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The effect of environmental and social performance on the stock performance of european corporations

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Abstract This paper examines the effect of sustainability performance of European corporations on their stock performance, measured as the average monthly stock return from 1996 to 2001. The econometric analysis is based on common empirical asset pricing models, particularly on the multifactor model according to Fama and French (1993, Journal of Financial Economics, 33:3–56). The consideration of sustainability performance is two-fold: The average sustainability performance of the industry in which a corporation operates and the relative sustainability performance of a corporation within a given industry. The main result is that the average environmental performance of the industry has a significantly positive influence on the stock performance. In contrast, the average social performance of the industry has a significantly negative influence. The variables of the relative environmental or social performance of a corporation within a given industry have no significant effect on the stock performance. As a by-product, the econometric analysis implies that some results of Fama and French (1993, 1996, The Journal of Finance, LI (1):55–84) regarding the risk factors of the multifactor model need not hold true for different observation periods, for different stock markets, and for the use of single stocks (instead of portfolios).

Keywords Sustainability · Environmental and social performance · Stock performance · CAPM · Multifactor model

JEL classification Q01 · Q56 · G12

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1 Introduction

Corporations can have very different motives to improve their environmental and social performance. For example, the central goal of environmentally friendly behavior is the conservation of living conditions on earth. This behavior does not necessarily need an economic justification. However, for investors, shareholders, and managers, it is important to know the nature of the relationship between environmental or social performance and economic performance of stock corporations. In this respect, an integrated perspective of environmental and social performance is understood as sustainability performance in the discussion about socially responsible investment. In the framework of an econometric analysis, we examine the effect of different sustainability performance variables on the economic performance of European corporations in this paper.

Sustainability performance is measured two-fold: On the one hand, it is measured as the average sustainability performance (evaluated in terms of the environmental and social risks) of the industry in which a corporation operates. On the other hand, it is measured as the relative sustainability performance of a corporation within a given industry (evaluated in terms of the environmental and social activities of a corporation compared with all other corporations in the same industry). We take the last available evaluations of sustainability performance from 2001. As a measure for economic performance of a corporation, the stock performance is used. The concrete measure is the average monthly stock return from 1996 to 2001. The appeal of this consideration is that stock prices are today's market price of the assets of a corporation. According to the well-known dividend discount model, this is equal to the discounted expected future stream of dividends paid to the shareholders. Therefore, we analyze the effect of sustainability performance on the market expectations of future economic performance such that the use of the sustainability performance in 2001 appears to be justified. In this respect, it should be noted that these sustainability performance evaluations are extremely stable over the years before 2001.

The econometric analysis regarding the effect of sustainability performance on the stock performance is based on common empirical asset pricing models. In other words, we examine cross-sectional regressions of the average monthly stock return on the environmental and social performance variables and (in addition to some control variables such as country dummies) on parameters that are estimated in time-series regressions of asset pricing models for each stock corporation in the sample. The first approach is based on the Capital Asset Pricing Model (CAPM) according to Sharpe (1964) and Lintner (1965) such that only the resulting estimated market-beta parameters (that capture the non-diversifiable risk of each corporation) are included in the final cross-sectional regressions. However, we also include recent insights from empirical finance, which have been neglected in earlier studies (e.g., event studies, see Sect. 2.1). Therefore, the second approach is based on a multifactor model according to Fama and French (1993). As a consequence, two additional estimated risk factors are included as baseline model variables in the final cross-sectional regressions besides the estimated market-beta parameters.

The main result of the econometric analysis is the significantly positive effect of the average environmental performance of the industry in which a corporation operates on the average monthly stock return from 1996 to 2001. In contrast, the average social performance of the industry has a significantly negative influence on the stock performance. The variables of the relative sustainability performance of a corporation within a given industry have no significant effect on the stock performance. The latter result holds true for both the variables of the environmental and the variables of the social activities of a corporation compared with all other corporations in the same industry. According to this, investors who applied a buy-and-hold strategy would have increased their portfolio value by investing in corporations with a good average environmental performance of the industry and would have decreased their portfolio value by investing in corporations with a good average social performance of the industry (and otherwise similar corporate characteristics). As a by-product, the econometric analysis implies that some results of Fama and French (1993, 1996) regarding the risk factors of the multifactor model need not hold true for different observation periods, for different stock markets, and for the use of single stocks (instead of portfolios).

The structure of this paper is as follows: The second section provides a literature review regarding methodological approaches and measures for sustainability and economic performance. The data and the definition of the variables for the empirical analysis are described in the third section. The fourth section explains the structure of the econometric approach that is based on empirical asset pricing models. In the fifth section, the results of the empirical analysis are discussed. The final section summarizes the main results and draws some conclusions.

2 Literature review

2.1 Methodological approaches

This paper applies cross-sectional regressions that are based on time-series regressions of asset pricing models to analyze the effect of sustainability performance on the stock performance. This econometric approach methodologically differs from other approaches used in the literature. One of these approaches are portfolio analyses (see e.g., White 1995; Cohen et al. 1997; Yamashita et al. 1999; Statman 2000; Kreander et al. 2000; Schröder 2004). Those studies compare the economic or financial performance of portfolios that consist of stock corporations with a better sustainability performance with portfolios that consist of stock corporations with a worse sustainability performance. However, the influence of sustainability performance variables on economic performance can hardly be separated from the influence of other variables since the latter are not considered in these approaches. Instead, such portfolio analyses only apply univariate statistical methods (e.g., in the framework of the comparison of correlation coefficients or means).

Event studies are another method to analyze the relationship between sustainability performance and economic performance. This approach (commonly based on time-series regressions of the CAPM) considers short-term reactions (usually for some days) of stock prices due to particular information being published about a corporation. It should be noted that (to our knowledge) only environmental event studies have been applied so far in this respect (see e.g., Muoghalu et al. 1990; Hamilton 1995; Klassen and McLaughlin 1996; Konar and Cohen 1997; Blacconiere and Northcut 1997; Khanna et al. 1998). In other words, only one component of sustainability performance has been examined in the past. Concerning this methodological approach, it should be emphasized that short-term over-reactions of stock markets are possible such that potential positive or negative stock price changes can become weaker or even disappear over time.

In contrast, we analyze a longer observation period in the econometric analysis. Due to the shortcomings of portfolio analyses and event studies described above, such econometric approaches have received increasing attention in recent years to examine the effect of sustainability performance on economic performance (see e.g., Hart and Ahuja 1996; Butz and Plattner 1999; Yamashita et al. 1999; Konar and Cohen 2001; King and Lenox 2001; Thomas 2001). It should be noted in this respect that a comparison of the estimation results is rather limited because the studies differ in the selected observation periods and in the regions under consideration. Furthermore, the existing econometric studies particularly differ in their measures for sustainability and economic performance. Such heterogeneity is also prevalent in event studies and portfolio analyses.

