SmartESG inside

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Smart ESG Integration: Factoring in Sustainability

Abstract

Smart ESG integration is an advanced ESG integration method developed by RobecoSAM's Quantitative Research team.

In a first step, an improved sustainability score is set up in terms of a predictive model of expected investment success. Significant evidence from RobecoSAM's comprehensive sustainability database is incorporated into the model, while biases induced by the heterogeneous and diverse nature of sustainability data are effectively removed, leading to more explanatory and predictive power of the resulting score.

In a second step, the smart score is used to establish a respective sustainability investment factor. Using multiple cross-sectional regression for factor estimation allows for the simultaneous control of other relevant model factors (e.g. country, industry, currency, beta, size, value, momentum, etc.) - and the application of the new factor in attribution reports, i.e., the direct attribution of portfolio risk and return to the new sustainability factor.

Finally, the risk and return profile of the sustainability factor exhibits low risk, considerable information ratio, and low correlation to other common risk factors. It is therefore a promising candidate for use in factor models with multiple sources of risk and return.

Smart ESG Integration: Factoring in Sustainability

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This is the first in a series of papers about score-based smart ESG integration. It is meant as an introduction and overview, while more detailed insights into methodology and results will be covered in the follow-up publications.

Table of contents

ABSTRACT 2

1 ESG INTEGRATION 4

1.1 Evidence-Based Score-Models 5

2 THE SUSTAINABILITY FACTOR 7

2.1 Factor-Mimicking Portfolio 8

3 RESULTS 9

3.1 Factor Correlation 9

3.2 Factor Performance 9

3.3 Risk and Return Attribution 11

4 CONCLUSIONS AND NEXT STEPS 13

REFERENCES 14

1 ESG Integration

RobecoSAM developed the annual Corporate Sustainability Assessment (CSA) in 1999 to identify companies that are better equipped to recognize and respond to emerging sustainability opportunities and challenges presented by global and industry trends.

As a result, RobecoSAM has compiled one of the world's most comprehensive sustainability databases.

The CSA serves as the basis for the construction of the prestigious Dow Jones Sustainability Indices (DJSI) as well as for RobecoSAM's and Robeco's investment strategies and ESG[1] integration practices, across its product range.

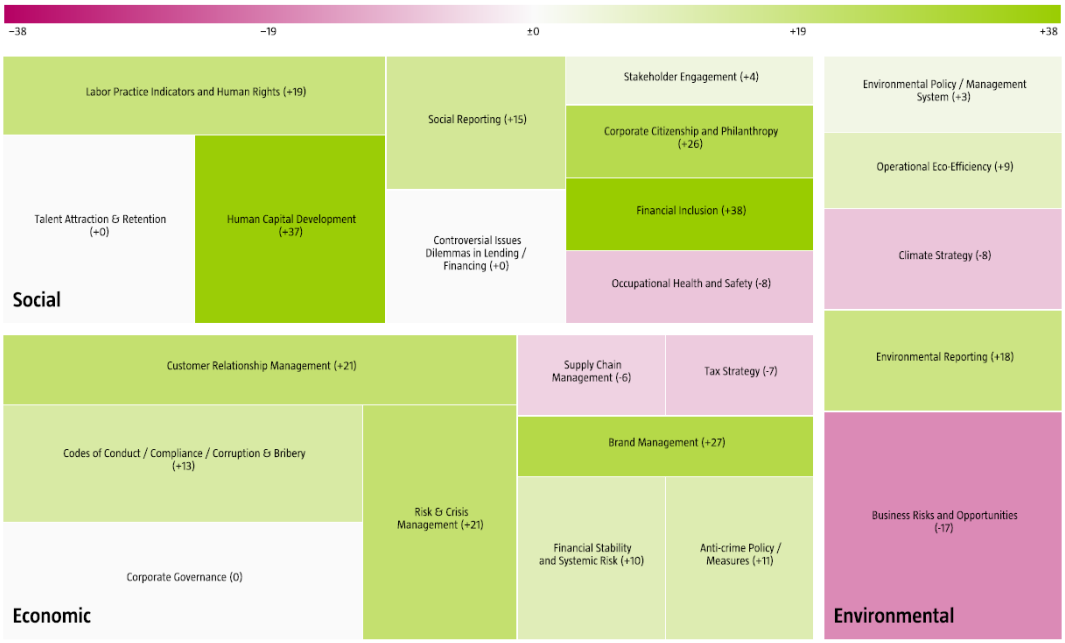
ESG Integration "[…] focuses on the potential impact of ESG issues on company financials (positive and negative), which in turn may affect the investment decision." [Eurosif, 2014].

