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Asymmetry in Stock Market Reactions to Changes in Membership of the Dow Jones Sustainability Index

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This article empirically explores investors' response to firm sustainability efforts as evidenced by inclusion or exclusion from the Dow Jones Sustainability Index (DJSI) using the event study method. The DJSI selection process is posited to mimic a relative performance evaluation tournament generating an incremental amplified sustainability valuation signal. While the extant literature has treated effects of DJSI additions and deletions as being theoretically symmetrical but opposite in direction, we hypothesize that expectation of such opposing symmetry of response is unwarranted. Deletion from the DJSI is conditional on initial inclusion in the DJSI, and investors are therefore likely to perceive deletion as an indicator of a failed strategy or investment and react non-positively. The results suggest that markets on average reacted negatively to DJSI inclusion and non-positively to exclusion as hypothesized, and corporate social responsibility leadership by highly leveraged firms is viewed less favorably.

Keywords: Corporate Social Responsibility, Event Study, Sustainability Index, Stock Market Reaction, Value Relevance

JEL Classification: M14, G14, M40

I. Introduction

Sustainability, triple bottom line performance, and corporate social responsibility (CSR) are commonly found terms in company annual reports, mission statements, and CEO talks, reflecting the growing importance of these concepts to corporate strategy. In a survey conducted by the Massachusetts Institute of Technology and the Boston Consulting Group, 70 percent of firms reported that sustainability was on their top management agenda, and 67 percent responded that sustainability was critically important to being competitive (Kiron *et al*., 2012). Another study found that about 80 percent of responding investors had considered sustainability concepts in one or more contexts within the past year (PWC, 2014). Sustainable, responsible, and impact investing (SRI) is growing rapidly; the total U.S.-domiciled assets under management using SRI strategies expanded from less than $0.3 trillion in 1995 to $6.57 trillion at the start of 2014, accounting for one sixth of professionally managed investments (US-SIF, 2015). Given the considerable interest in sustainability issues, a key question that arises is how stock markets perceive and respond to such sustainability efforts by corporations.

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We explore the value relevance of sustainability disclosures by empirically analyzing stock market reactions to a firm's inclusion in or exclusion from the Dow Jones Sustainability Index (DJSI). We focus on the DJSI because inclusion in the DJSI is based on a comprehensive sustainability performance evaluation that draws on multiple sources of information. Only the top performing 'best in class' firms in their industry sectors are included in the DJSI. Therefore, we consider DJSI inclusion as an informative relative performance indicator of a firm's sustainability leadership. To assess the value relevance of changes in sustainability leadership, we analyze stock market price responses to announcements about DJSI changes (196 additions and 133 deletions) during the period 2002-2011, using the event study method.

A large body of extant literature has analyzed stock market reactions to firm additions to and deletions from indices such as the S&P 500 Index. A few recent articles have specifically analyzed stock market reactions to DJSI inclusions and exclusions using the event study method (Hawn *et al*., 2014; Oberndorfer *et al*., 2013; Cheung and Roca, 2013; Hawn *et al.*, 2013; Lackmann *et al.*, 2012; Cheung, 2011; Robinson *et al.*, 2011; Consolandi *et al*., 2009). These studies test hypotheses about the average directional effect of DJSI inclusion/exclusion by estimating the cumulative abnormal return (CAR) in the event window, where the event of interest is the announcement of DJSI changes. However, the findings are not unequivocal; reported results range from positive or statistically insignificant to negative CARs in response to inclusion in the DJSI depending on the study period and geographical coverage. Even within a single study, both the direction and magnitude of reported CARs are sensitive to the choice and the length of the event window. (See Table 1 for a summary). For example, Oberndorfer *et al.* (2013) and Cheung and Roca (2013) report negative market reactions to DJSI inclusions, but Lackmann *et al.* (2012), and Consolandi *et al.* (2009) report generally positive reactions, while Cheung (2011) and Karlsson and Chakarova (2008) report either mixed or statistically insignificant reactions. Index deletions generally result in either negative or statistically insignificant market reactions in these studies.

