Rational Socially Responsible Investment

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Conference Theme

The paper addresses the conference theme 'Investment Strategy'. A detailed description regarding the relevance of the presented research for this conference theme is given in section 3.

Biographical Information

Benjamin Tobias Peylo, MBA, is lecturer for SRI and Financial Markets at the Centre for Sustainability Management (CSM) of Leuphana University, Lüneburg (Germany) where he also is a PhD student. Simultaneously he works as a Management Consultant for SRI and Corporate Sustainability at the Savings Bank Association Baden-Württemberg, Stuttgart (Germany). Prior to that he worked for several banks and consulting companies with a focus on financial risk management and portfolio management.

Benjamin Tobias Peylo has completed two academic studies on the field of financial economics and sustainability management. He also was joint founder of a software company developing software for financial portfolio optimization.

Abstract

The concept of rationality on part of the investor can be regarded as a central foundation of modern finance. It is considered incompatible with the assessment of non-financial criteria, thus constituting an important criticism on socially responsible investment (SRI). Recently, the extant literature has provided both qualitative arguments for the expediency of additional investment criteria and the empirical proof of their increasing application in the reality of investment. These results foster the logic and - in an expanded meaning of the word - also the rationality of SRI. In contrast, the status quo of the SRI methodology and investment process is still based on the separation of qualitative and quantitative investment criteria and results in portfolios that are often not clearly defined regarding their respective levels of sustainability or risk-return efficiency. It is this lacking ability to capture portfolio effects and to implement a comprehensive investment strategy that actually marks the gap to a truly rational investment.

To bridge the gap this paper integrates an optimization methodology combining quantitative financial criteria as well as qualitative sustainability criteria into a stringent investment framework. It enables the investor to define and implement his respective financial and SRI-related objectives in a balanced yet portable strategy and thus act as close to the concept of rationality as possible. For an empirical analysis, the framework is applied to the German Stock Market Index (DAX) for the period of 2003-2012. The findings confirm the concept with regard to both sustainability- and performance-related investment objectives.

Keywords

Socially Responsible Investment (SRI), investor, rational investment, portfolio management, optimization, sustainability, DAX, historic performance

Contents

August 15th 2012

1. Introduction and review of literature

The concept of rationality on part of the investors can be considered a central foundation of modern finance. It was gradually developed in the years following 1950 and has changed the view of an investor as a ‘normal’ human being with emotions, non-financial objectives and even biases into a calculating entity basing its decisions on investment return, risk and their respective interactions in the portfolio alone (Statman, 2005). This concept is at the very base of the central building blocks of financial theory like modern portfolio theory (Markowitz, 1952; Tobin, 1958; Roy, 1952), the capital asset pricing model CAPM (Sharpe, 1964; Lintner, 1965; Mossin, 1965) and the market efficiency theory (Fama, 1965 and 1970).

While the concept has considerable merits in that it simplifies an otherwise overly complex system of personal values and preferences and at the same time gives a normative base to the consensus of risk-related pricing, it is at the same time obviously not an accurate description of the investment reality (Beal et al., 2005). Especially the framework of Behavioral Finance presents strong evidence for the influences of rumors (Peterson, 2002), biases and individual psychology on investment decisions (Thaler, 1993). Yet still the concept of rational investment stands firm and in combination with the dominant objectives of return maximization and risk minimization that are derived from it, it is used as criticism and counter-argument against Socially Responsible Investment (SRI) (e.g. Dimtcheva, 2002; Adler and Kritzman, 2008).

As a difference to conventional investments, the investment type described by the terms SRI, sustainable investments or ethical investments (for notional differences see Eccles and Viviers, 2011) defines a set of ethical, environmental and social criteria which are also referred to as extra-financial criteria (e.g. Kurtz, 2005) or ESG-criteria (Environmental, Social and Governance; DVFA, 2010). They are applied as exclusion screens or positive assessment strategies (Benson et al., 2006; Statman, 2007). The latter methodology works with approaches to assess the relative sustainability of companies, such as the best-in-class approach which compares a company’s performance with the most sustainable or least unsustainable in each industry (e.g. Dillenburg et al., 2003; Hill et al., 2007). In summary, all SRIs have in common that they do not primarily pursue a maximization of financial returns. They rather offer investment choices which may reflect the ethical preferences of the investor (Beal et al., 2007; Nilsson, 2008; Barreda-Tarrazona et al., 2011) and then aim at achieving the best investment return within the given boundary.

The analysis of this return and its relationship to the SRI methodology has been a major research issue for academic and professional analysts alike (for a comprehensive overview see e.g. Orlitzky et al., 2003; Bauer et al., 2002 and 2006). The focus of this literature lies on comparing the performance of SRI portfolios with conventional investment portfolios, both of which are often market-traded SRI-mutual funds or SRI-indexes. The main conclusion is that on a risk-adjusted basis no difference in financial performance can be lead back to the application of SRI-approaches (Kurtz, 2005; Benson et al., 2006; Cortez et al., 2009).

