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Does the stock market value the inclusion in a sustainability stock index? An event study analysis for German firms ☆

Ulrich Oberndorfer [a], Peter Schmidt [b], Marcus Wagner [c,d], Andreas Ziegler [b,e,f,*]

[a] Permanent Mission of the Federal Republic of Germany to the OECD, 9 rue Maspéro, 75116 Paris, France
[b] Center for Corporate Responsibility and Sustainability (CCRS), University of Zurich, Zähringerstr. 24, 8001 Zürich, Switzerland
[c] Julius-Maximilians-University Würzburg, Stephanstr. 1, 97070 Würzburg, Germany
[d] Bureau d'Economie Théorique et Appliquée (BETA), University of Strasbourg, France
[e] University of Kassel, Nora-Platiel-Str. 5, 34109 Kassel, Germany
[f] Center for European Economic Research (ZEW), Mannheim, Germany

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ABSTRACT

This paper empirically analyzes the effect of the inclusion of German corporations in the Dow Jones STOXX Sustainability Index (DJSI STOXX) and the Dow Jones Sustainability World Index (DJSI World) on stock performance. In order to receive robust estimation results, we apply an (short-term) event study approach that is based on both a modern asset pricing model, namely the three-factor model according to Fama and French [24], and additionally a t-GARCH(1,1) model. Our empirical results suggest that stock markets may penalize the inclusion of a firm in sustainability stock indexes. This finding is mainly driven by a strongly negative effect of the inclusion in the DJSI World. In contrast, we do not find significant average cumulative abnormal returns for the inclusion in the DJSI STOXX. This suggests that the inclusion in a more visible sustainability stock index may have larger negative impacts.

1. Introduction

The question whether voluntary activities of a firm to protect the natural environment or to comply with social and ethical norms are financially beneficial has been of vital interest for corporate management for a long time. Knowledge about the relationship between corporate sustainability (i.e. environmental or social) performance and financial performance is also important for public policy. If corporate environmental or social activities are privately rewarded, while bad sustainability performance is penalized, it can be argued that the main goal of public policy would be to ensure publication and spreading of information about corporate sustainability performance. This approach can be thought to be more cost-efficient than traditional (e.g., command and control) regulation. Finally, for investors the question is whether socially responsible investing (SRI), also called ethical or sustainable investing (e.g., [54]), which refers to the practice of choosing stocks on the basis of environmental, social, and ethical screens, is rewarded or penalized by the stock market.

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* Corresponding author at: University of Kassel, Nora-Platiel-Str. 5, 34109 Kassel, Germany. Fax: +49 561 804 2501.
E-mail addresses: ulrich.oberndorfer@diplo.de (U. Oberndorfer), peter.schmidt@ccrs.uzh.ch (P. Schmidt), marcus.wagner@uni-wuerzburg.de (M. Wagner), andreas.ziegler@uni-kassel.de (A. Ziegler).

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Against this background, several portfolio analyses compare the risk-adjusted stock returns of socially responsible and conventional mutual funds (e.g., [6,5]). Other portfolio analyses focus on specific corporate sustainability performance assessments, such as those by Innovest (e.g., [19]) or KLD Research & Analytics (e.g., [36]). Such assessments are the basis for some sustainability stock indexes, such as the Domini 400 Social Index, which is constructed with the ratings from KLD. Another strand of economic SRI studies directly examines the financial performance of sustainability stock indexes (e.g., [58,6,59]), which are the basis for several socially responsible funds. However, a strong methodological drawback of portfolio analyses is that only the relationship between corporate sustainability and financial performance can be examined, whereas the causal effect of environmental or social activities cannot be identified.

Such an identification is in principle possible with common micro-econometric analyses which regress corporate financial performance on specific indicators for corporate sustainability performance and several control variables. While a few studies (e.g., [27,72]) consider stock returns as an indicator for corporate financial performance, most other studies apply accounting data based indicators.[1] While many of these analyses only use narrow indicators for corporate sustainability performance, such as emissions of pollutants, some studies consider more general indicators that refer to the environmental dimension or even incorporate both corporate environmental and social activities. Finally, a few studies examine the impact of the inclusion in a sustainability stock index on corporate financial performance, as measured with indicators based on accounting data (e.g., [49,8,70]).

Although micro-econometric approaches seem to be more appropriate to examine the effect of corporate sustainability performance on financial performance than portfolio analyses, the identification of the causality of this relationship in such studies can also be problematic since it is possible that corporate financial performance has an impact on environmental or social activities. If such a reverse effect exists, the corresponding parameter estimates could be biased. This problem is evident in micro-econometric analyses with cross-sectional data. But even in modern panel data models, the reliability of the estimations is ambiguous since appropriate instrumental variables are often not available. This shortcoming is a significant starting point for a third methodological approach, namely event studies. Event studies generally examine the mean stock returns for corporations experiencing a specific event (i.e. new information) and therefore aim to measure the effect of this event on the value of a corporation (e.g., [11,48,45]).

Short-term event studies[2] have been developed and particularly applied in financial economics and accounting to examine, for example, the effect of mergers and acquisitions, earnings announcements, or issues of new debt or equity. However, such event studies are also increasingly used to analyze the reactions of mean stock prices due to new information about corporate sustainability performance. Former event studies in this field often refer to relatively specific corporate environmentally, socially, or ethically relevant information (e.g., [33,43,53,48,37,18,32,12,13,28]). The corresponding events can have the character of negative news, such as information about environmental accidents or toxic emissions, as well as positive news, such as information about firms winning environmental awards, membership in voluntary environmental programs, or withdrawal from South Africa during the apartheid regime (as a reaction to human rights abuses).

Another small group of event studies recently analyzes the impact of the inclusion in a sustainability stock index on stock performance. For example, Curran and Moran [17] examine British firms with respect to their inclusion in the specific FTSE4Good UK 50 Index, i.e. an index that is based on corporate sustainability performance assessments by the FTSE Group. Furthermore, Doh et al. [21] analyze US firms with respect to the inclusion in the specific Calvert Social Index, i.e. an index created by Calvert Investments, an investment management firm which is one of the largest SRI firms in the US. Finally, Cheung [15] examines US firms with respect to their specific inclusion in the Dow Jones Sustainability World Index (DJSI World), i.e. an index that is based on corporate sustainability performance assessments by the SAM (Sustainable Asset Management) Group together with Dow Jones Indexes.