Our analysis differs from these prior studies in a number of ways. Theoretically, we posit that the DJSI selection process mimics a relative performance evaluation tournament, and as a result should create amplified valuation signals for the winners, i.e. firms that are ultimately included in the DJSI. Extant literature has treated effects of DJSI additions and deletions as being theoretically symmetrical but opposite in direction; i.e. if addition to the DJSI is value adding and results in positive CARs, then deletions from the DJSI should be value destroying resulting in negative CARs and vice versa. We argue that expectation of such opposing symmetry of response is unwarranted, because deletion from the DJSI is conditional on initial inclusion in the DJSI and hence addition and deletion events are not equivalent. Once a firm has been added to the DJSI, it has already incurred the costs of attaining the 'sustainability' reputation, and expected future costs and benefits of such sustainability leadership are incorporated into stock prices at the time. When such a firm is subsequently deleted from the DJSI, it will not be able to reap the potential future benefits from these prior reputation investments any more, and they become sunk costs. As a result, investors perceive deletion mostly as an indicator of a failed strategy or investment. Hence the stock market will negatively react to DJSI deletions regardless of their reaction to initial inclusion in the DJSI. In other words, while in consonance with prior literature we hypothesize that initial inclusion in the DJSI may have either positive or negative effects on firm returns (or CAR), we posit that subsequent deletion from the DJSI will always have a non-positive effect on stock returns. This novel theoretical insight helps to reconcile apparently inconsistent findings in prior studies.

Table 1: Summary of Main Results from Prior Event Studies of DJSI Status Change

Study	Index/geographical /temporal coverage	Event window	CAR for DJSI Addition	CAR for DJSI Deletion
Oberndorfer *et al*., 2013	German firms added to DJSI-STOXX and DJSI World (1999-2002)	AD or ED whichever is earlier. (0, +5)	Negative	NA
Cheung and Roca, 2013	DJS World Index-stocks listed in 9 Asia-Pacific countries (2002-10)	AD-15 to AD, AD to ED, ED+1 to ED+30	Usually negative and significant	Mixed: positive (ED windows) and negative (AD windows) and negative for longer windows
Lackmann *et al*., 2012	DJSI-STOXX, Europe (2001-08)	AD (-2,+2), (-5,+5) , (-10, +10)	Positive and significant for all windows	No significant effect
Cheung, 2011*	US firm inclusion/exclusion from DJSI World (2002-2008)	Various AD, AD+4, ED, ED+4 and a long AD-15 to CD+60	Mixed, not significant except two specific days ED(-ve), ED+2 (+)	Mixed, not significant, except CD+1 (-ve)
Robinson *et al*., 2011	DJSI-North America (2003-07)	AD to ED-1, ED to ED+60	Negative (not-significant) for AD to ED-1; and positive for ED to ED+60	Not significant
Consolandi *et al*., 2009	DJStoxx 600 and DJSI within DJStoxx 600, (2002-06)	Various, covering AD-10 to ED+10	Positive for [AD+1 to ED-1], [AD-10, ED+10]	Not significant for short windows; but negative for longer windows [AD-10 to ED+10]
Karlsson and Chakarova, 2008	Nine country firm inclusions/exclusions from DJSI World (2002-2006)	AD	No statistically significant effect	No statistically significant effect

AD= Announcement date, ED=Effective date.
***** Cheung (2011) refers to the effective date as change date (CD), but for consistency we rename his CD as ED.

Finally, our definition of the event is more nuanced compared to previous studies. We differentiate between the initial announcement date (AD), the effective date (ED) on which the changes in the DJSI become effective, and the actual day (AcD) on which the information about a particular firm becomes publicly available. We define the event as the day on which the information on addition/deletion becomes publicly available for the first time, which is more appropriate and accurate. Our approach helps to narrow the event window, unlike prior studies which have typically chosen longer event windows because of the long lag between the announcement date and effective date. It is well understood that longer event windows reduce the reliability of results because of other potential confounding events (MacKinlay, 1997; McWilliams and Siegel, 1997). Our study thus contributes to this literature by addressing the limitations of extant studies, presenting new theoretical insights that help reconcile conflicting results in prior studies, and providing supporting empirical analyses.

