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Abstract

This paper empirically examines the effect of the inclusion in one of the most prominent sustainability stock indexes, namely the Dow Jones Sustainability World Index (DJSI World), on corporate financial performance. On the basis of panel data for European firms that were included in the Dow Jones Stoxx 600 Index over time, our micro-econometric analysis confirms the relevance of unobserved firm heterogeneity since the validity of restricted pooled regression models is statistically rejected in favor of random or fixed effects models. As a consequence, the strong positive impacts of the inclusion in the DJSI World on return on assets and Tobin's Q in pooled regression models become weaker and less robust in the case of return on assets and even insignificant for Tobin's Q in the flexible panel data models that include unobserved firm heterogeneity. Therefore, we conclude that the application of misspecified panel data approaches, similar to cross-sectional models, can lead to biased parameter estimates and thus to premature conclusions with respect to the impact of corporate sustainability performance on financial performance. Our estimation results can be explained by the high number of confounding financial effects of corporate environmental or social activities. Another explanation for the predominant weak or neutral impacts of the inclusion in the DJSI World could be the composition of this stock index, which is influenced by factors that need not necessarily be directly connected to corporate environmental or social activities.

JEL-Classification: M14, Q01, Q56, C23

Keywords: Sustainability stock index, Corporate environmental and social activities, Corporate financial performance, Panel data models

1 Introduction

Knowledge about the relationship between corporate environmental or social performance and financial success generally contributes to the debate about whether managers systematically miss profit opportunities if they decide against the protection of the natural environment (e.g., King and Lenox, 2002) or against the compliance with social and ethical norms. Studies on this relationship are also interesting for investors. The question in this respect is whether socially responsible investing (SRI), also called ethical or sustainable investing (e.g., Renneboog et al., 2008), which refers to the practice of choosing stocks on the basis of environmental, social, and ethical screens, is rewarded or penalized by the stock markets. SRI assets have experienced a strong growth around the world, for example, 1200% between 1995 and 2005 in the USA. This growth has led to a current share of about 10% SRI assets in total assets under management in the USA and a share of over 10% in European funds.

Against this background, some portfolio analyses compare the risk-adjusted stock returns of socially responsible and conventional mutual funds (e.g., Bauer et al., 2005, 2007). Since the financial performance of existing funds is influenced by fund management decisions that cannot be separated from the SRI impact, other portfolio analyses focus on specific corporate sustainability performance assessments, such as from Innovest (e.g., Derwall et al., 2005) or KLD Research & Analytics (e.g., Kempf and Osthoff, 2007). Some of these assessments are the basis for widely considered 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., Sauer, 1997, Bauer et al., 2005, Schröder, 2007), which are the basis for several socially responsible funds. By examining one of the most prominent sustainability stock indexes, namely the Dow Jones Sustainability World Index (DJSI World), which claims to comprise the world-wide leaders in terms of corporate sustainability (i.e. environmental and social) performance, we contribute to this empirical literature in this paper.

However, we do not focus on the investor perspective, i.e. we do not analyze the stock returns of portfolios that are constructed on the basis of the inclusion in this specific sustainability stock index. Instead, this paper captures a firm-specific perspective. Similar to McWilliams and Siegel (2000) and Becchetti et al. (2008), we econometrically analyze the effect of the inclusion in a sustainability stock index on corporate financial performance (i.e. return on assets and Tobin's Q) on the basis of firm-level data. According to conventional perception, it is expected that firms are only incorporated in sustainability stock indexes if they are more environmentally or socially active than their competitors. Against this background, our analysis contributes to micro-econometric studies, which examine whether it pays to be "green" or "responsible" in other ways (e.g., Hart and Ahuja, 1996, King and Lenox, 2001, Ziegler et al., 2007). In this respect, it should be mentioned that corporate environmental and social performance is not yet standardized, so that many different measures with a certain amount of subjectivity are considered. Furthermore, the selection process through the rating and financial service institutions that are responsible for the composition of these stock indexes could also play a role (e.g., Ziegler and Schröder, 2009).

In contrast to many other cross-sectional micro-econometric studies on the effect of corporate environmental or social activities on financial performance, but in line with, for example, the studies of King and Lenox (2001, 2002) and Telle (2006), we use flexible panel data models in order to control for unobserved firm heterogeneity. Therefore, we can avoid biased estimation results due to potential model misspecifications and especially examine whether the estimation results in pooled panel data regression models are robust when unobserved firm heterogeneity is incorporated. Furthermore, this study refers to the entire European stock market and therefore considers firms of a region that has not been extensively analyzed so far since most micro-econometric studies instead examine US firms (e.g., Dowell et al., 2000, Guenster et al., 2006). Moreover, the few studies with a European focus only consider single countries, such as the United Kingdom (UK) (e.g., Elsayed and Paton, 2005) or Norway (e.g., Telle, 2006). Finally, we consider a specific sustainability stock index, namely the DJSI World, which is indeed popular in the SRI discussion, but has (to our knowledge) not been micro-econometrically examined so far with respect to the analysis whether it pays to be included in this index. In contrast, both McWilliams and Siegel (2000) and Becchetti et al. (2008) refer to the inclusion of US firms in the Domini 400 Social Index.

The structure of the paper is as follows: Section 2 provides a theoretical basis for the empirical analysis and reviews the corresponding literature. Section 3 gives an overview of our methodological approach. The data and variables in the micro-econometric analysis are described in section 4. Section 5 discusses the results of our empirical analysis and section 6 concludes.

2 Background

2.1 Theoretical Basis

This paper empirically analyzes the impact of the inclusion in the DJSI World on corporate financial performance. Such sustainability stock indexes are commonly considered an appropriate indicator for corporate environmental and social activities, corporate sustainability performance, or "corporate social responsibility" (CSR) (e.g., McWilliams and Siegel, 2001, Heal, 2005). However, current theory concerning the effect of corporate environmental and social activities on economic or financial success is quite ambiguous (e.g., Waddock and Graves, 1997, Guenster et al., 2006). For example, McWilliams and Siegel (2001) show within a model with two firms that produce identical products, where one firm adds an additional CSR attribute or feature to the product, which is valued by the market, that in equilibrium the overall effect of this attribute is neutral (see also McWilliams et al., 2006). Similarly, MacKey et al. (2007) use a theoretical decision making model comprising the supply and demand for corporate sustainability performance, which shows that environmental or social activities have in some cases no impact on the market value.

Arguments for a negative impact of corporate sustainability performance can be based on neoclassical micro-economics. According to this, it is mainly emphasized that the operating costs of corporate environmental (e.g., Telle, 2006) or social activities outweigh their financial benefits (e.g., due to cost reductions through energy savings or waste reduction), so that the underlying principle of shareholder wealth maximization is hurt. It is argued that CSR demands significant portions of corporate financial resources, although the benefits are often in a distant future if they were to occur. As a consequence, corporate sustainability performance can lead to reduced profits, decreased firm values, or competitive disadvantages, so that already Friedman (1970) argues that there is no role for CSR. This neoclassical argumentation is supported by corporate governance theory (e.g., Shleifer and Vishny, 1997, Tirole, 2006) by emphasizing that only if corporate governance structures (e.g., optimal incentive or control structures) are properly installed, management will find and choose the profit-maximizing path. Therefore, it can be argued that, for example, the consideration of goals of other groups, such as the general public, as motivation for corporate environmental and social activities enlarges the latitude of management, which is misused for maximizing the utility of managers, so that the risk of counterproductive activities with respect to competitiveness increases. In contrast, investors in purely profit-maximizing firms with a lower intensity of CSR can expect a higher financial performance.