In other words, ESG Integration is a strategy to integrate sustainability into the investment process.

Score-based ESG Integration is a specific ESG integration method implemented by use of an ESG score, which represents companies' sustainability performance in terms of a comprehensive set of ESG criteria, which are aggregated into a single global number per company by a hierarchical weighted sum of sub-scores [RobecoSAM, 2014].

Figure 1 shows a sector-specific score treemap, illustrating the particular set of criteria scores assessed for a company with an excellent total sustainability performance, and their respective initial weights used in the aggregation of the company's sustainability score. E.g., criterion "Human Capital Development" has a relatively high sustainability score, which will contribute strongly to the total sustainability score of the shown company, since its area (i.e. weight), is also large in comparison.

Figure 1: Sector-Specific Criteria Scores (Color) and Weights (Rectangle Size)



Source: RobecoSAM

[1] ESG stands for Environmental, Social, and Governance. At RobecoSAM, ESG is defined in terms of Environmental, Social, and Economic Dimensions, where Governance criteria are included in the Economic Dimension, see also [RobecoSAM "Measuring Intangibles"].

For RobecoSAM ESG scores, materiality considerations are seamlessly integrated into the score, since the initial weights used in the score aggregation are derived from the materiality analysis, which is used by RobecoSAM's sustainability analysts to determine the expected financial relevance of the sustainability criteria that are incorporated into the CSA. Materiality is defined in terms of the degree and likelihood of the impact of sustainability on long-term company value, see Figure 2 [GRI and RobecoSAM, 2015].

Starting from the forward-looking and sector-specific analysis of financial materiality, the objective of the smart score is to align score aggregation weights of the criteria with their respective explanatory and predictive power.

Figure 2: Example of Materiality Matrix: Software Industry

Source: RobecoSAM

1.1 Evidence-Based Score-Models

Smart ESG integration depends crucially on the predictive and explanatory power of the ESG score with respect to the investment decision outcome.

It is mandatory for an effective score to model expected (aka ex-ante, forward-looking) investment success to enable its use in the context of forward-looking models, e.g. valuation models used by financial analysts.

In other words, in addition to the assessment of sustainability in terms of criteria scores, it is essential to derive the optimal sustainability "model" for the aggregated score - i.e., the number of criteria and their respective weights in the aggregation - from the observed evidence (the data)[2].

Estimating an optimal set of model weights from the data, however, is demanding, because there is a trade-off between model bias and variance. Simple models tend to exhibit low variance, but high bias. E.g., if we included just a single criterion in the aggregation, the variance of predicted investment successes would be low, because single criteria cannot have wide ranges of outcomes. On the other hand, this simple model is likely to have a bias to a particular set of outcomes. In contrast, very complex, low-bias models with dozens of criteria tend to model the noise present in the data and will produce a high variability of predicted outcomes.[3]

[2] Note that the evidence (the data) may indicate a weight of zero for a criterion, which would effectively suggest the exclusion of the criterion, or even a negative weight for a criterion if its score appears to be negatively correlated with investment success.

[3] This feature of overly complex models is also known as "overfitting". In the financial research community, however, overfitting is often called "data mining", which we think is at best a misleading use of the term "data mining", see also e.g. [Hastie et al., 2009].

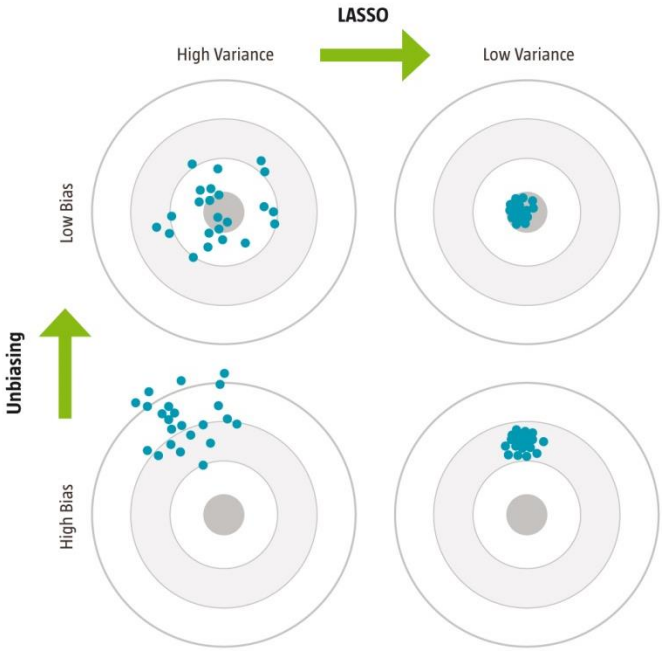
We propose a two-step procedure to solve the bias-variance dilemma for the ESG score models:

1) Reduction / elimination of criteria bias, e.g., potential biases induced by transparency issues or use of different input data sets across company groups, by neutralizing respective biases per criteria.