2.2 Measures for sustainability and economic performance

With regard to the measure for sustainability performance, this paper considers firstly the average sustainability performance (evaluated in terms of the environmental and social risks) of the industry in which a corporation operates. Secondly, it considers the relative sustainability performance of a corporation within a given industry (evaluated in terms of the environmental and social activities of a corporation compared with all other corporations in the same industry). While the first measure allows an inter-industry comparison of corporations, the second measure allows an intra-industry comparison of corporations regarding sustainability performance. In contrast, most other studies use only one-dimensional and more narrow measures for environmental performance. These approaches refer to temporarily environmentally friendly behavior being published in newspaper articles (see e.g., Klassen and McLaughlin 1996; Yamashita et al. 1999) or to temporary behavior that is harmful to the environment and, due to non-compliance with environmental regulation, leads to lawsuits or penalties (see e.g., Muoghalu et al. 1990). Such negative outcomes are often considered in addition to emissions data from the Toxic Release Inventory (TRI) (see e.g., Cohen et al. 1997; Konar and Cohen 2001). Many studies may even exclusively use the TRI data to measure environmental performance of companies (see e.g., Hamilton 1995; Hart and Ahuja 1996; Konar and Cohen 1997; Khanna et al. 1998; King and Lenox 2001).

However, it should be noted that the TRI data appear to be a weak indicator for the overall environmental performance since they do not give any information about the pollution from non-toxic substances such as carbon dioxide emissions. Other aspects such as the existence of an environmental management system are not included, either. Consequently, general conclusions on environmental performance cannot be drawn. Furthermore, the measures for environmental performance (e.g., with emissions data) often mix two independent constituents: Corporate environmental activities compared with other corporations within the sector and sector specific influences. However, both components should be considered separately. Only few other studies examine these constituents. Cohen et al. (1997), for example, analyze the corporate environmental activities compared with other corporations within the industry. King and Lenox (2001) even investigate both constituents separately in their econometric analysis. Finally, most studies only examine the environmental performance while neglecting the social dimension of sustainability performance. The social performance is only considered in the investigation of ethical funds so far (see e.g., Statman 2000; Kreander et al. 2000; Schröder 2004). According to this, the social dimension is generally missing in econometric studies (an exception is the examination of Butz and Plattner 1999).

Concerning the measure for economic performance of a corporation, this paper uses the stock performance. The appeal of this use is that stock prices are today's market price of the assets of a corporation. This is equal to the discounted expected future stream of dividends paid to the shareholders according to the well-known dividend discount model. The concrete measure is the average monthly stock return from 1996 to 2001. This stock return based approach differs from other studies that use accounting data and thereby use, for example, Tobin's Q, return on assets, return on sales, or return on equity as a measure for economic performance (see e.g., Hart and Ahuja 1996; King and Lenox 2001; Konar and Cohen 2001). In contrast to such studies, our approach has the advantage that the focus is not on the past realized but on the future expected economic performance of the stock corporation. We thus analyze the effect of sustainability performance on the market expectations of future economic performance. Unlike other stock return based econometric approaches (see e.g., Butz and Plattner 1999; Thomas 2001) or event studies (see e.g., Muoghalu et al. 1990; Hamilton 1995; Klassen and McLaughlin 1996; Konar and Cohen 1997; Khanna et al. 1998), our econometric analysis is also based on a modern empirical asset pricing model, in other words on the multifactor model according to Fama and French (1993).

3 Data and variables

3.1 Sustainability performance data and variables

In the empirical analysis, we use data regarding sustainability performance that stem from the Swiss bank Sarasin & Cie in Basle. This bank has evaluated environmental and social criteria of approximately 300 European corporations quoted on the stock exchange (date: September 2001). These corporations cover approximately 80% of the MSCI stock index for Europe. Many of them are large and, respectively important within their sector, and thus serve as a reference for the sustainability performance evaluation. Some corporations, however, with a lower market capitalization are also evaluated if they are interesting concerning their sustainability profile (from the perspective of the evaluators from Sarasin & Cie). Overall, large corporations are over-represented in the sample compared with their ratio in the population of all European corporations quoted on the stock exchange. Yet, this aspect is less relevant for the econometric analysis based on the multifactor model since the market capitalization is included as a determinant in this approach. All approximately 300 European stock corporations have been evaluated using a technique developed by Sarasin & Cie whose criteria conform with international standards of sustainability reporting such as the guidelines developed by the Global Reporting Initiative (2000). In this respect, it should be noted that these sustainability performance evaluations of 2001 are extremely stable over the years before 2001. Therefore, these measures can also be interpreted as the average sustainability performance for some years before 2001.

The measure for the average sustainability performance of the industry in which a corporation operates is based on the evaluation of the environmental or social risks of the industry (compared with other industries). Environmental risks stem from the use of natural resources, in other words from the use of energy, material, water, and land. Other criteria are emissions of air pollutants that do not result from energy use (e.g., chlorinated hydrocarbons), sewage emissions, and hazardous waste. A final criterion of environmental risks of a sector is the degree of centralization (or geographic clustering). This criterion considers the aspect that a sector consisting of a few centralized production facilities imposes a higher accident risk on the residents living nearby than sectors with a lot of small decentralized units. The criterion implicitly assumes the same population density in both cases. The degree of centralization is not only used as a criterion for environmental risks but also for social risks of a sector. The underlying assumption is that a high degree of centralization of industries leads to increasing pressure on the society due to high concentration of economic and political power. Another criterion of social risks concern burdens for social stability. Social instability is caused by unequal or unfair wages, by the production of goods potentially leading to social and political conflicts (e.g., weapons), and by the influence of pressure groups on political decisions. A final criterion of social risks of a sector is the damage of individual rights and values including workplace conditions (e.g., with regard to health and workers' participation), production of unhealthy goods, and violation of ethical norms (e.g., pornography).

It should be noted that the evaluation of the environmental and social performance of a sector is carried out along all phases of the value-added chain of the products from pre-production (i.e., the generation of raw materials) to production, to use of the products, and to waste disposal. For example, the automobiles industry is evaluated as one of the least sustainable sectors, particularly with regard to environmental risks. This evaluation is mainly based on the large use of energy, which causes extremely high emissions of air pollutants. These emissions are caused predominantly during the utilization phase of the product (i.e., by the use of the car) and not by the production. Each criterion for environmental and social risks of a sector is evaluated on a five-stage scale. The evaluation of the average environmental or social performance across all corporations of a sector is finally based on different weightings that reflect the severity of the risks for each criterion. The specification of the weights as defined by the evaluators from Sarasin & Cie is based on their perception of what is important for the environmental or social performance of an industry.