For the last two decades, investors have shown a growing interest in (often equity-related) instruments of Socially Responsible Investment (Beal et al., 2005; Schueth, 2003; Statman, 2007). The growing interest is particularly reflected in the increase of the market share of equity SRI products. In the United States this ratio already exceeds 11% of the assets managed by financial institutions, private mandates excluded (Minor, 2007). A more recent study estimates that 15-20% may be reached as early as 2015 (Robeco and Booz & Co., 2010). In Europe the market share of SRIs has grown to approximately 10% of the assets under management (Eurosif, 2010), with large regional differences notwithstanding. In Germany, the market share of SRI is just about 1% of assets invested but has risen by approximately 300% between 2005 and 2010 (Forum Nachhaltige Geldanlagen, 2011).

Given these figures and the results of recent research on investors investing in SRI (Beal et al., 2005; Nilsson, 2008; Glac, 2009; Pasewark and Riley, 2010; Barreda-Tarrazona et al., 2011), it can be concluded that in contrast to the proposition of conventional financial theory the pursuance of non-financial objectives by a growing number of investors is a fact that cannot be denied. From a systemically point of view it can also be argued that it is only logical for investors to apply additional terms to the lending of money, since they live in the same world in which they invest and are thus subject to the material consequences of the corporate actions they have helped to finance. In this sense it even would seem truly irrational to exclude existing personal values from the process of investing given the leverage the financial markets exert on the behavior of companies and thus their compliance to social and environmental objectives (Michelson et al., 2004; Rhodes, 2010). These developments and arguments as well as the findings of Behavioral Finance illustrate a fact that Statman (2007, p. 36) has recapitulated in his comprehensive assessment on rational investment as follows: ‘Investors were normal before they were described as rational […] and they remain normal today’. In this light the criticism of SRI for the lack of adherence to a theoretical concept whose existence is nearly impossible to prove even in conventional finance seems to be rather disputable.

Yet there is more to the concept of rationality then the stringency of motives and behavior. In financial theory the original definition of rational investment is attributed to Miller and Modigliani (1961, p. 412) who state that 'rational investors always prefer more wealth to less and are indifferent as to whether a given increment to their wealth takes the form of cash payments or an increase in the market value of their holdings of shares'. From this statement modern portfolio theory derives the demand that rationality requires the investment into the market portfolio (Sharpe, 1964). The reasoning is as follows: Wealth can only be maximized if all unnecessary risks are avoided. Unsystematic risks can be eliminated by means of diversification and are thus unnecessary. The avoidance of all unsystematic, unnecessary risks is only achieved to its full extent by an investment in the complete market (Fabozzi, 1999).

SRI cannot and does not adhere to this demand, because the applied ethical screens confine the investment universe and thus reduce possibilities of diversification (e.g. Derwall and Koedijk, 2009). While this is an incontestable fact, it only then would prove to be a valid argument against SRI if conventional investment was any different – i.e. a conventional investor really invested in the complete investment universe which is the market portfolio. Yet Markowitz (2005) himself proved that the market portfolio is a mere theoretical entity and that every given portfolio is but an inefficient subset of it. As a consequence, all existing funds are inefficient, and the actual degree of their risk-return efficiency is subject to the size of the individual portfolio and the quantitative composition of their shares subject to the investment strategy rather than the size of the theoretically available universe (Markowitz, 1998).

In synthesis, the prevailing arguments denying rationality to SRI investors can also be held against conventional investors. While the investment decision of neither party is limited to return and risk alone, neither invests into the market portfolio in order to maximize diversification. This argumentation may well indicate the limited value of the across-the-board criticisms SRI is often confronted with. Still, the shortcomings of the practice should not serve to undermine the value of the concept itself. Given the complexity and importance of the investment process as well as its material consequences to the society, the advantages of rational investment as an integrated, rule-driven and well balanced way of combining conflicting goals (as is exemplary if restricted achieved in modern portfolio theory) are obvious and appealing.

It is in this important aspect that the status quo of SRI methodology and strategies does not exploit its potential and thus can be rightly criticized as being not rational yet. Notwithstanding regional differences of investment processes and practices (e.g. Bengtsson, 2008; Sakuma and Luche, 2008; Humphrey and Lee, 2011), ethically driven selection is usually applied in addition to financial criteria. Thereby both sets of criteria are used separately and sequentially without considering interrelationships (Benson et al., 2006). This approach consequently neglects portfolio-effects between objectives resulting from competitive or synergetic interaction (Troutman, 2001). If portfolio techniques are applied at all (e.g. Dimtcheva et al., 2002; Troutman, 2001; Geczy et al., 2005), they are nonetheless conventional risk-return optimizations applied to an investment universe predefined by SRI-criteria but they are not comprehensive methods that combine SRI and financial criteria. In addition, the strategies and investment targets are often not as clearly defined as would befit a rational decision, especially as sustainable portfolios are not devised to meet controlled levels of sustainability but only to adhere to qualitative, often hard to measure positive or negative criteria instead (Kurtz, 2005).