The crucial assumption for the reliability of event studies is that the timing of the event is exogenous and thus cannot be influenced by the firm. The announcement of some environmental or social activities by a firm would therefore not be appropriate for an event study. Another substantial assumption is that capital markets are sufficiently efficient to react to events. This implies that the information of the event is not anticipated and the new information is relevant for the stock returns. If these conditions for the application of event studies are given, the essential feature of this approach is that the causality of the relationship between corporate sustainability performance and stock performance is clear (e.g., [34]). As a consequence, if the stock prices (as in many of the aforementioned studies) decrease subsequent to negative news or increase subsequent to positive news and if possible confounding effects in the analyzed time period are excluded, it can be reliably concluded that this is due to the corresponding release of environmentally, socially, or ethically relevant information. Therefore, it can also be concluded in these cases that there is a negative or positive causal effect of corporate sustainability performance on stock and thus financial performance.

As a consequence, our paper adopts this short-term event study approach. Specifically, we consider the impact of the inclusion of German corporations in two sustainability stock indexes, namely the Dow Jones STOXX Sustainability Index

[1] They thus examine the impact of corporate environmental or social activities on, for example, Tobin's Q, return on assets, return on sales, or return on equity (e.g., [68,56,44,38,39,66,31]).

[2] We focus on short-term event studies since they are generally considered as more reliable and robust than long-term approaches. Besides the existence of several sources for potential biases due to specific characteristics in stock market returns in long-term event studies (e.g., Lyon et al. [47]), these approaches can also increase the probability of selection due to sample attrition, which makes reliable results difficult. Furthermore, long-term event studies are more prone to complications due to a higher probability of multiple events (e.g., [57]).

(DJSI STOXX) and the DJSI World, which are both based on corporate sustainability performance assessments by the SAM Group together with Dow Jones Indexes, as aforementioned, as well as in cooperation with STOXX Limited. Since the inclusion in these indexes and particularly the announcement of this inclusion cannot be affected by a firm, its analysis is appropriate for the event study approach. The contribution of our event study is three-fold. First of all, our analysis is one of few studies for European and particularly continental European firms since most studies refer to Anglo-Saxon firms so far. By specifically focussing on German firms, our event study refers to the country with the third largest European stock market in terms of market capitalization and the largest national economy in Europe. Second, we compare the effects of the inclusion in two sustainability stock indexes with different visibility and importance. This allows to test whether the inclusion in a more recognized sustainability stock index has different effects on the stock performance of firms on the same stock market. Third, we use an advanced event study methodology by basing our analysis on the three-factor model according to Fama and French [24]. In addition, we consider a GARCH model (e.g., [22]) so that our results are reliable even if a varying conditional variance in the daily stock returns occurs, which is frequently the case on the stock market.

The structure of the paper is as follows: On the basis of theoretical considerations, Section 2 develops the hypotheses for our empirical analysis. Section 3 presents our event study approach and the data used. Section 4 discusses the empirical results and Section 5 concludes.

2. Theoretical background and hypotheses

This paper empirically analyzes the short-term impact of the inclusion in a sustainability stock index on stock performance as an indicator of corporate financial performance. Sustainability stock indexes are often considered an appropriate indicator for corporate environmental and social activities, corporate sustainability performance, or corporate social responsibility (CSR) (e.g., [49,8]). Against this background, our empirical analysis of the relationship between corporate sustainability performance and financial performance tests two different competing theoretical perspectives, namely the traditional view which suggests a negative relation and the revisionist view which suggests a positive relation (e.g., [52,69]). While this paper focuses on short-term financial effects, it should be mentioned that these theories or views have been formulated in a general way, i.e. irrespective of the time structure of the relationship. With respect to these arguments, possible effects of an inclusion in a sustainability stock index should already be observed in the short run if the capital markets are sufficiently efficient to react upon events (i.e. new information) regarding expected future profits of affected corporations even if the respective underlying rationale suggests a long-term relationship.

One argument for the revisionist view and thus for a positive effect of corporate sustainability performance on financial performance is based on neoclassical micro-economics. It suggests that governments do not fully resolve all problems with external effects and that competitive markets are not efficient (e.g., [34]). Therefore, corporate environmental and social activities can substitute missing markets (and thus missing regulations) if external costs arise from them and can reduce conflicts between firms and stakeholder groups, such as the government, the general public, non-governmental organizations, competitors, employees, or clients. As a consequence, it can be argued that the reduction of these conflicts increases corporate profits or financial performance and thus stock returns.

This stakeholder argument is strengthened by the strategic management literature (e.g., [68,3,17]). Stakeholder theory suggests that management has to satisfy several groups who have an interest or "stake" in a firm and can influence its outcome (e.g., [50]). It can therefore be financially beneficial to engage in environmental and social activities because otherwise these stakeholders could withdraw the support for the firm. For example, the avoidance of child labor in the full value-added chain of the products can reduce risks due to aggressive campaigns of non-governmental organizations. These arguments can further be linked to the resource-based view of the firm (e.g., [4]), which suggests that competitive advantages evolve from internal capabilities that are valuable, rare, and difficult to imitate or substitute (e.g., [56,40,38,50]). In this respect, stakeholder management abilities can be considered an important organizational capability or resource. New technologies that are installed due to proactive corporate environmental activities are a further example for a strategic resource if these technologies cannot be easily imitated by competitors.

The previous arguments exclusively refer to corporate environmental and social activities, which can lead to financial benefits. While negative news, for example, with respect to child labor or environmental pollution can relatively easily be observed and evaluated, it is much more difficult to identify proactive environmental or social activities. One example for a signal to stakeholders that a firm carries out such activities is the certification of environmental management systems according to ISO 14001 (e.g., [12]). Another signal for a high corporate sustainability performance associated with such activities is the inclusion in a sustainability stock index. Reputation gains through this positive signal can also attract new customers who are sensitive to sustainability issues, which could lead to higher sales and increased profitability. Furthermore, firms with a good reputation can increase its employee retention rate and additionally attract highly skilled and thus more productive employees. Regarding the embedding in the resource-based view of the firm, a good reputation is a further example for an intangible resource that is valuable, rare, and difficult to imitate or substitute.

In summary, this leads to the following hypothesis that represents the aforementioned revisionist view:

Hypothesis 1a. *The inclusion in a sustainability stock index has a positive effect on stock performance in the short run.*

It should be noted that a crucial assumption for the argumentation leading to our first hypothesis is that the inclusion in a sustainability stock index, such as the DJSI STOXX or the DJSI World, is a reliable signal for a higher intensity of environmental and social activities. In this respect, however, Koellner et al. [41] show that the differences between socially responsible and conventional funds, which are both managed on the basis of the MSCI World Index, indeed are present in terms of environmental impacts, but relatively small compared with possible expectations of investors. Ziegler and Schröder [71] analyze the determinants of the inclusion in the DJSI STOXX and the DJSI World and show that factors not related to corporate environmental or social activities matter significantly for the inclusion in these sustainability stock indexes. As a consequence, the reliability of the inclusion in these two stock indexes as a real indicator for higher corporate sustainability performance can be put into question (e.g., [29]), so that strong reputation gains also remain doubtful.