However, a positive impact of corporate sustainability performance on financial performance can also be based on neoclassical micro-economics by emphasizing the role of respective activities in reducing the extent of externalized costs. Friedman (1970) assumes in his criticism on CSR that the government defines property rights, so that no external effects exist. In this view, corporate environmental and social activities that benefit shareholders are pure profit-maximization, while activities not benefiting investors are theft from shareholders. In contrast, Heal (2005) argues that the government does not fully resolve all problems with external effects and that the competitive markets are not efficient. 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, at least in the long term.

This stakeholder argument is strengthened in the strategic management literature (e.g., Waddock and Graves, 1997, Barnett and Salomon, 2006, Curran and Moran, 2007). Stakeholder theory suggests that management has to satisfy several groups who have some interest or "stake" in a firm and can influence its outcome (e.g., McWilliams et al., 2006). Regarding corporate financial performance, it can therefore be 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 incalculable risk due to, for example, aggressive campaigns of non-governmental organizations. These arguments can be embedded in the resource-based view of the firm (e.g., Barney, 1991), which suggests that competitive advantages evolve from internal capabilities that are valuable, rare, and difficult to imitate or substitute (e.g., Russo and Fouts, 1997, Klassen and Whybark, 1999, King and Lenox, 2001, McWilliams et al., 2006). In this respect, stakeholder management 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 tangible or physical resource if these technologies can be capitalized and not easily imitated by competitors.

The previous arguments exclusively refer to actual corporate environmental and social activities, which indeed produce costs, but could also be an important organizational resource and reduce conflicts with stakeholder groups. 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 environmental activities is the certification of environmental management systems according to ISO 14001 (e.g., Cañón-de-Francia and Garcés-Ayerbe, 2009). Another signal for corporate sustainability performance is the inclusion in a sustainability stock index. Reputation gains through this positive signal can, for example, attract customers who are sensitive to such issues, which could lead to higher sales. 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. Against this background, it could be hypothesized that this reputation gain mechanism implies that the effect of the inclusion in the DJSI World on corporate financial performance is more positive than the effect of corporate sustainability performance that is only insufficiently communicated to corresponding stakeholders.

However, the prerequisite for this argumentation is that the inclusion in a sustainability stock index, such as the DJSI World, is a reliable signal for a higher intensity of environmental and social activities. In this respect, Koellner et al. (2007) 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 investor's expectations. Ziegler and Schröder (2009) further analyze the determinants of the inclusion in the DJSI World and show that factors that need not necessarily be directly connected to corporate environmental or social activities matter as well. As a consequence, the reliability of the inclusion in the DJSI World as an indicator for higher corporate sustainability performance can be questioned, so that strong reputation gains are also ambiguous. Regarding the proactivity of specific corporate environmental activities, Cañón-de-Francia and Garcés-Ayerbe (2009) argue that ISO 14001 certification could be interpreted as a pure symbolic action. In other words, corporate activities for this certification need not necessarily be voluntarily conducted under flexible conditions, but could also represent a compulsory response to market pressure. This argumentation can also be transferred to the inclusion in sustainability stock indexes. In this case, corresponding environmental and social activities may lead to additional unexpected costs, which are not directly productive, so that weaker positive or even negative impacts on financial success are possible. Due to this theoretical ambiguity, we conclude that the impact of the inclusion in the DJSI World on corporate financial performance is ultimately an empirical question.

2.2 Empirical Literature Review

The financial performance of sustainability stock indexes has already been analyzed by estimating their risk-adjusted returns (e.g., Sauer, 1997, Bauer et al., 2005, Schröder, 2007). This is methodologically in line with several corresponding portfolio analyses, which consider socially responsible and conventional mutual funds or portfolios that focus on specific corporate sustainability performance assessments (e.g., Derwall et al., 2005, Bauer et al., 2005, 2007, Kempf and Osthoff, 2007), as discussed above. In contrast, micro-econometric analyses that examine the effects of the inclusion in a sustainability stock index are rare. One example is the study of Curran and Moran (2007) who examine British firms and their inclusion in and exclusion from the specific FTSE4Good UK 50 Index. By using the event study methodology, i.e. by considering the mean stock returns for corporations experiencing a specific event (new information), they report no significant impact. This event study approach is methodologically in line with the study of Cañón-de-Francia and Garcés-Ayerbe (2009), who examine the certification according to ISO 14001, and with a growing number of CSR related event studies (e.g., Hamilton, 1995, Klassen and McLaughlin, 1996, Konar and Cohen, 1997, McWilliams and Siegel, 1997, Posnikoff, 1997, Khanna et al., 1998, Dasgupta et al., 2001, 2006, Gupta and Goldar, 2005). The corresponding events often refer to positive or negative news about specific components of CSR, such as information about toxic emissions or the disinvestment of corporations from South Africa during the apartheid regime. However, some weaknesses of such event studies are that they generally depend on unexpected events, that they only analyze short-run effects, and that they are limited to the analysis of stock performance as indicator for financial success.

Indeed, it could also be possible that the inclusion in sustainability stock indexes has a long-term effect on different measures of corporate financial performance. To our knowledge, the only micro-econometric analyses in this respect can be found in McWilliams and Siegel (2000) and Becchetti et al. (2008). They both examine the effect of the inclusion of US firms in the Domini 400 Social Index, which is an ethical stock index with a focus on firm assessments regarding gambling, tobacco, and alcohol. While McWilliams and Siegel (2000) do not find a significant impact, Becchetti et al. (2008) report positive effects on total sales per employee, but negative effects on returns on equity. It should be noted that Becchetti et al. (2008) use fixed effects models in order to control for unobserved firm heterogeneity in their panel data analysis, which is in contrast to McWilliams and Siegel (2000), who use panel data as well and emphasize the importance of a correct model specification to circumvent omitted variable biases, but do not apply flexible panel data approaches (i.e. they consider average annual values for both corporate financial performance and the inclusion in the Domini 400 Social Index). The application of flexible panel data models that include unobserved firm heterogeneity in Becchetti et al. (2008) is in line with the studies of Dowell et al. (2000), King and Lenox (2001, 2002), Elsayed and Payton (2005), and Telle (2006).

In contrast to some micro-econometric studies (e.g., Filbeck and Gorman, 2004, Ziegler et al., 2007) using stock returns as an indicator for corporate financial performance, McWilliams and Siegel (2000) and Becchetti et al. (2008) apply accounting data based indicators (Becchetti et al., 2008, additionally analyze conditional stock return volatility). This is in line with most other studies examining 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., Hart and Ahuja, 1996, Waddock and Graves, 1997, Russo and Fouts, 1997, Dowell et al., 2000, Konar and Cohen, 2001, King and Lenox, 2001, 2002, Salama, 2005, Elsayed and Paton, 2005, Telle, 2006, Guenster et al., 2006). Many of these studies, however, only use one-dimensional and rather narrow CSR indicators, such as emissions of pollutants (e.g., Hart and Ahuja, 1996, Konar and Cohen, 2001, King and Lenox 2001, 2002, Telle, 2006). Other micro-econometric analyses use more general indicators that only refer to the environmental dimension (e.g., Russo and Fouts, 1997, Dowell et al., 2000, Filbeck and Gorman, 2004, Salama, 2005, Elsayed and Paton, 2005, Guenster et al., 2006). Studies that incorporate both corporate environmental and social activities (e.g., Waddock and Graves, 1997, Ziegler et al., 2007), besides the studies on the Domini 400 Social Index as discussed above, are exceptions in this respect.