II. Background and Hypotheses

A. Value Relevance of Sustainability Performance

Discourse on whether firms should engage in CSR activities, and if and how sustainability efforts can add to firm value, has a long history. For example, Bowen (1953) argued that businessmen have obligations to pursue policies, decisions, and lines of action which are desirable in terms of the objectives and values of society, while Friedman (1970) suggested that the only social responsibility of business is to maximize shareholder wealth, subject to explicit compliance with extant laws and regulations. Others have suggested that there is no inherent conflict between shareholder wealth maximization and social responsibility because businesses stand to gain in the long run from their social responsibility (Davis, 1960). Beginning with Porter's (1991) contention that firms can be both 'green and competitive' by engaging in pollution prevention and efficiency improvement supported by smart regulations, researchers have identified a number of mechanisms through which sustainability efforts can contribute to improving firm value and shareholder wealth which draw on neo-classical economics, instrumental stakeholder theory, resource based view (RBV), and institutional theory. These include: CSR leads to reduced regulatory enforcement and lower costs of compliance relative to rivals; pollution reduction lowers environmental risks and contingent liabilities; CSR helps product differentiation and higher willingness to pay by the growing green consumer market segments due to "moral reputation capital"; CSR provides preferential access to scarce unique resources and assures sustainability of resources in the long run; stakeholder engagement provides legitimacy and reduces the risk of adverse social reactions to firm initiatives; it lowers the cost of capital by signaling long term viability and attracting socially conscious investors; improved CSR reputation attracts better employees and lowers employee turnover; and motivated efforts to address big societal issues enable sustained innovation and growth (Hart, 2005; Porter and Kramer, 2006; Orlitzky, 2008; Dhaliwal, *et al.*, 2011, Wang *et al.*, 2015). Porter and Kramer (2011) propose the concept of sustainability as a shared value creation process that can enhance the competitiveness of a company and unlock the next wave of business innovation and growth while simultaneously advancing the economic and social conditions of the communities in which it operates. The key message of this stream of literature is that firm value is positively associated with firm sustainability performance and strategy.

At the same time, researchers have also identified pathways by which CSR can adversely affect financial performance. For example, firms may make suboptimal choices because of additional constraints imposed by sustainability considerations on firm production technology; competitive disadvantage may result from CSR demands for regulatory over-compliance and higher costs; lost productivity may occur because of diversion of resources and managerial attention; managers may engage in CSR activities to further their personal agenda and reputation at the cost of investors. CSR may encourage unproductive ceremonial institutional practices decoupled from operational requirements; and CSR activities may result in corporate charity serving the interests of stakeholders at the cost of shareholders (Jaffe *et al.*, 1995; Waddock and Graves, 1997; Cheung and Roca 2013, Lys *et al.*, 2015).

Given the ambivalence of the theoretical predictions, a large number of studies have simply used a positive theory approach and empirically examined the relationship between corporate sustainability performance (CSP) and financial performance (FP). Orlitzky (2008) provides a review and synthesis of this literature and reports mixed results. Margolis *et al.* (2009) analyze 251 prior CSP/FP studies and find that 59 percent of these studies reported a non-significant

relationship, 28 percent a positive relationship, and 2 percent a negative relationship between CSP and FP. Allouche and Laroche (2005) review 82 prior studies and report that although 75 studies reported a positive association, a statistically significant positive effect was found only in 50 percent of them. Statistical meta-analysis of 42 studies by Wang *et al*. (2015) indicates an overall positive relationship between CSP and FP.

The mixed empirical findings have been attributed to several theoretical and empirical difficulties, such as defining reliable and consistent measures of CSP, controlling for macroeconomic, industry, and firm specific moderator and mediating factors, and incorporating delayed/nonlinear effects of CSP on FP. Understandably results vary depending on the measures of FP and CSP used, and the adequacy of control variables. Financial performance indicators used in these studies are relatively straightforward and include either accounting measures (e.g., return on assets, return on equity) or market measures (e.g., stock returns, market/book value ratio). We posit that stock market movements are likely to provide a better summary measure of expected future performance compared to past, period based accounting measures such as ROI and ROE because stock prices are forward looking, and, in efficient markets, incorporate all the available information about expected future cash flows of the firm.