Furthermore, activities aimed at increasing corporate sustainability performance can also be considered non-productive (e.g., [61]) and thus only serve societal goals (e.g., environmental protection). From the beginning of the debate on the "business case of CSR", it has been argued that CSR is expensive and demands significant portions of corporate financial resources, although benefits of CSR can be reaped only in the distant future if at all. Based on this, already Friedman [30] argues that there is no role for CSR. More specifically, Cañón-de-Francia and Garcés-Ayerbe [12] argue with respect to the proactivity of corporate environmental activities that ISO 14001 certification could be interpreted as a purely symbolic action driven by institutional and isomorphic pressures (e.g., [20]). In other words, corporate activities for this certification need not necessarily be voluntarily conducted. This argument also applies to the inclusion in sustainability stock indexes. In this case, corresponding environmental and social activities may lead to additional costs, which are not directly productive, so that weaker positive or even negative impacts on financial success are possible. This argumentation is also in line with the traditional view in neoclassical micro-economics. According to this, the operating costs of corporate environmental (e.g., [66]) or social activities outweigh their financial benefits. As a consequence, corporate sustainability performance can lead to reduced profits, decreased firm values, or competitive disadvantages, supporting the aforementioned argument of Friedman [30] that CSR is not a responsibility of the firm and should thus not be pursued.

This neoclassical notion is supported by corporate governance theory (e.g., [64,67]). According to a narrow definition, corporate governance comprises all measures, such as optimal incentive or control structures, which assure that investors get an adequate return for their investments. Only if corporate governance structures are properly designed, management will focus on profit maximization. According to this, it can, for example, be argued that the consideration of stakeholder goals as a motivation for corporate environmental or social activities and ultimately the inclusion in a sustainability stock index enlarges the latitude of management which could be misused for only maximizing the utility of managers, so that investors in purely profit-maximizing firms with a lower intensity of such measures can expect a higher financial performance.

In summary, this leads to the following competing hypothesis that represents the aforementioned traditionalist view:

Hypothesis 1b. *The inclusion in a sustainability stock index has a negative effect on stock performance in the short run.*

With respect to the previous discussion about the inclusion in a sustainability stock index as a positive signal for corporate sustainability performance or conversely a negative signal for a pure symbolic action, it should be noted that in both cases this signal has to be evident. In other words, a signal has to be visible for all actors and intermediaries on the stock market in order to have an impact on stock prices. The DJSI World was first published in 1999 and is certainly the most important sustainability stock index within the DJSI family. All other indexes from this family, such as the DJSI North America, the DJSI Asia Pacific, and particularly also the DJSI STOXX, were launched later. This latter European sustainability stock index was first published in 2001 and has in the meantime been substituted by the DJSI Europe, which was launched in 2010. This suggests that the DJSI World was more recognized than the DJSI STOXX, which implies that the signaling effect should be weaker for the latter sustainability stock index. As a consequence, the positive signal for corporate sustainability performance or the negative signal for a pure symbolic action is likely weaker for the DJSI STOXX than for the DJSI World, so that the positive or negative impact of the inclusion in the DJSI STOXX on corporate financial performance should be weaker than the corresponding impact of the inclusion in the DJSI World.

This leads to the following two hypotheses which are based on the two competing Hypotheses 1a and 1b and whose validity is conditional on the acceptance of the former ones, i.e. Hypothesis 2a (2b) can only apply when Hypothesis 1a (1b) holds:

Hypothesis 2a. *The positive (short-term) effect of the inclusion in a sustainability stock index on stock performance is stronger for the DJSI World than for the DJSI STOXX.*

Hypothesis 2b. *The negative (short-term) effect of the inclusion in a sustainability stock index on stock performance is stronger for the DJSI World than for the DJSI STOXX.*

3. Methodological approach and data

3.1. Event study approach

Event studies try to examine the stock return behavior for corporations which experience a specific event and therefore aim to measure the effect on the value of a corporation (e.g., [26,11,45]). One crucial assumption in this respect is that capital

markets are sufficiently efficient to react upon events (i.e. new information) regarding expected future profits of affected corporations. Short-term event studies mostly rest on the analysis of so-called "normal" and "abnormal" returns, which are estimated on the basis of asset pricing models. The main approaches are the market model [62,23] and the one-factor model that is based on the Capital Asset Pricing Model (CAPM) [63,46]. The one-factor model based on the CAPM for a corporation or stock i in day t (i=1,…,N; t=1,…,T) is

$$r_{it}-r_{ft} = \alpha_i + \beta_i(r_{mt}-r_{ft}) + \varepsilon_{it}$$

In this model r_{it} and r_{mt} are the returns for corporation i and the market portfolio at the end of period t (i.e. between t−1 and t), r_{ft} is the risk-free interest rate at the beginning of period t, and ε_{it} is the disturbance term with expectation $E(\varepsilon_{it})=0$ and variance $Var(\varepsilon_{it})=\sigma^2_{\varepsilon_i}$. Finally, α_i and β_i besides $\sigma^2_{\varepsilon_i}$ are the unknown parameters.

However, many studies (e.g., [24,25,35,73]) show that the three-factor model of Fama and French [24], which includes two additional factors to explain the excess returns $r_{it}-r_{ft}$, has more explanatory power than the one-factor model. The structure of this three-factor model for a corporation or stock i in day t is as follows (i=1,…,N; t=1,…,T):

$$r_{it}-r_{ft} = \alpha_i + \beta_{i1}(r_{mt}-r_{ft}) + \beta_{i2}SMB_t + \beta_{i3}HML_t + \varepsilon_{it}$$

In this model SMB_t represents the size factor and HML_t is the value factor in day *t* (for details see [24]). While ε_{it} is the disturbance term with $E(\varepsilon_{it})=0$, the parameters $Var(\varepsilon_{it})=\sigma^2_{\varepsilon_i}$, α_i, β_{i1}, β_{i2}, and β_{i3} are unknown and have to be estimated.