3 Methodological Approach

Similar to Dowell et al. (2000), King and Lenox (2001, 2002), Elsayed and Payton (2005), Telle (2006), and Becchetti et al. (2008), we consider panel data models for our micro-econometric analysis. While cross-sectional econometric models are still dominant so far, which is also due to limited data in the time dimension, it should be noted that unobserved firm heterogeneity and dynamic effects cannot be modeled in such approaches, so that biased parameter estimates due to omitted variables are at least possible. Our starting point is the following panel data model for firm i in year t (i = 1,…,N; t = 1,…,T):

(1) $CFP_{it} = \alpha + \beta\, DJSI_{it} + \gamma' X_{it} + \delta' Z_{it} + \varepsilon_{it}$

While CFP_{it} denotes corporate financial performance, $DJSI_{it}$ is a dummy variable that takes the value one if firm i is included in the DJSI World in year t. Furthermore, the vector X_{it} comprises several economic variables, as discussed below, which are potentially related to corporate financial performance. The vector Z_{it} comprises some time, country, and sector dummy variables. Finally, ε_{it} is the error term and α, β, and the components in the vectors γ and δ are the unknown parameters to be estimated.

Model approach (1) implies that corporate financial performance in year t is related to the inclusion in the DJSI World and to other economic variables (such as capital intensity) in the same year t. However, such approaches do not allow any conclusion about the causality of the relationship between the dependent and explanatory variables and in particular between corporate financial performance and the inclusion in the DJSI World since it can also be hypothesized that financial success positively affects the inclusion in sustainability stock indexes. Since reliable instruments are not available, we regress in the second step corporate financial performance on the inclusion in the DJSI World lagged by one year (i = 1,…,N; t = 2,…,T):

(2) $CFP_{it} = \alpha + \beta\, DJSI_{i,t-1} + \gamma'\, X_{it} + \delta'\, Z_{it} + \varepsilon_{it}$

In order to test the robustness of our estimation results, we additionally consider panel data models with additional one-year time lags for all explanatory economic variables (i = 1,…,N; t = 2,…,T):

(3) $CFP_{it} = \alpha + \beta\, DJSI_{i,t-1} + \gamma'\, X_{i,t-1} + \delta'\, Z_{it} + \varepsilon_{it}$

If it is assumed that the ε_{it} are independent and identically distributed for all i and t with expectation zero and variance $var(\varepsilon_{it}) = \sigma_{\varepsilon}^2$, we arrive at pooled regression models that can be straightforwardly estimated by ordinary least squares (OLS). Such approaches are similar to cross-sectional models and therefore could lead to spurious correlations due to unobserved firm characteristics. For example, specific management activities or business strategies may affect both the inclusion in the DJSI World and financial performance. Thus, micro-econometric studies that do not address these endogeneity problems can lead to biased parameter estimates. Therefore, we also apply panel data models including unobserved firm heterogeneity besides lagged explanatory variables as in the model approaches (2) and (3). Unobserved heterogeneity ν_i for firm i can be incorporated in (1), (2), and (3) when the error term ε_{it} is divided into two parts u_{it} and ν_i:

$$(4)\ CFP_{it} = \alpha + \beta\ DJSI_{it} + \gamma'\ X_{it} + \delta'\ Z_{it} + \nu_i + u_{it}$$

$$(5)\ CFP_{it} = \alpha + \beta\ DJSI_{i,t-1} + \gamma'\ X_{it} + \delta'\ Z_{it} + \nu_i + u_{it}$$

$$(6)\ CFP_{it} = \alpha + \beta\ DJSI_{i,t-1} + \gamma'\ X_{i,t-1} + \delta'\ Z_{it} + \nu_i + u_{it}$$

In these model approaches, the expectation of u_{it} is zero, $var(u_{it}) = \sigma_u^2$, and the covariances $cov(u_{it},u_{js}) = 0$ for $i \neq j$ or $t \neq s$ (i, j = 1,…,N; t, s = 1,…,T). If ν_i is a group specific random variable with expectation zero, $var(\nu_i) = \sigma_v^2$, $cov(\nu_i,\nu_j) = 0$ for $i \neq j$, $cov(\nu_i,u_{it}) = 0$, and ν_i uncorrelated with all explanatory variables, we arrive at different random effects models, which we will term as (4'), (5'), and (6') in the following. These models can be estimated by feasible generalized least squares (FGLS). If in contrast ν_i is a group specific constant term that does not vary over time and can be correlated with the explanatory variables, we arrive at different fixed effects models, which we will term as (4''), (5''), and (6'') in the following. The corresponding within-transformed models can be estimated by OLS as well, similar to the case of the pooled regression models.

Finally, it should be mentioned that dynamic effects could also matter. Corresponding dynamic panel data models (e.g., Bond, 2002) that include lagged dependent variables, i.e. in our case $CFP_{i,t-1}$, as explanatory variables can, for example, be estimated by Generalized Method of Moments (GMM) according to Arellano and Bond (1991). We have also experimented with this approach. However, the estimation results are rather inconsistent, which is obviously a consequence of our relatively short observation period due to the restricted availability of corresponding data. Dynamic panel data models obviously only work reliably for a larger time dimension, so that we do not report the corresponding estimation results. Furthermore, it should be mentioned that the estimation results of Elsayed and Paton (2005) suggest that allowing for unobserved firm heterogeneity is much more important with respect to correct conclusions than allowing for dynamic effects.

4 Data and Variables

Our dependent variable refers to corporate financial performance. Similar to, for example, Waddock and Graves (1997), we first consider return on assets, multiplied by 100 ("ROA*100"). Return on assets as an accounting-based measure is defined as the ratio between operating income and total assets, where operating income is equal to the after-tax profit plus net financial expenses. Thus, return on assets measures the profitability of a corporation after tax and interest. In line with, for example, Guenster et al. (2006), we alternatively consider the effect of the inclusion in the DJSI World on Tobin's Q ("Tobin's Q"). Tobin's Q is defined as the sum of market value and total debt divided by total assets. Besides the raw measure of Tobin's Q, we additionally consider the natural logarithm of Tobin's Q ("log Tobin's Q") in order to analyze the robustness of the estimation results, which is in line with the suggestion by Hirsch and Seaks (1993). While return on assets and Tobin's Q are similar in several aspects, they also have some differences. For example, return on assets is based on contemporaneous incomes, whereas Tobin's Q is rather a forward-looking measure.

Our main explanatory variable is the dummy ("DJSI World") for the inclusion in the DJSI World. Together with Dow Jones Indexes and Stoxx Limited, the SAM (Sustainable Asset Management) Group has launched a family of sustainability stock indexes to track the financial performance of corporations that are sector leaders in terms of sustainability performance (including environmental, social, and also economic criteria). All these sustainability stock indexes are based on corresponding assessments from SAM. The DJSI World intends to comprise 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). While our micro-econometric analysis refers to European corporations, we do not examine the Dow Jones Stoxx Sustainability Index (DJSI Stoxx), which intends to include the 20% most sustainable European corporations of each sector in the Dow Jones Stoxx 600 Index (DJ Stoxx 600 Index) (e.g., Ziegler and Schröder, 2009). The reason for this is that the DJSI Stoxx was first published in 2001, i.e. two years after the DJSI World, so that its analysis would strongly restrict our time dimension in the panel data.

We include several economic variables that can possibly affect corporate financial performance. The most common variable in corresponding micro-econometric analyses is firm size (e.g., Orlitzky, 2001) and is therefore also used in the studies of McWilliams and Siegel (2000) and Becchetti et al. (2008). As an indicator for firm size we include total assets (in millions Euro), which is, for example, in line with Waddock and Graves (1997). In this respect, the natural logarithm of total assets ("log total assets") is used to analyze a non-linear effect (e.g., King and Lenox, 2001, 2002, Salama, 2005, Elsayed and Paton, 2005). The second economic variable is leverage, measured by the ratio between total debt and total assets (e.g., Elsayed and Paton, 2005, Guenster et al., 2006). This variable ("debt/assets") can also be interpreted as an indicator of financing conditions of a corporation. Similar to, for example, Russo and Fouts (1997), Konar and Cohen (2001) and King and Lenox (2001, 2002) we further include the growth of sales as explanatory variable. We consider the annual growth rate (in decimals) of net sales (i.e. gross sales minus returns, discounts, and allowances) of one year compared with the net sales in the previous year ("sales growth"). This variable can be interpreted as a measure for growth dynamics of a corporation. A final explanatory economic variable is capital intensity ("capital intensity"). In line with King and Lenox (2001, 2002), we consider the ratio between capital expenditures and net sales. This variable can be considered a raw surrogate for research and development measures, which are obviously a relevant factor for corporate financial performance (e.g., McWilliams and Siegel, 2000). We do not include raw research and development measures due to the restricted availability of corresponding data, so that a corresponding analysis with a distinctly smaller number of firms could strongly distort the estimation results.

