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Antonella Basso and Stefania Funari

Relative performance of SRI equity funds: An analysis of European funds using Data Envelopment Analysis

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Relative performance of SRI equity funds: An analysis of European funds using Data Envelopment Analysis*

Antonella Basso
<basso@unive.it>
Dept. of Applied Mathematics
University of Venice and SSAV

Stefania Funari
<funari@unive.it>
Dept. of Applied Mathematics
University of Venice

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Abstract. The main aims of this contribution are first to analyse the ethical level of European socially responsible investment (SRI) funds, secondly to measure the overall performance of the European SRI mutual funds with an appropriate data envelopment analysis (DEA) model and, finally, to investigate the relationship between the ethical level of mutual funds and their financial performance. In order to do so, we build an ethical measure, based on the main socially responsible features usually taken into account by SRI mutual funds, which evaluate their ethical strategies. In the time period of economic recession considered in the analysis, the triennium June 2006–June 2009, the mean returns of most mutual funds are negative, preventing the usual DEA models from being applied. In order to overcome this difficulty, we apply a special modification of these DEA models which can be used regardless of the phase of business cycle.

Keywords: performance evaluation, SRI mutual funds, data envelopment analysis.

JEL Classification Numbers: C65, G1, G23.

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Correspondence to:

Stefania Funari	Dept. of Applied Mathematics, University of Venice
	San Giobbe, Cannaregio 873
	30121 Venezia, Italy
Phone:	[++39] (041)-2346956
Fax:	[++39] (041)-2347444
E-mail:	funari@unive.it

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1 Introduction

Green, social and ethical mutual funds, on the whole often referred to as socially responsible investment (SRI) funds, have seen an increasing interest among investors.

This phenomenon is relevant both in the United States and in Europe; for example, in 2007 there were 173 socially and environmentally screened mutual funds in the U.S., for a total net asset of 171.7 billion dollars, and 437 green social and ethical funds domiciled in Europe, for a total asset under management of 48.735 billion euros (see [25], [27]).

It is also very dynamic; for example, in 2009 the number of European SRI funds has grown to 683, for a total asset under management of 53.276 billion euros. The fast growth of socially responsible mutual funds is certainly linked to the higher and higher interest in socially responsible investing observed in the last years and SRI mutual funds are probably the most prominent financial instrument in the field of ethical finance.

The investors' behaviour that leads to socially responsible investment decisions in general and to investments in SRI mutual funds in particular has been investigated in the economic and financial literature from different points of view over the years; see for example [21], [23], [26], [28], [22], [24], which study the determinants of these investment choices.

Given the ethical considerations which drive green, social and ethical investments in general, ethical investors may be willing to accept even lower financial returns, if they are counterbalanced by appropriate ethical achievements. Actually, the literature on ethical investing has long investigated the issue of the eventual penalisation incurred by investments in SRI mutual funds, in search for an answer to the question whether it is possible "to do well while doing good"; see for example [16] and [22] for a brief review. As it will be discussed in Section 6, the answer which comes out from many empirical investigations are somewhat surprising, since most of the investigations presented in the literature suggest that it is not necessary to sacrifice returns in order to pursue ethical objectives.

Anyhow, if one wishes to evaluate the overall performance of SRI mutual funds it is necessary to use a technique which enables to take into account both primary objectives pursued by ethical investors: the ethical objective and the desire to get an optimal reward–to–risk result. A methodology that can be used to this aim is data envelopment analysis (DEA), an operational research technique widely used to assess the performance of a set of decision making units in many different fields (public organisations, schools, hospitals, banks, and so forth) and can be applied to evaluate the performance of mutual funds (see [2]); for a comprehensive introduction to DEA see [11]) .

The main aims of this contribution are first to analyse the ethical level of European SRI mutual funds, secondly to measure the overall performance of the European SRI mutual funds with an appropriate DEA model and, finally, to investigate wether, and how much, investors have to be prepared to give up something in terms of financial returns when investing in a socially responsible manner in Europe.

In order to do so, we build an ethical measure based on the main socially responsible features usually taken into account by green, social and ethical screened mutual funds; this measure evaluates the most widely used ethical strategies, namely negative and positive screening issues and the presence of an ethical or environmental committee.

The time period considered in the analysis, the triennium June 2006–June 2009 have

recorded a heavy economic recession and this have posed a challenge for the analysis of the performance of mutual funds. Indeed, in the triennium considered, the mean returns of most mutual funds turned out to be negative, preventing the usual DEA models for ethical and non ethical mutual funds from being applied. On the other hand, the presence of negative mean return gives trouble also to other widely used performance criteria; see for example [20], [4] for the problems that arise with the Sharpe ratio. In order to overcome this difficulty, we propose a special modification of these DEA models which can be used regardless of the phase of business cycle.

In the empirical analysis carried out these modified models are used to evaluate the performance of SRI equity mutual funds in the different European countries in which some socially responsible mutual funds are domiciled.

The paper is organized as follows. Section 2 presents the ethical measure used to assess the degree of socially responsibility of mutual funds. Section 3 analyses the presence of SRI mutual funds in Europe; in Section 4 we discuss the three different DEA models proposed to evaluate the performance of SRI mutual funds in the presence of negative mean returns. Section 5 presents the results of the empirical investigation carried out on European SRI mutual funds. Finally, Section 6 investigates the relationship between the ethical level of mutual funds and their financial performance, trying to assess the cost of "doing good".

2 A measure of the degree of social responsibility

In order to assess the degree of the socially responsible behaviour of the funds stated as SRI funds, we have focused our attention on a number of questions which define this behaviour and are related to either ethical, social or green issues. These questions can be grouped into issues used to exclude from the portfolios the assets of the companies with a profile that is bad for socially responsible criteria (negative screening), and issues used to include in the portfolio investments in companies which are selected on the ground of their SRI behaviour (positive screening).

More in detail, the questions considered are taken from the 'SRI Funds Service'[1] and can be summarized as follows:

- ***Negative screening issues****: 1. firearms; 2. weapons and military contracting; 3. nuclear energy; 4. tobacco; 5. gambling; 6. human rights violations; 7. Labour right violations; 8. oppressive regimes; 9. pornography; 10. alcohol; 11. animal testing; 12. factory farming; 13. furs; 14. excessive environmental impact and natural resources c.; 15. GMO; 16. products dangerous to health/environment; 17. other.*

- ***Positive screening issues****: 1. innovative and beneficial products and services for the environment; 2. innovative and beneficial products and services for the quality of life (e.g. health care, social housing); 3. responsible management of relations with*

[1]The 'SRI Funds Service' is a database of European SRI funds, offered since 1999 by the corporate social responsibility rating agency Vigeo Italia (formerly Avanzi SRI Research); financial data are added to the socially responsible database through a partnership with Morningstar. We thank Vigeo Italia for allowing us to use their database.

customers; 4. environmental protection; 5. responsible management of employees; 6. human rights protection & supply chain; 7. promotion of economic and social development of local communities; 8. corporate governance; 9. fund investing according to the Islamic religion principles; 10. fund investing according to the Christian religion principles; 11. other.

Another important information on the behaviour of SRI mutual funds is the (eventual) presence of an ethical or environmental committee which has the function of defining the guidelines of the socially responsible investments and controlling the actions of the fund management in this respect.

Basso, Funari [5] proposes to measure the degree of the socially responsible behaviour as follows. Let n_j^N and n_j^P be the number of negative and positive screening features presented by fund j, respectively, and let L be the maximum value assigned to the ethical measure, so that it will be defined in the real interval $[0, L]$. The ethical measure is defined as follows:

$$e_j = \omega^N \, \frac{n_j^N}{n^N} + \omega^P \, \frac{n_j^P}{n^P} + \omega^C \, C_j \tag{1}$$

where n^N and n^P are the total number of negative and positive screening issues taken into account, respectively, C_j is a variable which takes value 1 if fund j has an ethical or environmental committee and 0 otherwise and ω^N, ω^P and ω^C are positive weights such that $L = \omega^N + \omega^P + \omega^C$.

For example, in the empirical analysis carried out we have chosen $\omega^N = \omega^P = 2$ and $\omega^C = 1$, so that

$$e_j = 2\,\frac{n_j^N}{17} + 2\,\frac{n_j^P}{11} + C_j \tag{2}$$

and $0 \leq e_j \leq 5$. Notice that $e_j > 0$ denotes a socially responsible fund, while non SRI funds have $e_j = 0$.

3 SRI mutual funds in Europe

The fraction of overall total asset under management referred to SRI mutual funds domiciled in Europe may seem not much significant (1.11 % of total UCITS[2] on 30/06/2009, see [27]); it is nevertheless a question of more than 50 billion euros (53276 million euros on 30/06/2009). Moreover, the SRI phenomenon is rapidly expanding; see figure 1 for the growth of the total asset under management since 1999. In the triennium June 2006–June 2009 the total asset under management increased from 34009 to 53276 million euros, with a growth of +57 % (+381 % in ten years).

On 30/06/2006, at the beginning of the triennium considered in our analysis, the number of European SRI funds was equal to 388, spread over 15 countries (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Norway, Poland, Spain, Sweden, Switzerland, Netherlands, United Kingdom see [27]). Three years later, on 30/06/2009, this number has increased to 683 (+76 %). We may observe that the per cent increase in the number of

[2]Publicly offered open-end funds investing in transferable securities and money market funds.

funds is higher than the per cent increase in the total asset under management, meaning that the average asset under management per fund has slightly decreased.

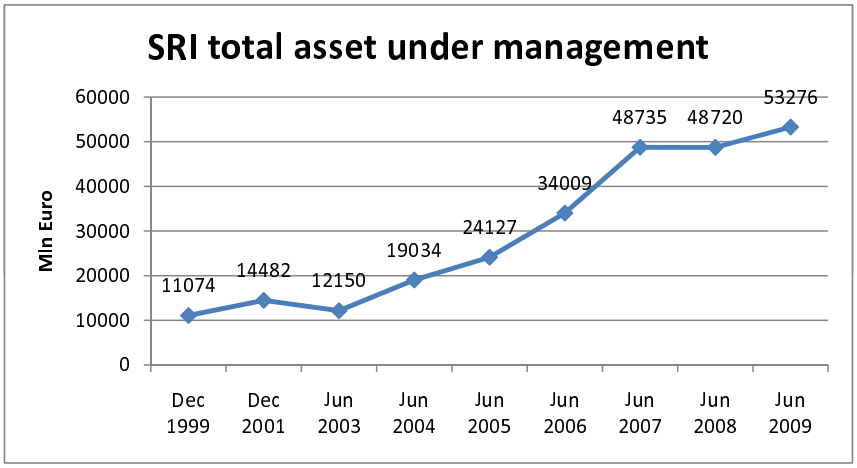

Figure 1: Trend of total asset under management of European SRI funds in the period December 1999-June 2009.

All the three typologies of funds (equity, balanced, fixed income) are represented; however, the breakdown varies in time: equity funds 61 %, fixed income funds 22 %, balanced funds 17 % in June 2006, equity 55 %, fixed income 33 %, balanced 12 % in June 2009. In this paper we turn our attention to the typology of equity funds.

For a more detailed presentation of the main features of socially responsible investing in Europe we refer to the Eurosif report [14] which analyses their presence in each European country. The analysis presented in this contribution considers the European socially responsible funds which use ethical, social and/or environmental screening to select the assets in their portfolios. Moreover the funds considered are retail funds available to the public, advertised as socially responsible investments.

In the analysis carried out we have included all the SRI European equity funds for which the data in the 'SRI Funds Service' database were available for the period 30/06/2006 to 30/06/2009.

The number of SRI equity funds considered is equal to 190; their distribution for the various European countries is reported in table 1, where they are grouped by country of domicile. As we can see, in the period considered the SRI funds are mainly concentrated in few countries, namely France, Luxembourg, Sweden and United Kingdom.