The measure for the relative sustainability performance of a corporation within a given industry refers to the evaluation of the activities of a corporation compared with all other corporations in the same sector to reduce the sector specific environmental or social risks. Besides the evaluation of corporate environmental strategies and management systems, particularly the life cycle approach is considered concerning the environmental activities, in other words the activities of a corporation to reduce environmental risks in the full value-added chain of the products (pre-production, production, use of products or services) are evaluated. For example, a producer of automobiles could decrease environmental risks by choosing a relatively environmentally friendly steel producer (pre-production), by the substitution of solvent based lacquers (production), or by the construction of fuel-efficient vehicles (use of products). Here the environmental activities are most significant for the products. All criteria (again evaluated on a five-stage scale) are therefore aggregated using different weights according to their relevance concerning environmental risks across the sectors. The relevance as defined again by the evaluators from Sarasin & Cie is based on their perception of what is important. In the example of the automobiles industry, the use of products has the highest weighting.

Concerning the social activities, particularly the so-called stakeholder approach is considered besides the evaluation of corporate social strategies and management systems. According to this approach, the activities of a corporation to improve its relationship to specific stakeholder groups such as the general public, suppliers, investors, employees, clients, and competitors are evaluated. The aggregation of the criteria (again evaluated on a five-stage scale) concerning the social activities of a corporation compared with all other corporations in the same sector results from weightings that are chosen due to the specific relevance of the stakeholder groups in the different sectors. The relevance as defined by the evaluators from Sarasin & Cie is based on their perception of who is important. For example, in the clothing industry, suppliers are particularly important concerning working conditions (particularly child labor) in the production in developing countries. In contrast, employees are most important in many services sectors (concerning e.g., motivation, personal initiative, or equality of opportunity).

In the following, we use the measures for the average environmental performance of the industry and for the average social performance of the industry in which a corporation operates as well as the measures for the relative environmental performance of a corporation and for the relative social performance of a corporation within a given industry. In the course of the paper, we symbolize the corresponding four variables by $EnvSect_i$, $SocSect_i$, $EnvCorp_i$, and $SocCorp_i$ for the $i = 1, \ldots, N$ European corporations in the sample. According to Sarasin & Cie, the different types of aggregated sustainability performance are evaluated on a five-stage scale. These ordinal ratings are coded with the integers from one to five and the variables take exactly one of these numbers for each corporation. In each case, the value five designates the best sustainability performance.

However, it is not certain that the ratings are equidistant in each case. In other words, it is possible that, for example, the distance between 5 and 4 differs from the distance between 4 and 3. Therefore, we also analyze dummies derived from the above variables in the empirical analysis. For example, the variables $EnvSect5_i$, $EnvSect4_i$, $EnvSect3_i$, $EnvSect2_i$, and $EnvSect1_i$ result from the variable $EnvSect_i$ with

$$EnvSect5_i = \begin{cases} 1 & \text{if } EnvSect_i = 5 \\ 0 & \text{otherwise} \end{cases}$$

$$EnvSect4_i = \begin{cases} 1 & \text{if } EnvSect_i = 4 \\ 0 & \text{otherwise} \end{cases}$$

$$EnvSect3_i = \begin{cases} 1 & \text{if } EnvSect_i = 3 \\ 0 & \text{otherwise} \end{cases}$$

$$EnvSect2_i = \begin{cases} 1 & \text{if } EnvSect_i = 2 \\ 0 & \text{otherwise} \end{cases}$$

$$EnvSect1_i = \begin{cases} 1 & \text{if } EnvSect_i = 1 \\ 0 & \text{otherwise} \end{cases}$$

Based on the variables $SocSect_i$, $EnvCorp_i$, and $SocCorp_i$, the variables $SocSect5_i$ etc., $EnvCorp5_i$ etc., and $SocCorp5_i$ etc. are defined in this way. The cross-sectional regressions to analyze the effect of sustainability performance on the stock performance either include the four variables $EnvSect_i$, $SocSect_i$, $EnvCorp_i$, and $SocCorp_i$ or the corresponding dummies as explanatory variables (excluding four dummies as reference variables) to check the robustness of the estimation results.

Table 1 Allocation of sectors to the values of the variables $EnvSect_i$ and $SocSect_i$

Sector	$EnvSect_i =$	$SocSect_i =$	Number of Corporations
Water utilities	5	5	5
Software	5	4	2
Telecommunications	5	3	7
Banking	5	2	21
Insurance	5	2	17
Health industry (not Pharma)	4	5	4
Media/communication	4	4	8
Business/other services	4	3	6
Machinery/engineering	3	4	19
White goods/furniture	3	4	2
Consumer electronics	3	3	6
Recycling/waste management	3	3	2
Transportation (shipping/rail)	3	3	1
Consumer goods/packaging	3	2	13
Trade/retail/merchandising	3	2	11
Pharmaceuticals	3	1	11
Electrical engineering/electronics	2	3	7
Forestry/paper	2	3	7
Tourism/leisure	2	2	1
Food/beverage	2	1	11
Construction/housing	1	3	7
Energy utilities	1	3	5
Chemicals	1	2	7
Automobiles	1	1	6
Energy sources	1	1	5
Other sectors	Different	Different	21
$\sum$			212

Table 1 reports the allocation of the sectors in the sample to the values of the variables $EnvSect_i$ and $SocSect_i$. If, for example, stock corporations belong to one of the sectors water utilities, software, telecommunications, banking, or insurance, the variable $EnvSect_i$ takes the highest value five (i.e., the best environmental performance) and thus $EnvSect5_i$ takes the value one. If corporations belong to one of the sectors construction/housing, energy utilities, chemicals, automobiles, or energy sources, $EnvSect_i$ takes the lowest value one (i.e., the worst environmental performance) and thus $EnvSect1_i$ takes the value one. If corporations belong to one of the industries water utilities or health industry (not pharma), the variable $SocSect_i$ takes the highest value five (i.e., the best social performance) and thus $SocSect5_i$ takes the value one. If corporations belong to one of the industries pharmaceuticals, food/beverage, automobiles, or energy sources, $SocSect_i$ takes the lowest value one (i.e., the worst social performance) and thus $SocSect1_i$ takes the value one. Corporations are assigned to the category "other sectors" if the spectrum of their products is different in such a way that they cannot be associated with one of the specific sectors in the table regarding the average environmental or social performance of these industries.

