# A Quantitative Approach to Responsible Investment: Using a ESG-Multifactor Model to improve Equity Portfolios

Dr. Andrij Fetsun[1] , Dr. Dirk Söhnholz[1],

[1] Veritas Investment GmbH, mainBuilding, Taunusanlage 18,
60325 Frankfurt am Main, Germany

## Abstract

In this article we show how we analyzed ESG (Environment, Social, and Governance) criteria to improve equity portfolios. We have used the data of Sustainalytics as a particularly detailed source of ESG-Data and the Alfa-Testing Module from FactSet as a powerful tool for conducting backtests. Sustainalytics provides an attractive and independent database with its up to 148 ESG sub-factors per company. In our analysis we used data from August 2009 until August 2013. Aggregated Environment, Social, and Governance scores were analyzed from 2004 until August 2013. The following issues were analyzed a) whether ESG-total score or Environment, Social, Governance scores improve portfolios b) what weights for Environment, Social and Governance factors should be used in the total ESG-score for reaching outperformance; c) whether and which single ESG-criteria bring outperformance and risk reduction, d) whether a ESG multifactor on the basis of the statistically significant single factors can bring outperformance.

The backtest analysis of the total ESG Score shows, that the results are not statistically significant. The total ESG Score has not led to better returns or lower risks in general not in different market environments. Using backtesting, the most relevant 10 out of up to 148 ESG-Factors in terms of statistically significance were selected. Additionally, a multifactor analysis was applied in backtests. Three multifactor's were constructed consisting of the five, seven and ten most significant ESG sub-factors. The optimization of equity portfolios with these multifactors models has resulted in

generating outperformance with quite strong statistical significance. From the risk side, there is no risk reduction of the optimized portfolio.

## 1. Introduction

Socially responsible investments have been getting popular in the investment society since the last century. The beginning point of the socially responsible investments may be considered by introducing an exclusion list. It excludes companies producing socially undesirable products, the so called "sin" products like alcohol, drugs, weapons, gambling, etc. The next stage in socially responsible investments is considering more factors which incorporate environment, social and governance (ESG) factors such as the ones included in the United Nations Principles for Responsible Investments. The Principles offer a menu of possible actions for incorporating ESG issues into the investment process, which are become more and more popular. Principles for Responsible Investments have more subscribers in Europe than in the US. In other words, European investors believe stronger, that the generation of long-term sustainable returns are dependent on stable, well-functioning and well governed social, environmental and economic systems. A responsible investment strategy should be tested as any other investment strategy in respect to its potential improvement for portfolio performance, either in reducing risk or increasing return. so far, quite some research has been conducted on the ESG-topic. There are evidences that responsible investments lead to the improvements of risk/return ratio of the investments [1], [2], [3], [4]. From the other side, there are evidences that negative ethical stocks deliver higher performance [5]. But most of the research is based on overall ESG-indicators, at best differentiating Environment, Social and Governance as groups of factors. There is little agreement on how to exactly define these factors so that different research is often not comparable. Therefore we focus on commercially available data which can be used by other researchers as well as practitioners. With Sustainyltics we identified a data source which according to our research shows the most suited data for statistical analysis since it goes back to 2009 in significant detail and accuracy for about 2300 stocks worldwide.

The main objective of this article is to analyze the influence of the total ESG Score as well as single aggregated Environment, Social, Governance Scores on investment performance starting from 2004 until 2013. ESG Scores are used as the single optimization criteria for the equity universe. The same analysis was done for the 148 single ESG factors starting from August 2009 until August 2013.

To analyze this issue, we use a dataset from Sustainalytics, which is a global responsible investment research firm specialized in ESG research and analysis. Sustainalytics covers 2,265 companies and all of them have been included in backtesting. All stocks are equally weighted in the selected portfolio for conducting our analysis.

The article is organized as follows: Section 2 describes the data availability and a principle of forming ESG sub-factors. Section 3 presents the empirical analysis. Section 4 concludes.

## 2. Data

A more sophisticated approach in socially responsible investments compared with an exclusion list is based on ESG scores. ESG scores are becoming the industry-standard for evaluating corporate social responsibility. There are several rating agencies focused on the compilation of ESG scores. These agencies generate data from various sources on numerous sub-topics regarding corporate social responsibility. The next step is a generalization of numerous sub-scores into a single composite ESG score for a company. We have used the ESG-data from Sustainalytics, which is a global leader in sustainability analysis according to its marketing material. It offers time series of environment, social and corporate governance sub-factors that are aggregated into a environment, social, corporate governance overall score per company.