Based on previous research (Peylo 2011 and 2012), this paper further develops and empirically applies a framework that integrates the concept of SRI in a systemic, comprehensive approach that meets the demands associated with rational investment. It enables the investor to formulate a portable investment strategy by firstly defining his personal priority between non-financial and financial objectives and secondly choosing an adequate, qualitatively defined target-portfolio that enables the further detailing of the strategy by accentuating one of the aspects return, risk or sustainability. The methodology is based on a multi-dimensional optimization that simultaneously allows to clearly define each criteria involved in terms of risk-return efficiency respectively rating-levels of sustainability and enables not only to control but to optimize these criteria in their interrelationship in the portfolio. Thus in synthesis an investor is able to integrate non-financial objectives in a stringent, balanced and rational way into his investment strategy.

In order to illustrate and evaluate the framework, several portfolios are constructed with a defined, constant target-level of sustainability from the German stock market index (DAX) as investment universe. The DAX is a general stock market index representing the largest European economy. It is not SRI-related but sufficient sustainability data is available. The performance of the selected portfolios is compared amongst each other and to the benchmark to analyze the success of the formulated strategies, both concerning the level of sustainability and financial performance. After establishing a link to the conference-topic in the next two short chapters, the following sections will explain the chosen optimization framework. It is then applied to the investment universe of the DAX in the period of 2003-2012. The results will be analyzed and discussed; finally the paper will derive with a conclusion that also addresses implications for further research.

2. Summary of the significance of the research

As discussed above, socially responsible investment is an investment category with an increasing prominence. The growing interest is not only due to the fact that it allows both private investors and institutional investors like e.g. charitable organizations to consequently extend their principles and values to their financial sphere. It is also regarded as an important instrument to 'steer' the capital into industries and corporations that are beneficial to the society in that they e.g. work against climate change or distinguish themselves by their compliance to ethical standards. Working against the influence and growth of SRI are prejudices originating in the conventional finance industry, whereupon personal biases are sometimes masked by attributing a lack of rationality and thus inferiority to the SRI methodology. Therefore it is important to both disprove the critique of SRI where it is undue and to improve SRI methodology where criticism is just and constructive. This paper strives for a synthesis of SRI and portfolio theory that has been called for but was not yet established. It thus presents a framework that places SRI and conventional investment on the same level regarding its methodological stringency and thus implicit rationality. If well received within the scientific community this approach could prove significant for the further discussion and maybe even development of SRI and may thus contribute to the strengthening of this important investment category.

3. Relevance to the conference research theme 'Investment Strategy'

The conference theme addresses ESG in investment strategies and styles as well as its integration into the asset allocation. This aspect is covered in depth by the paper on hand. Here ESG factors are integrated into the investment strategy via the results of comprehensive rating-schemes focusing on social and environmental aspects, which are then prioritized and implemented into asset allocation by an optimization algorithm. Thus ESG factors are not only included on their own, but in an adjustable balance with return and risk as other important investment criteria. The methodology presents a modus operandi for the formulation and implementation of complex investing strategies including financial and non-financial-targets, which is nonetheless portable for the investor as it replaces the requirement of utility-functions by a system of simple portfolio decisions. The result of the empirical application may also be relevant for the indicative question regarding the drivers of return as well as its relationship to ESG/SRI. As will be shown below, the analysis of different investment strategies reveals a distinct yet non-linear relationship between sustainability and financial return.

4. Methodology

A stringent integration of sustainability criteria in a portfolio context requires the application of a multi-dimensional optimization technique which combines return, risk and sustainability in one single analysis instead of considering them in a sequential manner as is usual with conventional SRI methodologies.

The methodology applied in this paper is based on modern portfolio theory as it was laid down by Markowitz (1952), Tobin (1958) and Roy (1952). Modern portfolio theory addresses the normative question of rational investment in a portfolio of securities. A portfolio is defined by the selection of assets from an investment opportunity set (IOS) and the allocation of relative shares of a given capital. Compared to an investment in individual stocks the portfolio obtains a quality of its own by diversification, comprising the compensation of both volatility and losses between its components (Markowitz, 1952). Since this effect cannot be realized to its full extent by an arbitrary combination of securities, portfolio theory comprises a framework for an optimized allocation of shares that can aid or dominate the asset allocation process (Fabozzi, 1999). Here the primary objective of the optimization is to identify portfolios that maximize the investment return. Since this objective can be compromised by the volatility of returns (standard deviation) or its more accurate multiple Value-at-Risk (VaR) (Jorion, 1997), those must be minimized in order to achieve the best possible risk/return-efficiency.