3.2 Financial data and variables

It should be noted that we cannot analyze all approximately 300 originally evaluated European stock corporations since the data base Thomson Financial Datastream used for our analysis does not provide the relevant financial data for each of these corporations. In other words, the total return indices (that contain both stock prices and cash flows to the investor) to compute the stock returns in addition to data on the market capitalization and on the book-value is not fully available for each corporation over the complete observation period. Furthermore, only those corporations are examined that have been quoted on the stock exchange and that have not merged or been taken over during the observation period. Unfortunately, this means that we cannot examine, for example, corporations from the renewable energies sector. The corporations of this sector would be very interesting for the question under consideration since they have the best sustainability performance, just like the corporations from the water utilities sector. An inclusion of such corporations would, however, only be possible if the relevant financial data were available for a longer period.

Finally, we also exclude those two corporations with the lowest values of the average monthly stock return from 1996 to 2001 (these corporations have an extremely low total return index at the end of the observation period 2001). Altogether, of the approximately 300 originally evaluated European stock corporations, we consider $N = 212$ corporations in the empirical analysis. The respective numbers of corporations in the different sectors are reported in the last column of Table 1. These 212 corporations in the sample are quoted on the stock exchanges of Switzerland, Germany, the United Kingdom, the Netherlands, France, Sweden, Italy, Austria, Spain, Denmark, Finland, Norway, and Belgium. It should be noted that country dummies are used as additional control variables to explain the average monthly stock return in the final cross-sectional regressions. The corresponding country dummies SWI_i, GER_i, UK_i, NET_i, FRA_i, SWE_i, ITA_i, AUS_i, SPA_i, DEN_i, FIN_i, NOR_i take the value one if the corporation is located in the respective country (the dummy variable for Belgium is the reference variable).

The period from January 1996 to August 2001 is chosen to have a sufficiently large number of corporations with data on the sustainability performance. We could increase this number by selecting a shorter period, but the time series used for the estimation of the baseline models should not be too short. For example, Fama and French (1993) use data from 1963 to 1991 for their extensive time-series regressions of the CAPM and the multifactor model. Therefore, the chosen time interval of 5–6 years appears to be a reasonable balancing of the need for a relatively large number of observations and a long observation period. The final date (August 2001) of the period is chosen to avoid the influence of the stock market shock associated with the September 11th terror attack in New York on the estimation results.

In spite of the relatively short observation period, it covers both the period of the worldwide surge in stock prices lasting approximately from 1998 until the beginning of 2000 and the subsequent decrease. As this stock price bubble was particularly a phenomenon of the technology sector, we include a dummy variable $Tech_i$ for this sector in our final cross-sectional regressions. It takes the value one if the corporation i belongs to the technology sector that comprises the sectors software, telecommunications, consumer electronics, and electrical engineering/electronics. The technology sector dummy is expected to capture that part of the average stock return which is not explained by the baseline model and sustainability variables due to the stock price bubble in this sector.

For the empirical analysis, we calculate the stock returns using total return indices from the Thomson Financial Datastream data base. All these total return indices are denominated in Swiss francs (SFR). The values are considered for all months

$t = 0, \ldots, T$ (with $T = 67$) from January 1996 to August 2001. In the following, RI_{it} is defined as the total return index of stock i ($i = 1, \ldots, 212$) in the middle of month t. It should be noted that some corporations have split their equity capital into different types of stocks, for example, common and preferred stocks. In these cases, the total return index refers to that type of equity capital with the highest number of stocks in 2001. Furthermore, the time-series regressions of the CAPM and the multifactor model require the inclusion of the return on a market portfolio of stocks and the risk-free interest rate. In this respect, the return index $RI_{\text{market},t}$ on a market portfolio of stocks (in the middle of month t) is represented by the FTSE Eurotop 300 index. This index covers the approximately 300 European corporations with the highest market capitalization. The riskfree interest rate $\tilde{r}_t^r$ in the middle of month t (in % per year) is represented by the return on a Swiss government bond with a constant duration of 1 month.

4 Model structure

4.1 Time-series regressions of baseline models

4.1.1 Baseline: CAPM

The econometric analysis of the effect of sustainability performance on stock performance is based on time-series regressions of asset pricing models. In the first approach, the following CAPM is estimated for each of the ($i = 1, \ldots, 212$) European corporations in the sample (ε_{it} are the error variables):

$$r_{it}^e = \alpha_i^{CAPM} + \beta_i^{CAPM} r_{\text{market},t}^e + \varepsilon_{it} \quad (t = 1, \ldots, 67) \tag{1}$$

The dependent variable is the excess return on stock i in month t which is defined as

$$r_{it}^e = r_{it} - r_{t-1}^r$$

with

$$r_{it} = \ln\left(RI_{it}\right) - \ln\left(RI_{i,t-1}\right)$$

and

$$r_t^r = \ln\left(\sqrt[12]{\frac{\tilde{r}_t^r}{100} + 1}\right)$$

The explanatory variable is the excess return on a market portfolio of stocks which is defined as

$$r_{\text{market},t}^e = r_{\text{market},t} - r_{t-1}^r$$

with

$$r_{\text{market},t} = \ln\left(RI_{\text{market},t}\right) - \ln\left(RI_{\text{market},t-1}\right)$$

One receives the (OLS) estimated parameters $\hat{\alpha}_i^{CAPM}$ and $\hat{\beta}_i^{CAPM}$ for each of the $i = 1, \ldots, 212$ corporations. The idea of the CAPM is that the estimated market-beta parameters $\hat{\beta}_i^{CAPM}$ capture the non-diversifiable risk of each corporation, which can be used in a second step to explain average stock returns.