Table 1 shows the average value of the ethical measure (2) for all countries. As it can be seen, the mean ethical level is not the same in all countries; for example, the ethical level of UK funds is on average almost twice the ethical level of Swedish funds.

Figure 2 shows the frequency distribution of European SRI equity funds by ethical

	Country	No. of funds	Ethical level	Mean return %	St. Dev. %	Excess return %	% of pos. returns	% of pos. Sharpe	Initial charges %	Exit charges %
AT	Austria	10	2.69	-9.74	22.00	-13.23	0%	0%	4.45	0.00
BE	Belgium	10	2.95	-8.72	21.08	-12.19	0%	0%	3.20	0.00
CH	Switzerland	5	2.92	-4.06	19.98	-5.86	20%	0%	3.40	0.01
DE	Germany	4	1.76	-7.89	18.96	-11.40	0%	0%	3.63	0.00
ES	Spain	2	1.15	-11.40	18.47	-14.89	0%	0%	0.00	3.00
FR	France	36	1.29	-6.96	20.36	-10.50	0%	0%	2.64	0.15
IR	Irland	3	2.06	-8.09	20.54	-11.61	0%	0%	2.67	0.00
IT	Italy	3	1.62	-10.68	19.05	-14.15	0%	0%	1.00	0.00
LU	Luxembourg	38	2.10	-6.46	20.46	-10.05	5%	3%	4.34	0.24
NE	The Netherlands	7	2.17	-6.33	20.09	-9.83	0%	0%	0.33	0.26
NO	Norway	1	3.81	-12.00	22.13	-16.60	0%	0%	0.20	0.30
SE	Sweden	32	1.27	-1.36	21.41	-4.77	47%	6%	0.31	0.36
UK	United Kingdom	39	2.26	-3.58	19.64	-8.19	23%	3%	4.22	0.00
	Europe	190	1.92	-5.53	20.45	-9.23	14%	2%	2.93	0.18

Table 1: Average features of European SRI mutual funds by country.

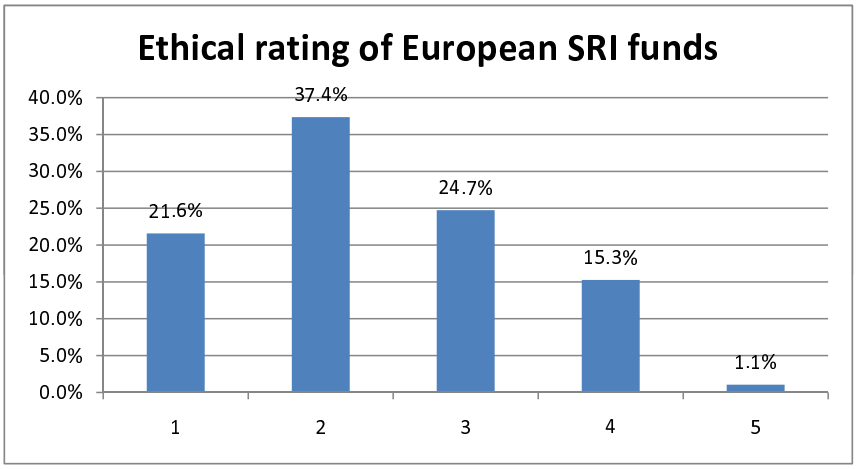

Figure 2: Frequency distribution of the ethical rating of European SRI funds.

rating; in this bar chart the label k, with $k = 1, 2, \ldots, 5$, groups the funds with ethical level $k - 1 < e_j \leq k$. This distribution is not symmetric: the values are mainly concentrated around 2 and only few funds fall in the highest rating class. This distribution, too, varies with the country; table 2 exhibits the frequency distribution for the 4 countries with the highest numbers of SRI equity funds. We may observe that the rating distributions of France and Sweden are concentrated in the lower value classes, while those of Luxembourg and UK show a somewhat more symmetric behaviour.

Table 1 reports also for all countries the average values of the relevant data which has been used in the performance analysis of mutual funds, namely the annual mean return and standard deviation (the return data taken into account are the monthly returns achieved by the mutual funds in the triennium 30/06/2006–30/06/2009; source: Morningstar Europe), the excess return, the initial and exit charges.

Ethical rating class	FR	LU	SE	UK	**Europe**
1	18.2%	9.4%	24.5%	2.9%	21.6%
2	57.6%	20.8%	64.2%	25.0%	37.4%
3	18.2%	31.3%	11.3%	49.0%	24.7%
4	6.1%	33.3%	0.0%	23.1%	15.3%
5	0.0%	5.2%	0.0%	0.0%	1.1%

Table 2: Frequency distribution of the ethical level of European SRI mutual funds; the frequency distributions for SRI funds of France, Luxembourg, Sweden and UK are also shown, separately.

The financial load due to the initial and exit charges differs substantially among the countries; we may notice that it is definitely heavy for some countries. On the other hand, while the average value of standard deviation is fairly similar for the different countries, the same cannot be said for the mean return, which shows great differences among the countries. In particular mutual funds domiciled in some countries seem to have suffered the negative trend of the financial markets in the triennium considered more than others.

Anyhow, due to the hardship of the financial crisis, most of the mutual funds considered exhibit a negative value for both the excess return and the mean return. In this regard, table 1 shows the per cent number of funds having a positive mean return for all countries; for most countries this number is even equal to zero. Even lower is the number of funds with a positive mean excess return (only 4 out of 190 funds), entailing a negative value of the Sharpe ratio for almost all the funds analysed.

This is an exemplary case in which it is better to avoid using the Sharpe ratio to evaluate the performance of mutual funds. Indeed, the Sharpe ratio would cause us to choose funds with higher standard deviations; for example, between two mutual funds with the same (negative) value of the excess return, the fund with the highest value of the Sharpe ratio is the one with the highest value of the standard deviation. This problem is known in the literature and severely affects the ability of Sharpe ratio to measure the performance of mutual funds in slump periods; see for example [20], [4].

4 DEA performance evaluation of SRI mutual funds

In order to evaluate the performance of SRI mutual funds, we apply some special models which use the operational research technique known as *data envelopment analysis* (DEA) and generalize the traditional Sharpe index.

Actually, the DEA technique can be used to define mutual fund performance measures that allow to take into consideration several input variables, such as different risk measures and the initial and exit fees of the investment, as well as several output variables, such as a return indicator but also other objectives (see [2]). In our case, among the objectives we may consider the ethical level of the mutual funds, analogously to what is proposed in [3], which presents some models specially designed to evaluate the performance of SRI mutual funds.

However, we have to point out that the negative trend observed in the three-year period considered in the empirical analysis, that causes the ex post mean return of most mutual funds to be negative, represents a drawback which interfere with the use of the models proposed in [2] and [3], since DEA models assume that input and output variables are non negative; on the problems that arise when using these models in slump periods, see [4].

In order to cope with such a drawback, we propose a modification of these DEA models designed to get models which can be used in any circumstances, independently of the sign of the ex post mean returns and thus of the phase of the business cycle of the period considered in the analysis. The modification introduces a different measure of profitability, conceived as a one-to-one function of the mean return with positive values.

The measure of profitability considered in place of the mean return $\overline{R}_j$ of fund j (with $j = 1, 2, \ldots, n$) is the capitalisation factor $\overline{U}_j = 1 + \overline{R}_j$, which gives the final value of a unit initial investment at the end of a unit period. This quantity cannot become negative, since in the worst case we may at most lose all the capital invested in a mutual fund.

Moreover, since the output is represented by the final value of a unit investment, we include among the inputs also the unit initial capital invested in the mutual fund.

With this choice, the basic DEA model for the computation of the performance measure of mutual funds can be written as follows:

$$\max_{\{u,v_i\}} \quad \frac{u\overline{U}_{j_0}}{v_1 + v_2\sigma_{j_0} + v_3 c_{Ij_0} + v_4 c_{Ej_0}} \tag{3}$$

subject to

$$\frac{u\overline{U}_j}{v_1 + v_2\sigma_j + v_3 c_{Ij} + v_4 c_{Ej}} \leq 1 \qquad j = 1, 2, \ldots, n \tag{4}$$

$$u \geq \varepsilon, \tag{5}$$

$$v_i \geq \varepsilon \qquad i = 1, 2, 3, 4 \tag{6}$$

where

$\{1, 2, \ldots, n\}$	is the set of mutual funds considered
$\overline{U}_j$	is the capitalisation factor of fund $j \in \{1, 2, \ldots, n\}$
σ_j	is the historical volatility of fund j, i.e. the standard deviation of the returns of fund j
c_{Ij}	is the initial charge of fund j
c_{Ej}	is the exit charge of fund j
u	is the weight assigned to the capitalisation factor $\overline{U}_j$
v_1	is the weight assigned to the unit initial investment
v_2	is the weight assigned to the standard deviation σ_j
v_3	is the weight assigned to the initial charge c_{Ij}
v_4	is the weight assigned to the exit charge c_{Ej}
ε	is a non-archimedean constant that prevents the weights from vanishing.

Problem (3)–(6) searches for the value of the weights that maximises the value of the performance of fund j_0, with the constraint that the value of the performance of all mutual funds analysed, computed with these weights, do not exceed 1, which represents the maximum value that can be obtained for the performance index (and will denote the efficient funds, that are not dominated by any other fund in the set considered or linear combination of them).

In essence, the DEA performance index is computed as a ratio of weighted outputs to weighted inputs, in which the most favourable weights are used for each fund. The idea is that the funds that turn out to be inefficient with the most favourable weights cannot blame the choice of the weights.

Of course, this optimisation procedure has to be carried out for each fund $j_0 = 1, 2, \ldots, n$, and the optimal value of the weights will in general be different for each mutual fund. The DEA performance measure for fund j_0, $I_{j_0,DEA-S}$, is the optimal value obtained for the objective function:

$$I_{j_0,DEA-S} = \frac{u^* \overline{U}_{j_0}}{v_1^* + v_2^* \sigma_{j_0} + v_3^* c_{Ij_0} + v_4^* c_{Ej_0}}. \tag{7}$$

From a computational point of view, the solution of problem (3)–(6) can be more conveniently computed by solving the following equivalent linear programming problem (see for example [11]):

$$\min_{\{u, v_i\}} \quad v_1 + v_2 \sigma_{j_0} + v_3 c_{Ij_0} + v_4 c_{Ej_0} \tag{8}$$

subject to

$$u \overline{U}_{j_0} = 1 \tag{9}$$

$$-u \overline{U}_j + v_1 + v_2 \sigma_j + v_3 c_{Ij} + v_4 c_{Ej} \geq 0 \quad j = 1, 2, \ldots, n \tag{10}$$

$$u \geq \varepsilon \tag{11}$$

$$v_i \geq \varepsilon \qquad i = 1, 2, 3, 4. \tag{12}$$

Let us observe that by setting $u = 1/\overline{U}_{j_0}$ the constraints (9)–(12) can be rewritten in a

simpler form as follows:

$$v_1 + v_2\sigma_j + v_3 c_{Ij} + v_4 c_{Ej} \geq \frac{\overline{U}_j}{\overline{U}_{j_0}} \quad j = 1, 2, \ldots, n \tag{13}$$

$$v_i \geq \varepsilon \qquad i = 1, 2, 3, 4. \tag{14}$$

Model (3)–(6) can be applied to evaluate the performance to any mutual funds, but it does not explicitly take into consideration a socially responsible objective. However, DEA models easily allows to include more variables among the outputs; this observation immediately leads to the following two-output generalization, which takes into account both a return indicator and an ethical measure, as well as a risk indicator and the initial and exit charges:

$$\max_{\{u_r, v_i\}} \quad \frac{u_1 \overline{U}_{j_0} + u_2 e_{j_0}}{v_1 + v_2\sigma_{j_0} + v_3 c_{Ij_0} + v_4 c_{Ej_0}} \tag{15}$$

subject to

$$\frac{u_1 \overline{U}_j + u_2 e_j}{v_1 + v_2\sigma_j + v_3 c_{Ij} + v_4 c_{Ej}} \leq 1 \qquad j = 1, 2, \ldots, n \tag{16}$$

$$u_r \geq \varepsilon \qquad r = 1, 2 \tag{17}$$

$$v_i \geq \varepsilon \qquad i = 1, 2, 3, 4, \tag{18}$$

A DEA performance measure for fund j_0 which gives social responsibility an additional premium is given by the optimal value of the objective function (15):

$$I_{j_0, DEA-SE} = \frac{u_1^* \overline{U}_{j_0} + u_2^* e_{j_0}}{v_1^* + v_2^*\sigma_{j_0} + v_3^* c_{Ij_0} + v_4^* c_{Ej_0}}. \tag{19}$$