By calculating portfolio return and risk and filtering out the best combinations with an optimization algorithm (for an overview of existing algorithms see e.g. Pardalos et al., 1994), an efficient frontier emerges as a hyperbola that contains all risk-return efficient portfolio combinations. It comprises all portfolios which can be invested in accordance with the rationality principle. Only the question which portfolio is to be selected remains to be solved in dependency of the individual preferences of each investor (Markowitz, 1998). Empirical research has revealed that optimized portfolios will in most cases lead to superior results compared to an arbitrary selection or non-optimized benchmark (e.g. Jobson & Korkie, 1982; Michaud, 1989 or Clarke et al., 2006). This result gives credit to the value of rational investment based on an integrative, rule-driven framework. Therefore it is important that this framework itself is maintained even if the dominance of return and risk as sole investment criteria is dismissed.

Allowing for more realistic axioms, Steuer et al. (2007 and 2008) demonstrate that rational investment is compatible with multi-dimensional investment strategies even within the framework of modern portfolio theory. Meeting the prerequisites of rational behavior as defined by Popper (1959), they show that rationality does not depend on an arbitrary limitation to return and risk but on clear defined strategies and decision criteria as well as the consideration of their respective effects and mutual interactions. Their framework makes use of several investment objectives that are pursued in parallel. Dependent on the number of criteria used the result is an n-dimensional surface labeled 'nondominated' instead of a two-dimensional 'efficient' frontier (Steuer et al., 2007). Multi-dimensional optimizations like these have previously been applied to various criteria, for example linked to portfolio size, transaction costs, or aspects of taxation (see e.g. Konno and Wijayanayake, 2000; Donohue and Yip, 2003). Yet the framework of Steuer et al. differs in two important aspects: Firstly it formulates a general concept of multi-objective optimization that can generically be applied to any given investment objective. Secondly, in contrast to the more pragmatic approaches mentioned above, it not only widens the conceptual borders of portfolio far enough for the practical needs of portfolio management to be met, but instead clearly defines that the focus on return and risk is arbitrary in nature and not necessary for the investment process to be regarded as rational.

While Steuer et al. (2007 and 2008) mention SRI as a possible investment objective among others, the methodology to implement it with respect to the previously unsolved problem of portfolio choice was proposed by Peylo (2011 and 2012). In the present paper, this concept is further developed with regard to its application as a framework for the investor that enables him to formulate and implement balanced and successful SRI-investment strategies.

Here portfolio sustainability is defined as a linearly weighted combination of the SRI-ratings of the individual stocks included in the portfolio. In comparison with the use of qualitative screens, SRI ratings have the advantage of comprehensive coverage of ESG factors and result in a relative, weighted and quantitative assessment of both the environmental and social impacts of the stock-issuing company (Haßler and Reinhard, 2000; Dillenburg et al., 2003). This figure is also compatible with return and risk in the portfolio as they are also both quantitative and relative in nature. To further enhance the compatibility and enable direct comparability, return and risk are then combined into the fraction of both, resulting in the Return on Risk adjusted Capital (RORAC) as key figure for the risk-/return efficiency. This combination reduces the formerly three dimensions of investment decision into two, which considerably simplifies the investment decision for the investor who otherwise could easily be overburdened with complexity. Now as a basic investment strategy, the investor only has to weight his decision between risk/return efficiency and sustainability rating as the two relevant criteria which nonetheless cover all relevant information for his financial and non-financial objectives.

The strategic decision of weighting both key criteria forms the basis of the investment strategy and is implemented by a weighting function. For this both the financial and the sustainability-related criteria are arranged in an order of decreasing attractiveness for the available portfolio choices. Thus the lowest ordinal number of portfolio efficiency O_{PE} marks the portfolio with the highest risk/-return-efficiency and the lowest ordinal number of portfolio sustainability O_{PS} is attributed to the portfolio with the highest combined SRI-rating. Based on these classifications a simple weighting function using the weight λ allows constructing optimized portfolios with a pre-defined target-level of sustainability:

$$\min!\{(1-\lambda) * O_{PE} + \lambda * O_{PS}\}$$

Starting from a given portfolio that can either be the portfolio with the highest level of return or the lowest level of risk, the optimization-algorithm tests other portfolio combinations by a variation of portfolio shares in incremental steps. Thereby from all available choices the portfolio with the best combination of O_{PE} and O_{PS} (weighted with the preset sustainability-weight λ) is chosen as the next portfolio to continue the process. When repeated many times, this incremental optimization reveals the optimal portfolio choices and finally results in a nondominated line which comprises all portfolio-choices that are efficient and meet the preferred balance between sustainability and risk/return-efficiency (see Figure 1).