Because CSP is a complex multidimensional construct, developing satisfactory CSP measures is a major challenge. Margolis *et al.* (2009) discuss two main strategies used in empirical operationalization of CSP, first based on dimensions of CSP (e.g. corporate policies, disclosure, environmental emissions, philanthropic donations, and misdeeds), and the second based on the source of CSP appraisal (e.g. self-reports, observer perceptions, third party audit ratings). CSR dimensions suggested by others include measures of principles, processes, responsiveness, and outcomes (Carroll, 1979; Wood, 1991; Wartick and Cochran, 1985). Many organizations such as the Global Reporting Initiative (GRI), the International Standards Organization (ISO) through their ISO 14000 and ISO 26000 series of standards, the Investor Responsibility Research Center (IRRC), the Sustainability Accounting Standards Board (SASB), and Kinder, Lydenberg, Domini Inc. (KLD) have invested significant efforts in identifying key performance metrics and developing aggregate indices that enable reliable and consistent assessment and disclosure of corporate sustainability performance that can be compared across firms and over time. For example, GRI recommends sustainability disclosures covering economic, environmental, and social dimensions that include direct and indirect economic impacts, materials, energy and emission information, labor practices, human rights, societal impacts, and product responsibility. Moreover, because relevant performance metrics are likely to vary significantly across industries, GRI is developing sector specific guidance documents. In contrast, ISO standards are primarily process focused, and KLD ratings are based on evaluations of strengths and areas of concern. Most of the ‘socially responsible’ mutual funds tend to use relatively simple environmental, safety, and governance (ESG) screening criteria to decide on which firms to exclude from their portfolios.

B. Relative Performance Appraisal and Tournaments

An investor who views CSR as a long term sustainable value creation proposition and wants the firm management to invest in CSP faces two key uncertainties. First, there is imperfect information arising from difficulties in measuring sustainability performance combined with unobservable managerial effort toward meeting sustainability goals. Second, the ultimate sustainability performance, however measured, depends not only on a firm's strategy and activities, i.e. managerial effort, but also on external circumstances, macroeconomic and sector specific market conditions, stakeholder reactions, and the broader socio-political environment. From an investor's perspective therefore, a firm's sustainability performance is characterized by both high environmental uncertainty and imperfect information. Economic theory suggests that under circumstances characterized by these attributes, relative performance appraisal and rank order tournaments can facilitate better performance. The intuition is that relative performance appraisal controls for common uncertainty in the environment, while tournament schemes where the rewards are based mainly on the relative rank, incentivize managers (firms) to overcome risk aversion and adopt more 'profitable' production techniques (Lazear and Rosen, 1981; Green and Stokey, 1983; Nalebuff and Stiglitz, 1983; Holmstrom, 1982).

Rosen (1986) seeks to theoretically explain relatively large rewards for top ranks in tournaments. For example, it is commonly observed that the top four semifinalists receive more than 50 percent of the total purse in premier tennis tournaments. He analytically shows that an elimination tournament design requires an extra reward for the overall winner in order to maintain performance incentives throughout the game. The intuition of this result is that a competitor's performance incentives at any stage are set by an option value; while the loser's prize is guaranteed at that stage, winning gives the option to continue on to all successive stages of the tournament. The difference in prize money between winning and losing must incorporate the equivalent of the survival option that maintained incentives at earlier stages. The large reward at the top arises from the no-tomorrow aspects of the final stage of the game where all options expire. In other words, Rosen (1986) suggests that large top-ranking prizes are required to incentivize competitors to aspire to higher goals independent of achievements in the previous rounds of the tournament. If top prizes are not large enough, those who have succeeded in achieving somewhat higher ranks (or won previous rounds) can rest on their laurels and slack off in their attempts to climb higher.

In the next section, we briefly describe the process used by Dow Jones to select firms for inclusion in the DJSI, and then suggest that the selection process mimics a relative sustainability performance based tournament, where the winning firm is rewarded with inclusion in the DJSI. Investors reward firms who win such CSP contests by "voting with their feet," by their higher willingness to pay for the stocks of winning firms, thereby increasing their stock prices. This mechanism also has the added benefit of indirectly rewarding managers who have traditional stock price based incentive compensation contracts. On the other hand, if investors perceive that CSR efforts do not create value, they can reduce their holdings of stocks of firms winning such CSP contests, which is equivalent to penalizing the worst performers in traditional tournament based compensation schemes.

We hypothesize that winning such CSP contests will have information value over and above (i.e. incremental to) other firm-specific CSP indicators because of the relative performance appraisal aspect. Further, drawing on the model results from Rosen (1986), we postulate that stock market reaction to such winning will provide an amplified signal of investor valuation of CSR,

because in order to maintain appropriate incentives, the winners of such CSP contests must receive extra rewards that represent expired option values of earlier stages.