Again, model (15)–(18) is equivalent to a linear programming problem which can be easily solved:

$$\min_{\{u_r, v_i\}} \quad v_1 + v_2\sigma_{j_0} + v_3 c_{Ij_0} + v_4 c_{Ej_0} \tag{20}$$

subject to

$$u_1 \overline{U}_{j_0} + u_2 e_{j_0} = 1 \tag{21}$$

$$-u_1 \overline{U}_j - u_2 e_j + v_1 + v_2\sigma_j + v_3 c_{Ij} + v_4 c_{Ej} \geq 0 \quad j = 1, 2, \ldots, n \tag{22}$$

$$u_r \geq \varepsilon \qquad r = 1, 2 \tag{23}$$

$$v_i \geq \varepsilon \qquad i = 1, 2, 3, 4. \tag{24}$$

Model (15)–(18) is fairly straightforward and is effective in measuring the performance of SRI and non SRI funds under the assumption that investors choose their investment in mutual funds by trying to maximise their satisfaction which depends, among other things, on both the return of the investment and its ethical level.

On the other hand, when investing in a socially responsible manner, some investors fix the value of the ethical level they prefer in advance, and try to maximise their satisfaction

by choosing among the funds with at least this value. In such a case, a constraint is actually imposed on the fund chosen; indeed, investors that chose a given ethical level discard the funds with lower ethical levels and try to maximize their satisfaction among all the funds that satisfy the required ethical level.

Formally, this entails that the ethical level has to be considered as an exogenously fixed output; on DEA models for exogenously fixed inputs or outputs see [1].

In order to take this constraint into consideration, let us first consider the dual of linear program (20)–(24):

$$\max \quad z_0 + \varepsilon s_1^+ + \varepsilon s_2^+ + \varepsilon \sum_{i=1}^{4} s_i^- \tag{25}$$

subject to

$$\overline{U}_{j_0} z_0 - \sum_{j=1}^{n} \overline{U}_j \lambda_j + s_1^+ = 0 \tag{26}$$

$$e_{j_0} z_0 - \sum_{j=1}^{n} e_j \lambda_j + s_2^+ = 0 \tag{27}$$

$$\sum_{j=1}^{n} \lambda_j + s_1^- = 1 \tag{28}$$

$$\sum_{j=1}^{n} \sigma_j \lambda_j + s_2^- = \sigma_{j_0} \tag{29}$$

$$\sum_{j=1}^{n} c_{Ij} \lambda_j + s_3^- = c_{Ij_0} \tag{30}$$

$$\sum_{j=1}^{n} c_{Ej} \lambda_j + s_4^- = c_{Ej_0} \tag{31}$$

$$\lambda_j \geq 0 \qquad j = 1, 2, \ldots, n \tag{32}$$

$$s_r^+ \geq 0 \qquad r = 1, 2 \tag{33}$$

$$s_i^- \geq 0 \qquad i = 1, 2, 3, 4 \tag{34}$$

$$z_0 \qquad \text{unconstrained,} \tag{35}$$

where z_0 is the dual variable associated with the equality constraint (21), λ_j are the dual variables associated with the mutual funds constraints (22) and s_i^- and s_r^+ are the dual variables connected with the output and input weight constraints (23) and (24), respectively.

It is known (see e.g. [11] and [2]) that the solution of a dual problem such as (25)–(35) enables to identify a virtual unit made up of a linear combination of efficient funds, with coefficients given by the optimal values of the dual variables λ_j $(j = 1, 2, \ldots, n)$, that uses a level of inputs which is not greater than that employed by fund j_0 and obtains a level of outputs that is not lower than that obtained by fund j_0.

When the ethical level is considered as an exogenously fixed output, the virtual unit is required to have an ethical level not lower than that of fund j_0

$$\sum_{j=1}^{n} e_j \lambda_j^* \geq e_{j_0} \tag{36}$$

and constraint (27) of the dual problem has to be substituted by the following constraint

$$\sum_{j=1}^{n} e_j \lambda_j - s_2^+ = e_{j_0}; \tag{37}$$

see also [5].

Moreover, following the suggestion of Banker and Morey [1], we relax the constraint on the weight u_2 in the primal problem to a pure non negativity constraint; this entails that the coefficient of the slack variable s_2^+ in the objective function of the dual problem vanishes.

With these modifications, the dual program can be written as follows:

$$\max \quad z_0 + \varepsilon s_1^+ + \varepsilon \sum_{i=1}^{4} s_i^- \tag{38}$$

subject to

$$\overline{U}_{j_0} z_0 - \sum_{j=1}^{n} \overline{U}_j \lambda_j + s_1^+ = 0 \tag{39}$$

$$\sum_{j=1}^{n} e_j \lambda_j - s_2^+ = e_{j_0} \tag{40}$$

$$\sum_{j=1}^{n} \lambda_j + s_1^- = 1 \tag{41}$$

$$\sum_{j=1}^{n} \sigma_j \lambda_j + s_2^- = \sigma_{j_0} \tag{42}$$

$$\sum_{j=1}^{n} c_{Ij} \lambda_j + s_3^- = c_{Ij_0} \tag{43}$$

$$\sum_{j=1}^{n} c_{Ej} \lambda_j + s_4^- = c_{Ej_0} \tag{44}$$

$$\lambda_j \geq 0 \qquad j = 1, 2, \ldots, n \tag{45}$$

$$s_r^+ \geq 0 \qquad r = 1, 2 \tag{46}$$

$$s_i^- \geq 0 \qquad i = 1, 2, 3, 4 \tag{47}$$

$$z_0 \qquad \text{unconstrained,} \tag{48}$$

By construction, the performance index when the ethical level is exogenously fixed, $I_{j_0,DEA-SEef}$, is the reciprocal of the optimal value of z_0.

This model for the exogenously fixed ethical level is similar to the $DEA-U$ model proposed in [3]; it differs in the choice of the return indicator and the use of the initial capital as additional input, introduced to tackle the problem of negative returns in slump periods.

It can be proved (see [5]) that among the performance indexes obtained with the three DEA models *DEA-S*, *DEA-SE* and *DEA-SEef* there exists the following relation

$$I_{j_0,DEA-S} \leq I_{j_0,DEA-SEef} \leq I_{j_0,DEA-SE}. \tag{49}$$

Moreover, it is easy to see that for a mutual fund j_0 with ethical measure equal to 0 (non SRI fund) the three performance measures give the same result since we have

$$I_{j_0,DEA-S} = I_{j_0,DEA-SEef} = I_{j_0,DEA-SE}. \tag{50}$$

5 An analysis of the performance of the European SRI mutual funds

In this section we present the results of the empirical analysis carried out to assess the performance of SRI equity mutual funds in Europe. Moreover, in next section we will cope with the crucial issue wether the ethical objective is in general accompanied by a reduction in the returns.

To this aim, in order to compare the performance obtained by SRI and non SRI equity funds, we have also analysed a set of non socially responsible funds. More precisely, we have included in the set of funds considered some non SRI equity funds with features analogous to those of the European SRI funds: for each SRI fund considered, a non SRI fund with similar features and a similar investment style was selected among those offered by the same fund company, whenever one such fund was available in the Morningstar Europe database. In this way the number of non SRI funds considered is lower than the number of SRI funds, but the comparison of the performance achievements takes place among SRI and non SRI funds with a similar management.

The main features of the non SRI funds considered are summarised in table 3, which exhibits the average values by country. The last row also reports the average value of SRI European funds, by comparison. On the whole, the average values for the SRI and non SRI funds are fairly close, although we may observe that the SRI funds exhibit a slightly higher mean return as well as a slightly higher standard deviation. The appropriate statistical test for equality of the means (Welch's t test) and that for equality of the variances (F-test), however, indicate that the differences are not statistically significant.

We have computed the performance index with the DEA model with non negative outputs for slump periods I_{DEA-S} and the two DEA models devised specifically for SRI mutual funds, I_{DEA-SE} and $I_{DEA-SEef}$, presented in the previous section. The analysis has been carried out for the European mutual funds considered on the whole (281 mutual funds, 190 SRI funds and 91 non SRI funds). Moreover, given the significant differences

observed among the various countries, the investigation has also been replicated for the set of mutual funds of the most relevant single countries, separately: France, Luxembourg, Sweden, UK.

	Country	No. of funds	Mean return %	St. Dev. %	Excess return %	% of pos. returns	% of pos. Sharpe	Initial charges %	Exit charges %
AT	Austria	6	-11.66	20.63	-15.16	0%	0%	3.33	0.00
BE	Belgium	4	-9.27	18.64	-12.72	0%	0%	3.25	0.00
CH	Switzerland	3	-5.60	18.11	-7.44	0%	0%	4.33	0.33
DE	Germany	2	-5.82	17.09	-9.29	0%	0%	4.00	0.00
ES	Spain	2	-13.56	18.39	-16.97	0%	0%	0.00	1.00
FR	France	21	-7.38	19.77	-10.88	0%	0%	3.05	0.05
IT	Italy	3	-8.32	18.86	-11.82	0%	0%	2.33	0.00
LU	Luxembourg	16	-7.13	19.43	-10.69	0%	0%	3.45	0.00
NE	The Netherlands	4	-4.41	18.18	-7.93	25%	0%	0.35	0.35
SE	Sweden	10	-1.87	21.51	-5.29	40%	10%	0.10	0.00
UK	United Kingdom	20	-1.48	20.36	-6.10	30%	10%	4.15	0.00
	Europe non SRI	91	-5.74	19.79	-9.43	12%	3%	2.92	0.06
	Europe SRI	190	-5.53	20.45	-9.23	14%	2%	2.93	0.18

Table 3: Average features of European non SRI mutual funds by country.

Tables 4–7 show the results of the analysis carried out on the single countries, separately for socially responsible and non socially responsible mutual funds. The first columns of these tables display the features taken into account in the analysis for all mutual funds. The last columns, instead, report the main results of the performance analysis obtained with the three DEA models considered; in particular, tables 4–7 report for all funds the value of the performance indexes I_{DEA-S}, I_{DEA-SE} and $I_{DEA-SEef}$, as well as the ranking obtained with such models (in brackets).

Of course, as pointed out in the previous section, the values of the three performance indexes computed coincide for the non SRI funds, while for the socially responsible funds we have $I_{DEA-SE} \geq I_{DEA-SEef} \geq I_{DEA-S}$. Hence, the funds which are efficient with the *DEA-S* model ($I_{DEA-S} = 1$) remain efficient also with the other two models. Moreover, let us observe that the fact that the two DEA models devised for socially responsible behaviour raise the value of the performance index of the SRI funds while keeping it constant for the non SRI funds does change the overall ranking, even for the non SRI funds.

In accordance with the fundamental idea of the DEA technique, it can be seen that a fund which excels with respect to one of the input or output variables is generally efficient: therefore it is efficient the fund with the highest mean return, the fund with the lowest standard deviation, the fund with the highest ethical level.