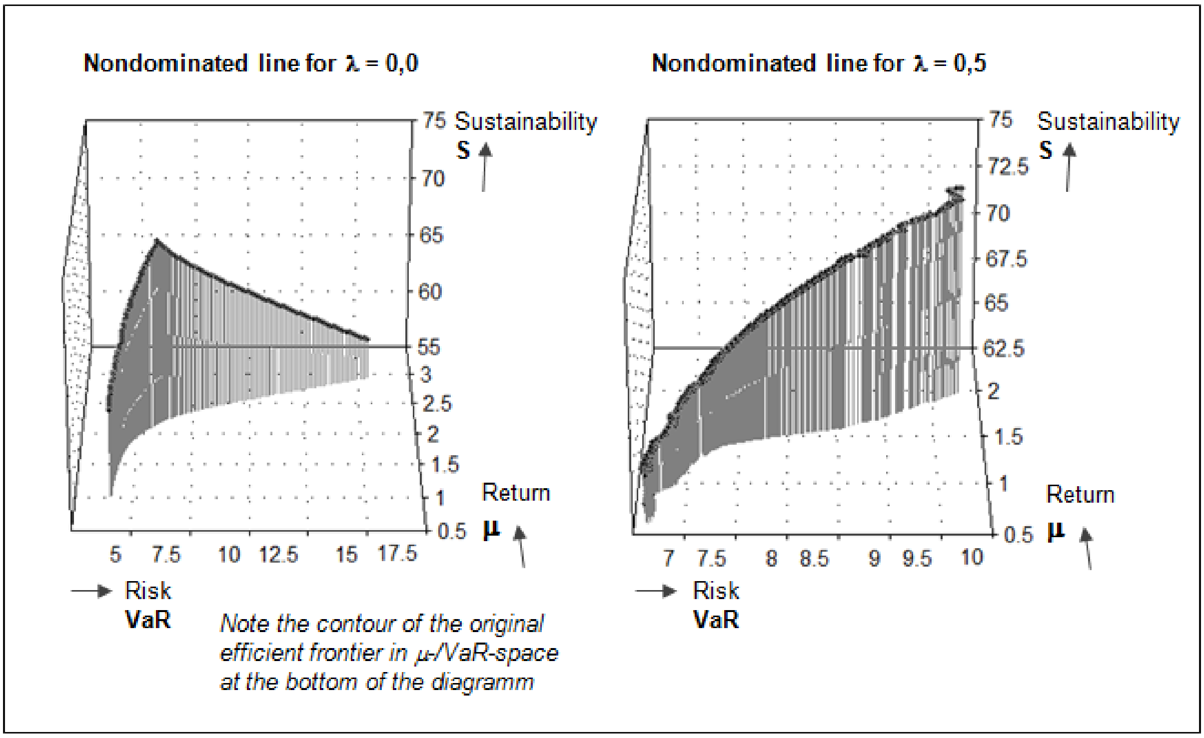

Figure 1: Two examples for nondominated lines of the DAX-IOS (similar to Peylo, 2012)

The definition of the weight λ creates a stable proportion of sustainability and risk-return efficiency in the portfolio that allows the investor to clearly express his preference between both objectives as a basic step of formulating his investment strategy. The next step refining the investment strategy is the decision which portfolio on the nondominated line is to be selected. Here similar mechanisms can be applied that guide the portfolio selection process in conventional portfolio theory. The original approach of a utility-function used to identify the individual risk preference of each investor has proven to be difficult to implement for most investors (Markowitz, 1998). Thus in the literature a portable approach is chosen by a qualitative characterization and selection of portfolios, the most important choice being the portfolio with the highest degree of diversification and thus the minimal risk (e.g. Clarke et al., 2006; Best and Grauer, 1992). It will be referred to as 'Risk-Min' below. In an equal manner also the portfolio with the highest financial performance RoRaC can be chosen (labeled 'RoRaC-Max') or the portfolio that has the highest weighted SRI-rating and maximizes sustainability ('S-Max').

Figure 2 gives a summary of the concept and results of the investment-process based on the presented framework in comparison to the traditional SRI-investment process. It is argued that since all steps are clearly defined and integrated in a stringent system, the proceeding adheres to the demands of rational investment as summarized by Steuer et al. (2007 and 2008).

