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Is socially responsible investing just screening? Evidence from mutual funds

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Is socially responsible investing just screening? Evidence from mutual funds[1]

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Abstract. This paper presents the results of an empirical study concerning conventional and socially responsible mutual funds. We apply a sophisticated operations research algorithm embedded in inverse portfolio optimization on financial market data, ESG-scores and CRSP fund data. Due to our results we cannot find strong evidence of differences between conventional and socially responsible mutual funds. In particular, the calculated risk tolerance parameters describing the real portfolio composition best show that socially responsible mutual funds may be even less concerned about the ESG-scores in the preference functional than conventional funds.

JEL Classification: C61, G11

Keywords: Socially Responsible Investing, Inverse Portfolio Selection

1. Introduction

In finance, the procedure of allocating assets for an investment portfolio bases on multiple parameters. In the seminal work of Markowitz (1952) the expected financial returns and the covariance matrix of the financial returns of all considered assets are taken into account to form the optimal investment decision. Yet, several studies agree about a more complex and manifold decision model to shape the investors' preference more appropriately (Abdelaziz, Aouni, and Fayedh, 2007; Ballestero, Bravo, Perez-Gladish, Arenas-Parra, and Pla-Santamaria, 2011; Dorfleitner and Utz, 2011; Hallerbach, Ning, Soppe, and Spronk, 2004; Steuer, Qi, and Hirschberger, 2007). Besides its applications in the field of finance, the theoretical fundament of multi-objective decision making is a widespread often discussed item in the operations research literature.

According to the idea of investors' preferences, especially the conceptions of *socially responsible investing* (SRI) gather increasing attention in recent years.

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Several studies like Bello (2005); Guerard (1997); Hamilton, Jo, and Statman (1993) compare the performance of conventional or unscreened mutual fundsto socially responsible (SR) mutual funds or screened portfolios. These studies coincide that conventional and sustainable investments do not yield statistically significant different performances, except for very few combinations of screening variants and exclusion criteria. However, by comparing only the financial performances, these studies to not take into account that investors may gain additional utility by investing in socially responsible companies. The results of various studies generate evidence on using multi-criteria portfolio selection shapes the investors' preferences more suitable than a classical risk-reward paradigm though. Benson and Humphrey (2008) find in their fund flow analysis that SRI investors are less concerned about returns than conventional investors. Bollen (2007) and Hallerbach, Ning, Soppe, and Spronk (2004) show frameworks for sustainable portfolio selection with multi-attributive utility functions to meet the requirements of further than financial parameters in the objective function of a portfolio model.

The aim of this paper is to show whether the label 'sustainability' for mutual funds is merely a sales pitch or whether funds' managers really take sustainable ratings of the assets into account in the asset allocation process. We examine a sample of conventional and SR mutual funds and use ESG ratings from an outside sustainability rating agency.[2] We contribute to the asset management literature by finding that the groups of conventional and SR mutual funds differ significantly in portfolio volatility and the average ESG-scores. Moreover, we show that SR mutual funds are not anxious to give up financial performance in favor for higher ESG-scores. For this aim, we employ several tools from Operations Research. We implement an extension of the Markowitz Critical Line Algorithm to calculate a three-dimensional efficient frontier. Moreover, we combine this algorithm with the idea of inverse portfolio optimization (Zagst and Pöschik, 2008) to determine the coefficients of the objective function in our setup, that has to be used by the fund manager if she applies a straight-forward extension of the Markowitz portfolio framework.

The paper is structured as follows. Section 2. introduces the hypotheses and Section 3. the used data and the mutual fund sample. The empirical methodology is contained in Section 4., as well as the results. Section 5. concludes.

2. Hypothesis Development

In this section, we develop several testable hypotheses regarding the investment policies of SR mutual funds. While the first two hypotheses consider the actual

[2] The commonly used sustainable attitudes of investments are the Environment, Social and Governance (ESG) issues.

level of social responsibility of a fund, the next three hypotheses regard solely the financial performance, and the last two hypotheses consider a market model.