The main results of the analysis carried out for all the 281 European equity mutual funds considered altogether are presented in table 8, which reports the mean value of the performance indexes and the average ranking for each country, separately for SRI and non SRI funds. It is important to remark that the values of the DEA indexes, and the relative rankings, depend on the set of funds considered in the analysis; therefore, when this set is changed, as it happens when we enlarge the set to include all European funds, this value may well change. Hence, the mean values obtained in the European investigation for all countries reported in table 8 do not in general coincide with the mean values reported in the single country tables 4–7. For example, the mean value of the *DEA-S* index for French

Fund name	Init. charge %	Exit charge %	Std. Dev. %	Mean re-turn %	Ethic. level	DEA S	DEA SE	DEA SEef
SRI funds								
AGF Euro Actions (C)	3.00	0.00	20.98	-6.48	1.57	0.959 *(23)*	0.973 *(18)*	0.973 *(18)*
AGF Valeurs Durables	3.00	0.00	20.50	-6.36	2.69	0.960 *(22)*	0.995 *(7)*	0.995 *(7)*
AXA Euro Valeurs Respons.	4.50	0.00	20.49	-4.32	1.36	0.972 *(10)*	0.992 *(8)*	0.991 *(8)*
BNP Paribas Etheis	2.00	0.00	19.04	-6.36	0.18	0.967 *(13)*	0.967 *(25)*	0.967 *(25)*
BNP Paribas Retraite Hor. P 100	2.00	0.00	18.27	-7.92	0.18	0.951 *(31)*	0.951 *(38)*	0.951 *(37)*
CAAM Actions Durables	5.00	0.00	20.47	-9.84	0.36	0.913 *(56)*	0.919 *(56)*	0.918 *(56)*
CM-CIC Valeurs Ethiques	2.00	0.00	21.13	-7.44	1.02	0.956 *(26)*	0.956 *(35)*	0.956 *(35)*
Ecureuil Bnfices Respons.	2.00	0.00	20.85	-8.64	1.59	0.943 *(42)*	0.952 *(37)*	0.950 *(38)*
Epargne Ethique Actions	2.00	0.00	22.39	-8.40	2.51	0.946 *(38)*	0.971 *(21)*	0.970 *(22)*
Ethique et Partage - CCFD	0.00	0.00	21.94	-9.36	2.13	0.949 *(33)*	1.000 *(1)*	1.000 *(1)*
Ethis Vitalit	4.00	0.00	21.52	-6.96	1.21	0.948 *(35)*	0.962 *(30)*	0.961 *(30)*
Etoile Environnement	2.00	0.00	21.25	-8.52	0.55	0.944 *(41)*	0.944 *(44)*	0.944 *(44)*
Etoile Partenaires	2.00	0.00	20.63	-5.88	0.55	0.972 *(9)*	0.972 *(20)*	0.972 *(20)*
Euro Active Investors	5.00	0.00	22.92	-5.40	1.60	0.957 *(25)*	0.985 *(12)*	0.984 *(12)*
Euro Capital Durable I	2.00	0.00	17.63	-4.44	0.18	0.988 *(5)*	0.988 *(9)*	0.988 *(9)*
Europe Gouvernance P	3.00	0.50	19.89	-9.96	1.18	0.923 *(55)*	0.931 *(52)*	0.930 *(53)*
EuroSocitale P	3.00	0.50	22.60	-7.80	0.55	0.946 *(40)*	0.946 *(43)*	0.946 *(43)*
Federal Actions Ethiques P	3.00	0.00	24.43	-3.72	0.55	0.987 *(6)*	0.987 *(10)*	0.987 *(10)*
Gnration Ethique	3.00	1.50	20.70	-8.76	1.49	0.936 *(49)*	0.949 *(39)*	0.947 *(40)*
George V Europe PEA	5.00	0.00	16.95	-6.00	1.36	0.951 *(30)*	0.976 *(16)*	0.975 *(16)*
Groupama Euro Capital Durable Retr.	5.00	0.00	17.66	-4.56	1.09	0.966 *(17)*	0.985 *(11)*	0.984 *(11)*
HSBC Actions Dvel. Durable A	3.00	0.00	22.16	-8.04	0.73	0.943 *(44)*	0.943 *(46)*	0.943 *(46)*
Insertion Emplois Dynamique R	0.00	0.00	19.13	-7.08	1.18	0.975 *(7)*	0.975 *(17)*	0.975 *(17)*
LBPAM Responsable Actions Euro	2.50	0.00	20.22	-6.12	1.55	0.966 *(15)*	0.977 *(15)*	0.976 *(15)*
LCL Actions Dev Durable Euro	2.00	0.00	22.60	-7.92	1.74	0.951 *(31)*	0.962 *(32)*	0.961 *(32)*
Macif Croissance Durable & Solid.	2.00	0.00	20.98	-6.24	0.91	0.968 *(12)*	0.968 *(23)*	0.968 *(23)*
Macif Croissance Durable	4.00	0.00	20.35	-8.04	1.73	0.937 *(48)*	0.960 *(33)*	0.959 *(33)*
Macif Croissance Durable Europe	2.00	0.00	21.27	-6.36	1.73	0.967 *(13)*	0.977 *(14)*	0.977 *(14)*
MAM Actions Environnement	2.00	1.00	16,72	-9,60	0,12	0,938 *(47)*	0,938 *(49)*	0,938 *(49)*
MAM Actions Ethique	2.00	1.00	20,61	-8,40	1,08	0,946 *(38)*	0,946 *(42)*	0,946 *(42)*
MG Croissance Durable Europe	2.00	0.00	20.57	-7.80	1.73	0.952 *(29)*	0.963 *(29)*	0.961 *(31)*
Objectif Ethique Socialement Resp.	4.00	1.00	18.92	-5.28	0.55	0.965 *(19)*	0.968 *(24)*	0.968 *(24)*
Regard Actions Devel. Durable	5.00	0.00	20.18	-6.36	2.09	0.948 *(36)*	0.984 *(13)*	0.983 *(13)*
SGAM Invest Europe Dvel. Durable	2.00	0.00	19.14	-7.44	3.51	0.956 *(26)*	1.000 *(1)*	1.000 *(1)*
UFG Sarasin Actions Euro Flexible I	0.00	0.00	17.95	-4.92	1.93	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
UFG Sarasin Actions Euro Mid-Cap I	0.00	0.00	20.05	-4.44	1.93	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
Mean – SRI funds	2.64	0.15	20.36	-6.98	1.29	0.957 *(27)*	0.968 *(24)*	0.968 *(24)*
Non SRI funds								
AGF Eurolan	3.00	0.00	20.98	-6.96	0.00	0.954 *(28)*	0.954 *(36)*	0.954 *(36)*
AGF Actions VD	4.00	0.00	20.56	-6.00	0.00	0.958 *(24)*	0.958 *(34)*	0.958 *(34)*
AXA Valeurs Euro A Acc	4.50	0.00	21.49	-6.60	0.00	0.948 *(34)*	0.948 *(40)*	0.948 *(39)*
Parvest Europe Alpha C	5.00	0.00	20.40	-7.56	0.00	0.936 *(50)*	0.936 *(50)*	0.936 *(50)*
CAAM Actions Euro Acc	2.50	0.00	21.40	-6.12	0.00	0.966 *(15)*	0.966 *(26)*	0.966 *(26)*
CM-CIC Europe	2.00	0.00	19.48	-8.64	0.00	0.943 *(42)*	0.943 *(45)*	0.943 *(45)*
Ecureuil Actionas Europennes	2.00	0.00	21.76	-8.28	0.00	0.947 *(37)*	0.947 *(41)*	0.947 *(41)*
Ecofi Actions Rendement Euro	2.00	0.00	17.28	-10.32	0.00	0.928 *(53)*	0.928 *(54)*	0.928 *(54)*
Etoile Actions Rendement	2.00	0.00	21.34	-6.48	0.00	0.966 *(18)*	0.966 *(27)*	0.966 *(27)*
Astorg Actions Euro I	2.75	0.00	18.20	-6.36	0.00	0.962 *(21)*	0.962 *(31)*	0.962 *(29)*
Ina Actions Europennes	3.00	0.00	20.28	-13.20	0.00	0.890 *(57)*	0.890 *(57)*	0.890 *(57)*
Orion Sicav Actions Europe	5.00	0.00	15.12	-1.20	0.00	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
Groupama Euro Stock I	2.75	0.00	18.00	-6.24	0.00	0.963 *(20)*	0.963 *(28)*	0.963 *(28)*
HSBC Actions Europe Acc	5.00	0.00	21.10	-7.08	0.00	0.940 *(46)*	0.940 *(48)*	0.940 *(48)*
ABP Actions C/D	4.75	0.00	21.75	-8.16	0.00	0.931 *(52)*	0.931 *(53)*	0.931 *(52)*
LBPAM Actions Euro R	2.50	0.00	20.41	-5.76	0.00	0.970 *(11)*	0.970 *(22)*	0.970 *(21)*
LCL Actions Europe	2.00	0.00	19.62	-10.32	0.00	0.926 *(54)*	0.926 *(55)*	0.926 *(55)*
MAM Europe Rendement	2.00	1.00	15.84	-5.76	0.00	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
CNP Actions EMU LF A	0.00	0.00	19.13	-7.32	0.00	0.972 *(8)*	0.972 *(19)*	0.972 *(19)*
Regard Actions Europe	5.25	0.00	21.16	-7.92	0.00	0.932 *(51)*	0.932 *(51)*	0.932 *(51)*
SGAM Invest Europe Actions B	2.00	0.00	19.86	-8.76	0.00	0.942 *(45)*	0.942 *(47)*	0.942 *(47)*
Mean – non SRI funds	3.05	0.05	19.77	-7.38	0.00	0.951 *(32)*	0.951 *(36)*	0.951 *(36)*

Table 4: Empirical results of the analysis of the performance of the French SRI mutual funds. The last columns report the value of the performance indexes I_{DEA-S}, I_{DEA-SE} and $I_{DEA-SEef}$ and (in brackets) the relative ranking.