In short-term event studies the unknown normal (excess) returns $E(r_{it}-r_{ft})$ are defined as the expected (excess) returns without conditioning on the event. The so-called abnormal returns for a corporation i in day t are defined as the difference between the actual and the normal (excess) returns:

$$ar_{it} = (r_{it}-r_{ft}) - E(r_{it}-r_{ft})$$

The unknown parameters in $E(r_{it}-r_{ft})$ can be estimated by OLS on the basis of the three-factor model for all days t in the time interval $[T_0,\ldots,T_1]$, i.e. in the "estimation window". Based on this, the normal and abnormal returns are estimated for each corporation i and for separate days t in the time interval $[T_2,\ldots,T_3]$, i.e. in the "event window". The estimated abnormal returns for a corporation i in day t on the basis of the three-factor model are

$$est(ar_{it}) = (r_{it}-r_{ft}) - est(\alpha_i) - est(\beta_{i1})(r_{mt}-r_{ft}) - est(\beta_{i2})SMB_t - est(\beta_{i3})HML_t$$

If the estimation window is sufficiently large, the $est(ar_{it})$ are approximately normally distributed with expectation zero and variance $\sigma^2_{\varepsilon_i}$ under the null hypothesis that the event has no impact on the (excess) returns.

The estimated abnormal returns can be aggregated across corporations and over time. For an aggregation across affected corporations, the estimated average abnormal returns $est(aar_t)$ for a day t in the event window are the means of the estimated abnormal returns for the corporations i=1,…,N:

$$est(aar_t) = \frac{1}{N}\sum_{i=1}^{N} est(ar_{it})$$

For an aggregation over time, the estimated cumulative abnormal returns $est(car_i)$ for a corporation i are the sums of the considered estimated abnormal returns for all days t from T_a to T_b (with $T_2-1 < T_a < T_b < T_3+1$):

$$est(car_i) = \sum_{t=T_a}^{T_b} est(ar_{it})$$

For a combined aggregation over time and across affected corporations, the estimated average cumulative abnormal returns est(acar) are the means of the estimated cumulative abnormal returns for the corporations i=1,…,N:

$$est(acar) = \frac{1}{N}\sum_{i=1}^{N} est(car_i)$$

As discussed below, we consider the event day and several days subsequent to the event day as it is common in short-term event studies. Based on the estimated average abnormal and estimated average cumulative abnormal returns, one main task of an event study is the testing of the null hypothesis that the event has no impact on the (excess) returns. In this respect, we focus on the non-parametric test according to Corrado [16] which implicitly accounts for correlations across corporations (e.g., [42]).[3]

Another possibly even more robust approach is to apply GARCH models (e.g., [10]), which consider a varying conditional variance and are therefore very appealing approaches for the analysis of time series on a daily frequency. In this respect, the use of the specific GARCH(1,1) model is widespread since it sufficiently explains systematic variation of stock return volatility in most cases (e.g., [1,22]). We specifically consider a t-GARCH(1,1) model because its estimated conditional variances have desirable properties, i.e. they are positive and covariance stationary and have a finite kurtosis (e.g., [55]).[4]

[3] In order to test the robustness of our test results, we additionally consider the common z-statistic according to Campbell et al. [11] and the corrected z-statistic according to Boehmer et al. [9].

[4] We restrict the GARCH specific parameters to be positive and all parameters so that the GARCH process is stationary. In addition, we also filter the time series of daily stock returns according to Rodríguez and Ruiz [55] to eliminate misleading effects of outliers.

While GARCH models are already applied for several event studies so far (e.g., [2,51]), only very few event studies use a simple GARCH model (e.g., [7]) or even a t-GARCH(1,1) model to analyze the impact of corporate environmental or social performance on stock returns. For testing whether the inclusion in a sustainability stock index actually had an impact on stock returns the corresponding z-statistic according to Campbell et al. [11] is considered within this approach.

3.2. Data

In our event study we analyze German corporations that were included in a sustainability stock index in the years between 1999 and 2002. As discussed above, we consider the DJSI STOXX and the DJSI World. Together with Dow Jones Indexes and STOXX Limited, the SAM Group, which is an independent and internationally active financial services institution with an exclusive focus on sustainability, has launched a family of sustainability stock indexes to track the financial performance of corporations that are sector leaders in terms of sustainability performance (e.g., [29]). The basis for the inclusion in a sustainability stock index by SAM is a questionnaire distributed to all relevant firms asking for detailed information on environmental, social, and also economic criteria. The assessment process follows the so-called best-in-class approach identifying sustainability leaders within a sector. The final assessments are then verified by an external and independent auditor.

The DJSI STOXX comprised the European leaders, i.e. the 20% most sustainable European corporations of each sector in the Dow Jones STOXX 600 Index (DJ STOXX 600 Index) were intended to be included. The DJSI World comprises the world-wide leaders, i.e. the 10% most sustainable corporations of each sector of the biggest 2500 corporations in the Dow Jones World Index (DJ World Index) are intended to be included in this sustainability stock index. The DJSI indexes are annually reviewed. Changes in the indexes and thus the new list of all firms in the indexes are commonly announced in September each year. For example, the DJSI World in 2007 comprised 318 firms of which 42 were added and 33 deleted, whereas the DJSI STOXX comprised 156 firms of which 17 were added and 22 deleted.

In a first step of our analysis, 33 inclusions in the DJSI STOXX (for 33 German corporations listed in the Frankfurt stock exchange) for the years 2001 and 2002 and 29 inclusions in the DJSI World between 1999 and 2002 (for 28 German corporations listed in the Frankfurt stock exchange due to a double inclusion of one firm, namely Allianz, in 1999 and 2002 after its exclusion in 2001) have been identified. With respect to the DJSI STOXX, we can only examine these two years since this sustainability stock index was launched only in 2001, as aforementioned. Furthermore, we can only examine the years 1999, 2001, and 2002 in the case of the DJSI World since in 2000 no German firm was included in this sustainability stock index. However, we do not analyze all these events due to several confounding effects, i.e. important other events within or shortly before the event window.[5]

As a consequence, 23 inclusions in the DJSI STOXX (for 23 corporations) are examined in our event study. Moreover, we examine 28 inclusions in the DJSI World (for 27 corporations) since the inclusion of one firm (namely Aixtron) in 2002 is not considered.[6] Table 1 reports the list of all firms in our event study as well as the sectoral affiliation for the groups of firms that were included in the DJSI STOXX and for the group of firms that were included in the DJSI World. The sectoral affiliations are additionally compared with the group of all primary listed firms in the Frankfurt stock exchange. The table reveals that the consumer goods, consumer services, and industrials sectors have the highest frequencies with respect to the inclusion in the DJSI STOXX and the consumer goods sector is the clearly most relevant sector for the DJSI World. While the respective percentages for the latter sector are higher than the percentages for all primary listed firms in the Frankfurt stock exchange, other sectors (e.g., the financials sector) in our event study are below average. Table 2 reports the corresponding descriptive statistics for the market values and the number of employees. It shows that the firms in our event study belong to the biggest firms on the Frankfurt stock exchange as expected since firms could only be included in the DJSI STOXX or DJSI World if they were listed in the DJ STOXX 600 Index or DJ World Index, i.e. if they belong to the European or world-wide firms with the highest market values.