Finally, time, country, and sector dummies are included as control variables to capture time, country, and sector specific effects on corporate financial performance. Regarding the time effects, it should be noted that data are available for the years between 1999 and 2003. Against this background, we incorporate the corresponding dummy variables “2003”, “2002”, “2001”, and “2000” into the model approaches (1), (4’), and (4’’) and therefore consider the dummy for the year 1999 as omitted category. In the case of lagged explanatory variables in (2), (3), (5’), (6’), (5’’), and (6’’) we include “2003”, “2002”, “2001” and thus leave “2000” as omitted category. Regarding potential regional or political effects in different countries, we include the corresponding corporation specific dummy variables for Belgium, France, Germany, Ireland, Italy, The Netherlands, Portugal, Spain, Sweden, Switzerland, and the UK and thus treat the dummy variables for Austria, Denmark, Finland, Greece, and Norway, from which the number of analyzed firms is only between two and five, as joint omitted category. These dummy variables take the value one if a corporation has its headquarters in the respective country. It should be mentioned that the inclusion of all 15 country dummies (considering one omitted dummy variable) has led to qualitatively nearly identical estimation results for the main explanatory variables (these estimation results are not reported for brevity). The firm specific sector dummy variables refer to the different main industries according to the Industry Classification Benchmark (ICB) of Dow Jones Indexes and FTSE (http://www.icbenchmark.com), namely oil & gas, basic materials, industrials, consumer goods, health care, consumer service, telecommunications, utilities, financials, and as omitted category the technology sector. It should be noted that the sector and country dummies cannot be included in the fixed effects model since they are constant over time. Furthermore, the estimation results for these dummy variables in the pooled regression and random effects models are not presented for brevity (but are available upon request).

The population for our empirical analysis refers to the European corporations that were continuously included in the DJ Stoxx 600 Index between 1999 and 2003. In other words, we consider a balanced panel. In the case of the panel data models with unlagged explanatory variables, we can therefore examine a total of N = 266 corporations in the DJ Stoxx 600 Index and thus 1330 observations, for which we have all relevant financial data (that stem from Bloomberg) over the entire observation periods. In the case of the models with lagged explanatory variables, the number of observations for the N = 266 corporations reduces to 1064 for the time period from 2000 to 2003. We do not analyze an unbalanced panel for two reasons: First, such panel data would comprise firms that are only temporarily included in the underlying DJ Stoxx 600 Index due to their market value, which could lead to biased estimation results. Second, the additional inclusion of firms for only one or two periods could also distort the identification of unobserved firm heterogeneity over time.

5 Empirical Results

Table 1 reports the means and standard deviations as well as the minimums, medians, and maximums for the dependent and main explanatory variables in the micro-econometric analysis. According to this, for example, the inclusion in the DJSI World on average amounts to about 32% for the 266 corporations over the five years between 1999 and 2003. Table 2 and Table 3 report the mutual (Pearson) correlation coefficients for these variables, respectively. While Table 2 comprises the relationships between the dependent and unlagged explanatory variables for the time period from 1999 to 2003, Table 3 refers to the correlations between the dependent and lagged explanatory variables for the time period from 2000 to 2003. Both tables report the expected high positive correlation coefficients between the three indicators of corporate financial performance, namely “ROA*100”, “Tobin’s Q”, and “log Tobin’s Q”.

Furthermore, the high negative correlation coefficients between firm size and corporate financial performance are worth mentioning. However, the main result in these tables is the very weak and even negative relationship between the inclusion in the DJSI World and the three corporate financial performance variables. Moreover, the relationships between the explanatory variables are mostly very weak as well, so that multicollinearity problems should not distort the estimation results. The highest correlation coefficients refer to the relationship between firm size and the inclusion in the DJSI World, but are still moderate with values of 0.26 and 0.25.

Table 4, Table 5, and Table 6 report the estimation results of our micro-econometric analysis with different panel data models. While Table 4 refers to the findings for "ROA*100" as dependent variable, Table 5 and Table 6 refer to the raw measure and the natural logarithm of Tobin's Q as alternative indicators for corporate financial performance. All tables comprise the estimation results in the pooled regression models as well as the results in the random and fixed effects models, which include unobserved firm heterogeneity, respectively. Furthermore, all three tables report the findings in three different approaches for each panel data model, as discussed above. In other words, the model approaches (1), (4'), and (4'') refer to the inclusion of unlagged explanatory variables. In contrast, (2), (5'), and (5'') comprise the inclusion in the DJSI World lagged by one year as explanatory variable and the model approaches (3), (6'), and (6'') additionally comprise one-year time lags for all explanatory economic variables. According to the corresponding F tests in the pooled regression and fixed effects models as well as the Wald tests (being χ^2 tests) in the random effects models, the null hypotheses that all parameters are jointly zero can be rejected without exception at all common significance levels.

If we only consider the restrictive pooled regression models, the estimation results for our main explanatory variable are obviously clear. According to Table 4 and Table 6, the inclusion in the DJSI World is strongly positively related with return on assets and the natural logarithm of Tobin's Q at the 1% significance level, irrespective of the incorporation of unlagged or lagged explanatory variables. While Table 5 reports that this relationship is slightly weaker in the case of "Tobin's Q", it remains significant at least at the 10% significance level. Furthermore, capital intensity and (in line with the univariate correlation coefficients according to Table 2 and Table 3) particularly firm size are negatively related with corporate financial performance in all pooled regression models, mostly at the 1% significance level. Finally, the correlations between "debt/assets" and "log Tobin's Q" are strongly positive at the 1% significance level and the lagged growth of net sales has a significantly positive impact on both versions of Tobin's Q in these restricted panel data models.

However, some of these estimation results strongly change in the flexible panel data models that include unobserved firm heterogeneity. For example, the negative relationship between capital intensity and return on assets indeed remains significant in the random effects models (4') and (5'), but becomes insignificant in the random effects model (6') and in all fixed effects models. Furthermore, the correlations between capital intensity and both versions of Tobin's Q become insignificant in all random and fixed effects models. According to this, the inclusion of unobserved firm heterogeneity is obviously important with respect to the reliability of the estimation results. This conclusion is strongly confirmed by the results of the corresponding diagnostic tests. While Breusch-Pagan tests (being χ^2 tests) with respect to the random effects models can check the null hypothesis that no random effects are existent (i.e. that $\sigma_v^2 = 0$), corresponding F tests with respect to fixed effects models are able to check the null hypothesis that no fixed effects are existent (i.e. that all $v_i = 0$). Against this background, the reported test statistics imply that in each case the underlying null hypothesis that unobserved firm heterogeneity is not existent and thus the validity of pooled regression models is rejected at all common significance levels.