Fund name	Init. charge %	Exit charge %	Std. Dev. %	Mean re-turn %	Ethic. level	DEA S	DEA SE	DEA SEef
SRI funds								
Allianz RCM Global Sustain. A EUR	5.00	0.00	19.02	-7.68	2.63	0.920 *(31)*	0.955 *(29)*	0.953 *(29)*
Aviva Inv. Sust. Future Pan-Europ. Eq.	5.00	0.00	18.48	-5.76	3.74	0.942 *(21)*	1.000 *(1)*	1.000 *(1)*
Carnegie Worldwide Ethical 1A	0.00	0.00	17.19	-4.44	0.35	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
Dexia Eqs L Sust World	3.50	0.00	18.64	-11.40	3.93	0.895 *(43)*	1.000 *(1)*	1.000 *(1)*
DWS Invest Responsibility FC	0.00	0.00	19.75	-3.12	2.66	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
DWS Invest Responsibility LC	1.50	0.00	19.83	-3.60	2.66	0.982 *(10)*	0.994 *(15)*	0.993 *(15)*
DWS Invest Responsibility NC	2.00	0.00	19.74	-4.44	2.66	0.970 *(11)*	0.986 *(16)*	0.985 *(17)*
Fortis L Equity Soc. Resp. Inv. Eur.	5.00	0.00	20.48	-10.92	0.55	0.881 *(50)*	0.881 *(52)*	0.881 *(52)*
HSBC Amanah Gl. Eq. In. Fu. Inc GBP	5.25	0.00	15.55	-1.44	0.89	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
ING (L) Invest Sust. Growth P	3.00	0.00	18.04	-8.28	3.75	0.933 *(24)*	1.000 *(1)*	1.000 *(1)*
JPM Gl. Soc. Respons. A (dist)-USD	5.00	0.00	19.45	-3.72	1.25	0.957 *(16)*	0.963 *(23)*	0.962 *(23)*
LIGA-Pax-CattolicoUnion Inc	2.50	0.00	15.97	-5.28	0.24	0.985 *(9)*	0.985 *(17)*	0.985 *(16)*
Living Planet Fund A	5.00	0.00	20.52	-6.48	4.17	0.924 *(27)*	1.000 *(1)*	1.000 *(1)*
Meridio Green Balance	5.00	0.00	22.22	-7.80	1.77	0.903 *(40)*	0.919 *(42)*	0.916 *(43)*
Oyster Respons. Develop. EUR	5.00	3.00	19.16	-12.24	2.27	0.874 *(52)*	0.902 *(47)*	0.898 *(47)*
Pictet Funds (LUX) Eur. Sust. Eq. P	5.00	1.00	19.83	-10.56	2.90	0.887 *(48)*	0.928 *(37)*	0.924 *(38)*
Pictet Funds (LUX) Eur. Sust. Eq. R	5.00	3.00	19.82	-11.40	2.90	0.879 *(51)*	0.920 *(40)*	0.915 *(44)*
Pioneer Funds-Gl. Ecology Cl. A EUR	5.00	0.00	20.66	-3.12	0.71	0.957 *(18)*	0.957 *(26)*	0.957 *(26)*
Pioneer Funds-Gl. Sust. Eq. Cl. E EUR	4.75	0.00	18.45	-9.72	2.55	0.904 *(38)*	0.937 *(35)*	0.933 *(35)*
Pioneer Funds-Gl. Sust. Eq. Cl. F EUR	0.00	0.00	18.42	-10.56	2.55	0.930 *(25)*	1.000 *(1)*	1.000 *(1)*
Postbank Dynamik-Vision Acc	3.75	0.00	22.01	-7.08	0.73	0.919 *(33)*	0.919 *(41)*	0.919 *(40)*
SAM Smart Energy Fund EUR B	5.00	0.00	35.85	9.84	1.26	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
SAM Sustainable Europe Active B	5.00	0.00	20.67	-6.72	1.26	0.921 *(30)*	0.927 *(38)*	0.925 *(37)*
SAM Sustainable Global Active B	5.00	0.00	17.23	-11.88	1.26	0.887 *(49)*	0.895 *(48)*	0.892 *(48)*
SAM Sust. Global Fund (EUR) B	5.00	0.00	17.38	-8.64	1.73	0.919 *(34)*	0.936 *(36)*	0.934 *(34)*
SAM Sustainable Water Fund EUR B	5.00	0.00	20.83	-5.28	1.26	0.935 *(23)*	0.940 *(32)*	0.939 *(31)*
Sarasin New Energy Fund EUR	5.00	0.00	29.03	-5.64	0.59	0.890 *(47)*	0.890 *(51)*	0.890 *(51)*
Sarasin OekoSar Equity-Gl. A EUR	5.00	1.00	19.86	-3.12	1.55	0.961 *(14)*	0.973 *(20)*	0.972 *(20)*
Sarasin Sust. Equity - Global	5.00	1.00	19.05	-10.32	3.02	0.894 *(44)*	0.937 *(34)*	0.933 *(36)*
SEB Ethical Europe Fund C SEK	5.00	0.00	23.75	-11.28	0.82	0.861 *(54)*	0.861 *(54)*	0.861 *(54)*
SEB koLux A	4.50	0.00	22.72	-8.16	1.90	0.900 *(41)*	0.916 *(45)*	0.913 *(45)*
Swisscanto (LU) Port.Fu. Green In. Eq.	5.00	0.00	21.06	-6.48	2.67	0.922 *(29)*	0.956 *(27)*	0.954 *(28)*
UBS (Lux) Eq. Fund-Eco Perf. (CHF) P	6.00	0.00	18.77	-7.68	3.58	0.920 *(32)*	0.976 *(19)*	0.974 *(19)*
UBS (Lux) Eq. Fund-Gl. Innov. (EUR) P	6.00	0.00	27.00	-2.64	3.70	0.928 *(26)*	1.000 *(1)*	1.000 *(1)*
UBS (Lux) Eq. Fund2 -Sust. Eur. Eq. P	6.00	0.00	19.96	-7.80	3.58	0.913 *(37)*	0.970 *(21)*	0.967 *(22)*
UBS (Lux) Islamic Fund-Gl. Eq.	6.00	0.00	15.08	-4.44	0.89	1.000 *(8)*	1.000 *(1)*	1.000 *(1)*
ko-Aktienfonds Acc	5.00	0.00	22.79	-1.20	1.84	0.964 *(13)*	0.981 *(18)*	0.980 *(18)*
koWorld koVision Classic Acc	5.00	0.00	23.09	-7.92	3.14	0.897 *(42)*	0.944 *(31)*	0.938 *(33)*
Mean – SRI funds	4.34	0.24	20.46	-6.54	2.10	0.930 *(28)*	0.957 *(24)*	0.955 *(24)*
Non SRI funds								
Allianz RCM Global Equity AT EUR	5.00	0.00	18.47	-8.16	0.00	0.918 *(35)*	0.918 *(43)*	0.918 *(41)*
Carnegie Worldwide 1A EUR	5.00	0.00	17.21	-5.04	0.00	0.956 *(19)*	0.956 *(28)*	0.956 *(27)*
Dexia Eqs L World C	3.50	0.00	17.52	-9.24	0.00	0.923 *(28)*	0.923 *(39)*	0.923 *(39)*
DWS Invest Global Equities FC	0.00	0.00	21.24	-2.64	0.00	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
DWS Invest Global Equities LC	5.00	0.00	21.23	-3.48	0.00	0.950 *(20)*	0.950 *(30)*	0.950 *(30)*
DWS Invest Global Equities NC	3.00	0.00	21.22	-4.20	0.00	0.957 *(17)*	0.957 *(25)*	0.957 *(25)*
Fortis L Equity Europe	5.00	0.00	19.80	-10.20	0.00	0.891 *(46)*	0.891 *(50)*	0.891 *(50)*
ING (L) Invest Global Brands P	3.00	0.00	17.04	-6.24	0.00	0.959 *(15)*	0.959 *(24)*	0.959 *(24)*
JPMorgan Funds JF Gl. Eq. (USD) A	5.00	0.00	20.46	-2.04	0.00	0.968 *(12)*	0.968 *(22)*	0.968 *(21)*
UniGlobalTitans 50 net A Inc	0.00	0.00	14.62	-10.20	0.00	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
Pioneer Funds-Gl. Trends E EUR ND	4.75	0.00	18.24	-8.64	0.00	0.916 *(36)*	0.916 *(44)*	0.916 *(42)*
Pioneer Funds-Gl. Trends F EUR ND	0.00	0.00	18.16	-9.84	0.00	0.939 *(22)*	0.939 *(33)*	0.939 *(32)*
Julius Baer Multipar.-Qual. Eur. Eq. B	5.00	0.00	22.91	-8.52	0.00	0.892 *(45)*	0.892 *(49)*	0.892 *(49)*
Julius Baer Multis. I-MobiFo. Sel. 90B	0.00	0.00	15.53	-7.68	0.00	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
SEB Europe 1 Fund C	5.00	0.00	24.03	-10.80	0.00	0.865 *(53)*	0.865 *(53)*	0.865 *(53)*
UBS (Lux) Eq. Fu.Euro Countr.(EUR) P	6.00	0.00	23.23	-7.08	0.00	0.904 *(39)*	0.904 *(46)*	0.904 *(46)*
Mean – non SRI funds	3.45	0.00	19.43	-7.13	0.00	0.940 *(24)*	0.940 *(31)*	0.940 *(30)*

Table 5: Empirical results of the analysis of the performance of the Luxembourg SRI mutual funds. The last columns report the value of the performance indexes I_{DEA-S}, I_{DEA-SE} and $I_{DEA-SEef}$ and (in brackets) the relative ranking.

Fund name	Init. charge %	Exit charge %	Std. Dev. %	Mean re-turn %	Ethic. level	DEA S	DEA SE	DEA SEef
SRI funds								
Aktie-Ansvar Europa	0.00	0.00	20.17	-4.80	0.47	0.910 *(40)*	0.910 *(40)*	0.910 *(40)*
Aktie-Ansvar Sverige	0.00	0.00	24.20	1.44	0.47	0.961 *(19)*	0.961 *(30)*	0.961 *(30)*
Banco Etisk Global Utd	0.00	0.25	15.05	-5.40	1.82	0.982 *(7)*	0.989 *(13)*	0.989 *(13)*
Banco Etisk Sverige	0.00	0.25	26.85	0.24	1.00	0.944 *(32)*	0.951 *(34)*	0.950 *(34)*
Banco Hjlp	0.00	0.25	26.80	-0.12	1.71	0.940 *(34)*	0.974 *(22)*	0.972 *(22)*
Banco Human Pension	5.00	5.00	26.81	0.84	1.89	0.949 *(28)*	0.990 *(11)*	0.989 *(11)*
Banco Humanfonden	0.00	0.25	26.81	-0.12	1.89	0.940 *(35)*	0.981 *(16)*	0.980 *(17)*
Banco Samarit Pension	5.00	5.00	26.82	0.84	1.89	0.949 *(29)*	0.990 *(11)*	0.989 *(11)*
Banco Samaritfonden	0.00	0.25	26.79	-0.12	1.89	0.940 *(33)*	0.981 *(16)*	0.980 *(17)*
Banco Svensk Milj	0.00	0.25	25.42	1.08	1.18	0.955 *(26)*	0.967 *(26)*	0.966 *(27)*
Danske Invest SRI Global	0.00	0.00	14.98	-4.68	1.94	0.991 *(5)*	1.000 *(1)*	1.000 *(1)*
Danske Invest SRI Sverige (index)	0.00	0.00	25.42	1.68	1.94	0.960 *(20)*	1.000 *(1)*	1.000 *(1)*
Eldsjl Bistndsfond	0.00	0.00	21.12	0.48	1.47	0.958 *(23)*	0.981 *(18)*	0.980 *(16)*
Eldsjl Gvofond	0.00	0.00	24.04	2.88	1.47	0.975 *(10)*	0.995 *(9)*	0.995 *(9)*
Eldsjl Sverigefond	0.00	0.00	23.50	2.28	1.47	0.970 *(12)*	0.991 *(10)*	0.991 *(10)*
Folksams Idrottsfond	0.00	0.00	19.19	-0.96	1.24	0.955 *(25)*	0.968 *(24)*	0.967 *(25)*
KPA Etisk Aktiefond	0.00	0.00	18.99	-0.48	2.30	0.963 *(17)*	1.000 *(1)*	1.000 *(1)*
SEB Cancerfonden	0.00	0.00	20.60	-8.40	0.47	0.874 *(42)*	0.874 *(42)*	0.874 *(42)*
SEB Etisk Globalfond	0.00	0.00	16.59	-8.76	0.94	0.921 *(39)*	0.922 *(39)*	0.922 *(39)*
SEB Stiftelsefond Sverige	0.00	0.00	29.54	6.84	0.82	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
SEB Stiftelsefond Utland	0.00	0.00	16.76	-8.40	0.82	0.922 *(38)*	0.922 *(38)*	0.922 *(38)*
SEB stersjfond/WWF Utd	0.00	0.00	22.27	1.32	0.59	0.964 *(16)*	0.964 *(28)*	0.964 *(28)*
Skandia Ider Fr Livet	0.00	0.00	24.07	2.52	0.47	0.971 *(11)*	0.971 *(23)*	0.971 *(23)*
SPP Aktieindexfond Gl. Sust.	0.00	0.00	15.82	-4.08	2.32	0.982 *(8)*	1.000 *(1)*	1.000 *(1)*
Swedbank Robur Ethica Gl. MEGA	0.00	0.00	14.82	-4.20	1.59	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
Swedbank Robur Ethica Milj Sv. Utd	0.00	0.00	25.86	2.16	1.18	0.964 *(15)*	0.976 *(20)*	0.975 *(20)*
Swedbank Robur Ethica Sv. Gl.	0.00	0.00	19.61	-0.96	1.71	0.949 *(30)*	0.978 *(19)*	0.977 *(19)*
Swedbank Robur Talent. Aktief. MEGA	0.00	0.00	20.02	0.24	1.71	0.958 *(22)*	0.988 *(14)*	0.987 *(14)*
hman Etisk Index Europa	0.00	0.00	16.40	-5.16	0.47	0.961 *(18)*	0.961 *(29)*	0.961 *(29)*
hman Etisk Index Japan	0.00	0.00	15.38	-9.24	0.47	0.936 *(37)*	0.937 *(37)*	0.937 *(37)*
hman Etisk Index Pacific	0.00	0.00	19.70	4.56	0.59	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
hman Etisk Index USA	0.00	0.00	14.61	-7.08	0.59	0.984 *(6)*	0.984 *(15)*	0.984 *(15)*
Mean – SRI funds	0.31	0.36	21.41	-1.36	1.27	0.957 *(21)*	0.972 *(18)*	0.972 *(19)*
Non SRI funds								
Banco Sverige	1.00	0.00	26.54	0.24	0.00	0.944 *(31)*	0.944 *(35)*	0.944 *(35)*
Danske Invest Sverige	0.00	0.00	28.02	3.84	0.00	0.975 *(9)*	0.975 *(21)*	0.975 *(21)*
SEB Europafond	0.00	0.00	20.68	-7.44	0.00	0.883 *(41)*	0.883 *(41)*	0.883 *(41)*
SEB Globalfond	0.00	0.00	15.21	-6.48	0.00	0.968 *(13)*	0.968 *(25)*	0.968 *(24)*
SEB Sverigef. Smabolag Chance/Risk	0.00	0.00	26.49	-0.24	0.00	0.940 *(36)*	0.940 *(36)*	0.940 *(36)*
SEB Globalfond-Lux ack	0.00	0.00	15.46	-7.20	0.00	0.956 *(24)*	0.956 *(32)*	0.956 *(32)*
SEB Nordenfond	0.00	0.00	22.73	0.48	0.00	0.955 *(27)*	0.955 *(33)*	0.955 *(33)*
Swedbank Robur Globalfond MEGA	0.00	0.00	15.02	-3.72	0.00	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
Swedbank Robur SverigefondUtd	0.00	0.00	25.87	2.52	0.00	0.967 *(14)*	0.967 *(27)*	0.967 *(26)*
Swedbank Robur IP Aktiefond	0.00	0.00	19.08	-0.72	0.00	0.960 *(21)*	0.960 *(31)*	0.960 *(31)*
Mean – non SRI funds	0.10	0.00	21.51	-1.87	0.00	0.955 *(22)*	0.955 *(28)*	0.955 *(28)*