4.1.2 Baseline: multifactor model

However, there is a large literature on the empirical weaknesses of the CAPM. In other words, it is now well-known that the estimated market-beta parameters of the CAPM are in most cases not able to sufficiently explain the cross-sectional variation in average stock returns (see e.g., Fama and French 1992). For this reason, Fama and French (1993) propose to expand the CAPM by two additional risk factors to explain the expected stock returns. This multifactor model usually has a stronger explanatory power than the CAPM (see e.g., Fama and French 1996; Davis et al. 2000; Berkowitz and Qiu 2001) and can capture the most important anomalies that have been found in the literature. Therefore, such a model is estimated in time-series regressions for each of the ($i = 1, \ldots, 212$) European corporations in the sample in the second approach:

$$r_{it}^{e} = \alpha_i^{MFM} + \beta_i^{MFM} r_{\text{market},t}^{e} + \gamma_{1i}^{MFM} r_{MC,t} + \gamma_{2i}^{MFM} r_{BVMV,t} + \varepsilon_{it} \quad (t = 1, \ldots, 67) \quad (2)$$

In this multifactor model, $r_{MC,t}$ and $r_{BVMV,t}$ are included as additional explanatory variables. Both factors are constructed using the originally approximately 600 stock corporations of the FTSE Eurotop 300 and the FTSE EuroMid (at the beginning of 2002). But only those corporations are used for which the relevant financial data are fully available throughout the whole observation period. These corporations are ranked first on their market capitalization and second on their book-to-market value ratio. Then the median of the market capitalizations and the 30% and 70% percentiles of the book-to-market value ratios are calculated. From these three values (in each January from 1996 to 2001), six portfolios are constructed. These six portfolios are defined as *SH* (small market capitalization, high book-to-market value ratio), *SM* (small market capitalization, medium book-to-market value ratio), *SL* (small market capitalization, low book-to-market value ratio), *BH* (big market capitalization, high book-to-market value ratio), *BM* (big market capitalization, medium book-to-market value ratio), and *BL* (big market capitalization, low book-to-market value ratio). Each January from 1996 to 2001, the 212 European corporations in the sample are allocated anew to one of these six portfolios and stay there for all months of the same year. Then the value-weighted returns $r_{SH,t}$, $r_{SM,t}$, $r_{SL,t}$, $r_{BH,t}$, $r_{BM,t}$, and $r_{BL,t}$ of the corresponding six portfolios are calculated for all months $t = 1, \ldots, 67$. Finally, the two factors

$$r_{MC,t} = \frac{r_{SH,t} + r_{SM,t} + r_{SL,t}}{3} - \frac{r_{BH,t} + r_{BM,t} + r_{BL,t}}{3}$$

and

$$r_{BVMV,t} = \frac{r_{SH,t} + r_{BH,t}}{2} - \frac{r_{SL,t} + r_{BL,t}}{2}$$

arise. One receives the (OLS) estimated parameters $\hat{\alpha}_i^{MFM}$, $\hat{\beta}_i^{MFM}$, $\hat{\gamma}_{1i}^{MFM}$, and $\hat{\gamma}_{2i}^{MFM}$ for each of the $i = 1, \ldots, 212$ corporations.

4.2 Final cross-sectional regressions

The final cross-sectional regressions of the average monthly stock return $\bar{r}_i$ ($i = 1, \ldots, 212$) from February 1996 to August 2001 on the environmental and social performance variables, subsumed in the $K \times 1$-dimensional vector $SUST_i$, also include the estimated parameters from the time-series regressions of the CAPM and the multifactor model as discussed above as explanatory variables. The analysis of the average monthly stock returns can be interpreted as a buy-and-hold investment strategy. In other words, the investor buys the stocks in January 1996 and evaluates the portfolio at the end of the investment period in August 2001.

With regard to the CAPM, the estimated market-beta parameters $\hat{\beta}_i^{CAPM}$ are included as baseline model variables. The country and sector dummies, represented by the $L \times 1$-dimensional-vector D_i, are considered as additional control variables. The final regression model based on the CAPM has the following structure (ε_i are the error variables):

$$\bar{r}_i = \alpha + \beta' SUST_i + \gamma \hat{\beta}_i^{CAPM} + \delta' D_i + \varepsilon_i \tag{3}$$

The dependent variable $\bar{r}_i$ is defined (in %) as:

$$\bar{r}_i = \left(\frac{1}{67} \sum_{t=1}^{67} r_{it} \right) \cdot 100$$

This approach leads to the (OLS) estimates $\hat{\alpha}$ and $\hat{\gamma}$ of the parameters α and γ as well as $\hat{\beta}$ and $\hat{\delta}$ of the parameter vectors $\beta = (\beta_1, \ldots, \beta_K)'$ and $\delta = (\delta_1, \ldots, \delta_L)'$. As the estimated market-beta parameters $\hat{\beta}_i^{CAPM}$ of the CAPM are theoretically considered as risk factors, the estimate $\hat{\gamma}$ should be positive in the cross-sectional regressions.

In contrast to the cross-sectional regression model based on the CAPM, the corresponding model based on the multifactor model includes the baseline model variables $\hat{\beta}_i^{MFM}$, $\hat{\gamma}_{1i}^{MFM}$, and $\hat{\gamma}_{2i}^{MFM}$ to explain the average monthly stock return as discussed above. By again incorporating the environmental and social performance variables in $SUST_i$ in addition to the dummies in D_i as control variables, this regression model has the following structure ($i = 1, \ldots, 212$):

$$\bar{r}_i = \alpha + \beta' SUST_i + \gamma_1 \hat{\beta}_i^{MFM} + \gamma_2 \hat{\gamma}_{1i}^{MFM} + \gamma_3 \hat{\gamma}_{2i}^{MFM} + \delta' D_i + \varepsilon_i \tag{4}$$

This approach leads to the (OLS) estimates $\hat{\alpha}$, $\hat{\gamma}_1$, $\hat{\gamma}_2$ and $\hat{\gamma}_3$ of the parameters α, γ_1, γ_2 and γ_3 as well as $\hat{\beta}$ and $\hat{\delta}$ of the parameter vectors $\beta = (\beta_1, \ldots, \beta_K)'$ and $\delta = (\delta_1, \ldots, \delta_L)'$. The baseline model variables (here the estimated market-beta parameters $\hat{\beta}_i^{MFM}$ as well as $\hat{\gamma}_{1i}^{MFM}$ and $\hat{\gamma}_{2i}^{MFM}$) are again theoretically considered as risk factors such that the estimates $\hat{\gamma}_1$, $\hat{\gamma}_2$, and $\hat{\gamma}_3$ should be positive. All time-series and cross-sectional regressions (as well as all further calculations) have been performed with the software package STATA.

5 Results

5.1 Descriptive statistics

Table 1 implies that the relationship between $EnvSect_i$ and $SocSect_i$ is positive for all 212 European corporations in the sample. Spearman's rank correlation coefficient has been calculated due to the ordinal scale of these variables resulting in a value of 0.19. It should be noted that the positive correlation is strongly influenced by the 38 corporations of the banking and insurance sector with $EnvSect_i = 5$ and $SocSect_i = 2$. In contrast, the positive relationship between $EnvCorp_i$ and $SocCorp_i$ is clearly stronger. The corresponding value of Spearman's rank correlation coefficient is 0.47. Apparently, the variation of the values of $SocCorp_i$ is rather weak since $SocCorp_i = 3$ for 119 of the 212 corporations in the sample. However, multicollinearity problems with

Table 2 Descriptive statistics on the financial variables

Variable	Mean	SD	Minimum	Maximum
$\bar{r}_i$	1.31	1.00	−2.43	4.44
$\hat{\beta}_i^{CAPM}$	1.04	0.44	0.11	2.69
$\hat{\beta}_i^{MFM}$	1.22	0.39	0.26	2.78
$\hat{\gamma}_{1i}^{MFM}$	0.59	0.69	−1.77	2.15
$\hat{\gamma}_{2i}^{MFM}$	0.03	0.49	−1.09	1.32

the constant in the final cross-sectional regressions should not arise since there is nevertheless enough variation.