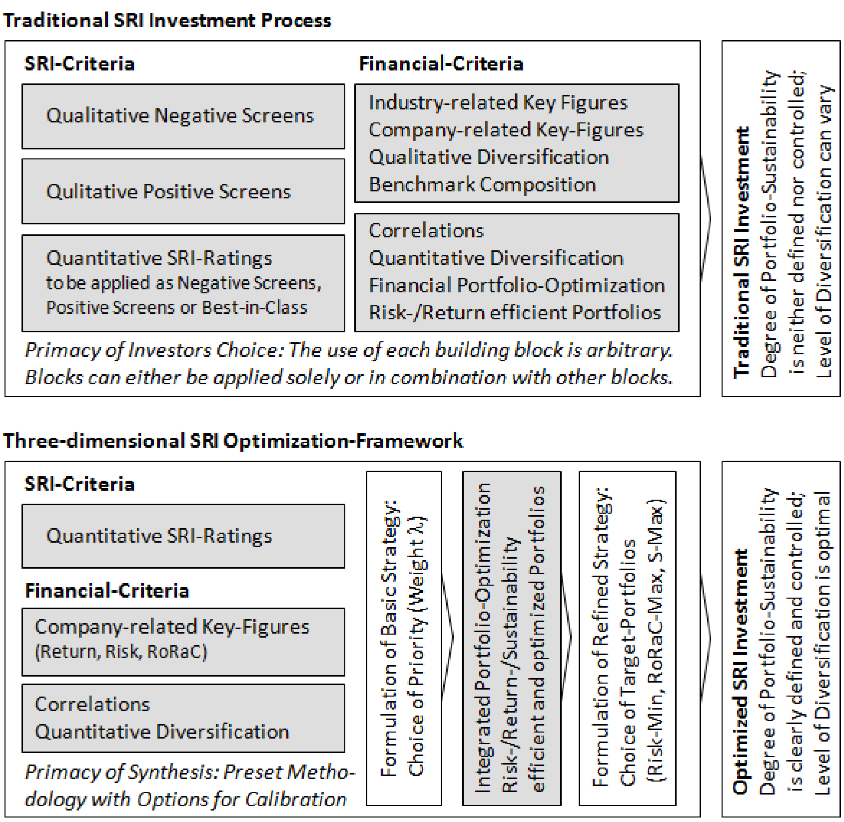

Figure 2: Overview and comparison of the traditional and the optimized SRI-investment process

5. Empirical Evaluation

As an empirical analysis to illustrate and evaluate the definition and implementation of the investment strategies using this framework, it is applied to the main German stock index DAX. This index constitutes the investment universe for the portfolio construction and is used as a conventional benchmark. The DAX is not SRI-related, but SRI-ratings are available for all stocks in the index. Launched in 1987 by Deutsche Börse AG, the DAX contains the 30 stocks with the largest market capitalization (Deutsche Börse, 2008) and is often used as a representation of the German equity market. Due to reallocations in the period of analysis, 42 different stocks were at least for some time part of the index (Deutsche Börse Group, 2010).

The period of analysis is October 2003 until June 2012. The SRI-ratings used are the publicly available ratings from the SRI-rating agency Systainalytics as they are published in a bi-annual study (e.g. Systainalytics, 2010). Being established by a merger of the SRI-rating companies Dutch Sustainability Research (Netherlands), Scoris (Germany), AIS Analistas Internacionales en Sostenibilidad (Spain) and Jantzi Research (Canada), Systainalytics is now one of the world's largest companies specializing in the analysis of socially responsible investment (Systainalytics, 2012). Its rating system is transparent and acknowledged (e.g. Surroca et al., 2010) and its SRI-database with more than 2,400 companies covers the complete investment universe of the DAX. With regard to the results of this analysis it is important to note that the SRI-ratings are not correlated with the returns of the corresponding stocks (Mauritz & Wilhelm, 2005, p. 23).

The returns and risks for the RoRaC-ratio are computed from the daily closing prices of all DAX stocks. For their computation all requirements of the German banking supervision as stated in BaFin (2002) are met to avoid results that cannot be achieved in investment reality due to regulatory restrictions. Thus risk/return-figures are calculated based on the historical data of 250 trading days and are considered to be valid for a holding period of 10 trading days. As measure of portfolio risk Value-at-Risk is calculated with a confidence level of 99%, resulting in a high and very cautious level of risk assessment.

The algorithm used for the optimization implements the principles presented above and was programmed in Visual Basic for Applications by the author. The aim of these optimizations is to construct portfolios which are optimized for different combinations of risk-return efficiency and sustainability as defined by the basic investment strategy respectively the chosen weight λ. For a detailed empirical assessment, ten basic investment strategies were defined and analyzed, each characterized by a different level of λ starting from λ=0% and climbing in steps of 10% up to λ=90%. For these different levels each a nondominated line in three-dimensional space was calculated analog to the examples in Figure 1 in each optimization. The defined holding period determines that the results of those optimizations are only valid for ten days, thus the procedure had to be repeated every 10 trading days – or even sooner, if the index has experienced a restructuring between 10-day intervals. Overall, 231 portfolio optimizations where conducted for each sustainability-weight (λ), totaling in 2,310 portfolio optimizations.

From every optimization three target-portfolios (minimum-risk portfolio Risk-Min, maximum financial performance-portfolio RoRaC-Max and maximum sustainability-portfolio S-Max) are recorded to represent all alternatives of a refined investment strategy. From those 6,930 portfolios 10-day returns, risks and weighted sustainability-ratings were recorded as key figures and compared to each other and the DAX-index as a benchmark. They are presented here as an average over the complete period of analysis for all 30 strategy-variants that are formed by the possible combinations of λ-weight and target-portfolio.