Table 6: Empirical results of the analysis of the performance of the Swedish SRI mutual funds. The last columns report the value of the performance indexes I_{DEA-S}, I_{DEA-SE} and $I_{DEA-SEef}$ and (in brackets) the relative ranking.

Fund name	Init. charge %	Exit charge %	Std. Dev. %	Mean re-turn %	Ethic. level	DEA S	DEA SE	DEA SEef
SRI funds								
Aberdeen Ethical World A	4.25	0.00	21.02	2.16	1.72	0.878 *(25)*	0.886 *(34)*	0.884 *(34)*
Aberdeen Fellowship R	4.25	0.00	18.16	-3.48	2.54	0.873 *(27)*	0.950 *(19)*	0.941 *(19)*
Aberdeen Multi-Manager Ethical	4.00	0.00	17.26	-0.60	1.56	0.936 *(10)*	0.968 *(16)*	0.965 *(15)*
AEGON Ethical Equity A	5.50	0.00	18.08	-1.92	2.76	0.886 *(21)*	0.971 *(14)*	0.965 *(14)*
Aviva Inv. Sust. Future Eur. Growth SC1	4.00	0.00	19.57	2.52	2.89	0.890 *(19)*	0.953 *(18)*	0.944 *(17)*
Aviva Inv. Sustainable Future Gl. Growth	4.00	0.00	18.81	-0.84	2.89	0.883 *(24)*	0.962 *(17)*	0.955 *(16)*
Aviva Investors UK Ethical SCA	5.00	0.00	19.32	-4.44	2.89	0.835 *(45)*	0.901 *(29)*	0.885 *(32)*
Aviva Investors UK Growth SC1	0.00	0.00	18.61	-3.48	2.89	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
AXA Ethical Distribution I	0.00	0.00	20.80	-9.36	1.53	0.887 *(20)*	0.909 *(27)*	0.906 *(25)*
AXA Ethical Distribution R	5.00	0.00	20.81	-9.84	1.53	0.775 *(55)*	0.783 *(57)*	0.780 *(57)*
AXA Framlington Health	5.50	0.00	15.85	2.04	0.59	0.984 *(9)*	1.000 *(1)*	1.000 *(1)*
CIS Sustainable Leaders Trust Inc	5.00	0.00	18.77	-0.96	2.78	0.878 *(26)*	0.946 *(22)*	0.938 *(21)*
CIS UK FTSE4Good Tracker Tr	0.00	0.00	18.36	-5.40	1.56	0.993 *(7)*	0.993 *(10)*	0.993 *(10)*
Ecclesiastical Amity UK A Inc	5.00	0.00	18.77	-4.92	2.96	0.843 *(39)*	0.922 *(24)*	0.910 *(24)*
F&C Stewardship Growth 1	5.00	0.00	19.50	-8.04	2.89	0.799 *(51)*	0.867 *(39)*	0.845 *(45)*
F&C Stewardship Income 1	5.00	0.00	17.82	-7.20	2.89	0.845 *(38)*	0.949 *(20)*	0.938 *(22)*
F&C Stewardship International 1	5.00	0.00	18.44	0.24	2.89	0.897 *(14)*	0.977 *(13)*	0.973 *(13)*
Family Charities Ethical Trust	7.00	0.00	21.72	-7.56	1.18	0.795 *(53)*	0.799 *(56)*	0.798 *(54)*
First State As Pac Sustainability A	4.00	0.00	19.64	15.48	1.91	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
Halifax Ethical C Inc	0.00	0.00	19.61	1.32	0.66	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
Henderson Global Care Growth	4.50	0.00	19.62	3.00	3.91	0.892 *(17)*	1.000 *(1)*	1.000 *(1)*
Henderson Global Care UK Income A	4.50	0.00	21.73	-7.08	3.79	0.799 *(52)*	0.970 *(15)*	0.896 *(27)*
Henderson Industries of the Future A	5.00	0.00	19.22	3.24	3.61	0.904 *(13)*	1.000 *(1)*	1.000 *(1)*
Insight Investment Evergreen A	4.00	0.00	20.45	-0.24	2.53	0.858 *(32)*	0.912 *(26)*	0.898 *(26)*
Jupiter Ecology	5.00	0.00	19.88	2.40	3.61	0.884 *(23)*	0.981 *(12)*	0.976 *(12)*
Jupiter Environmental Income	5.25	0.00	19.82	-5.16	3.26	0.820 *(46)*	0.904 *(28)*	0.886 *(31)*
Legal & General Ethical Trust (R)	0.00	0.00	21.80	-6.00	1.53	0.914 *(12)*	0.942 *(23)*	0.939 *(20)*
Marlborough Ethical A	5.25	0.00	20.28	-6.36	1.38	0.805 *(50)*	0.810 *(52)*	0.809 *(51)*
Old Mutual Ethical A	4.00	0.00	20.73	-10.20	2.80	0.772 *(58)*	0.849 *(46)*	0.822 *(50)*
Prudential Ethical Trust A	4.75	0.00	21.81	-9.96	1.29	0.774 *(56)*	0.779 *(58)*	0.778 *(58)*
RBS FTSE 4Good Tracker	5.00	0.00	19.10	-3.36	0.35	0.849 *(37)*	0.849 *(45)*	0.849 *(44)*
Real Life A	4.00	0.00	16.54	-7.32	1.59	0.896 *(15)*	0.948 *(21)*	0.943 *(18)*
Scottish Widows Environ. Investor A	7.00	0.00	19.99	-10.32	2.12	0.774 *(57)*	0.808 *(54)*	0.786 *(56)*
Scottish Widows Ethical A	7.00	0.00	19.82	-9.60	2.24	0.781 *(54)*	0.819 *(51)*	0.797 *(55)*
Skandia IM Ethical	5.00	0.00	19.47	-3.24	1.53	0.842 *(40)*	0.842 *(47)*	0.842 *(46)*
Sovereign Ethical	3.00	0.00	21.65	-14.16	1.19	0.758 *(59)*	0.764 *(59)*	0.761 *(59)*
Standard Life UK Ethical R	4.00	0.00	22.32	-5.88	3.01	0.809 *(47)*	0.894 *(31)*	0.873 *(35)*
SWIP Global SRI E	5.00	0.00	19.16	-4.44	2.41	0.838 *(43)*	0.884 *(36)*	0.870 *(38)*
SWIP Pan-European SRI Equity E	5.00	0.00	21.50	-0.60	2.41	0.855 *(35)*	0.898 *(30)*	0.885 *(33)*
Mean – SRI funds	4.22	0.00	19.64	-3.58	2.26	0.864 *(32)*	0.913 *(27)*	0.903 *(28)*
Non SRI funds								
Aberdeen World Equity A	4.25	0.00	19.64	3.00	0.00	0.892 *(18)*	0.892 *(33)*	0.892 *(29)*
Aberdeen Alpha Growth R	4.25	0.00	17.98	-4.32	0.00	0.871 *(29)*	0.871 *(38)*	0.871 *(37)*
Aviva Investors European Equity SC1	0.00	0.00	23.55	4.08	0.00	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
Aviva Investors World Leaders SC1	5.25	0.00	18.48	-3.24	0.00	0.865 *(30)*	0.865 *(40)*	0.865 *(39)*
Aviva Investors UK Focus SC1	5.00	0.00	22.59	-2.28	0.00	0.840 *(41)*	0.840 *(48)*	0.840 *(47)*
F&C Global Growth 1	5.00	0.00	19.50	-1.68	0.00	0.855 *(34)*	0.855 *(43)*	0.855 *(42)*
F&C UK Opportunities 1	5.00	0.00	21.82	-6.24	0.00	0.806 *(49)*	0.806 *(55)*	0.806 *(53)*
F&C UK Opportunities 2	1.00	0.00	21.83	-5.64	0.00	0.886 *(22)*	0.886 *(35)*	0.886 *(30)*
First State Asia Pacific A	4.00	0.00	20.31	16.32	0.00	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
Henderson UK Equity A	5.00	0.00	18.48	-6.48	0.00	0.836 *(44)*	0.836 *(50)*	0.836 *(49)*
Legal & General Equity Trust (R)	5.00	0.00	18.72	-4.20	0.00	0.851 *(36)*	0.851 *(44)*	0.851 *(43)*
MFN Bowland	7.00	0.00	23.23	-6.00	0.00	0.808 *(48)*	0.808 *(53)*	0.808 *(52)*
Old Mutual Equity Income	4.00	0.00	18.10	-4.56	0.00	0.872 *(28)*	0.872 *(37)*	0.872 *(36)*
Prudential Equity Income Trust A	4.75	0.00	18.06	-4.80	0.00	0.861 *(31)*	0.861 *(41)*	0.861 *(40)*
RBS FTSE 100 Tracker	0.00	0.00	18.89	-3.72	0.00	0.984 *(8)*	0.984 *(11)*	0.984 *(11)*
Scottish Widows UK Eq Income A	7.00	0.00	17.84	-7.68	0.00	0.840 *(42)*	0.840 *(49)*	0.840 *(48)*
Skandia Newton Managed Fund	5.00	0.00	15.15	1.56	0.00	1.000 *(1)*	1.000 *(1)*	1.000 *(1)*
Standard Life UK Eq Unconstrained	4.00	0.00	31.57	6.96	0.00	0.920 *(11)*	0.920 *(25)*	0.920 *(23)*
SWIP MM International Equity P Inc	3.75	0.00	19.08	0.48	0.00	0.894 *(16)*	0.894 *(32)*	0.894 *(28)*
SWIP Pan-European Equity E	3.75	0.00	22.31	-1.20	0.00	0.855 *(33)*	0.855 *(42)*	0.855 *(41)*
Mean – non SRI funds	4.15	0.00	20.36	-1.48	0.00	0.887 *(26)*	0.887 *(34)*	0.887 *(33)*

Table 7: Empirical results of the analysis of the performance of the UK SRI mutual funds. The last columns report the value of the performance indexes I_{DEA-S}, I_{DEA-SE} and $I_{DEA-SEef}$ and (in brackets) the relative ranking.