It should be noted that for our event study two different dates in each year are of interest for the inclusion in a sustainability stock index, namely the new composition of the index as well as its corresponding announcement. The announcement of the new composition of the DJSI World was in each year (i.e. 08.09.1999, 04.09.2001, 04.09.2002) between one and three weeks before its real new composition (i.e. 17.09.1999, 21.09.2001, 23.09.2002). The announcement of the new composition of the DJSI STOXX in the year 2002 (04.09.2002) was more than three weeks before its real new composition (30.09.2002). In contrast, the real new composition of the DJSI STOXX in the year 2001 (28.09.2001) was before its public announcement in this year (15.10.2001). In order to avoid confounding effects, we only consider in each case the first date as event day. For the analysis of the DJSI World the event date therefore refers to the announcement of the new composition of this sustainability stock index. The event dates for the analysis of the DJSI STOXX are 28.09.2001 and 04.09.2002. In contrast to the other event dates, 28.09.2001 refers to the real new composition of the DJSI STOXX in this year and not to its public announcement.

[5] The main confounding effects in our sample refer to the double inclusion in or exclusion from one of the sustainability stock indexes. According to this, seven inclusions in the DJSI STOXX in 2001 are not considered since the same corporations have been included in the DJSI World in the same year and the corresponding announcement was one week before the announcement of the inclusion in the DJSI STOXX. Furthermore, two inclusions in the DJSI STOXX in 2001 and one inclusion in 2002 are not considered since the same corporations have been excluded from the DJSI World in the respective year and the corresponding announcements were one week before the announcements of the inclusion in the DJSI STOXX.

[6] The reason for this is that this corporation was excluded from the DJ World Index in this year.

Table 1
This table reports the list of all firms in the event study as well as the percentages and numbers of firms in specific sectors. The values refer to the firms in the analysis of the inclusion in the DJSI STOXX and DJSI World. The frequencies (at the beginning of the observation period 1999) are compared with those of all primary listed firms in the Frankfurt stock exchange.

Firms in the event study of the inclusion in the DJSI STOXX (including the year of inclusion):
Aixtron (2001), BASF (2001), Bayer (2001), BMW (2001), Buderus (2002), Deutsche Bank (2001), Deutsche Börse (2002), Deutsche Telekom (2001), Gehe/Celesio (2001), Heidelberger Druck (2001), Henkel (2001), Linde (2002), MAN (2002), Metro (2001), Münchner Rück (2001), Preussag (2001), ProSiebenSAT1 (2001), RWE (2001), SAP (2002), Siemens (2001), T Online (2001), VW (2001), Wella (2001)

Firms in the event study of the inclusion in the DJSI World (including the year of inclusion):
Adidas-Salomon (2001), Allianz (1999, 2002), BASF (2002), Bayer (1999), Bayerische Hypo & Vereinsbank (2001), BMW (1999), Commerzbank (1999), Continental (1999), Daimler Chrysler (2001), Degussa (2001), Deutsche Bank (1999), Deutsche Lufthansa (2001), Deutsche Telekom (1999), Gehe/Celesio (2002), Heidelberger Druck (2002), Heidelberger Zement (1999), Henkel (1999), Karstadt (2001), Metro (1999), MG Technologies (2001), Münchner Rück (2002), RWE (1999), SAP (1999), Schering (1999), Siemens (1999), VW (1999), Wella (2002)

Sectors	Percentage and number of firms in analysis of inclusion in DJSI STOXX	Percentage and number of firms in analysis of inclusion in DJSI World	Percentage and number of all primary listed firms in Frankfurt stock exchange
Consumer goods	17.39% (4)	25.93% (7)	12.10% (198)
Consumer services	17.39% (4)	14.81% (4)	9.72% (159)
Industrials	17.39% (4)	14.81% (4)	19.32% (316)
Financials	13.04% (3)	18.52% (5)	25.73% (421)
Basic materials	13.04% (3)	11.11% (3)	5.62% (92)
Technology	13.04% (3)	3.70% (1)	14.55% (238)
Telecommunications	4.35% (1)	3.70% (1)	1.22% (20)
Utilities	4.35% (1)	3.70% (1)	2.93% (48)
Healthcare	0.00% (0)	3.70% (1)	5.26% (86)
Oil and gas	0.00% (0)	0.00% (0)	3.55% (58)
All firms	100.00% (23)	100.00% (27)	100.00% (1636)

Our estimation window $[T_0,\ldots,T_1]$ comprises 100 trading days and ends 25 days prior to the event. If we define the event day as $t=0$, then $T_0=-125$ and $T_1=-26$. This window has been used for the estimation of the unknown parameters α_i, β_{i1}, β_{i2}, and β_{i3} in the Fama–French three-factor model irrespective of the inclusion of a t-GARCH (1,1) process in the conditional disturbance terms. Based on the corresponding parameter estimates est(α_i), est(β_{i1}), est(β_{i2}), and est(β_{i3}) for each event firm i, the corresponding abnormal returns could be estimated. Our event window comprises the event day [0] and five days subsequent to the event days, as it is common in corresponding short-term event studies. Therefore, our event window $[T_2,\ldots,T_3]$ with $T_2=0$ and $T_3=5$ comprises overall six days. In this event window all individual abnormal returns ar_{i0} at the event day [0] have been estimated.[7] Furthermore, we have estimated individual cumulative abnormal returns car_i for the time interval [0,5] (with $T_a=0$, $T_b=5$). In addition, we have estimated the average abnormal returns aar_0 at the event day [0] and particularly the average cumulative abnormal returns acar for the complete aforementioned event window. In order to underline our results, we have additionally analyzed cumulative "abnormal" returns for several time intervals prior to the event. If the new information on the inclusion in a sustainability stock index is not anticipated before the event but relevant for the investors, the average (cumulative) abnormal returns should be insignificant prior to the event, but significantly different from zero in the event window. Therefore, we additionally examine the time intervals [−24,−19], [−18,−13], [−12,−7], and [−6,−1] prior to the event.

Our financial data stem mainly from a carefully controlled unique database for German stock corporations [65,60]. The data contain the daily (discrete) stock returns r_{it} and r_{mt} (in %) for the event firms and for the German market portfolio, which comprises all stocks traded on the Frankfurt stock exchange. To calculate the two risk factors SMB_t and HML_t for the estimation of the Fama–French three-factor model, the data also contain the market and book values of all corporations whose stocks are traded on the Frankfurt stock exchange, except banks and insurances as well as stock corporations with negative book values (for details see [73]). The risk-free interest rates r_{ft} (in %) are based on the one-month Frankfurt Interbank Offered Rate (FIBOR) and the one-month Euro Interbank Offered Rate (EURIBOR).