This finding is particularly relevant for our main explanatory variable, namely the inclusion in the DJSI World. In contrast to the estimation results in the pooled regression models, its positive relationship with return on assets becomes distinctly weaker and in some cases even insignificant in the flexible panel data models that include unobserved firm heterogeneity. This shifting of the estimation results is even stronger if "Tobin's Q" or "log Tobin's Q" are the dependent variables. Irrespective of the application of random or fixed effects models, the correlation with "DJSI World" becomes completely insignificant compared with the estimation results in the pooled regression models. This finding also holds true in the respective panel data models (5'), (5''), (6'), and (6'') with lagged "DJSI World". Against this background, neither the discussed stakeholder arguments nor the hypothesis that the reputation gains through the inclusion in a sustainability stock index are beneficial can be confirmed. On the other hand, more pessimistic views on the negative impact of necessary environmental and social activities for the inclusion in sustainability stock indexes, which can lead to additional unexpected costs being not directly productive, cannot be supported, either. In contrast, our estimation results imply a neutral effect of the inclusion in the DJSI World.

While these estimation results hold true for both the random and fixed effects models, the general superiority of one of these two flexible panel data models that include unobserved firm heterogeneity is ambiguous. This superiority can be checked by respective Hausman tests (being χ^2 tests), which test the random effects model versus the fixed effects model. The null hypothesis is the orthogonality of the random effects and the explanatory variables. Under this hypothesis, the parameter estimates in the random and fixed effects models should not differ systematically, so that the Hausman test is based on their difference. A high value of the respective test statistic thus implies the rejection of the null hypothesis, i.e. the random effects model, in favor of the validity of the fixed effects model. However, the test results are ambiguous according to Table 4, Table 5, and Table 6, i.e. the null hypothesis is in some cases rejected and in other cases not. Table 6 also reports one negative test statistic in the model approach (4'), so that no conclusion can be drawn in this case. For our preferred model approaches (6') and (6''), which allow the interpretation of causal effects of the inclusion in the DJSI World and the economic variables, the Hausman test suggests the use of the fixed effects model for the explanation of "ROA*100" (see Table 4) or "log Tobin's Q" (see Table 6) and the use of the random effects model for the explanation of "Tobin's Q" (see Table 5).

6 Conclusions

This paper empirically analyzes the effect of the inclusion in a sustainability stock index on corporate financial performance. In this respect, we examine the prominent DJSI World, which claims to comprise the world-wide leading corporations in terms of environmental and social performance. In contrast to many former studies, we consider a European perspective and therefore examine firms that were continuously included in the DJ Stoxx 600 Index between 1999 and 2003. On the basis of the corresponding firm-level data, we apply different restricted and flexible panel data models, which are able to control for unobserved firm heterogeneity. Our micro-econometric analysis with pooled regression models implies strong positive impacts of the inclusion in the DJSI World on both return on assets and Tobin's Q. However, these estimation results are obviously distorted since the validity of these restricted panel data models is statistically rejected in favor of random or fixed effects models. In these flexible panel data models, the positive impacts of the inclusion in the DJSI World on return on assets are distinctly weaker and less robust as well as even insignificant in the case of Tobin's Q. Against this background, we conclude that the estimation results in misspecified restricted panel data or cross-sectional models in former studies could be biased as well.

The rather neutral effect of the inclusion in the DJSI World on corporate financial performance can be explained by several mutual confounding factors. For example, corporate environmental and social activities in general can, on the one hand, reduce conflicts with stakeholder groups or increase the firm reputation, which could lead to higher sales or attract highly skilled and thus more productive employees. The reputation gains can further be strengthened by the inclusion in a sustainability stock index as a positive signal for a higher corporate sustainability performance. This would imply positive consequences for financial success. On the other hand, however, proactive corporate environmental and social activities that are necessary for the inclusion in the DJSI World could also be a compulsory response to market pressure and thus lead to additional unexpected costs, which are not directly productive, and therefore to negative consequences for corporate financial performance.

While these arguments implicitly assume that the inclusion in the DJSI World (similar to other sustainability stock indexes) is an appropriate indicator for corporate sustainability performance, it should be noted that the assessment and selection process for the composition of sustainability stock indexes is not yet standardized. As a consequence, factors that need not necessarily be directly connected to corporate environmental or social activities could also play a role. In this respect, Ziegler and Schröder (2009) show that the selection process by SAM, i.e. the rating and financial service institution that is responsible for the composition of the DJSI World, has a strong influence. According to this, a relatively high number of firms in the DJ World Index is never assessed at all, so that these corporations cannot be included in the DJSI World, irrespective of their environmental or social activities. This lowers the quality of the inclusion in the DJSI World as reliable indicator for environmental and social activities, so that both potential positive and negative effects of corporate sustainability performance on financial performance can be weakened.

In future studies, it would certainly be interesting to empirically disentangle the interrelationship between corporate environmental and social activities, the inclusion in sustainability stock indexes, and corporate financial performance if appropriate firm-level data are available. In order to test the robustness of our estimation results, another possible direction of further research would be the analysis of alternative sustainability stock indexes for the European or other non-US stock markets. While this paper considers return on assets and Tobin's Q as indicators for corporate financial performance, an analysis of stock performance would also be interesting, for example, by applying the event study methodology with respect to new information about the inclusion in or exclusion from the DJSI World or alternative sustainability stock indexes. In this respect, not only the common short-term event study approaches (e.g., Curran and Moran, 2007), but especially long-term event studies could be additionally applied, as they were developed and applied in financial economics (e.g., Barber and Lyon, 1997, Kothari and Warner, 1997, Lyon et al., 1999).

References

Arellano, M. and S.R. Bond (1991), Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations, *Review of Economic Studies* 58, 277-297.

Barber, B.M. and J.D. Lyon, (1997), Detecting Long-Run Abnormal Stock Returns: The Empirical Power and Specification of Test Statistics, *Journal of Financial Economics* 43, 341-372.

Barnett, M.L. and R.M. Salomon (2006), Beyond Dichotomy: The Curvilinear Relationship between Social Responsibility and Financial Performance, *Strategic Management Journal* 27, 1101-1122.

Barney, J. (1991), Firm Resources and Sustained Competitive Advantage, *Journal of Management* 17, 99-120.

Bauer, R., J. Derwall, and R. Otten (2007), The Ethical Mutual Fund Performance Debate: New Evidence from Canada, *Journal of Business Ethics* 70, 111-124.

Bauer, R., K. Koedijk, and R. Otten (2005), International Evidence on Ethical Mutual Fund Performance and Investment Style, *Journal of Banking and Finance* 29, 1751-1767.

Becchetti, L., S. Di Giacomo, and D. Pinnacchio (2008), Corporate Social Responsibility and Corporate Performance: Evidence from a Panel of US Listed Companies, *Applied Economics* 40, 541-567.

Bond, S.R. (2002), Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice, *Portugese Economic Journal* 1, 141-162.

Cañón-de-Francia, J. and C. Garcés-Ayerbe (2009), ISO 14001 Environmental Certification: A Sign Valued by the Market?, *Environmental and Resource Economics*, forthcoming.

Curran, M.M. and D. Moran (2007), Impact of the FTSE4Good Index on Firm Price: An Event Study, *Journal of Environmental Management* 82, 529-537.

Dasgupta, S., B. Laplante, and M. Nlandu (2001), Pollution and Capital Markets in Developing Countries, *Journal of Environmental Economics and Management* 42, 310-335.

Dasgupta, S., J.H. Hong, B. Laplante, and N. Mamingi (2006), Disclosure of Environmental Violations and Stock Market in the Republic of Korea, *Ecological Economics* 58, 759-777.

Derwall, J., N. Guenster, R. Bauer, and K. Koedijk (2005), The Eco-Efficiency Premium Puzzle, *Financial Analysts Journal* 61, 51-63.

Dowell, G., S. Hart and B. Yeung (2000), Do Corporate Global Environmental Standards Create or Destroy Market Value?, *Management Science* 46, 1059-1074.