	Country	No. of funds	DEA-S	DEA-SE	DEA-SEef
	SRI funds				
AT	Austria	10	0.779 *(249)*	0.862 *(166)*	0.834 *(197)*
BE	Belgium	10	0.817 *(194)*	0.903 *(115)*	0.880 *(131)*
CH	Switzerland	5	0.870 *(129)*	0.934 *(76)*	0.922 *(83)*
DE	Germany	4	0.828 *(182)*	0.842 *(195)*	0.833 *(198)*
ES	Spain	2	0.865 *(115)*	0.874 *(147)*	0.871 *(144)*
FR	France	36	0.836 *(160)*	0.852 *(176)*	0.847 *(173)*
IR	Irland	3	0.825 *(171)*	0.862 *(165)*	0.848 *(169)*
IT	Italy	3	0.847 *(145)*	0.866 *(157)*	0.862 *(153)*
LU	Luxembourg	38	0.826 *(183)*	0.875 *(150)*	0.862 *(158)*
NE	The Netherlands	7	0.890 *(82)*	0.943 *(68)*	0.938 *(66)*
NO	Norway	1	0.833 *(166)*	0.974 *(38)*	0.966 *(42)*
SE	Sweden	32	0.952 *(34)*	0.965 *(44)*	0.964 *(41)*
UK	United Kingdom	39	0.851 *(143)*	0.893 *(125)*	0.883 *(128)*
	Europe	190	0.856 *(143)*	0.894 *(127)*	0.884 *(130)*
	Non SRI funds				
AT	Austria	6	0.799 *(208)*	0.799 *(232)*	0.799 *(225)*
BE	Belgium	4	0.815 *(194)*	0.815 *(225)*	0.815 *(219)*
CH	Switzerland	3	0.839 *(148)*	0.839 *(191)*	0.839 *(183)*
DE	Germany	2	0.853 *(129)*	0.853 *(174)*	0.853 *(166)*
ES	Spain	2	0.859 *(153)*	0.859 *(167)*	0.859 *(164)*
FR	France	21	0.829 *(173)*	0.829 *(206)*	0.829 *(198)*
IT	Italy	3	0.839 *(153)*	0.839 *(194)*	0.839 *(185)*
LU	Luxembourg	16	0.843 *(157)*	0.843 *(189)*	0.843 *(180)*
NE	The Netherlands	4	0.916 *(59)*	0.916 *(94)*	0.916 *(84)*
SE	Sweden	10	0.952 *(33)*	0.952 *(59)*	0.952 *(52)*
UK	United Kingdom	20	0.872 *(114)*	0.872 *(149)*	0.872 *(140)*
	Europe	91	0.858 *(137)*	0.858 *(170)*	0.858 *(161)*

Table 8: Mean results of the European SRI mutual funds by country.

SRI funds is equal to 0.957 in the analysis of the French funds while it is equal to 0.836 in the comparison with all European funds.

First of all, let us notice that for the SRI funds the value of the I_{DEA-SE} and $I_{DEA-SEef}$ indexes and the relative ranking are often very closed while they differ more notably with respect to the value of I_{DEA-S}. With regard to this, we have computed the correlation coefficients for the values of these indexes in the analysis of European funds. The correlation coefficient between I_{DEA-SE} and $I_{DEA-SEef}$ is equal to 0.98, which points out how close these values are; on the contrary, the correlation coefficient between I_{DEA-S} and I_{DEA-SE} is equal to 0.76, which indicates that these values are far less similar, while the correlation coefficient between I_{DEA-S} and $I_{DEA-SEef}$ is equal to 0.84, which accounts for the fact that the $I_{DEA-SEef}$ is comprised between the values of the other two indexes.

Therefore, the empirical results seem to indicate that considering the ethical level as fixed a priori does not affect the performance results significantly, while the inclusion of the ethical level in the analysis does raise the results of the SRI funds considerably.

As for the differences among the various countries, we may observe that the SRI mutual funds in general exhibit a better performance in the four countries with the higher number of funds (France, Luxembourg, Sweden, UK): indeed, the mean value of the I_{DEA-S} index in these countries is equal to 0.863 while it is equal to 0.832 in the other countries, and analogously the mean value of the ranking is 134 against 171. The difference is much slighter when the ethical level is taken into account in the performance measurement: for example, with the *DEA-SE* model the mean value of the performance index is 0.894 against 0.893. This is probably due to the good performance obtained by the Swedish funds, which are well better than the European average, and by the UK funds, with a performance near the average, mainly because of the relatively better behaviour (actually, less negative) of the mean return in these countries. On the other hand, the performance of the funds of France and Luxembourg is worse than the European average.

6 Performance analysis: SRI vs non SRI

As we have seen, from a financial point of view, investing in SRI mutual funds raises the interesting question as to wether the social aim has to be pursued at the expense of the financial performance of the investment. This question has been widely discussed in the literature, with sometimes opposite and surprising conclusions (for a review see for example [22] and [12]).

Of course, at least in theory, we would generally expect that the non SRI mutual funds outperform SRI mutual funds, since they may select the assets without any restrictions. However, the empirical results presented in the literature do not always support the conclusion that non SRI mutual funds obtain better financial performances; rather most empirical studies suggest that the differences in the performance obtained by SRI and non SRI mutual funds are not statistically significant.

Several empirical studies regard the nineties. For example, in 1993 [16] compares the performance of 17 U.S. SRI equity mutual funds with that of 170 randomly selected conventional mutual funds in the period from January 1981 through December 1990 and finds

that the performance of socially responsible funds is not statistically different from the performance of conventional mutual funds. For the successive period May 1990–September 1998, [26] compares the performance of 31 U.S. SRI equity mutual funds with that of 62 conventional funds near to them in asset size; the conclusion is that SRI mutual funds performed better than conventional funds of equal asset size, although the difference is not statistically significant.

As regards Europe, [18] investigates the financial performance of 40 ethical funds from 7 European countries for the period 1996–1998 and finds that investors in ethical funds suffer no appreciable loss in return per unit of market risk with respect to a benchmark portfolio. Analogously, [7] finds no evidence of significance differences in risk-adjusted returns between 103 German, UK and U.S. ethical mutual funds and 309 conventional funds of similar age and size in the period from January 1990 through March 2001. In addition, [19] studies the performance of 30 ethical European mutual funds from UK, Sweden, Germany and the Netherlands in the period January 1995–December 2001. Their performance is compared with that of 30 non ethical mutual funds with similar age, size, country and investment universe; in this case, too, the findings suggest that there is no difference between ethical and non ethical mutual funds in terms of performance.

To the same conclusion comes [9] for the period January 1994 to March 2001 for 42 U.S. socially responsible domestic equity funds, compared with 84 randomly selected conventional funds of similar net assets. As for Australian ethical funds, [8] studies 25 ethical open-ended equity mutual funds and 281 conventional funds in the period November 1992–April 2003 and, again, concludes that ethical funds do not underperform relative to conventional funds. An analogous conclusion is obtained by [6] for 8 Canadian ethical mutual funds, in an analysis that concerns the domestic equity funds in the period January 1995-January 2003.

In the last decade, an analysis carried out by [12] on 88 SRI mutual funds from 7 European countries during the period August 1996–February 2007 suggests that "investors who wish to hold European funds can add social screens to their investment choices without compromising financial performance".

Even, some empirical studies on the performance of socially responsible investments show evidence that SRI portfolios exhibit a better performance than unscreened conventional investments. Along this line, we may cite [13] for U.S. stock portfolios in the period July 1995-December 2003, [17] for U.S. stock portfolios in the years 1992-2004 and [15] for Spanish mutual funds in the period from June 1998 through June 2001.

On the other hand, there exists also some empirical results supporting the opposite conclusion that SRI mutual funds exhibit an inferior reward-to-risk performance; see the analysis of U.S. mutual funds in the period 1993-2008 presented in [10].

It is therefore interesting to see which indications come out from the results of our analysis concerning the European funds in the period 30/06/2006–30/06/2009.

First of all, in order to answer the question of wether or not the financial returns of SRI funds are worst than those of non SRI funds, we may analyse the frequency distribution of the fund ranking obtained with the performance indexes considered in the analysis for all European funds.

Figure 3 shows the frequency distribution of the I_{DEA-S} performance index for the SRI

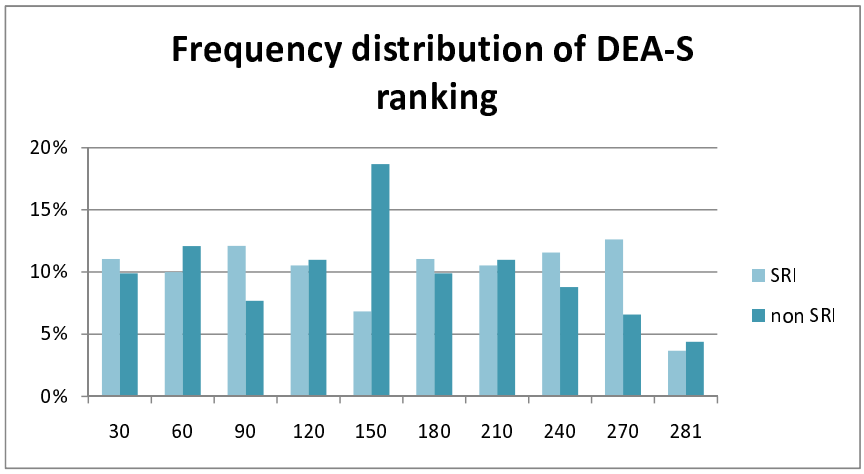

Figure 3: Comparison of the frequency distributions of the rank obtained with the DEA-S model of SRI and non SRI European mutual funds.