4. Results

4.1. Joint analysis of the DJSI STOXX and the DJSI World

With respect to the overall 51 inclusions in the DJSI STOXX or the DJSI World, Fig. 1 reports the estimated average cumulative "abnormal" returns on the basis of the three-factor model as discussed above with an additional inclusion of a t-GARCH (1,1) model for the time intervals [−24,−19], [−18,−13], [−12,−7], and [−6,−1] before the event as well as the

[7] Since many short-term event studies additionally consider some few days before the event, we have also analyzed the day prior to the event. However, the corresponding average abnormal returns at this day are—similar to the first day after the event—not significantly different from zero.

Table 2
This table reports several descriptive statistics (mean, median, standard deviation, maximum) for market values and numbers of employees. The values (at the beginning of the observation period 1999) refer to the firms in the analysis of the inclusion in the DJSI STOXX and DJSI World as well as to all primary listed firms in the Frankfurt stock exchange.

Market value (in million Euro)				
	Mean	Median	Standard deviation	Maximum
Firms in analysis of inclusion in DJSI STOXX	28,169.16	13,506.28	46,735.02	213,793.89
Firms in analysis of inclusion in DJSI World	31,617.95	18,716.35	44,515.77	213,793.89
All primary listed firms in Frankfurt stock exchange	1767.13	146.40	10,293.84	213,793.89
Number of employees				
	Mean	Median	Standard deviation	Maximum
Firms in analysis of inclusion in DJSI STOXX	99,569.90	66,563.00	109,410.31	416,000.00
Firms in analysis of inclusion in DJSI World	111,363.60	62,357.00	121,000.00	441,502.00
All primary listed firms in Frankfurt stock exchange	7953.66	740.00	30,533.04	441,502.00

corresponding estimated average cumulative abnormal return for the complete event window [0,5]. The figure additionally comprises the corresponding 95% confidence regions (based on the z-statistics according to [11]). It reveals that the average cumulative "abnormal" returns before the event are not significantly different from zero, whereas the average cumulative abnormal return for the complete event window [0,5] is strongly significantly negative. Table 3 reports the corresponding values for these time intervals and additionally the estimated average abnormal returns at the event day [0]. The table additionally reports the percentages of negative estimated abnormal and cumulative abnormal returns as well as the Corrado test statistics in addition to the commonly estimated average abnormal and cumulative abnormal returns based on the three-factor model without a GARCH model.

The table shows that the average cumulative abnormal return in the complete event window [0,5] is also significantly negative on the basis of the Corrado test (although only at the 10% significance level[8]). The estimated values are furthermore very similar in the amount of −1.83% on the basis of the three-factor model and the t-GARCH(1,1) model as well as -1.95% based on the three-factor model without a GARCH model.[9] In contrast, the average cumulative "abnormal" returns in the time intervals [−24,−19], [−18,−13], [−12,−7], and [−6,−1] before the event are not only insignificantly different from zero with the inclusion of a t-GARCH (1,1) model, but also on the basis of the Corrado test in addition to the commonly estimated average cumulative abnormal returns. As a consequence, it can be concluded that the inclusion of German firms in the DJSI World or DJSI STOXX had a negative impact on their stock returns. Against this background, Hypothesis 1a can be rejected and Hypothesis 1b can be confirmed. It should be noted that in addition, the average abnormal return at the event day [0] is significantly negative with the inclusion of the t-GARCH(1,1) model. However, this result is not very robust since the average abnormal return is not significantly different from zero on the basis of the three-factor model without a GARCH model.[10]

In this respect, it can be argued that the joint negative effect of the inclusion in the DJSI World or DJSI STOXX on the stock returns is particularly driven by specific effects in several industries or some firm characteristics. To test this hypothesis, we have additionally conducted an econometric analysis of the impact of several firm characteristics and sector dummies on the estimated cumulative abnormal returns for the complete event window [0,5]. As firm characteristics we have included the (logarithm of the) price earnings ratio, the market-to-book equity, the number of employees, the market capitalization, and the dividend yield (five out of the 51 firms with zero dividends were excluded from the analysis due to the taking of the logarithm of this explanatory variable). With respect to possible sectoral effects, we have considered dummy variables for industrials and utilities, consumer goods, consumer services, telecommunications and technology, as well as financials (see also Table 1). In addition, we have incorporated dummy variables for the inclusion in the DJSI STOXX (instead of the DJSI World) as well as for the two years 2001 and 2002. According to the corresponding OLS parameter estimates and heteroskedasticity robust z-statistics in several linear regression models, however, none of these variables have any significant effect on the estimated cumulative abnormal returns.[11] Therefore, the hypothesis that these estimated cumulative abnormal returns are specifically driven by certain industries or firm characteristics cannot be confirmed.

4.2. Separate analysis of the DJSI STOXX and the DJSI World

In the next step, we separately consider the inclusion in the DJSI STOXX and in the DJSI World to test (in line with the rejection of Hypothesis 1a) Hypothesis 2b that the inclusion in the DJSI World leads to stronger negative effects than the

[8] This higher significance level is not surprising since the Corrado test has indeed generally relatively low power, but is also known to be very robust with respect to the specified underlying significance level even in small samples and in different data specifications.

[9] In order to test the robustness of the results, we have also examined the common z-test according to Campbell et al. [11] and the corrected z-test according to Boehmer et al. [9] on the basis of the estimated abnormal returns without the additional inclusion of a GARCH model as discussed above. The corresponding results (which are available upon request) are qualitatively very similar to the reported results.

[10] This insignificant effect also refers to the use of the corrected z-test according to [9], as discussed above.

[11] The corresponding estimation results are available upon request.

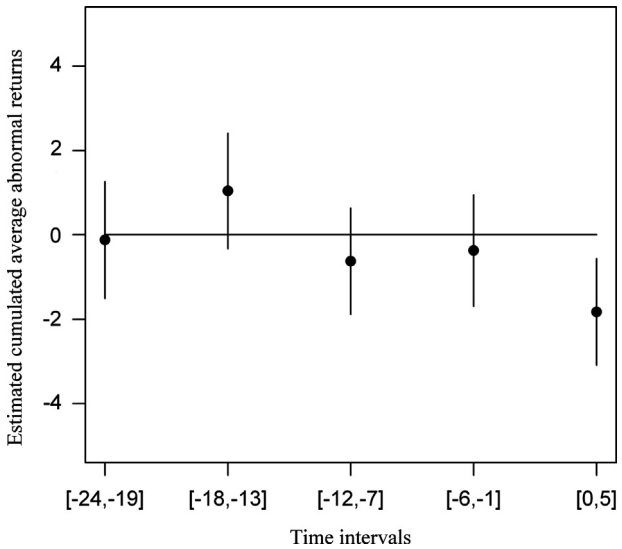

Fig. 1. This figure reports the estimated average cumulative abnormal returns and the corresponding 95% confidence regions for the event study of the inclusion in the DJSI STOXX or the DJSI World based on the three-factor model with an additional inclusion of a t-GARCH (1,1) model. Regarding the time intervals, the figure incorporates the four periods [−24,−19], [−18,−13], [−12,−7], and [−6,−1] prior to the event as well as the complete event window [0,5]. The number of events is 51 and the number of firms in this event study is 35.