Table 2 reports some descriptive statistics on the financial variables. It shows that the mean of the average monthly stock returns $\bar{r}_i$ from February 1996 to August 2001 over the 212 corporations in the sample is 1.31%. Thus, this mean is slightly higher than the average monthly return on the market portfolio of stocks that is used based on the FTSE Eurotop 300 index (the exact average of $r_{\text{market},t}$ from February 1996 to August 2001 is 1.23%, the average of the monthly riskfree interest rates r_{t-1}^r is 0.15%). Table 2 also shows that the mean of $\hat{\beta}_i^{MFM}$ is clearly higher than the mean of $\hat{\beta}_i^{CAPM}$, although the corresponding estimated market-beta parameters belong to the same explanatory variables $r_{\text{market},t}^e$ in the time-series regressions. This is obviously due to the frequently substantial differences between $\hat{\beta}_i^{CAPM}$ and $\hat{\beta}_i^{MFM}$ in these respective 212 regressions. But it should be emphasized that the repeatedly significantly positive or negative effect of $r_{MC,t}$ and $r_{BVMV,t}$ on r_{it}^e enforces the advantage of the multifactor model compared with the CAPM.

5.2 Econometric analysis

First of all, we have excluded the sustainability performance variables and the other control variables to explain the average monthly stock return $\bar{r}_i$ (the corresponding estimation results are not displayed in this paper, but are available on request). In other words, we have only included the estimated parameters $\hat{\beta}_i^{CAPM}$, $\hat{\beta}_i^{MFM}$, $\hat{\gamma}_{1i}^{MFM}$ and $\hat{\gamma}_{2i}^{MFM}$ of the baseline models. The reason for this analysis is to evaluate the characteristics of the common empirical asset pricing models in a standard setting. With the CAPM as the baseline, the estimated market-beta parameter $\hat{\beta}_i^{CAPM}$ has a positive effect at the 1% level of significance (it should be noted that we consider in this paper a robust estimation of the standard deviation of the parameter estimates according to White 1982) as expected since these estimates are theoretically considered as risk factors. With the multifactor model as the baseline, the estimated market-beta parameter $\hat{\beta}_i^{MFM}$ has a positive effect only at the 10% level of significance. However, the main result is that $\hat{\gamma}_{2i}^{MFM}$ and even to a greater extent $\hat{\gamma}_{1i}^{MFM}$ have a negative influence on $\bar{r}_i$ at the 5% or even 1% level of significance. Since these estimated parameters are also theoretically considered as risk factors, this result is rather surprising.

Concerning the negative effect of $\hat{\gamma}_{1i}^{MFM}$ and $\hat{\gamma}_{2i}^{MFM}$ these results contradict some results from the empirical finance literature, where Fama and French (1993, 1996) consider these variables as risk factors such that they should have a positive influence on average stock returns. Our deviating estimation results can be explained as follows: First and most important, the other studies are based on extremely long observation periods. Fama and French (1993), for example, consider a period of 29 years (1963–1991). In contrast, we have had to choose a comparatively short period for our analysis. Further own examinations with multifactor models according to Fama and French (1993) for the German stock market, however, show that the consideration of different short observation periods can lead to rather different results regarding the risk factors. Second, the other studies examine entire stock markets (particularly of the USA). In contrast, we only consider those European stock corporations that are evaluated by Sarasin & Cie. These are particularly corporations with a relatively high market capitalization. Third, the results of the other studies are based on analyses of stock portfolios. In contrast, we only analyze single stocks. According to this, our estimation results should not fundamentally invalidate the application of the multifactor model according to Fama and French (1993). Nevertheless, our estimation results could be the basis for further research regarding the advantage of different multifactor models, for example, compared with the CAPM, since the results obviously could depend on the chosen observation periods, on the chosen stock markets, and on the use of single stocks (instead of portfolios).

Tables 3 and 4 report the estimation results from the cross-sectional regressions including the baseline model variables, the other control variables (technology sector dummy and country dummies), and particularly the sustainability performance variables. While Table 3 comprises the estimation results with the CAPM as baseline, Table 4 comprises those with the multifactor model as baseline. The estimation results from the first regressions (1) refer in both tables to the inclusion of the sustainability performance variables $EnvSect_i$, $SocSect_i$, $EnvCorp_i$, and $SocCorp_i$. In contrast, the estimation results from the second regressions (2) refer in both tables to the incorporation of the dummies based on these sustainability performance variables. According to Table 4, the significantly negative effect of $\hat{\gamma}_{1i}^{MFM}$ and $\hat{\gamma}_{2i}^{MFM}$ also remains very robust if different sustainability performance variables are included in the cross-sectional regressions. In contrast, the positive influence of the estimated market-beta parameters $\hat{\beta}_i^{CAPM}$ and $\hat{\beta}_i^{MFM}$ now becomes less significant according to Tables 3 and 4.

According to the estimation results based on the first regressions (1) in both tables, no significant effect (at the 10% level of significance) of $EnvCorp_i$ and $SocCorp_i$ on $\bar{r}_i$ arises. This result holds true with either the CAPM or the multifactor model as the baseline. Thus, neither a positive influence of the relative environmental performance nor a positive influence of the relative social performance of a corporation within a given industry on the stock performance can be proved. However, this also means that negative effects of these variables on $\bar{r}_i$ can not be verified from the econometric analysis, either. The estimation results regarding the variables of the environmental or social activities of a corporation compared with all other corporations in the same industry are very robust if only dummies based on $EnvCorp_i$ and $SocCorp_i$ are included in the cross-sectional regressions. According to the estimation results based on the second regressions (2) in both tables, none of these dummy variables has a significant effect on the average monthly stock return $\bar{r}_i$. It should be noted that by applying the adequate χ^2-tests, the hypotheses that either $EnvCorp_i$ and $SocCorp_i$ together or the eight dummy variables together are all zero can never be rejected at the 10% level of significance.