The fulfillment of the sub-factors are estimated between 0% and 100% by an analyst of Sustanalitycs, who is responsible for the analysis and monitoring of the company on a at least the monthly basis. Each analysis is periodically validated by at least a second analyst. The highest value for the Sub-factor means that the sub-factor is fully fulfilled in the corresponding field. For example, the governance sub-factor "Disclosure of

Director's Remuneration" with the value 100% means that a policy on the director's remuneration is in place. A remuneration policy explains how directors are to be remunerated, including all forms of remuneration and payments to any past directors with reference to the long term strategic performance of the company. This policy will be binding by a shareholder vote and reviewed and submitted for shareholder approval. Any subsequent changes will have to be voted on during the company's general meeting. If the changes are not approved by the shareholders, either the remuneration must be paid in line with the existing policy or a special resolutions meeting will need to be sought. Sustainalytics estimates the social sustainability of the company by using one hundred forty eight ESG sub-factors, which are aggregated on the Environment, Social and Governance level. Thirty four sub-factors belong to the governance score, fifty eight sub-factors to the social score, fifty five sub-factors to the environment score. If the ESG sub-factor is not relevant to the activity or to business model of a company, the ESG sub-factor will be weighted with zero.

The total ESG score of a company is aggregated by Sustainalytics as the weighted score of its individual scores. The weight of each score in the total ESG-score can be selected by a user of the ESG-data himself. This means that an investor can adjust the influence of each score according to his/her expectations on how important this factor is ton the specific investor. The data on the aggregated level of environment, social, governance scores are available on a monthly basis.

### 3. Empirical analysis

The standard investment strategy of a socially responsible investor is to use an exclusion list avoiding companies involved in any "sin" business such as alcohol, tobacco, gambling. This strategy does not consider performance opportunity costs. The socially responsible investments can be applied much wider than with an exclusion list and respectively getting more attractive for investors, for who social return is not the first priority.

 In our analysis, we are trying to find a solution on how an ESG-investment strategy can bring both an attractive financial return to an investor and to the society. For this purpose, we have conducted backtests for separate Environment, Social and

Governance scores as well as for the total ESG score. Thus any investor can choose individual weight of each sub-score in the total ESG score. In most of the cases such decision is done intuitively or in other words without using a quantitative approach. This intuitive approach in the selection of the score weights can lead to underestimation or overestimation of the Environment, Social or Governance scores influence on the portfolio performance. One of the goals of this paper is to provide an asset manager with quantitative estimation of the weights for Environment, Social and Governance scores. This estimation has been done based on the analysis of the single ESG sub-factors, which is discussed below.

Our hypothesis is that corporate governance is more crucial compared to the other two factors in generating performance (see Zagst [6]). According to the results of the quantitative approach discussed below, the weight of 2/3 was applied to the corporate governance score and 1/6 respectively to environment and to social scores in constructing the total ESG score. This relatively heavy weight for Governance is quite unusual. Most often Environment seems to receive the highest relative weight. Initial backtests of data conducted at the end of 2012 and using data until middle 2012 showed a risk reduction effect of the selected portfolio which also was found by Auer [7]. The current backtesting using data until middle 2013 shows, that the results are not statistically significant (Information Coefficient T-Stat=0.29 and information coefficient (IC) is very low 0.01). The statistical significance of IC corresponds to the confidence interval of 38%. The ESG total score did neither lead to additional performance generation ((F1-F3=-0.013, where F1 is the return generated by first quintile (ESG Sub-factors with the highest score) and F3 is the return generated by the last quintile (ESG Sub-factors with the lowest score)) nor to risk reduction in the estimated period of time. There is no evidence of a connection between performance of the portfolio and an optimization of a portfolio with an ESG total score in the observed period.

This motivates us to go deeper with our analysis. The next step is to analyze separate Environment, Social and Governance Scores. The plot below shows the performance of the portfolio optimized with separate Environment, Social and Governance scores.