Asset allocation of a SR mutual fund is typically conducted in a two-step approach. In the first step, a set of suitable assets is selected by some kind of screening all available assets, which is a binary selection process of the assets an investor is willing to buy. Among the criteria for the screening process there can be minimum requirements for the size and liquidity of the stock, or certain predefined standards regarding their social responsibility (see Renneboog, Horst, and Zhang, 2008). In the second step, the fund's manager then allocates the fund's total wealth to the selected assets. We wish to analyze whether this asset allocation is influenced only by the expected financial returns and the covariance of the financial returns, or whether the individual degree of social responsibility of each asset also play a role here.

Hypothesis 1a: The asset allocation after screening of SR mutual funds depends on the degree of SR of the individual assets.

Traditional textbook finance, like the CAPM of Sharpe (1964), Lintner (1965), and Mossin (1966), builds on the paradigm that investment decisions are solely driven by the future financial return, particularly the total expected financial returns and the covariance of the financial returns. When assuming either a quadratic utility function, or an exponential utility function under normal assumption, this leads an investor to maximizing the standard preference functional $\Phi = -\sigma_P + \lambda_\mu \mu_P$, where μ_P denotes the expected financial return of an investor's portfolio, σ_P its volatility, and λ_μ signifies the risk tolerance of the investor. Varying the risk tolerance parameter λ_μ from zero to infinity and maximizing the utility Φ, this preference functional yields the Markowitz (1952) efficient frontier in the reward-volatility space.

Since the standard preference functional cannot explain why certain investors would specifically choose SR funds, Bollen (2007) suggests that these investors also obtain utility from the social component of their investment. Therefore, he proposes including an addend $\lambda_\nu \nu_P$ to the standard preference functional, where ν_P measures the degree of social responsibility of the portfolio and λ_ν signifies the (financial) risk tolerance of the investor regarding the social component. Bollen (2007) defines ν_P as a simple indicator function equaling one if the portfolio satisfies the individual investor's demand for social responsibility. However, this definition makes ν_P a subjective quantity depending on each investor's perception. Therefore, we incorporate a more objective measure for the definition of ν_P. While the expected financial return and the volatility of the financial return can be directly inferred from past data, the degree of social responsibility of a firm cannot. Nevertheless, there are rating agencies specialized in assessing the amount of SR of a firm, which is usually condensed into a single score capturing a firm's effort regarding

environmental, social, and governance (ESG) issues. While the future ESG-score could be interpreted as a stochastic quantity, we consider the ESG-score to be deterministic in this paper (see e.g. also Kempf and Osthoff, 2007). That is, we suppose that—in contrast to the financial return—investors are only interested in the expected social responsibility of a firm, which is proxied by the current ESG-score.

While Hypothesis 1 conjectures that the ESG-score plays a role in the second stage of the asset allocation, i.e., after the screening process has been conducted, it can also be asked whether the overall weighted ESG-scores of SR mutual funds exceed their conventional peers.

Hypothesis 1b: SR mutual funds show higher weighted ESG-scores than conventional mutual funds.

The overall weighted ESG-scores measure the skill of a fund's manager to invest into assets that are considered the be socially responsible. A high weighted ESG-score can be explained either by a sound screening process or by giving assets with a high ESG-score more weight in the fund's portfolio.

Having challenged the fund's abilities to incorporate ESG-scores into their asset allocation, we now continue with hypotheses regarding their capabilities of generating financial performance.

The financial performance of SR mutual funds is a heavily discussed area in literature (see Bauer, Koedijk, and Otten, 2005; Bauer, Derwall, and Otten, 2007; Bello, 2005; Guerard, 1997; Hamilton, Jo, and Statman, 1993; Kreander, Gray, Power, and Sinclair, 2005; Mallin, Saadouni, and Briston, 1995; Statman, 2000). In a first step, we review the overall return, overall risk, and risk tolerance of the conventional and SR mutual funds.

Hypothesis 2a: SR mutual funds show lower financial return than conventional mutual funds.

Hypothesis 2b: SR mutual funds show lower financial risk than conventional mutual funds.

Hypothesis 2c: SR mutual funds show higher financial risk tolerance than conventional mutual funds.

Secondly, in order to assess the financial performance of the funds, we compare the standard market performance measures, i.e. Jensen's α and the CAPM β, between the conventional and SR mutual funds.