The main result in Tables 3 and 4 refers to the variables of the average environmental or social performance of the industry in which a corporation operates. According to the first cross-sectional regressions (1), $EnvSect_i$ has a positive effect

Table 3 OLS parameter estimates in the cross-sectional regressions, $N = 212$ ($T = 67$ in the basic time-series regressions), dependent variable: $\bar{r}_i$, baseline: CAPM

Explanatory variables	(1)	(2)	Explanatory variables	(1)	(2)
$EnvSect_i$	0.19***		$\hat{\beta}_i^{CAPM}$	0.35	0.56**
$SocSect_i$	−0.19***		$Tech_i$	0.01	0.08
$EnvCorp_i$	0.00		SWI_i	−0.00	0.10
$SocCorp_i$	0.09		GER_i	−0.20	−0.18
$EnvSect5_i$		0.56**	UK_i	0.13	0.08
$EnvSect4_i$		0.90***	NET_i	−0.22	−0.26
$EnvSect3_i$		0.30	FRA_i	0.42**	0.32
$EnvSect2_i$		−0.26	SWE_i	0.39	0.59
$SocSect5_i$		−0.49	ITA_i	0.35	0.16
$SocSect4_i$		−1.43***	AUS_i	−0.16	−0.11
$SocSect3_i$		−0.76***	SPA_i	0.40***	0.03
$SocSect2_i$		−0.69***	DEN_i	−0.18	−0.37
$EnvCorp5_i$		−0.09	FIN_i	0.70	0.81
$EnvCorp4_i$		−0.14	NOR_i	0.74	0.76
$EnvCorp3_i$		−0.16	Constant	0.49	1.26
$EnvCorp2_i$		−0.11			
$SocCorp5_i$		0.25			
$SocCorp4_i$		0.01			
$SocCorp3_i$		−0.09			
$SocCorp2_i$		−0.04			

Notes: * (**,) means that the null hypothesis that the appropriate parameter is zero can be rejected at the 10% (5%, 1%) level of significance (according to the corresponding two-tailed test) $R^2 = 0.199$ in the first regression (1) and $R^2 = 0.294$ in the second regression (2)

(parameter estimates: 0.19 and 0.11) and $SocSect_i$ has a negative effect (parameter estimates: −0.19 and −0.15) on $\bar{r}_i$ at the 1% level of significance with the CAPM as the baseline and at the 5% level of significance with the multifactor model as the baseline. It should be emphasized that these estimation results again remain robust if only dummies based on the sustainability performance variables are included in the cross-sectional regressions. According to the second cross-sectional regressions (2), the parameters of the dummy variables for high values of $EnvSect_i$ (the reference variable is $EnvSect1_i$) have rather higher estimates than those for low values and the parameters of the dummy variables for high values of $SocSect_i$ (the reference variable is $SocSect1_i$) have rather lower estimates than those for low values (an exception are the parameter estimates −0.49 and −0.30 for $SocSect5_i$ that imply no significant influence of this dummy variable at the 10% level of significance). Therefore, the environmental performance of the industry appears to have a positive influence and the social performance of the industry appears to have a negative influence on the stock performance.

According to these estimation results, the stock market rewards investments in stock corporations of clean sectors (with otherwise similar corporate characteristics) with a premium. In contrast, the stock market penalizes investments in stock corporations of sectors with a good social performance (and otherwise similar corporate characteristics) with a negative premium. In other words, investors who applied a buy-and-hold strategy would have increased their portfolio value by investing in corporations with a good average environmental performance of the industry and would

Table 4 OLS parameter estimates in the cross-sectional regressions, $N = 212$ ($T = 67$ in the basic time-series regressions), dependent variable: $\bar{r}_i$, baseline: multifactor model

Explanatory variables	(1)	(2)	Explanatory variables	(1)	(2)
$EnvSect_i$	0.11**		$\hat{\beta}_i^{MFM}$	0.34	0.51*
$SocSect_i$	−0.15**		$\hat{\gamma}_{1i}^{MFM}$	−0.45***	−0.43***
$EnvCorp_i$	0.03		$\hat{\gamma}_{2i}^{MFM}$	−0.43***	−0.32**
$SocCorp_i$	0.05		$Tech_i$	−0.30	−0.21
$EnvSect5_i$		0.36	SWI_i	0.26	0.27
$EnvSect4_i$		0.61**	GER_i	0.00	−0.04
$EnvSect3_i$		0.16	UK_i	0.16	0.09
$EnvSect2_i$		−0.22	NET_i	−0.14	−0.20
$SocSect5_i$		−0.30	FRA_i	0.47***	0.37
$SocSect4_i$		−1.14***	SWE_i	0.83***	0.88**
$SocSect3_i$		−0.60***	ITA_i	0.34	0.15
$SocSect2_i$		−0.57***	AUS_i	−0.11	−0.09
$EnvCorp5_i$		0.04	SPA_i	0.52***	0.17
$EnvCorp4_i$		−0.06	DEN_i	−0.33	−0.46
$EnvCorp3_i$		−0.04	FIN_i	0.98	0.96
$EnvCorp2_i$		−0.05	NOR_i	1.14**	1.06
$SocCorp5_i$		0.41	Constant	0.76*	1.11
$SocCorp4_i$		0.13			
$SocCorp3_i$		0.13			
$SocCorp2_i$		0.14			

Notes: * (**, ***) means that the null hypothesis that the appropriate parameter is zero can be rejected at the 10% (5%, 1%) level of significance (according to the corresponding two-tailed test)
$R^2 = 0.285$ in the first regression (1) and $R^2 = 0.345$ in the second regression (2)

have decreased their portfolio value by investing in corporations with a good average social performance of the industry (and otherwise similar corporate characteristics). The estimation results also imply that a strong environmental or social behavior of the management does not diminish the stock performance of a corporation. Therefore, such corporate environmental and social activities could be increased since they obviously do not lead to decreased competitiveness. Furthermore, investors who applied a buy-and-hold strategy would not have decreased their portfolio value by investing in corporations with more environmental or social activities (and otherwise similar corporate characteristics) compared with all other corporations in the same sector.

In further analyses, we have examined the robustness of these estimation results (the corresponding estimation results are not displayed in this paper, but are available on request). For example, we have replaced the dependent variable $\bar{r}_i$ in the cross-sectional regressions which is the mean of the continuous return or in other words the logarithm of the average growth factor of the discrete return on stock i over time by the average growth rate of the discrete return over time $e^{\bar{r}i} - 1$. The result was that the parameter estimates (and corresponding z-statistics) are nearly identical to those in Tables 3 and 4. Furthermore, we have analyzed the cross-sectional regressions that also include the two corporations with the lowest values of the average monthly stock return as discussed in Sect. 3.2. The result was that the parameter estimates (and corresponding z-statistics) for the sustainability performance variables are relatively robust. However, the corresponding parameter estimates (and z-statistics) for the baseline model variables can strongly deviate from those in Tables 3 and 4 obviously due to an outlier problem.