2) Estimation of criteria significance using an advanced statistical model which is able to balance bias and variance, e.g. the "Least Absolute Shrinkage and Selection Operator" (LASSO) [Tibshirani, 1996][4]

Figure 3 illustrates the bias / variance dilemma and its solution in the context of ESG score development.

Figure 3: Solving the Bias / Variance Dilemma for ESG Score Models



Source: RobecoSAM

A simple but effective model robustness check is out-of-sample testing, where the data is split into two parts, and then the model is estimated using the first part, and the model's predictions are checked using the second part. The discrepancy between predicted and actual values for the second part will then indicate the overall expected performance of the model, including bias and variance.

[4] Other methods include "Stepwise Regression", "Cross-Validation", "Bayesian Shrinkage", etc.

2 The Sustainability Factor

ESG integration aims to improve the sustainability exposure of portfolios. At the same time, an improved risk-return profile is expected, which should eventually lead to long-term value creation [RobecoSAM, 2015].

A straightforward approach for the implementation of ESG integration is to tilt the portfolio weights in proportion to the score. Active weights of portfolio components with high scores are increased, while active weights of portfolio components with low scores are decreased.

While the strength of the resulting increase in sustainability exposure of the portfolios can be controlled by the amount of tilt, it is crucial to also control for unintended exposures to other factors, in particular to factors whose risk is not adequately compensated for by additional return, see e.g., [Cochrane, 1999].

Using an optimizer for portfolio construction will allow for the required systematic control of risk factors without reducing sustainability exposures, e.g., by imposing optimizer constraints on the minimum required level of sustainability and the maximum acceptable levels of exposure to other risk factors.

Finally, risk-factor attribution can be used to analyze and further control exposure to factors like „Country", „Industry", „Value", „Momentum", Low-Volatility" etc. and "Specific Risk" to optimize the risk/return profile of the portfolio.

Portfolios tilted strongly to the Sustainability Score will typically show positive exposures to size and both dividend and earnings yield, and negative exposure to residual volatility, see Table 1. Exposures to dividend yield, earnings yield and (negative exposure to) residual volatility[5] contribute positively, while the exposure to size contributes negatively to the portfolios return.

Table 1: Typical Exposures of Portfolio tilted to Sustainability Score, 2002-2014

Source of Return	Average Active Exposure
Beta	0.02915
Book-to-Price	0.03225
Dividend Yield	**0.09795**
Earnings Yield	**0.09794**
Growth	-0.04821
Leverage	0.05555
Liquidity	-0.06136
Momentum	0.03018
Residual Volatility	**-0.10536**
Size	**0.23700**

Source: RobecoSAM, Factor Estimation Platform: BARRA Portfolio Manager

It remains an open question, however, to what degree sustainability directly contributes to the risk / return profile of a portfolio.

If it were possible to represent the smart ESG score in terms of an investment factor, the question could be answered.

[5] Negative exposures to "Residual Volatility" correspond to positive exposures to "Low-Volatility" factors, see [MSCI Barra, 2013]

2.1 Factor-Mimicking Portfolio

A general and widely-used procedure to establish a factor is based on multiple cross-sectional regressions: it allows for the simultaneous estimation of a number of factor returns. More importantly, the regression coefficients, i.e., the factor returns, are defined in terms of exact "factor-mimicking portfolios" [Menchero, 2010; Axioma, 2013].

Exact factor-mimicking portfolios have zero exposure to all other covariates in the regression, i.e., any factor represented in the regression, e.g., country, industry, momentum, etc., is controlled for by construction.

Table 2: Exposures of Exact Factor-Mimicking Portfolio / Smart Sustainability Factor, 2002-2014

Source of Return	Average Active Exposure
Beta	0.00000
Book-to-Price	0.00019
Dividend Yield	**0.00000**
Earnings Yield	**0.00021**
Growth	0.00015
Leverage	0.00019
Liquidity	0.00000
Momentum	0.00000
Residual Volatility	**0.00000**
Size	**0.00000**
Sustainability	**1.00000**

Source: RobecoSAM, Factor Estimation Platform: BARRA Portfolio Manager[6]

I.e., the estimated sustainability factor from the multiple cross-sectional regression is neutral with respect to all other factors. Its factor return represents pure sustainability, without any contribution from other factors, see Table 2.