Hypothesis 3a: SR mutual funds show different Jensen's α from conventional mutual funds.

Hypothesis 3b: SR mutual funds show different CAPM β from conventional mutual funds.

3. Data and Summary Statistics

Applying the idea of inverse portfolio optimization on conventional and SR mutual funds, we use data from three primary sources. Firstly, our calculations base on ESG-scores from the sustainability rating agency Inrate for 1822 companies in 2009 and 1818 companies in 2008. These scores consist of valuations for a huge number of indicators according the sustainability of a company aggregated by a agency specific model for every year. Due to the fact that these valuations base on existing processes already implemented in the observed company as well as on planned or started programs regarding the sustainable performance of a company—for example illustrated in the annual report—the ESG-score measured with the existing data at the end of year t is an appropriate proxy for the social performance in year $t + 1$. The range of the ESG-scores is 0 to 100, which we interpret as percentage values in the following. Secondly, we use monthly stock prices from Thomson Reuters Datastream to calculate monthly returns. We estimate the parameters using an exponentially weighted moving average model with decay factor 0.97, and with time series from January 1, 1990 or first trading day of an asset until the day of the fund composition. Thirdly, as the main information we need for the inverse portfolio optimization, we gather portfolio weights of international mutual funds in 2009 and 2010. We incorporate a mutual fund to our sample if the provided ESG-scores cover at least 70% of the total fund's weights. If we have no ESG-score in 2009 but in 2008 we take this score instead. Finally, our preliminary sample[3] comprises 82 conventional mutual funds and 105 sustainable mutual funds from the CRSP database.

Table 1 lists the number of mutual funds in both of our panels (conventional and socially responsible mutual funds) as well as descriptive statistics of the average ESG-scores for the considered mutual funds of the years 2009 and 2010. The average mean and the average median of fund's ESG-score of the SR mutual funds exceed those of the conventional funds for both years. Nevertheless, the average minimum ESG-score of SR mutual funds—that a sustainable investor would suppose to be higher than the average minimum ESG-score of conventional mutual funds—does not seem to significantly differ from the one of panel (C). The average standard deviation of the ESG-scores of the conventional mutual fund panel conspicuously increases from 2009 to 2010 whereas the average standard deviation of the ESG-scores of the SR mutual funds remains nearly unchanged. This result is consistent with the change in the range of the average ESG-scores form 2009 to 2010, where the average minimum ESG-score declines and the average maximum ESG-score increases in the conventional mutual fund panel.

[3] We plan to extend the sample to cover all mutual funds listed in the CRSP database.

Table 1 Summary Statistics. Listed are the number, the average mean ESG, the average median ESG, the average minimum ESG, the average maximum ESG and the average standard deviation of the mutual funds by year and panel. A fund is included in a given year dependent on the date of the portfolio composition and the corresponding ESG-scores. Some mutual funds are comprised in a panel several times—for different weight compositions at various dates.

Panel (C): Conventional Funds						
	No. of Funds	Mean ESG	Median ESG	Min ESG	Max ESG	St. Dev. ESG
2009	51	0.612	0.601	0.477	0.773	0.067
2010	31	0.654	0.660	0.448	0.821	0.085
Panel (S): SR Funds						
	No. of Funds	Mean ESG	Median ESG	Min ESG	Max ESG	St. Dev. ESG
2009	30	0.685	0.696	0.467	0.835	0.081
2010	75	0.693	0.706	0.485	0.852	0.081

4. Empirical Methodology and Results

4.1 Empirical Methodology

In the following, we introduce the precise model used in this study. For each fund, we first calculate the non-dominated frontier that would be achievable with the assets available after the screening process, i.e., the best possible combinations of financial volatility, expected financial return, and ESG-score. For the calculation of the non-dominated frontier we make two assumptions. Firstly, we presume that the assets the fund is invested in actually comprise all assets that are available after the screening process. Secondly, we assume that due to risk control, the fund enforces a minimal and maximal investing rule. That is, for the calculation of the non-dominated frontier we require a minimum and maximum investment into each asset, which is given by the actual individual minimum and maximum investment of the fund. After setting up the non-dominated frontier, we minimize the distance of the fund to it. As the precise metric for the distance we choose the Euclidean norm of the difference of the given portfolio weights of the fund and the weights of the non-dominated surface. Given a fund containing n securities, the parameters of our model thus are the weights w_i, the expected returns μ_i, the ESG-scores ν_i, and the standard deviations σ_i of the returns of all asset $i = 1, \ldots, n$. Moreover, we denote the covariance matrix of the financial returns by $\mathbf{\Sigma}$. The unknowns are the