Finally, we have also examined cross-sectional regressions that include dummy variables for the banking and for the insurance sectors. One motivation for the inclusion of these dummies is that the assessment of the book value of corporations in these sectors differs from that in other sectors. Thus, it can be assumed that book-to-market value ratios of corporations in the banking and insurance sectors are not directly comparable with those in the other industries. Therefore, these dummy variables should account for such differences. With regard to the banking sector, the inclusion of the corresponding dummy variable can also be justified since banks benefited strongly by the increase in capital supply and demand during the stock price bubble from 1998 until the beginning of 2000.

With regard to the cross-sectional regressions that include both dummy variables, but not the sustainability performance variables, the result was that the banking and insurance sector dummies have a significantly positive effect on $\bar{r}_i$. The inclusion of the different variables regarding the relative environmental performance or social performance of a corporation within a given industry has only minor consequences. In other words, these sustainability performance variables again have no significant effect on $\bar{r}_i$ (at the 10% level of significance) as well as the banking and insurance sector dummies again have a significantly positive effect. In contrast, the inclusion of both the different variables regarding the average environmental or social performance of the industry in which a corporation operates in addition to the banking and insurance sector dummies is problematic. It should be noted that $EnvSect_i$ and $SocSect_i$ as well as the dummies based on these variables are sector specific variables (i.e., $EnvSect_i = 5$ and $SocSect_i = 2$ for all banks and insurances) such that the relationships between these sustainability performance variables and the banking and insurance sector dummies can lead to strong multicollinearity problems. Therefore, an interpretation of the estimation results based on the corresponding cross-sectional regressions that include both types of variables is difficult.

6 Summary and conclusions

This paper examines the effect of different environmental and social performance variables on the stock performance of European corporations. The econometric analysis is based on common empirical asset pricing models, in other words on the CAPM and particularly on the multifactor model according to Fama and French (1993). The final cross-sectional regressions show that the average environmental performance of the industry in which a corporation operates has a significantly positive effect on the average monthly stock return from 1996 to 2001. In contrast, the average social performance of the industry has a significantly negative influence on the stock performance. According to this, the stock market rewards investments in stock corporations of clean sectors with a premium and penalizes investments in stock corporations of sectors with a good social performance (and otherwise similar corporate characteristics) with a negative premium. In other words, investors who applied a buy-and-hold strategy would have increased their portfolio value by investing in corporations with a good average environmental performance of the industry and would have decreased their portfolio value by investing in corporations with a good average social performance of the industry (and otherwise similar corporate characteristics).

It should be noted that some sectors with the highest value of the environmental performance variable $EnvSect_i$ (i.e., the best environmental performance) are often considered as sectors with a worse sustainability performance. This is particularly true for the banking and the insurance sector. Both industries have the second lowest value of the social performance variable $SocSect_i$ (i.e., the second worst social performance) on the five-stage scale. In further investigations, we have included variables of an average overall sustainability performance (i.e., both environmental and social performance together) of the industries to explain the average monthly stock return. These variables usually have no significant influence due to the obvious rivalry between the positive effect of the average environmental performance and the negative effect of the average social performance of the industry. Thus, investments in stock corporations of sectors with a good overall sustainability performance appear to be as good as investments in other stock corporations (with otherwise similar corporate characteristics). Therefore, this restriction of the investment universe should not reduce the stock performance for the investor.

The variables of the relative sustainability performance of a corporation within a given industry have no significant effect on the stock performance. This result holds true for both the variables of the environmental and the variables of the social activities of a corporation compared with all other corporations in the same industry. Thus, a strong environmental or social behavior of the management does not diminish the stock performance of a corporation. Therefore, such corporate environmental and social activities could be increased since they obviously do not lead to decreased competitiveness. Furthermore, investors who applied a buy-and-hold strategy would not have decreased their portfolio value by investing in corporations with more environmental or social activities (and otherwise similar corporate characteristics) compared with all other corporations in the same sector. However, it should be noted that a stronger sustainable behavior obviously does not have a positive effect, either, such that many corporations do not perform such socially desirable activities. Hence, the results of this paper do not excuse policy from further regulation, for example, to internalize negative external effects.

As a by-product, the econometric analysis implies some differences to the empirical finance literature since the results from the cross-sectional regressions that only include the baseline model variables contradict some results of Fama and French (1993, 1996) who consider these variables as risk factors such that they should have a positive influence on average stock returns. These deviating estimation results are obviously particularly due to different observation periods since further own examinations with multifactor models according to Fama and French (1993) for the German stock market show that the consideration of different short observation periods can lead to rather different results regarding the risk factors. Furthermore, these deviating estimation results can also be explained by different stock markets and the use of single stocks (instead of portfolios). According to this, the estimation results should not fundamentally invalidate the use of the multifactor model according to Fama and French (1993). These estimation results could rather be considered as basis for further research regarding the advantage of different multifactor models compared, for example, with the CAPM.

It should be noted that the econometric analysis examines the average monthly stock return of European corporations quoted on the stock exchange during the period from 1996 to 2001. The region under consideration and the observation period could also influence the estimation results regarding the effect of sustainability performance on economic performance. To our knowledge, there are no comparable studies for European corporations considering this period and particularly using the measures for sustainability and economic performance as well as applying the econometric approach in this paper. Therefore, our estimation results cannot be directly compared with the estimation results of other (US dominated) econometric studies. In the future, it would be desirable to perform econometric analyses based on empirical asset pricing models with other observation periods, different regions, and/or different measures for sustainability performance.

Another field for future research is the examination of the causality of the relationship between sustainability performance and economic performance. The cross-sectional regressions in this paper assume that the variables of the (average) sustainability performance (for some years before 2001) can influence the average monthly stock return (between 1996 and 2001). But it could also be possible that a reverse effect between these variables existed. In this case, the parameter estimations could be biased. With regard to this problem, lagged explanatory variables are often used in other studies (see e.g., Hart and Ahuja 1996; King and Lenox 2001; Konar and Cohen 2001). In the future, we also plan to use lagged explanatory variables within cross-sectional regression models. But the necessary time series of sustainability performance variables are not available yet. If we were able to apply such time series, we could furthermore connect these lagged explanatory variables with panel data models (see e.g., King and Lenox 2001). In the framework of such models, possible intertemporal effects on the dependent variable such as (in our case) the stock return could be considered. If intertemporal effects really existed and if they were not modeled, the parameter estimations could also be biased.

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