[6] The number and type of factors used in multi-factor models of return is not standardized. On the other hand, there is some agreement in the financial community about the set of important investment factors. Estimation results will depend on the particular set chosen. For practical considerations, we used the factors provided with BARRA Portfolio Manager, see e.g. [MSCI Barra, 2013].

3 Results

Given the exact factor, it is now possible to explore and validate the sustainability factor, e.g., if it is a persistent, stable, and statistically significant factor.

3.1 Factor Correlation

Table 3: Factor Correlation Matrix, EOY 2014

Factor	Sustainability	Beta	Book-to-Price	Dividend Yield	Earnings Yield	Growth	Leverage	Liquidity	Momentum	Size	Residual Volatility
Sustainability	**1.000**										
Beta	**0.060**	1.000									
Book-to-Price	**0.055**	0.111	1.000								
Dividend Yield	**-0.015**	-0.012	0.122	1.000							
Earnings Yield	**0.041**	0.023	-0.066	-0.264	1.000						
Growth	**0.008**	0.082	-0.043	-0.089	-0.062	1.000					
Leverage	**0.041**	0.120	0.219	0.040	-0.038	-0.025	1.000				
Liquidity	**-0.010**	0.192	-0.046	-0.100	0.000	0.081	0.104	1.000			
Momentum	**-0.061**	-0.203	-0.205	-0.113	-0.152	0.024	-0.171	-0.133	1.000		
Size	**0.059**	0.213	0.223	0.074	0.118	-0.041	0.113	0.102	-0.188	1.000	
Residual Volatility	**0.073**	0.564	0.136	-0.031	0.034	0.075	0.231	0.226	-0.180	0.208	1.000

Source: RobecoSAM, Factor Estimation Platform: BARRA Portfolio Manager

The new factor shows weak correlation with all established score-based factors, see Table 3, with a mix of positive and negative correlations, indicating no commonalities between the sustainability score and the other measures. This suggests that the sustainability score provides a (linearly) independent signal for the investment decision. It is therefore a promising candidate for portfolios with multiple sources of return.

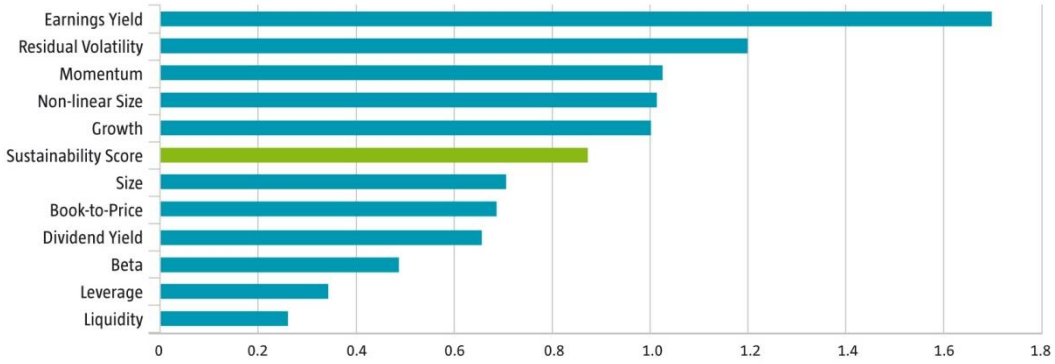
3.2 Factor Performance

The main characteristic of the sustainability factor is its low volatility, allowing for a solid information ratio in comparison to the established factors, see Figures 4 and 5.

Figure 4: Risk/Return Map of Sustainability Score and Common Risk Factors, 2005-2014

Source: RobecoSAM, Factor Estimation Platform: BARRA Portfolio Manager

Figure 5: Information Ratio of Sustainability and Common Risk Factors, 2005-2014



Source: RobecoSAM, Factor Estimation Platform: BARRA Portfolio Manager

3.3 Risk and Return Attribution

The sustainability factor can also be used in comprehensive risk/return attribution analyses, e.g., attributing risk/return of an arbitrary equity fund or portfolio to sustainability, and reporting the contribution of sustainability to risk/return of the fund.

In the following two reports, the return of a portfolio with considerable sustainability exposure is attributed to common risk factors and a specific component.

In the first attribution report (Table 4), the risk model used does not contain the sustainability factor. Therefore, a sizeable amount of return is attributed to the specific component and it is unclear if the return contribution is purely specific or contributed by sustainability.