Plot 1. First – last Fractile
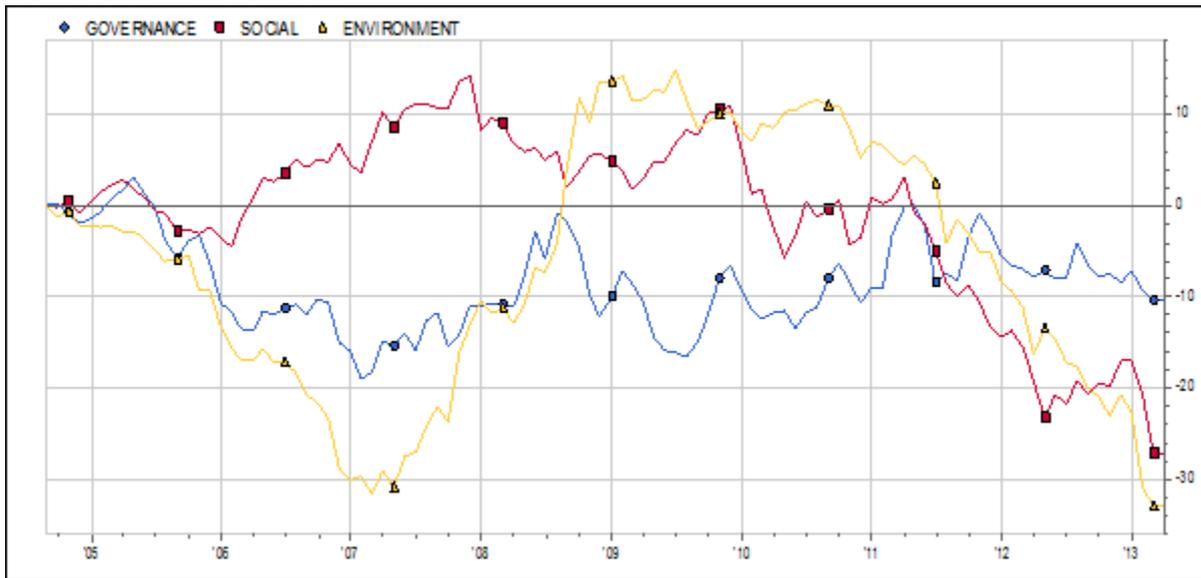


Optimization of the portfolio by Environment, Social and Governance scores does not result in generating sustainable additional return before a crisis, neither after a crisis nor during a crisis period. The information coefficient below shows very small values and therefore no important link between the return of a portfolio and the selected ESG scores.

Plot 2. Average Information coefficient
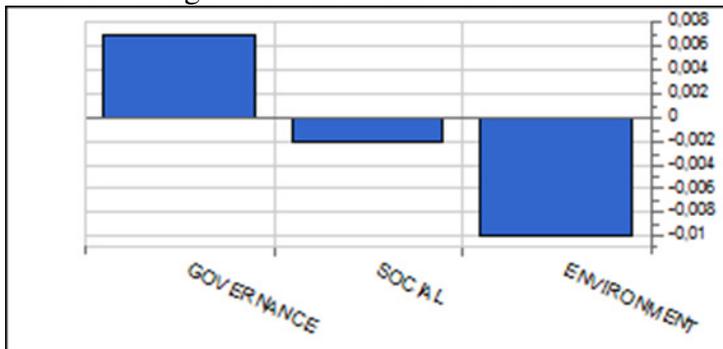


Based on the above-mentioned analysis of aggregated ESG scores, we have formed the following hypothesis. 148 ESG Factors from Sustainalytics are important for a wide variety of investment society goals, but not necessary all of them can be applied to the portfolio optimization as criteria for sustainable alpha generation. The backtest was applied for the analysis of all 148 ESG Sub-factors in the same way as it was done for the analysis of separate ESG scores. The results of the analysis are below, which contain the statistics of the ten best ESG Sub-Factors in terms of statistical

significance. The Board Independence has the highest statistically significance level, which equals to 84.30%. The worst ESG sub-factor (Employee Related Controversies) out of the first ten in terms of statistically significance has the statistically significance 66.20%. It corresponds to 0.42 T-Stat. The Board Independence sub-factor also has higher IC compared with the tenth EGS sub-factor (1.01 vs. 0.009). Ranking of ESG sub-factors by statistical significance shows that seven out of ten ESG sub-factors belong to the Governance score, two ESG sub-factors to the Social score and only one to the Environment score. Interestingly, there is a significant overlap with the sub factors selected prior to backtesting as potentially being the most relevant for portfolio improvements (Table 1).