Elsayed, K. and D. Paton (2005), The Impact of Environmental Performance on Firm Performance: Static and Dynamic Panel Data Evidence, *Structural Change and Economic Dynamics* 16, 395-412.

Filbeck, G. and R.F. Gorman (2004), The Relationship Between the Environmental and Financial Performance of Public Utilities, *Environmental and Resource Economics* 29, 137-157.

Friedman, M. (1970), The Social Responsibility of Business is to Increase its Profits, *The New York Times Magazine*, 13 September 1970.

Guenster, N., J. Derwall, R. Bauer, and K. Koedijk (2006), *The Economic Value of Corporate Eco-Efficiency*, LIFE Working Paper 06-15, Department of Finance, Maastricht University.

Gupta, S. and B. Goldar (2005), Do Stock Markets Penalize Environment-Unfriendly Behaviour? Evidence from India, *Ecological Economics* 52, 81-95.

Hamilton, J.T. (1995), Pollution as News: Media and Stock Market Reactions to the Toxics Release Inventory Data, *Journal of Environmental Economics and Management* 28, 98-113.

Hart, S.L. and G. Ahuja (1996), Does it Pay to be Green? An Empirical Examination of the Relationship Between Emission Reduction and Firm Performance, *Business Strategy and the Environment* 5, 30-37.

Heal, G. (2005), Corporate Social Responsibility: An Economic and Financial Framework, *Geneva Papers* 30, 387-409.

Hirsch, B.T. and T.G. Seaks (1993), Functional Form in Regression Models of Tobin's q, *The Review of Economics and Statistics* 75 (2), 381-385.

Kempf, A. and P. Osthoff (2007), The Effect of Socially Responsible Investing on Portfolio Performance, *European Financial Management* 13, 908-922.

Khanna, M., W.R. Quimo, and D. Bojilova (1998), Toxics Release Information: A Policy Tool for Environmental Protection, *Journal of Environmental Economics and Management* 36, 243-266.

King A. and M Lenox (2001), Does it Really Pay to be Green?, *Journal of Industrial Ecology* 5, 105-116.

King, A. and M. Lenox (2002), Exploring the Locus of Profitable Pollution Reduction, *Management Science* 48, 289-299.

Klassen, R.D. and C.P. McLaughlin (1996), The Impact of Environmental Management on Firm Performance, *Management Science* 42, 1199-1214.

Klassen, R.D. and D.C. Whybark (1999), The Impact of Environmental Technologies on Manufacturing Performance, *Academy of Management Journal* 42, 599-615.

Koellner, T., S. Suh, O. Weber, C. Moser, and R.W. Scholz (2007), Environmental Impacts of Conventional and Sustainable Investment Funds Compared Using Input-Output Life-Cycle Assessment, *Journal of Industrial Ecology* 11 (3), 41-60.

Konar, S. and M.A. Cohen (1997), Information as Regulation: The Effect of Community Right to Know Laws on Toxic Emissions, *Journal of Environmental Economics and Management 3*2, 109-124.

Konar, S. and M.A. Cohen (2001), Does the Market Value Environmental Performance, *The Review of Economics and Statistics* 83, 281-289.

Kothari, S.P. and J.B. Warner (1997), Measuring Long-Horizon Security Price Performance, *Journal of Financial Economics* 43, 301-339.

Lyon, J.D., B.M. Barber, and C.-L. Tsai (1999), Improved Methods for Tests of Long-Run Abnormal Stock Returns, *Journal of Finance* 54, 165-201.

MacKey, A., T.B. MacKey, and J.B. Barney (2007), Corporate Social Responsibility and Firm Performance: Investor Preferences and Corporate Strategies, *Academy of Management Review* 32, 817-835.

McWilliams, A. and D. Siegel (1997), Event Studies in Management Research: Theoretical and Empirical Issues, *Academy of Management Journal* 40, 626-657.

McWilliams, A. and D. Siegel (2000), Corporate Social Responsibility and Financial Performance: Correlation or Misspecification?, *Strategic Management Journal* 21, 603-609.

McWilliams, A. and D. Siegel (2001), Corporate Social Responsibility: A Theory of the Firm Perspective, *Academy of Management Review* 26, 117-127.

McWilliams, A., D. Siegel, and P.M. Wright (2006), Corporate Social Responsibility: Strategic Implications, *Journal of Management Studies* 43, 1-18.

Orlitzky, M. (2001), Does Firm Size Confound the Relationship Between Corporate Social Performance and Firm Performance, *Journal of Business Ethics* 33, 167-180.

Posnikoff, J.F. (1997), Disinvestment from South Africa: They Did Well by Doing Good, *Contemporary Economic Policy* 15, 76-86.

Renneboog, L., J.T. Horst, and C. Zhang (2008), Socially Responsible Investments: Institutional Aspects, Performance, and Investor Behavior, *Journal of Banking and Finance* 32, 1723-1742.

Russo, M.V. and P.A. Fouts (1997), A Resource-Based Perspective on Corporate Environmental Performance and Profitability, *Academy of Management Journal* 40, 534-559.

Salama, A. (2005), A Note on the Impact of Environmental Performance on Financial Performance, *Structural Change and Economic Dynamics* 16, 413-421.

Sauer, D.A. (1997), The Impact of Social-Responsibility Screens on Investment Performance: Evidence from the Domini 400 Social Index and Domini Equity Mutual Fund, *Review of Financial Economics* 6, 137-149.

Schröder, M. (2007), Is there a Difference? The Performance Characteristics of SRI Equity Indices, *Journal of Business Finance and Accounting* 34 (1) & (2), 331-348.

Shleifer, A. and R.W. Vishny (1997), A Survey of Corporate Governance, *Journal of Finance* 52, 737-783.

Telle, K. (2006), "It Pays to be Green" – a Premature Conclusion?, *Environmental and Resource Economics* 35, 195-220.

Tirole, J. (2006), *The Theory of Corporate Finance*, Princeton: Princeton University Press.

Waddock, S. and S.B. Graves (1997), The Corporate Social Performance – Financial Performance Link, *Strategic Management Journal* 18, 303-319.

Ziegler, A. and M. Schröder (2009), What Determines the Inclusion in a Sustainability Stock Index? A Panel Data Analysis for European Companies, *Ecological Economics*, forthcoming.

Ziegler, A., M. Schröder, and K. Rennings (2007), The Effect of Environmental and Social Performance on the Stock Performance of European Corporations, *Environmental and Resource Economics* 37, 661-680.

Appendix

Table 1: Descriptive statistics, N = 266 corporations, time dimension refers to the period between 1999 and 2003 (1330 observations)

Variable	Mean	Std. deviation	Minimum	Median	Maximum
ROA*100	6.79	6.70	-23.14	5.82	60.16
Tobin's Q	1.29	1.55	0.04	0.90	17.96
Log Tobin's Q	-0.09	0.80	-3.25	-0.11	2.89
DJSI World	0.32	0.47	0	0	1
Log total assets	23.53	1.64	18.80	23.21	27.57
Debt/assets	0.29	0.16	0	0.29	1.42
Net sales growth	0.10	0.41	-0.86	0.05	10.86
Capital intensity	0.09	0.23	0	0.05	4.56

Table 2: Mutual correlation coefficients between dependent and unlagged explanatory variables, N = 266 corporations, 1330 observations, time dimension refers to the period between 1999 and 2003

	ROA*100	Tobin's Q	Log Tobin's Q	DJSI World	Log total assets	Debt/assets	Net sales growth	Capital intensity
ROA*100	1							
Tobin's Q	0.70	1						
Log Tobin's Q	0.73	0.77	1					
DJSI World	-0.05	-0.06	-0.05	1				
Log total assets	-0.57	-0.42	-0.60	0.26	1			
Debt/assets	-0.10	-0.09	0.08	0.01	0.14	1		
Net sales growth	0.07	0.06	0.03	-0.08	0.00	-0.02	1	
Capital intensity	-0.05	-0.03	0.01	0.00	-0.06	0.12	0.01	1