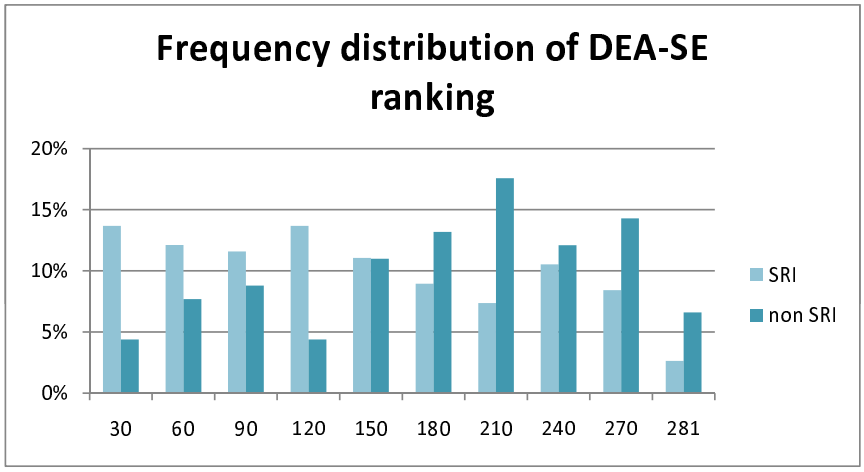

Figure 4: Comparison of the frequency distributions of the rank obtained with the DEA-SE model of SRI and non SRI European mutual funds.

and non SRI funds, separately; the histogram has been obtained by dividing the ranking interval $[1, 281]$ in ten classes $[1, 30]$, $[31, 60]$, ..., $[241, 270]$, $[271, 281]$ and comparing the per cent number of SRI and non SRI funds that fall in each class (the percentage has been computed with respect to the total number of SRI and non SRI funds, respectively). We can see that with the I_{DEA-S} index, which does not take into account the SRI objectives, the relative comparison is not definite: the difference is clear only for the central class of the distribution, where the non SRI funds prevail. This seems to be an indication that the financial performance of the SRI funds is not penalised. On the other hand, if we look at figure 4, showing the frequency distribution of the I_{DEA-SE} performance index, that rewards the socially responsible behaviour, we notice that the SRI funds tend to place in the best ranking classes, letting the non SRI funds concentrate in the last classes.

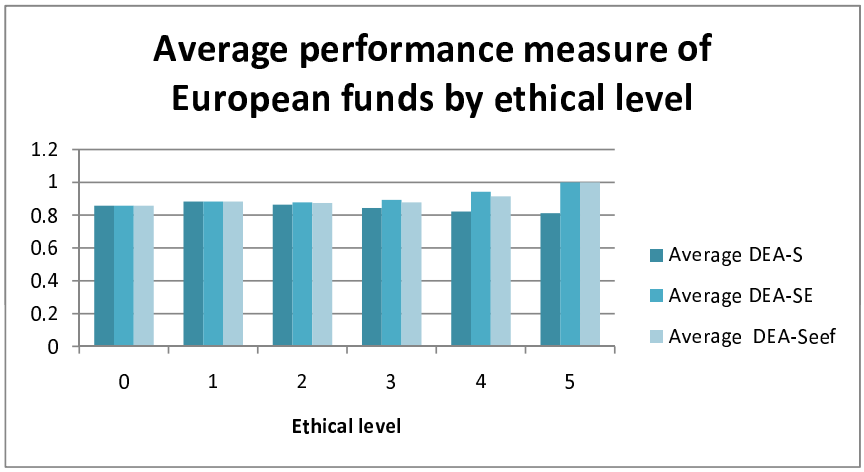

Figure 5: Average DEA performance measures of European mutual funds by ethical level.

In addition, figure 5 displays the frequency distribution of the average performance measures I_{DEA-S}, I_{DEA-SE} and $I_{DEA-SEef}$ for European SRI and non SRI funds with respect to the ethical level, zero being the level assigned to the non SRI funds; here the class k groups the funds with ethical level $k - 1 < e_j \leq k$. Again, for the I_{DEA-S} measure there is not a clear indication of penalisation for SRI funds, while the two performance measures which take the ethical level into account tend to reward the funds with a higher ethical level.

Moreover, in order to cope with the issue of wether and how much the ethical level affects the performance of mutual funds, we have analysed the (eventual) presence of a linear dependence of the performance indexes on the ethical level. To this aim, we have regressed the I_{DEA-S}, I_{DEA-SE}, and $I_{DEA-SEef}$ performance indexes, separately, on the ethical level of the funds. Table 9 presents the results of the analysis of all European funds; the table reports the values of the intercept and the slope, as well as the t values, the value of R^2 and the F-value of the regression; in addition, the table shows the critical values of

Country	Intercept	*t-value*	Slope	*t-value (crit.)*	R^2	F-value	*(crit.)*
DEA-S model							
France	0.9524	*246.02*	0.0028	*0.86 (2.00)*	0.01	0.74	*(4.02)*
Luxembourg	0.9429	*116.97*	-0.0065	*-1.63 (2.01)*	0.05	2.65	*(4.03)*
Sweden	0.9510	*137.50*	0.0057	*1.02 (2.02)*	0.03	1.03	*(4.08)*
UK	0.8861	*67.56*	-0.0096	*-1.45 (2.00)*	0.04	2.10	*(4.01)*
Europe	0.8673	*158.45*	-0.0084	*-2.74 (1.97)*	0.03	7.52	*(3.88)*
DEA-SE model							
France	0.9506	*254.61*	0.0140	*4.47 (2.00)*	0.27	19.96	*(4.02)*
Luxembourg	0.9364	*119.56*	0.0104	*2.65 (2.01)*	0.12	7.02	*(4.03)*
Sweden	0.9468	*143.17*	0.0219	*4.07 (2.02)*	0.29	16.53	*(4.08)*
UK	0.8782	*66.55*	0.0172	*2.57 (2.00)*	0.10	6.61	*(4.01)*
Europe	0.8550	*156.69*	0.0208	*6.85 (1.97)*	0.14	46.93	*(3.88)*
DEA-SEef model							
France	0.9506	*252.73*	0.0137	*4.35 (2.00)*	0.26	18.89	*(4.02)*
Luxembourg	0.9362	*117.20*	0.0098	*2.45 (2.01)*	0.10	5.99	*(4.03)*
Sweden	0.9468	*142.80*	0.0215	*3.99 (2.02)*	0.28	15.90	*(4.08)*
UK	0.8795	*64.08*	0.0122	*1.76 (2.00)*	0.05	3.09	*(4.01)*
Europe	0.8572	*150.47*	0.0143	*4.50 (1.97)*	0.07	20.22	*(3.88)*

Table 9: Mean results of the European SRI mutual funds.

the t test and of the F test with a significance level $\alpha = 0.05$.

If we look at the F-test, we have to say that the significance of the linear dependence is generally higher for the results of the analysis of European funds: the F-test indicates that the regression is highly significance for all the three performance indexes. In particular, the significance of the regression for the I_{DEA-S} performance index, which does not take the ethical level into account, means that the empirical results does indicate the presence of a linear dependence. The negative sign of the slope, on the other hand, shows that the ethical level negatively affects the performance results; however the value of the slope (-0.0084) is very small, indicating that the average loss in the performance result incurred when increasing the ethical level by one unit is around 1 %, therefore quite negligible in absolute term.

The situation is displayed in figure 6, which shows the regression line as well as the dispersion of the *DEA-S* performance values of the European funds analysed with respect to the ethical level. Of course, this values are widely dispersed around the regression line, and for this reason the R^2 value is very low; on the other hand, we may not expect the performance value of a fund to be entirely explained by its ethical level.

On the contrary, the results obtained with one of the models that explicitly takes into consideration and reward the ethical level in the computation of the performance shows that the relation between the performance value and the ethical level is stronger and positive. For example, for the *DEA-SE* model, the value of R^2 increases and the slope not only changes sign but also becomes steepest. The situation is well depicted in figure 7.

The behaviour of the results obtained with the *DEA-SEef* model is intermediate between those of the *DEA-S* and *DEA-SE* models. The regression lines obtained with the three models are compared in figure 8, which shows the average variation in the performance

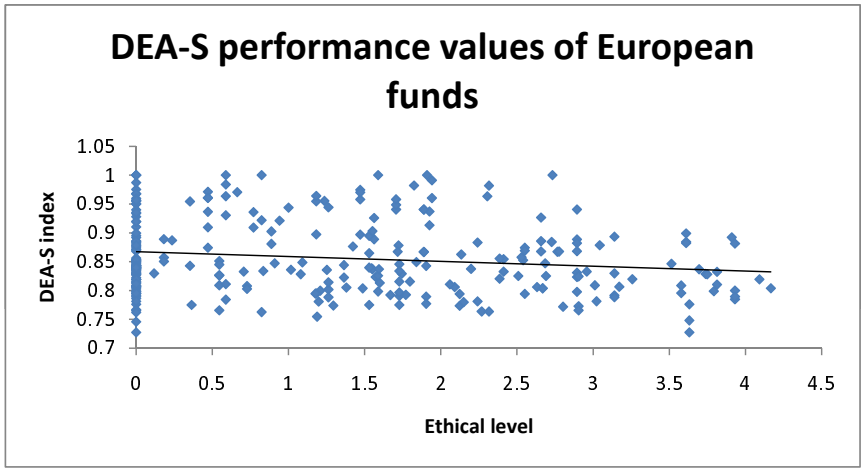

Figure 6: Dispersion graph of the performance values and regression line for the *DEA-S* model.

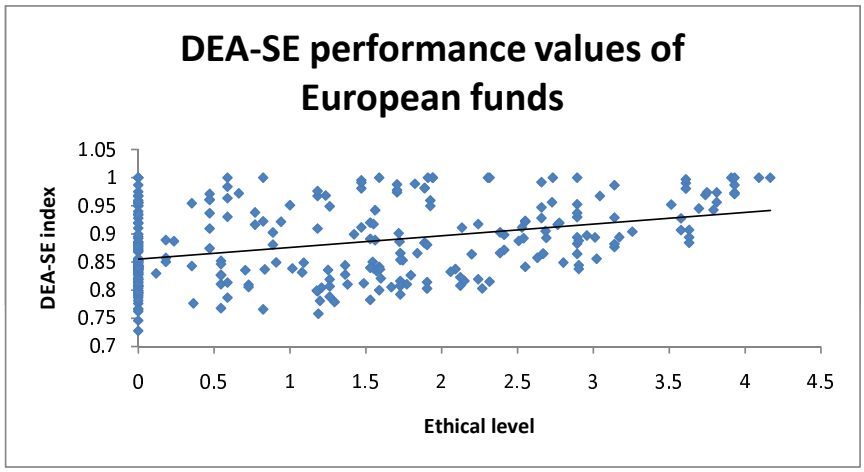

Figure 7: Dispersion graph of the performance values and regression line for the *DEA-SE* model.

values as the value of the ethical level changes.

As regards the analysis carried out separately for France, Luxembourg, Sweden and UK, from table 9 we can see that the results of the regression analysis for the *DEA-SE* and *DEA-SEef* models are similar to those obtained for the European funds as a whole, with the exception of the poor significance of the UK regression. For the *DEA-S* model, on the contrary, the regressions are not significant; hence the empirical results do not show a definite linear dependence, probably due to to the high dispersion of the performance values with respect to the ethical level.

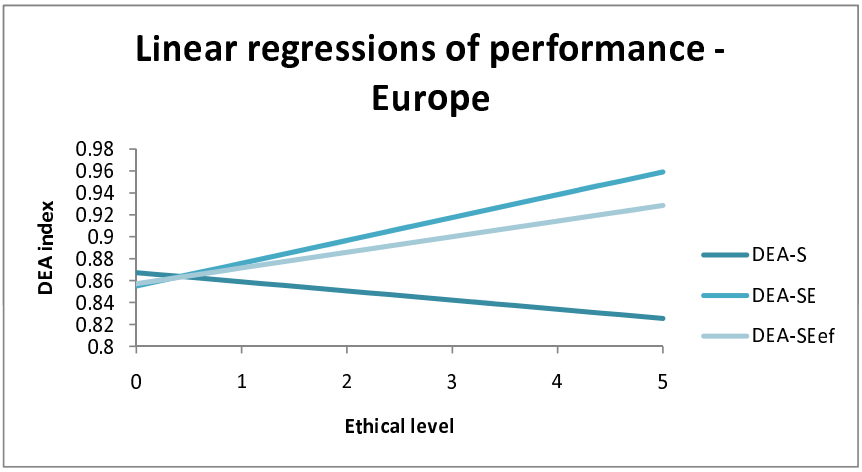

Figure 8: Regression lines of the performance values for the *DEA-S*, *DEA-SE* and *DEA-SEef* models on the ethical level.

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