weights of the optimal portfolio $\hat{w}_i$. Therewith, the formal notation of our model is

$$\begin{aligned}
&\min_{\lambda_\mu,\lambda_\nu} \|\hat{\boldsymbol{w}} - \boldsymbol{w}\| \\
&\quad \text{s.t.} \quad \max_{\hat{w}_1,\ldots,\hat{w}_n} \Phi(\hat{\boldsymbol{w}}, \boldsymbol{\Sigma}, \boldsymbol{\mu}, \boldsymbol{\nu}, \lambda_\mu, \lambda_\nu) \\
&\qquad \text{s.t.} \quad \textstyle\sum_{i=1}^{n} \hat{w}_i = 1 \\
&\qquad\qquad \hat{w}_i \geq \min_i \{w_i\} \qquad \forall \ i = 1, \ldots, n \\
&\qquad\qquad \hat{w}_i \leq \max_i \{w_i\} \qquad \forall \ i = 1, \ldots, n.
\end{aligned}$$

Hereby we use the preference functional motivated in Section 2.

$$\Phi(\hat{\boldsymbol{w}}, \boldsymbol{\Sigma}, \boldsymbol{\mu}, \boldsymbol{\nu}, \lambda_\mu, \lambda_\nu) = -\sqrt{\hat{\boldsymbol{w}}'\boldsymbol{\Sigma}\hat{\boldsymbol{w}}} + \lambda_\mu \hat{\boldsymbol{w}}'\boldsymbol{\mu} + \lambda_\nu \hat{\boldsymbol{w}}'\boldsymbol{\nu}, \tag{2}$$

containing one quadratic and two linear variables, where λ_μ and λ_ν quantify the risk tolerance of the fund's manager corresponding to the financial return and social responsibility, respectively. In particular, the notation of the preference functional (2) suggests that a manager is willing to bear an additional financial volatility of λ_μ percent if it is offset by an additional expected financial return of one percent, or an additional financial volatility of λ_ν percent if it is offset by an additional ESG-score of one percent.

4.2 Results

Based on the computations we implemented with the described data and the introduced methodology, we review the hypotheses constituted in Section 2. above. Table 2 gives an overview on the relevant parameters of both panels for the tests according to hypotheses introduced above. We check the hypotheses by two sample

Table 2 Results, descriptive statistics.

Panel (C): Conventional Funds								
	λ_ν	$\boldsymbol{w}'\boldsymbol{\nu}$	$\boldsymbol{w}'\boldsymbol{\mu}$	$\sqrt{\boldsymbol{w}'\boldsymbol{\Sigma}\boldsymbol{w}}$	λ_μ	$\|\hat{\boldsymbol{w}} - \boldsymbol{w}\|$	α	β
Mean	0.314	0.64	0.0079	0.072	1.35	0.15	−0.0003	0.78
Median	0.027	0.63	0.0068	0.069	0.22	0.16	−0.0006	0.81
Panel (S): SR Funds								
	λ_ν	$\boldsymbol{w}'\boldsymbol{\nu}$	$\boldsymbol{w}'\boldsymbol{\mu}$	$\sqrt{\boldsymbol{w}'\boldsymbol{\Sigma}\boldsymbol{w}}$	λ_μ	$\|\hat{\boldsymbol{w}} - \boldsymbol{w}\|$	α	β
Mean	0.089	0.70	0.0085	0.076	1.72	0.13	−0.0003	0.78
Median	0.014	0.70	0.0083	0.077	0.18	0.13	−0.0002	0.91

mean tests. Due to the results of F-tests for all test samples showing that the variance homogeneity is not given for any of them, we need to drop the condition of equal sample variances. For sake of this requirement, we apply the Welch's t-test with an adaptation to this fact instead of a simple Student's t-test. Furthermore, we conduct Mann-Whitney U-tests to our sample to check differences between the distributions of the parameters of both panels. We provide the test statistics and the corresponding p-values for each test in Table 3.