Table 3: Mutual correlation coefficients between dependent and lagged explanatory variables, N = 266 corporations, 1064 observations, time dimension refers to the period between 2000 and 2003

	ROA*100	Tobin's Q	Log Tobin's Q	DJSI World	Log total assets	Debt/assets	Net sales growth	Capital intensity
ROA*100	1							
Tobin's Q	0.69	1						
Log Tobin's Q	0.72	0.78	1					
DJSI World	-0.04	-0.05	-0.04	1				
Log total assets	-0.56	-0.45	-0.61	0.25	1			
Debt/assets	-0.08	-0.08	0.09	0.01	0.13	1		
Net sales growth	0.03	0.08	0.11	-0.10	-0.02	0.01	1	
Capital intensity	-0.04	-0.04	0.01	-0.01	-0.06	0.12	0.02	1

*Table 4: Parameter estimates (z statistics) in different panel data models, dependent variable: ROA*100, N = 266 corporations*

	Pooled regression models			Random effects (RE) models			Fixed effects (FE) models		
Explanatory variables	(1)	(2)	(3)	(4’)	(5’)	(6’)	(4’’)	(5’’)	(6’’)
DJSI World	1.07*** (3.69)	-- (--)	-- (--)	0.41 (1.44)	-- (--)	-- (--)	0.21 (0.69)	-- (--)	-- (--)
DJSI World (lagged)	-- (--)	1.01*** (3.01)	1.10*** (3.23)	-- (--)	0.53* (1.74)	0.58* (1.88)	-- (--)	0.46 (1.39)	0.55* (1.69)
Log total assets	-2.17*** (-12.88)	-2.04*** (-11.38)	-- (--)	-2.51*** (-11.84)	-1.90*** (-8.39)	-- (--)	-4.11*** (-9.63)	-1.83*** (-3.21)	-- (--)
Log total assets (lagged)	-- (--)	-- (--)	-2.10*** (-10.92)	-- (--)	-- (--)	-1.80*** (-8.26)	-- (--)	-- (--)	-0.74 (-1.63)
Debt/assets	0.71 (0.43)	-0.22 (-0.13)	-- (--)	1.03 (0.92)	-3.54*** (-2.77)	-- (--)	1.21 (0.89)	-6.24*** (-3.70)	-- (--)
Debt/assets (lagged)	-- (--)	-- (--)	1.26 (0.77)	-- (--)	-- (--)	6.23*** (5.49)	-- (--)	-- (--)	9.83*** (7.12)
Net sales growth	1.17 (1.42)	0.97 (1.09)	-- (--)	0.89*** (4.10)	0.76*** (3.61)	-- (--)	0.92*** (4.21)	0.74*** (3.52)	-- (--)
Net sales growth (lagged)	-- (--)	-- (--)	0.52 (0.87)	-- (--)	-- (--)	-0.29 (-0.89)	-- (--)	-- (--)	-0.54 (-1.64)
Capital intensity	-2.76*** (-5.04)	-3.17*** (-4.98)	-- (--)	-1.54** (-2.48)	-1.65* (-1.69)	-- (--)	-0.91 (-1.34)	-1.09 (-0.93)	-- (--)
Capital intensity (lagged)	-- (--)	-- (--)	-2.12*** (-3.78)	-- (--)	-- (--)	-0.63 (-1.03)	-- (--)	-- (--)	-0.16 (-0.24)
2003	-0.99** (-2.10)	-0.84* (-1.83)	-0.45 (-1.03)	-0.78*** (-2.94)	-0.75*** (-3.20)	-0.63** (-2.57)	-0.34 (-1.21)	-0.72*** (-3.05)	-1.00*** (-3.69)
2002	-1.20** (-2.46)	-0.91* (-1.89)	-0.64 (-1.45)	-1.01*** (-3.78)	-0.92*** (-4.01)	-0.81*** (-3.47)	-0.53* (-1.87)	-0.91*** (-3.92)	-1.19*** (-4.55)
2001	-0.61 (-1.38)	-0.42 (-0.97)	-0.33 (-0.77)	-0.48* (-1.82)	-0.44* (-1.94)	-0.39* (-1.69)	0.02 (0.06)	-0.43* (-1.90)	-0.65*** (-2.68)
2000	-0.19 (-0.43)	-- (--)	-- (--)	-0.07 (-0.29)	-- (--)	-- (--)	0.28 (1.04)	-- (--)	-- (--)
Constant	61.01*** (13.46)	56.90*** (12.12)	57.50*** (12.10)	68.34*** (14.01)	54.41*** (10.40)	50.42*** (10.08)	103.31*** (10.36)	51.81*** (3.87)	21.73** (2.06)
Country and sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
F statistic (all parameters)	51.66***	44.89***	40.95***	--	--	--	18.63***	8.87***	11.11***
Wald statistic (all parameters)	--	--	--	390.79***	287.66***	283.84***	--	--	--
R^2 (overall)	0.44	0.43	0.43	0.43	0.42	0.41	0.33	0.31	0.08
Breusch-Pagan statistic (RE)	--	--	--	1148.52***	835.38***	812.05***	--	--	--
F statistic (FE)	--	--	--	--	--	--	13.55***	14.25***	14.60***
Hausman statistic (RE, FE)	--	--	--	14.04	9.46	20.61***	--	--	--
Time period	1999-2003	2000-2003	2000-2003	1999-2003	2000-2003	2000-2003	1999-2003	2000-2003	2000-2003
Number of observations	1330	1064	1064	1330	1064	1064	1330	1064	1064

Note:
** (**, ***) means that the appropriate parameter is different from zero or that the underlying null hypothesis is rejected at the 10% (5%, 1%) significance level, respectively.*

Table 5: Parameter estimates (z statistics) in different panel data models, dependent variable: Tobin's Q, N = 266 corporations