Table 1 gives the results for all ten λ- levels. The first key figure in the first column is the average of the risk/return-performance RoRaC as the ratio between 10-days ex-post return the selected target-portfolio has generated and its respective portfolio risk (VaR). To enhance the information about portfolio-performance, the second column in the table lists the excess-performance (Lawrence et al., 1993), expressed here as the difference between the RoRaC of the target-portfolio and the RoRaC of the DAX-benchmark. This figure is comparable to the term ‘investment alpha’ (Warwick, 2000), but since alpha is often associated with the individual abilities of the portfolio manager rather than the outcome of a mathematical optimization algorithm, it here will be labeled ‘RoRaC+’ instead. It allows an instant evaluation of the investment result as a positive RoRaC+ indicates that the target-portfolio has financially outperformed the DAX-benchmark. The third and fourth columns give the key figures for the sustainability of the portfolio. Thereby first the share-weighted average SRI-rating is given and then, in analogy to RoRaC+, also the excess-sustainability as the difference between portfolio sustainability and the sustainability of the benchmark (labeled S+). Consequently, a positive figure S+ indicates that the mean of the SRI-rating points of the portfolio was above the mean of the SRI-rating of the benchmark DAX (63.53 of 100 rating points in the given period).

	DAX		Risk-Min				RoRaC-Max				S-Max			
λ S	RoRaC	S	RoRaC	RoRaC+	S	S+	RoRaC	RoRaC+	S	S+	RoRaC	RoRaC+	S	S+
0,0	3,54%	61,21	7,67%	4,13%	58,70	-2,51	11,49%	7,95%	60,81	-0,40	9,32%	5,78%	65,93	4,72
0,1	3,54%	61,21	9,72%	6,19%	59,23	-1,98	12,25%	8,71%	63,35	2,14	11,60%	8,06%	69,20	8,00
0,2	3,54%	61,21	9,89%	6,36%	61,97	0,77	11,70%	8,16%	66,36	5,15	10,96%	7,42%	71,45	10,24
0,3	3,54%	61,21	9,13%	5,59%	63,31	2,10	10,80%	7,27%	68,26	7,05	11,42%	7,88%	72,30	11,09
0,4	3,54%	61,21	5,14%	1,61%	64,80	3,59	8,19%	4,65%	70,12	8,92	7,22%	3,68%	73,09	11,88
0,5	3,54%	61,21	4,14%	0,61%	66,45	5,24	7,36%	3,82%	71,56	10,35	6,41%	2,87%	73,80	12,59
0,6	3,54%	61,21	3,89%	0,35%	66,95	5,74	5,24%	1,71%	72,66	11,45	4,54%	1,00%	74,79	13,58
0,7	3,54%	61,21	5,48%	1,94%	67,61	6,40	5,54%	2,01%	73,83	12,62	4,91%	1,37%	75,52	14,31
0,8	3,54%	61,21	4,87%	1,33%	68,86	7,65	4,37%	0,83%	74,30	13,09	2,39%	-1,15%	75,76	14,46
0,9	3,54%	61,21	2,96%	-0,57%	69,42	8,21	3,18%	-0,36%	74,99	13,78	3,86%	0,33%	76,46	15,25

Table 1: Mean of the analyzed key figures for all sustainability-weights and target-portfolios (10/2003-06/2012)

Considering the financial performance, the first result of the analysis is that up to a level of λ = 50% most of the optimized portfolios have significantly outperformed the DAX benchmark (see column RoRaC+). The significance was confirmed for 14 of the 18 strategies within this boundary by the use of the Student t-test. Significance was confirmed for the figures highlighted in dark grey color with a severe p-value of 0.01. For the figures accentuated in light grey color the significance of the outperformance was confirmed with a moderated yet still reliable p-value of 0.05. The excess-performance was generally the least strong in the Risk-Min. This result is in line with the characteristics of this portfolio, since the portfolio is designed for stability and avoidance of extremes and not for extraordinary performance. In contrast, the RoRaC-Max portfolio is designed to maximize returns and thus often shows a significant outperformance. Interestingly enough a similar outperformance is achieved by the portfolio with the highest sustainability (S-Max), although to a slightly lesser extent.

The second result is that excess-sustainability increases with the sustainability weight λ in a near linear way up to a value of approximately 25% above the benchmark (see column S+). This shows the validity of the three dimensional optimization with regard to the improvement of the sustainability-level of the portfolio. The refined investment strategy maximizing this non-financial objective by selecting the S-Max portfolio naturally achieves the best results with an initially considerably large gap to the results of the RoRaC-Max that subsequently diminishes with an increasing λ-weight of sustainability. The explanation is that an increasing weight of λ shifts the nondominated line onto a higher sustainability level for all portfolios. This effect is least strong for the Risk-Min, because here the level of diversification is maximized, causing dilution effects and hence a reduction of the sustainability level.

The third and most important result concerns the relationship between sustainability and risk-return efficiency of the analyzed strategies. It is visualized in Figure 3.