Table 3
This table reports the estimation results of the event study for the inclusion in the DJSI STOXX or the DJSI World based on the three-factor model. The number of events is 51 and the number of firms in this event study is 35. The first column refers to the percentages of negative commonly estimated abnormal returns est(ar_t) for the event day [0] and of negative commonly estimated cumulative abnormal returns est(car) for several time intervals. The second column reports the commonly estimated average abnormal returns est(aar_t) for the event day [0] and the commonly estimated average cumulative abnormal returns est(acar) for the time intervals, including the Corrado test statistic. The third column reports the estimated average abnormal returns est(aar_t) for the event day [0] and the estimated average cumulative abnormal returns est(acar) for the time intervals on the basis of a t-GARCH (1,1) model, including the corresponding z-statistic. * (**, ***) means that the null hypothesis that the average abnormal returns aar_t or the average cumulative abnormal returns acar are zero can be rejected at the 10% (5%, 1%) significance level (according to the corresponding two-tailed tests).

Day or time interval	Percentage of negative est(ar_t) or est(car) without inclusion of GARCH model	est(aar_t) or est(acar) without inclusion of GARCH model (Corrado test statistic)	est(aar_t) or est(acar) with inclusion of t-GARCH (1,1) model (z-statistic)
[−24,−19]	56.86%	−0.39% (−0.04)	−0.12% (−0.17)
[−18,−13]	50.98%	0.36% (0.50)	1.04% (1.49)
[−12,−7]	56.86%	−1.08% (−0.37)	−0.62% (−0.97)
[−6,−1]	58.82%	−0.45% (−0.81)	−0.37% (−0.55)
[0]	50.98%	−0.52% (−0.02)	−0.53%** (−2.01)
[0,5]	58.82%	−1.95%* (−1.80)	−1.83%*** (−2.84)

inclusion in the DJSI STOXX.[12] The main result of Table 4, which reports the estimation results for the inclusion in the DJSI STOXX, is that the average cumulative abnormal returns in the complete event window [0,5] are not significantly different from zero. In contrast, the average abnormal return at the event day [0] based on the t-GARCH(1,1) model is significantly negative. However, this result is not robust and reliable since the average abnormal return is not significantly different from zero on the basis of all other test statistics. In addition, the medians instead of the means of the estimated abnormal returns are even positive. Furthermore, the significantly negative estimated average cumulative "abnormal" returns in time interval [−12,−7] seems to be an artefact that cannot sufficiently be explained.[13] Overall, however, a robust effect of the inclusion in the DJSI STOXX on stock returns cannot be confirmed.

[12] It should be noted that the only analysis of the dummy variable for the inclusion in the DJSI STOXX in the linear regression analysis as discussed before is not sufficient for the testing of Hypothesis 2b. The examination of the competing Hypothesis 2a has already become irrelevant in our case since the joint analysis of the DJSI STOXX and the DJSI World in the previous section has identified negative effects of the inclusion in the two sustainability stock indexes on stock returns.

[13] Although we have analyzed the firms for possible confounding factors not only in the event window, but also in the 24 days prior to the event, such confounding effects are nevertheless possible for single firms. In this respect, it should be noted that the number of 23 events is relatively low so that a confounding event for only one or very few firms can strongly affect estimated average "abnormal" returns across all 23 firms.

Table 4
This table reports the estimation results of the event study for the inclusion in the DJSI STOXX based on the three-factor model. The number of events is 23 which corresponds with the number of firms in this event study. The first column refers to the percentages of negative commonly estimated abnormal returns est(ar_t) for the event day [0] and of negative commonly estimated cumulative abnormal returns est(car) for several time intervals. The second column reports the commonly estimated average abnormal returns est(aar_t) for the event day [0] and the commonly estimated average cumulative abnormal returns est(acar) for the time intervals, including the Corrado test statistic. The third column reports the estimated average abnormal returns est (aar_t) for the event day [0] and the estimated average cumulative abnormal returns est(acar) for the time intervals on the basis of a t-GARCH (1,1) model, including the corresponding z-statistic. * (**, ***) means that the null hypothesis that the average abnormal returns aar_t or the average cumulative abnormal returns acar are zero can be rejected at the 10% (5%, 1%) significance level (according to the corresponding two-tailed tests).

Day or time interval	Percentage of negative est(ar_t) or est(car) without inclusion of GARCH model	est(aar_t) or est(acar) without inclusion of GARCH model (Corrado test statistic)	est(aar_t) or est(acar) with inclusion of t-GARCH (1,1) model (z-statistic)
[−24,−19]	69.57%	−1.01% (−0.65)	−0.56% (−0.50)
[−18,−13]	47.83%	0.33% (0.26)	1.36% (1.17)
[−12,−7]	65.22%	−2.66%* (−1.94)	−2.11%** (−2.11)
[−6,−1]	52.17%	0.46% (−0.16)	0.70% (0.66)
[0]	39.13%	−0.71% (1.23)	−0.82%** (−2.03)
[0,5]	43.48%	−1.39% (−0.14)	−1.32% (−1.31)

In contrast, the estimation results for the inclusion in the DJSI World are very consistent and robust. Table 5 indeed reports insignificant negative average abnormal returns at the event day [0], but very robust significantly negative average cumulative abnormal returns (with estimated values of −2.23% and −2.41%) in the complete event window [0,5]. Similarly, the average cumulative "abnormal" returns for the time intervals [−24,−19], [−18,−13], [−12,−7], and [−6,−1] before the event are not significantly different from zero.[14] Overall, the estimation results in Tables 4 and 5 therefore imply that the significantly negative impacts on stock returns according to Table 3 are mainly generated by the significantly negative effects of the inclusion in the DJSI World since the inclusion in the DJSI STOXX did not lead to significant average cumulative abnormal returns for the complete event window [0,5]. According to this, the inclusion in a more recognized sustainability stock index, namely the DJSI World, leads to stronger negative impacts on stock returns than the inclusion in a less visible sustainability stock index, namely the DJSI STOXX.[15] As a consequence, Hypothesis 2b can be confirmed by our event study.