Table 3 Test statistics, p-values. $*$, $**$, $***$ denote significant parameters at a 10%, 5%, and 1% level, respectively, corresponding to the hypotheses given in Section 2..

Welch t-Test							
	λ_ν	$\boldsymbol{w'\nu}$	$\boldsymbol{w'\mu}$	$\sqrt{\boldsymbol{w'\Sigma w}}$	λ_μ	α	β
Corresp. Hypothesis	H1a	H1b	H2a	H2b	H2c	H3a	H3b
Test statistics	1.47	−13.03	−0.66	−2.22	−0.39	−0.0027	−0.091
p-value	(0.072)*	(<2.2e-16)***	(0.74)	(0.014)**	(0.65)	(1)	0.93
Mann-Whitney U-Test							
	λ_ν	$\boldsymbol{w'\nu}$	$\boldsymbol{w'\mu}$	$\sqrt{\boldsymbol{w'\Sigma w}}$	λ_μ	α	β
Corresp. Hypothesis	H1a	H1b	H2a	H2b	H2c	H3a	H3b
Test statistics	5224	858	3670.5	3035	4413	4305.5	3699
p-value	(0.0062)***	(<2.2e-16)***	(0.96)	(0.00027)***	(0.38)	(1)	(0.099)*

The parameters λ_μ and λ_ν display the risk tolerance, which we compute using the inverse portfolio optimization algorithm introduced above. Zero λ_μ or λ_ν would imply a risk aversion of infinity—or in words of portfolio management—the effort to reduce risk as far as possible without taking into account the opportunity, which an increase in expected return (in case of $\lambda_\mu = 0$) or an increase in the ESG-score (in case of $\lambda_\nu = 0$) offers. While on a fund-level basis, a few funds exhibit zero λ_μ or zero λ_ν, we see that most fund managers are willing to take further risk to the minimal variance portfolio to gather additional financial return and/or a higher ESG-score, as the mean and median lambdas are positive non-zero.

To show whether screening of SR issues is the only approach fund managers use to create SR mutual funds, we test the risk tolerance parameters λ_ν of both panels. In principal, conventional mutual funds are supposed to maximize a preference functional containing financial parameters in the objective function only and hence to have λ_ν equal to zero. However, conventional funds may exhibit non-zero λ_ν due to random noise stemming from the inverse portfolio optimization. If SR mutual funds value assets with high ESG scores more, we expected their λ_ν to exceed to random λ_ν's of their conventional peers. We find a p-value of 0.072 for the t-test with null hypothesis $H_0 : (\lambda_\nu)_C = (\lambda_\nu)_S$ and the alternative hypothesis $H_a : (\lambda_\nu)_C > (\lambda_\nu)_S$. Hence, we find some evidence on the significance level of 10% to reject the null hypothesis and conclude that the risk tolerance parameter of SR

mutual funds according to ESG-scores is significant smaller than the risk tolerance parameter of conventional funds. Moreover, the U-test concerning this hypothesis finds strong evidence with a p-value of 0.0062. This result is in stark contrast to the common opinion about SR mutual funds are more likely comprised on sustainability creating issues than conventional mutual funds. Concerning the commonly used term of financial risk tolerance displayed as λ_μ, we investigate the hypothesis $H_0 : (\lambda_\mu)_C = (\lambda_\mu)_S$ and the alternative hypothesis $H_a : (\lambda_\mu)_C > (\lambda_\mu)_S$, but we find neither significant differences between SR mutual funds and conventional mutual funds with the t-test nor with the U-test.

Furthermore, we test whether there are any differences in the sustainable performance of both panels. We can reject the null hypothesis $H_0 : (\boldsymbol{w}'\boldsymbol{\nu})_C = (\boldsymbol{w}'\boldsymbol{\nu})_S$ on behalf of the alternative hypothesis $H_a : (\boldsymbol{w}'\boldsymbol{\nu})_C < (\boldsymbol{w}'\boldsymbol{\nu})_S$ by any arbitrary confidence level. Therefore, our SR mutual funds sample exhibit higher ESG-scores than conventional mutual funds.

