the results of a regression, $AVE\ ESG = \beta_0 + marketcap + \epsilon_i$, where $AVE\ ESG$ is the average ESG rating for the companies used in this study, β_0 is a constant, $marketcap$ is the average market cap for the companies and ϵ_i is the error term. This figure clearly reveals the problem with outliers, i.e. a heteroscedastic problem. The time period is 2009-2013.