Table 4: Return Attribution of Portfolio with Sustainability Tilt using Standard Risk Model, 2014

Source of Return	Return Contribution
Total Managed	3.95580%
Total Benchmark	0.17747%
Bottom-up Benchmark	0.17747%
Total Active	3.77833%
Local Excess	3.75803%
Residual	3.75803%
Common Factor	2.26791%
Risk Indices	1.92600%
Beta	0.17927%
Book-to-Price	0.08530%
Dividend Yield	0.05151%
Earnings Yield	0.92401%
Growth	-0.15049%
Leverage	0.10050%
Liquidity	0.03493%
Momentum	0.41083%
Non-linear Size	-0.44454%
Residual Volatility	1.24861%
Size	-0.51393%
Industry	0.28655%
Country	0.05537%
Specific	**1.49011%**
Currency	0.02030%

Source: RobecoSAM, Factor Estimation Platform: BARRA Portfolio Manager

In the second attribution report (Table 5), the same portfolio is analyzed with a risk model that includes the sustainability factor. The return which used to be attributed to the specific component in Table 4 is now almost completely attributed to the sustainability factor, quantifying the amount of sustainability tilt in the portfolio.

Table 5: Return Attribution of Portfolio with Sustainability Tilt using Risk Model including Sustainability Factor, 2014

Source of Return	Return Contribution
Total Managed	3.95580%
Total Benchmark	0.17747%
Bottom-up Benchmark	0.17747%
Total Active	3.77833%
Local Excess	3.75803%
Residual	3.75803%
Common Factor	2.26791%
Risk Indices	1.92600%
Beta	0.17927%
Book-to-Price	0.08530%
Dividend Yield	0.05151%
Earnings Yield	0.92401%
Growth	-0.15049%
Leverage	0.10050%
Liquidity	0.03493%
Momentum	0.41083%
Non-linear Size	-0.44454%
Residual Volatility	1.24861%
Size	-0.51393%
Sustainability	**1.47180%**
Country	0.05537%
Industry	0.28655%
Specific	**0.01831%**
Currency	0.02030%

Source: RobecoSAM, Factor Estimation Platform: BARRA Portfolio Manager

4 Conclusions and Next Steps

Smart ESG integration consists of two elements: an improved sustainability score model and a respective sustainability investment factor estimated from the score.

Key steps to improve the explanatory and predictive power of the score are: unbiasing of the data, incorporation of evidence from the data, and the combination of analysts' expectations with empirical evidence[7]. The approach ensures that the model amends (reduces) the weights of the criteria which have shown to be able (not to be able) to forecast return.

In particular, the approach makes it possible to efficiently capture the dynamic nature of sustainability criteria, eg, changing levels of return for "Corporate Governance" for the decade 1990-2000 vs. the 2000-2010 [Gompers et al., 2003; Bebchuk et al. 2013].

By estimating a sustainability investment factor based on the improved score, it is possible to explain the risk / return profile of portfolios tilted to sustainability in terms of factor exposures to common factors and "pure" sustainability. Unintended exposures to factors which increase risk but are not compensated for by a risk premium are identified and can be eliminated by neutralizing the respective exposures in a multifactor context.

The "pure" sustainability factor features an attractive risk / return profile with low volatility and considerable information ratio.

The objective now is to further verify the robustness of the sustainability factor to set the stage for the development of stable, scalable, and successful products. Back-tests with RobecoSAM's partners, e.g., Standard & Poor's, already indicate the potential of the new factor across our product range.

[7] A detailed description of the unbiasing procedure and an example of model selection using LASSO will be provided in a forthcoming article.

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About RobecoSAM

Founded in 1995, RobecoSAM is an investment specialist focused exclusively on Sustainability Investing. It offers asset management, indices, engagement, voting, impact analysis, sustainability assessments, and benchmarking services. Asset management capabilities cater to institutional asset owners and financial intermediaries and cover a range of ESG-integrated investments (in public and private equity), featuring a strong track record in resource efficiency theme strategies. Together with S&P Dow Jones Indices, RobecoSAM publishes the globally recognized Dow Jones Sustainability Indices (DJSI). Based on its Corporate Sustainability Assessment, an annual ESG analysis of 2,900 listed companies, RobecoSAM has compiled one of the world's most comprehensive databases of financially material sustainability information.

RobecoSAM is a member of the global pure-play asset manager Robeco, which was established in 1929 and is the center of expertise for asset management within the ORIX Corporation. As a reflection of its own commitment to advocating sustainable investment practices, RobecoSAM is a signatory of the UNPRI and a member of Eurosif, ASrIA and Ceres. Approximately 130 professionals work for RobecoSAM, which is headquartered in Zurich. As of March 31, 2015, RobecoSAM had assets under management, advice and/or license in listed and private equity* of approximately USD 10 billion. Additionally, RobecoSAM's Governance & Active Ownership team** had USD 82 billion of assets under engagement and USD 50 billion of assets under voting.

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