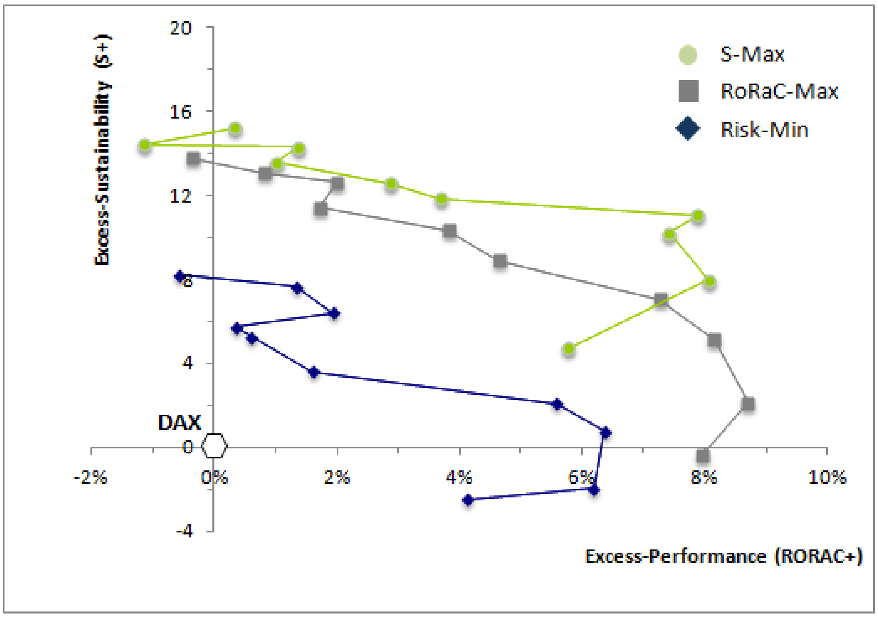

Figure 3: Relationship between sustainability and risk-return performance

In Figure 3 the excess-return RoRaC+ is plotted on the X-axis and the excess-sustainability S+ on the Y-axis for all ten λ-weights and all three target-portfolios over the entire period of analysis. The DAX as the conventional benchmark is located at the axis intersection. While not being smooth, the resulting curves show a clear trend to the right before turning to the left, revealing that an increase of the sustainability level in a portfolio by the selection of a higher weight λ in the basic strategy is at first rewarded with a higher financial performance before a turning point and then a decline can be identified. The result is thus an inverted U-shaped relationship between different sustainability levels and financial performance. The initial positive relationship reverses at the level of approximately λ=20% due to the fact that sustainability is calculated as an equally weighted mean of the SRI-ratings and does not profit from diversification and portfolio size. Thus if the primary objective is to further increase the sustainability level of a portfolio beyond the λ=20% mark, the number of stocks has to be reduced in the portfolio at the cost of risk-return efficiency and portfolio performance accordingly. The turning point marks the optimum up to which the beneficial effects of increased sustainability compensate the reduced focus on risk-return efficiency. While a further increase of the level of sustainability results in a comparable loss of financial performance, the latter is still above the benchmark even for very high levels of λ.

6. Conclusions

In the literature the status quo of the SRI methodology is regarded as incompatible with the principles and demands of rational investing which is at the same time a central prerequisite for the success of the investment. While it can be shown that many of the arguments used to criticize SRI in this context are equally valid for conventional investment, both the lack of clearly defined investment objectives and the sequential, isolated way of the investment analysis that cannot account for portfolio effects considerably weaken the position of SRI.

In this paper it has been argued that these criticisms can be overcome by a transparent optimization framework. In two steps that consist first of a weighting between performance-oriented and sustainability-related investment objectives and second the selection of a target-portfolio that further pronounces one of the financial- or sustainability related criteria involved, the framework allows the investor to define a balanced SRI-investment strategy that can be stringently implemented. It also accounts for the interrelationship of financial and sustainability-related criteria in the portfolio due to the combined optimization that replaces the sequential, isolated approach of traditional SRI-strategies. The framework is conceptually close to the original portfolio theory and thus arguably qualifies to be comparably rational in its results.

In addition the empirical findings from the analysis of different investment strategies, this framework may shed new light on the relationship of investment return and portfolio sustainability. As presented in the literature review, the extant consensus of no significant influence of sustainability on financial performance was established for non-optimized SRI-portfolios without defined target-levels for sustainability or diversification. The relationship found in this analysis may indicate a different outcome for optimized portfolios with clearly defined investment objectives – an aspect that will be subject to further research, including a variation of the SRI-ratings used. Without anticipating the results of a further analysis, the significant outperformance of the target-portfolios found here strongly indicates that investors at the very least do not need to fear a financial disadvantage when implementing sustainability-related investment objectives within the context of a multi-dimensional optimization framework.

As a conclusion, the scope of this paper is to illustrate that SRI is not necessarily less rational then conventional investment; it can be implemented in an equally stringent and clearly defined methodology. The empirical results show that a leeway exists for the investors to pursue non-financial objectives without sacrificing excess-performance compared to a non-optimized benchmark. It is expected that these findings do not only appeal to investors considering SRI but may also contribute to the discussion of SRI methodology and investment strategies.

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