Table 1.

| | | |
|---|---|---|
| Governance | 1 | Whistleblower Programmes |
| | 2 | Tax Transparency |
| | 3 | Policy on Money Laundering |
| | 4 | Business Ethics Related Controversies or Incidents |
| | 5 | External Verification of CSR Reporting |
| | 6 | Disclosure of Directors' Remuneration |
| | 7 | Disclosure of Directors' Biographies |
| | 8 | Separation of Board Chair and CEO Roles |
| | 9 | Board Independence |
| | 10 | Audit Committee Independence |
| | 11 | Non-Audit Fees Relative to Audit Fees |
| | 12 | Compensation Committee Independence |
| | 13 | Governance Related Controversies or Incidents |
| | 14 | Transparency on Payments to Host Governments |
| | 15 | Public Policy Related Controversies or Incidents |
| Social | 1 | Formal Policy on Working Conditions |
| | 2 | Formal Policy on the Elimination of Discrimination |
| | 3 | Employee Related Controversies or Incidents |
| | 4 | Policy on Conflicts of Interest |
| | 5 | Customer Related Controversies or Incidents |
| | 6 | Society & Community Related Controversies or Incidents |
| Environment | 1 | Environmental Management System |
| | 2 | Environmental and Social Impact Assessments |
| | 3 | Operations Related Controversies or Incidents |
| | 4 | Contractors & Supply Chain Related Controversies or Incidents |
| | 5 | Products & Services Related Controversies or Incidents |

Looking at table 2, the higher weight of Governance score in the total ESG score apparently makes sense.

The rebalancing of the portfolio was done on a monthly basis. The annualized return for the Sub-factor "Board Independence" is 2.94% compared with the ESG total Score portfolio return of 1.71%. The details of the backtests are provided in table 2.

Table 12. The best ten sub-factors in terms of statistically significance.

| Factors | Ann. return | IC | IC T-Stat | IC Std. Dev. |
|---|---|---|---|---|
| Board Independence | 2.94 | 0.024 | 1.01 | 0.13 |
| Disclosure of Directors's Renumeration | 3.37 | 0.020 | 0.80 | 0.18 |
| Compensation Committee Independence | 2.35 | 0.020 | 0.79 | 0.11 |
| Whistlebower Programmes | 2.20 | 0.014 | 0.63 | 0.07 |
| Operations Related Controversies or Incidents | 4.08 | 0.013 | 0.60 | 0.05 |
| Policy on Bribery and Corruption | 2.29 | 0.014 | 0.58 | 0.09 |
| Society&Community Related Controversies or Incidents | 3.45 | 0.013 | 0.55 | 0.06 |
| Policy on Political Involvement and Contribution | -0.75 | 0.012 | 0.46 | 0.10 |
| Board Diversity | 0.86 | 0.012 | 0.44 | 0.13 |
| Employ Related Controversies or Incidents | 10.48 | 0.010 | 0.42 | 0.04 |

Analyzing risk criteria of the backtest like maximum drawdown and standard deviation shows that a portfolio optimization using ESG Sub-factors does not result in risk reduction. The further details of the analysis are provided in table 3.

Table 3. The risk numbers of the best ten sub-factors in terms of statistically significance.

| Factors | Std. Dev. Return | | | Maximum Drawdown | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 1 | 2 | 3 |
| Board Independence | 21.56 | 21.74 | 16.44 | 16.38 | 7.16 | 9.04 |
| Disclosure of Director's Renumeration | 20.10 | 22.31 | 16.74 | 12.83 | 6.21 | 10.93 |
| Compensation Committee Independence | 21.75 | 30.17 | 17.95 | 17.18 | 2.53 | 8.07 |
| Whistleblower Programmes | 20.25 | 20.66 | 16.21 | 14.95 | 15.95 | 10.09 |
| Operations Related Controversies or Incidents | 18.91 | 10.30 | 12.01 | 12.93 | 13.29 | 2.28 |
| Policy on Bribery and Corruption | 20.96 | 17.38 | 17.69 | 16.07 | 10.86 | 12.51 |
| Society&Community Related Controversies or Incidents | 18.90 | 12.58 | 12.84 | 13.74 | 2.65 | 1.77 |
| Policy on Political Involvement and Contribution | 15.85 | 18.46 | 19.43 | 6.73 | 19.36 | 11.98 |
| Board Diversity | 19.55 | 19.54 | 18.97 | 15.19 | 10.97 | 8.44 |
| Employ Related Controversies or Incidents | 18.78 | 17.48 | 9.45 | 13.02 | 14.22 | 1.55 |