5. Conclusions

This paper empirically analyzes the effect of the inclusion of German corporations in sustainability stock indexes on stock performance. In this respect, we examine the DJSI STOXX, which claimed to comprise the European leaders in terms of sustainability performance, and the DJSI World, which claims to comprise the respective world-wide leaders. In order to arrive at robust estimation results, our short-term event study approach is based on both a modern asset pricing model, namely the three-factor model of Fama and French [24], and additionally on a t-GARCH(1,1) model. Our empirical analysis implies negative average cumulative abnormal returns, for example, in the amount of almost 2% in the complete six days event window [0,5]. This result is obviously mainly driven by the effect of the inclusion in the DJSI World. While the average cumulative abnormal returns are insignificant if a firm is included in the DJSI STOXX, the inclusion in the DJSI World leads to strong negative impacts. For example, our empirical analysis implies in this case an average decrease of the stock returns in the amount of more than 2% in the complete six days event window [0,5].

Our estimation results point to important conclusions. First, the German stock market has obviously penalized the inclusion of a firm in a sustainability stock index. Assuming that the inclusion in a sustainability stock index is an appropriate indicator for CSR, our results therefore would suggest that a higher corporate environmental or social performance and thus possible associated reputation gains or cost savings were not financially rewarded. However, it should be noted that the assessment and selection process for the composition of sustainability stock indexes is not yet standardized. With respect to the selection process, Ziegler and Schröder [71] show that, for example, relatively high numbers of firms in the DJ STOXX 600 Index and the DJ World Index are never assessed at all, so that these corporations cannot be included in the DJSI STOXX or DJSI World, irrespective of their environmental or social activities. This lowers the quality of the inclusion in these sustainability stock indexes as reliable indicator for sustainability performance (e.g., [29]). Against this background, our estimation results are in line with the notion of Cañón-de-Francia and Garcés-Ayerbe [12] for the case of the adoption of environmental management systems, namely that the inclusion in a sustainability stock index can be negatively assessed by investors as a purely symbolic action. According to this argumentation, the inclusion in a

[14] The common z-test according to Campbell et al. [11] and the corrected z-test according to Boehmer et al. [9] on the basis of the estimated abnormal returns without the additional inclusion of a GARCH model have also been examined for the event study of the only inclusion in the DJSI STOXX and the only inclusion in the DJSI World. The corresponding results (which are available upon request) are again qualitatively very similar to the reported results.

[15] This systematic difference between the DJSI World and the DJSI STOXX for the complete event window [0,5] is also confirmed by Mann–Whitney non-parametric rank-sum tests which compare the average abnormal or cumulative abnormal returns for the inclusion in these two sustainability stock indexes. The corresponding test results are available upon request.

Table 5
This table reports the estimation results of the event study for the inclusion in the DJSI World based on the three-factor model. The number of events is 28 and the number of firms in this event study is 27. The first column refers to the percentages of negative commonly estimated abnormal returns est(ar_t) for the event day [0] and of negative commonly estimated cumulative abnormal returns est(car) for several time intervals. The second column reports the commonly estimated average abnormal returns est(aar_t) for the event day [0] and the commonly estimated average cumulative abnormal returns est(acar) for the time intervals, including the Corrado test statistic. The third column reports the estimated average abnormal returns est(aar_t) for the event day [0] and the estimated average cumulative abnormal returns est(acar) for the time intervals on the basis of a t-GARCH (1,1) model, including the corresponding z-statistic. * (**, ***) means that the null hypothesis that the average abnormal returns aar_t or the average cumulative abnormal returns acar are zero can be rejected at the 10% (5%, 1%) significance level (according to the corresponding two-tailed tests).

Day or time interval	Percentage of negative est(ar_t) or est(car) without inclusion of GARCH model	est(aar_t) or est(acar) without inclusion of GARCH model (Corrado test statistic)	est(aar_t) or est(acar) with inclusion of t-GARCH (1,1) model (z-statistic)
[−24,−19]	46.43%	0.12% (0.42)	0.25% (0.28)
[−18,−13]	53.57%	0.39% (0.40)	0.78% (0.92)
[−12,−7]	50.00%	0.22% (0.99)	0.60% (0.72)
[−6,−1]	64.20%	−1.20% (−0.88)	−1.26% (−1.47)
[0]	60.71%	−0.36% (−0.97)	−0.29% (−0.85)
[0,5]	71.43%	−2.41%** (−2.09)	−2.23%*** (−2.68)

sustainability stock index is only a reaction to institutional pressures, which require corporate activities and therefore lead to additional unproductive costs. Thus, our results do not support the pursuance of voluntary corporate activities aimed at the inclusion in a sustainability stock index.

From a public policy perspective, our results furthermore question the application of information-based mechanisms in order to correct for market failures due to negative (environmental or social) external effects. The publication and spreading of such "bad news" about the inclusion in a sustainability stock index can rather lead to a further reduction of corresponding voluntary corporate activities, with negative implications for social welfare. Moreover, the German stock market has penalized the inclusion in the DJSI World to a larger extent than the inclusion in the DJSI STOXX. In fact, the inclusion in the DJSI STOXX had (in line with the results of [21], for the inclusion of US firms in the Calvert Social Index) no robust impact on stock returns at all. Therefore, our estimation results are in line with the notion that the inclusion in a more visible sustainability stock index has larger impacts.

With respect to the latter finding, it seems plausible that the world-wide DJSI World has a higher recognition on the stock markets than the DJSI STOXX. However, it would be interesting to analyze the impact of the inclusion in several further more or less recognized sustainability stock indexes for the same group of firms, such as German corporations analyzed here. Examples are alternative Dow Jones Sustainability Indexes, such as the DJSI World 80 and the DJSI Eurozone, or other specific sustainability stock indexes with an environmental focus, such as the Natur-Aktien-Index (NAI). Another direction for further research would be the additional analysis of the exclusion from such sustainability stock indexes (such as in [21], with respect to the Calvert Social Index). In fact, we have additionally considered the exclusion of German corporations from the DJSI STOXX or DJSI World between 1999 and 2002. However, the corresponding estimation results should be treated with caution since the small numbers of analyzed events (only four exclusions from the DJSI STOXX and three exclusions from the DJSI World) make robust conclusions almost impossible. In other words, it is likely that the estimation results are influenced by single firm characteristics.

Finally, it would be interesting in the future to expand the population within a comparative international analysis, for example, with European, American, and Asian firms. However, the prerequisite for such event studies is the availability of corresponding financial data, particularly with respect to risk factors. While such risk factors, for example, according to Fama and French [24] or Carhart [14] are accessible for the US stock market, they are not available for most other world-wide stock markets so far (at least not on a daily frequency). Therefore, making risk factors available for other world regions would be an additional valuable contribution to enable future research.

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