	Pooled regression models			Random effects (RE) models			Fixed effects (FE) models		
Explanatory variables	(1)	(2)	(3)	(4')	(5')	(6')	(4'')	(5'')	(6'')
DJSI World	0.17** (2.41)	-- (--)	-- (--)	0.02 (0.29)	-- (--)	-- (--)	-0.05 (-0.66)	-- (--)	-- (--)
DJSI World (lagged)	-- (--)	0.11* (1.65)	0.13** (1.96)	-- (--)	0.03 (0.37)	0.04 (0.50)	-- (--)	-0.01 (-0.10)	-0.00 (-0.04)
Log total assets	-0.37*** (-8.37)	-0.31*** (-7.18)	-- (--)	-0.49*** (-9.44)	-0.31*** (-6.64)	-- (--)	-1.17*** (-10.22)	-0.48*** (-3.49)	-- (--)
Log total assets (lagged)	-- (--)	-- (--)	-0.32*** (-7.56)	-- (--)	-- (--)	-0.33*** (-7.35)	-- (--)	-- (--)	-0.46*** (-4.17)
Debt/assets	0.46 (1.48)	0.48 (1.63)	-- (--)	0.83*** (2.89)	0.14 (0.50)	-- (--)	1.12*** (3.06)	-0.23 (-0.57)	-- (--)
Debt/assets (lagged)	-- (--)	-- (--)	0.42* (1.68)	-- (--)	-- (--)	0.25 (1.00)	-- (--)	-- (--)	0.10 (0.31)
Net sales growth	0.14 (1.27)	0.10 (0.95)	-- (--)	0.06 (0.96)	0.03 (0.67)	-- (--)	0.07 (1.12)	0.03 (0.52)	-- (--)
Net sales growth (lagged)	-- (--)	-- (--)	0.24** (2.54)	-- (--)	-- (--)	0.09 (1.12)	-- (--)	-- (--)	0.08 (1.07)
Capital intensity	-0.45*** (-4.13)	-0.51*** (-4.27)	-- (--)	-0.23 (-1.40)	-0.21 (-0.98)	-- (--)	-0.02 (-0.10)	0.05 (0.18)	-- (--)
Capital intensity (lagged)	-- (--)	-- (--)	-0.35*** (-3.74)	-- (--)	-- (--)	-0.15 (1.08)	-- (--)	-- (--)	-0.04 (-0.26)
2003	-0.62*** (-5.28)	-0.43*** (-4.19)	-0.33*** (-3.45)	-0.57*** (-8.06)	-0.41*** (-7.39)	-0.33*** (-5.75)	-0.40*** (-5.29)	-0.40*** (-7.06)	-0.29*** (-4.34)
2002	-0.64*** (-5.48)	-0.44*** (-4.28)	-0.37*** (-3.84)	-0.60*** (-8.36)	-0.44*** (-8.03)	-0.37*** (-6.67)	-0.41*** (-5.31)	-0.43*** (-7.76)	-0.32*** (-5.11)
2001	-0.39*** (-3.19)	-0.20* (-1.86)	-0.19* (-1.80)	-0.35*** (-5.03)	-0.20*** (-3.75)	-0.17*** (-3.15)	-0.15** (-1.97)	-0.19*** (-3.42)	-0.14** (-2.40)
2000	-0.20 (-1.39)	-- (--)	-- (--)	-0.17** (-2.38)	-- (--)	-- (--)	-0.02 (-0.26)	-- (--)	-- (--)
Constant	13.07*** (11.06)	10.97*** (9.03)	11.15*** (9.22)	15.64*** (13.25)	10.98*** (10.26)	11.29*** (11.06)	28.76*** (10.74)	12.78*** (3.97)	12.06*** (4.73)
Country and sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
F statistic (all parameters)	18.79***	17.22***	17.25***	--	--	--	30.02***	13.18***	13.82***
Wald statistic (all parameters)	--	--	--	406.43***	290.64***	304.81***	--	--	--
R^2 (overall)	0.38	0.38	0.39	0.37	0.38	0.38	0.18	0.20	0.21
Breusch-Pagan statistic (RE)	--	--	--	877.88***	644.50***	637.00***	--	--	--
F statistic (FE)	--	--	--	--	--	--	11.88***	11.00***	10.90***
Hausman statistic (RE, FE)	--	--	--	49.79***	8.09	9.55	--	--	--
Time period	1999-2003	2000-2003	2000-2003	1999-2003	2000-2003	2000-2003	1999-2003	2000-2003	2000-2003
Number of observations	1330	1064	1064	1330	1064	1064	1330	1064	1064

Note:
** (**, ***) means that the appropriate parameter is different from zero or that the underlying null hypothesis is rejected at the 10% (5%, 1%) significance level, respectively.*

Table 6: Parameter estimates (z statistics) in different panel data models, dependent variable: Log Tobin's Q, N = 266 corporations

	Pooled regression models			Random effects (RE) models			Fixed effects (FE) models		
Explanatory variables	(1)	(2)	(3)	(4')	(5')	(6')	(4'')	(5'')	(6'')
DJSI World	0.16*** (4.67)	-- (--)	-- (--)	0.02 (0.95)	-- (--)	-- (--)	0.01 (0.31)	-- (--)	-- (--)
DJSI World (lagged)	-- (--)	0.13*** (3.30)	0.14*** (3.75)	-- (--)	0.03 (1.09)	0.03 (1.26)	-- (--)	0.03 (0.97)	0.02 (0.85)
Log total assets	-0.24*** (-17.98)	-0.23*** (-15.58)	-- (--)	-0.22*** (-10.71)	-0.17*** (-7.36)	-- (--)	-0.23*** (-6.52)	-0.02 (-0.45)	-- (--)
Log total assets (lagged)	-- (--)	-- (--)	-0.23*** (-16.19)	-- (--)	-- (--)	-0.19*** (-9.23)	-- (--)	-- (--)	-0.13*** (-3.63)
Debt/assets	1.14*** (10.10)	1.16*** (9.12)	-- (--)	0.75*** (7.59)	0.57*** (4.93)	-- (--)	0.62*** (5.53)	0.27* (1.92)	-- (--)
Debt/assets (lagged)	-- (--)	-- (--)	1.09*** (8.90)	-- (--)	-- (--)	0.50*** (5.01)	-- (--)	-- (--)	0.26** (2.31)
Net sales growth	0.05 (0.84)	0.03 (0.44)	-- (--)	0.01 (0.53)	0.00 (0.06)	-- (--)	0.01 (0.44)	-0.00 (-0.05)	-- (--)
Net sales growth (lagged)	-- (--)	-- (--)	0.24*** (5.75)	-- (--)	-- (--)	0.08*** (2.90)	-- (--)	-- (--)	0.06** (2.17)
Capital intensity	-0.12*** (-3.22)	-0.12** (-2.57)	-- (--)	-0.05 (-1.03)	0.03 (0.30)	-- (--)	-0.05 (-0.91)	-0.01 (-0.09)	-- (--)
Capital intensity (lagged)	-- (--)	-- (--)	-0.09** (-2.35)	-- (--)	-- (--)	-0.04 (0.83)	-- (--)	-- (--)	-0.06 (-1.03)
2003	-0.30*** (-6.42)	-0.24*** (-5.25)	-0.17*** (-3.95)	-0.28*** (-12.63)	-0.23*** (-11.66)	-0.18*** (-8.74)	-0.27*** (-11.72)	-0.23*** (-11.85)	-0.19*** (-8.51)
2002	-0.35*** (-7.15)	-0.27*** (-5.68)	-0.23*** (-5.07)	-0.32*** (-14.60)	-0.27*** (-14.25)	-0.23*** (-11.67)	-0.32*** (-13.46)	-0.28*** (-14.64)	-0.24*** (-11.19)
2001	-0.15*** (-3.24)	-0.09** (-1.99)	-0.09** (-2.13)	-0.14*** (-6.47)	-0.09*** (-4.99)	-0.08*** (-4.13)	-0.14*** (-5.82)	-0.10*** (-5.55)	-0.09*** (-4.33)
2000	-0.06 (-1.20)	-- (--)	-- (--)	-0.05** (-2.38)	-- (--)	-- (--)	-0.05** (-2.13)	-- (--)	-- (--)
Constant	6.37*** (20.17)	5.86*** (16.91)	5.89*** (17.46)	6.06*** (12.44)	4.67*** (8.87)	5.17*** (10.72)	5.30*** (6.44)	0.43 (0.39)	3.09*** (3.56)
Country and sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
F statistic (all parameters)	57.42***	45.82***	46.95***	--	--	--	55.48***	34.92***	38.05***
Wald statistic (all parameters)	--	--	--	896.23***	625.79***	687.58***	--	--	--
R^2 (overall)	0.59	0.59	0.60	0.58	0.57	0.58	0.41	0.11	0.40
Breusch-Pagan statistic (RE)	--	--	--	1572.55***	1021.54***	992.85***	--	--	--
F statistic (FE)	--	--	--	--	--	--	28.20***	27.66***	27.35***
Hausman statistic (RE, FE)	--	--	--	[-17.91]	33.36***	20.55***	--	--	--
Time period	1999-2003	2000-2003	2000-2003	1999-2003	2000-2003	2000-2003	1999-2003	2000-2003	2000-2003
Number of observations	1330	1064	1064	1330	1064	1064	1330	1064	1064

Note:
** (**, ***) means that the appropriate parameter is different from zero or that the underlying null hypothesis is rejected at the 10% (5%, 1%) significance level, respectively.*

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