The single ESG sub-factors deliver better results than the aggregated Environment, Social and Governance Scores and the total ESG score and at the same time the results are statistically more significant. This is the reason for using a multifactor analysis in

order to create a multifactor, which has more explanatory power and has a higher statistical significance than the aggregated ESG scores. Three multifactors were constructed. The first multifactor consists of the first ten ESG sub-factors, which are ranked by statistical significance. The second multifactor consists of seven ESG sub-factors, which are the best seven in terms of statistical significance. The lowest statistical significance for the seventeen sub-factor is 71%. The third multifactor consists of five ESG sub-factors. Two factors, which are not available for all 2,265 firms, were deselected from the seven sub-factors. The multifactors are constructed in the following way: The constituents of the multifactors are equally weighted and the Z-score is applied in order to combine the ESG sub-factors. The plot below shows the performance of the portfolio optimized by the multifactors, by ESG Total Score and by one ESG sub-factor "Board Independence". The optimization of the portfolio by multifactors as well as by the sub-factor "Board Independence" has resulted in generating alpha with quite strong statistical significance.

Plot 3. First-Last Fractile
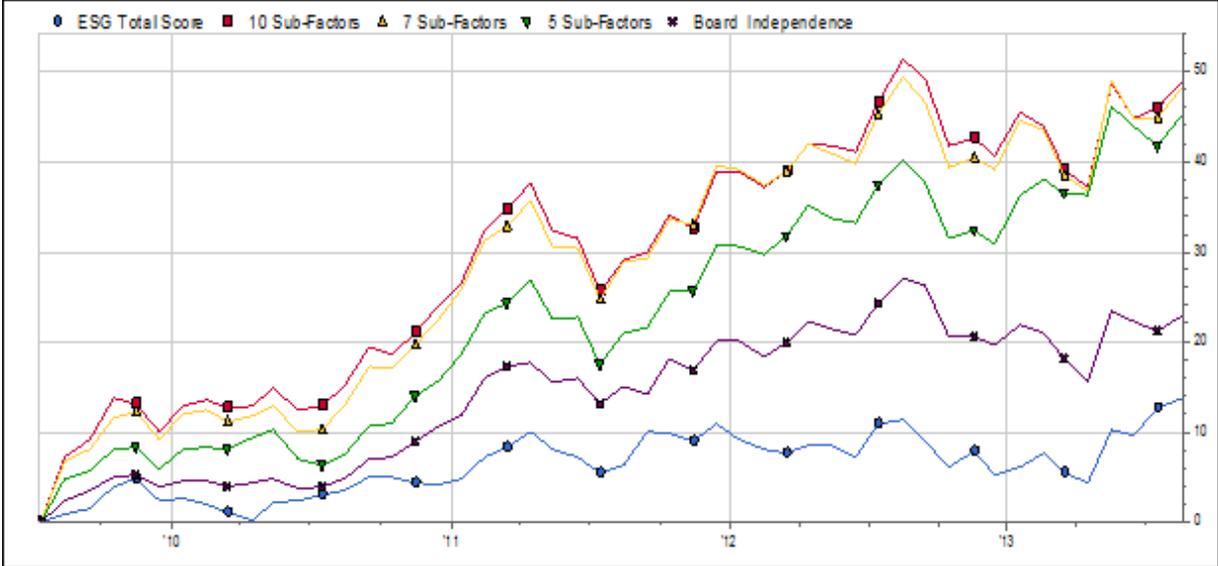


Plot 4 shows the information coefficient for the above mentioned factors. ICs for the three multifactors are much higher than for the total ESG score. The IC of the most statistical significant ESG sub-factor (Board Independence) is also higher than the IC for the total ESG score. Multifactor analysis therefore is an appropriate one for a social responsible investment strategy.