Adler and Kritzman (2008) and Dorfleitner and Utz (2011) show that comprising socially responsible portfolios with sustainable objective variables yields to a decrease of the financial return compared to the case where sustainability is of minor importance. Following this result, we test whether the financial return of SR mutual funds is significantly smaller than the one of conventional mutual funds ($H_0 : (\boldsymbol{w}'\boldsymbol{\mu})_C = (\boldsymbol{w}'\boldsymbol{\mu})_S$ against the alternative hypothesis $H_a : (\boldsymbol{w}'\boldsymbol{\mu})_C > (\boldsymbol{w}'\boldsymbol{\mu})_S$). We do not find statistical evidence applying the t-test and the U-test. This indicates that we cannot reject the null hypothesis, which states that the distribution function of the financial portfolio return of the conventional mutuals funds does not differ from the one of the SR mutual funds at any arbitrary significance level. Moreover, we calculate Jensen's α and the CAPM β for every fund using the MSCI World performance index as the market's benchmark. We do not find any significant differences between both parameters with respect to both panels. For both panels the average beta is less than one. Therefore, we are in line with several former studies (Bauer, Koedijk, and Otten, 2005; Bauer, Derwall, and Otten, 2007; Bello, 2005; Guerard, 1997; Hamilton, Jo, and Statman, 1993; Kreander, Gray, Power, and Sinclair, 2005; Mallin, Saadouni, and Briston, 1995; Statman, 2000) about the performance of SR mutual funds that also find no significant differences in fund performance of conventional and SR mutual funds.

We also test the mutual funds' standard deviations and find that the null hypothesis $H_0 : (\sqrt{\boldsymbol{w}'\boldsymbol{\Sigma}\boldsymbol{w}})_C = (\sqrt{\boldsymbol{w}'\boldsymbol{\Sigma}\boldsymbol{w}})_S$ could be rejected against the alternative hypothesis $H_a : (\sqrt{\boldsymbol{w}'\boldsymbol{\Sigma}\boldsymbol{w}})_C < (\sqrt{\boldsymbol{w}'\boldsymbol{\Sigma}\boldsymbol{w}})_S$ at a significance level of 5%. Thus, the conventional mutual funds in our sample have significantly smaller standard deviations than the SR mutual funds. We partially explain this observation by less opportunity for diversification because of the applied screening approaches and the subsequent portfolio optimization on the screened subset.

5. Summary and Conclusion

In this article we provide evidence on the effects of socially responsible screening approaches on both conventional and socially responsible mutual funds by analyzing the risk tolerance parameters used comprising the portfolio structure and standard portfolio key indicators like volatility, expected financial portfolio return, expected sustainability of a portfolio, Jensen's α and CAPM β. The risk tolerance parameters are evaluated applying the multicriterial portfolio selection with financial return, sustainability return and volatility as the objective dimensions embedded in inverse portfolio optimization. We find that expected financial portfolio returns, Jensen's α, and CAPM β do not significantly differ between conventional and socially responsible mutual funds. Although the average ESG-scores of socially responsible mutual funds are significantly higher than the ones of the conventional mutual funds, we show that the risk tolerance parameter λ_v of conventional mutual funds is significantly higher than the one of the socially responsible mutual funds. Thus, ESG-scores seem to be only marginally important as an objective parameter comprising socially responsible mutual funds. However, these findings confirm the assumption of a two step portfolio selection approach with socially screening first and solely financial optimization second, since one the one side, socially responsible mutual funds hold high average ESG-scores, but on the other side, objective functions with less importance of ESG-scores. The screening approach, which restrict the sample of assets taking into account for the portfolio optimization, can lead to reduced diversification. Our evaluation is in line with that speculation, showing a significantly higher volatility of the socially responsible mutual funds.

Taken together, our findings suggest that socially responsible mutual funds are still a label to silence investors' conscience wheres several academic paper provide approaches that handle sustainability ratings like ESG-scores as objective numbers.

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