Plot 4. Average Information Coefficient
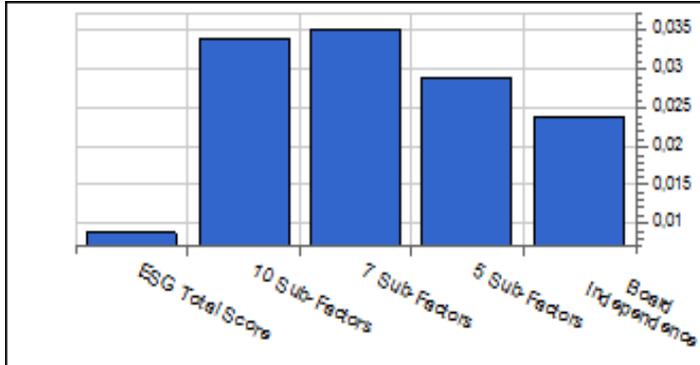


The statistical details of the backtesting approach are summarized in tables 3 and 4. The results are ranked according to statistical significance. According to the risk numbers of the backtest shown in table 4, the optimization of the portfolio by multifactors has not led to a risk reduction of the portfolio.

Table 4

| Factors | Annul. return | IC | IC T-Stat | IC Std. Dev. |
|---|---|---|---|---|
|  |  |  |  |  |
| 7 Factors | 5.89 | 0.035 | 1.49 | 0.13 |
| 10 Factors | 6.32 | 0.034 | 1.45 | 0.13 |
| 5 Factors | 4.97 | 0.029 | 1.26 | 0.10 |
| ESG total Score (70%G, 12.5%E,12.5%S) | 1.71 | 0.009 | 0.36 | 0.08 |

Table 5

| Factors | Std. Dev. Return | | | Maximum Drawdown | | |
|---|---|---|---|---|---|---|
|  | 1 | 2 | 3 | 1 | 2 | 3 |
| 7 Factors | 23.46 | 18.81 | 14.50 | 16.22 | 13.13 | 7.83 |
| 10 Factors | 23.76 | 18.91 | 14.24 | 15.47 | 13.66 | 7.44 |
| 5 Factors | 23.57 | 18.29 | 14.68 | 16.65 | 11.23 | 8.48 |
| ESG total Score (70%G, 12.5%E,12.5%S) | 19.38 | 18.44 | 17.60 | 14.39 | 13.86 | 9.42 |

## 4.    Conclusion

The up to 148 ESG Factors per stock collected by Sustainalytics are potentially important for investors who want to follow a dedicated responsible Investment strategy, but not necessary all of them lead to better portfolios in terms of return increase or risk reduction.    As it is proposed by PRI principles, a tailor made investment strategy based on a multifactor analysis was created. The backtests for the three specifically created multifactors delivered statistically significance results in germs of return enhancement, not risk reduction. Further analyis in the future can work with longer time series and can evaluate industry and regional specific aspects.

## Acknowledgment

**References:**

[1] Gompers, P., Ishii, J., Metrick, A. (2003): "Corporate governance and equity prices", The Quarterly Journal of Economics, Vol. 118, No.1, pp. 107-155.

[2] Benson, K, Braisford, T., Humphrey, J. (2006): „Do Socially Responsible Fund Managers Really Invest Differently?" Journal of Business Ethics No. 65, pp. 337-357

[3] Renneboog, L., Ter Horst, J., Zhang, C. (2008):„Socially Responsible Investments: Institutional Aspects, Performance, and Investor Behaviour". Journal of Banking and Finance No. 32 (9), pp. 1723-1742.

[4] Kempf, A.¸Osthoff, P. (2007): „The Effect of Socially Responsible Investing on Portfolio Performance. European Financial Management" No. 13 (5), pp. 908-922.

[5] Hong, H., Kacperczyk, M. (2009): „The Price of Sin: The Effects of Social Norms on Markets". Journal of Financial Economics No. 93 (1), pp. 15-36.

[6] Zagst, Rudi, Krimm, Theresa, Hörter, Steffen, Menzinger, Barbara (2010): „Responsible Investing: Verantwortlich investieren".

[7] Auer, Benjamin R. (2013): "Do Socially Responsible Investment Policies Add or Destroy European Stock Portfolio Value?"