C. Dow Jones Sustainability Index

The DJSI is administered by the Sustainability Asset Management (SAM), a Zurich-based fund management firm that devised the idea for the DJSI. SAM is also responsible for the selection process. Firms are selected for inclusion in the DJSI from the population of firms in the Dow Jones Global Total Stock Market (DJGTSM) index consisting of the largest 2,500 companies by free-float market capitalization. DJSI firms come from 18 different sectors. For selecting firms, SAM conducts comprehensive corporate sustainability assessments drawing on four sources of information:

1) Company Questionnaires: Companies that wish to be considered for index membership fill out a detailed questionnaire signed by a senior company representative. The questionnaire has weighted questions on economic, social, and environmental factors that cover both generic and industry specific topics (DJSI, 2011).

2) Company Documentation: Documents requested from companies include sustainability reports, environmental reports, health and safety reports, social reports, annual financial reports, special reports (e.g., reports on corporate governance, R&D, employee relations, etc.), and all other sources of company information (e.g., internal documentation, brochures, and website).

3) Media and Stakeholder Analysis (MSA): SAM uses MSA to identify and assess issues that may present financial, reputational, and compliance risks to the assessed companies. SAM makes use of media coverage, stakeholder commentaries, and other publicly accessible sources.

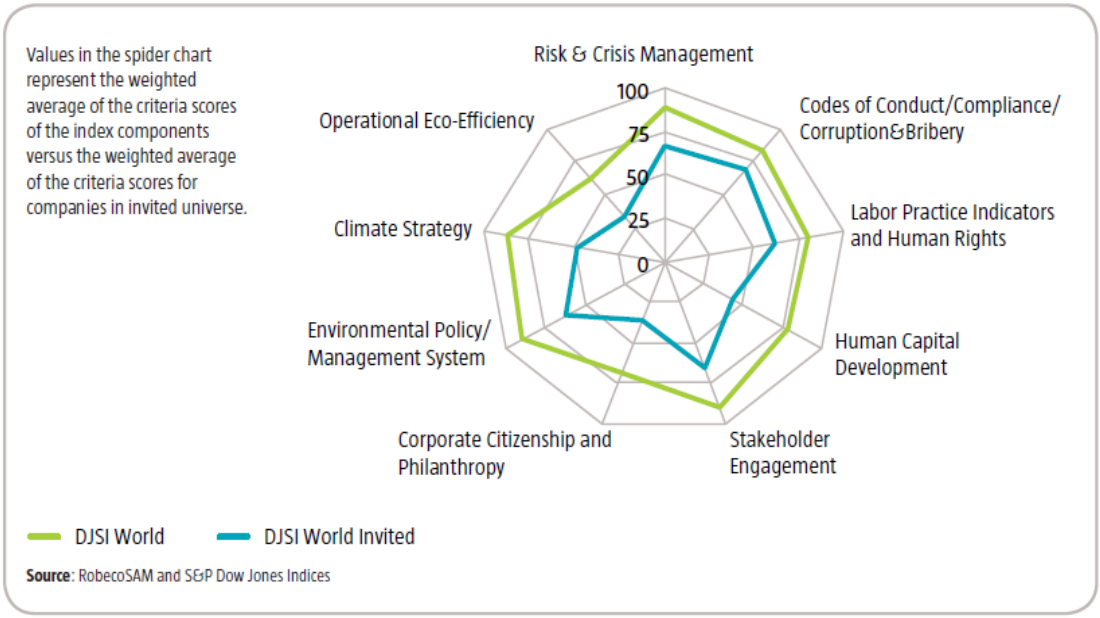
4) Contact with Companies: SAM analysts personally contact individual companies to clarify open points that may arise during analysis of the MSA, questionnaire, and company documents.

The questions and evaluation criteria are based on widely accepted standards, best practices, and audit procedures, as well as input from industry specialists and consultants. The results based on these analyses are then subjected to an external and internal audit, after which a corporate Total Sustainability Score (TSS) is calculated for each company. Only the companies that are sustainability leaders, i.e. judged to be in the top 10 percent in their industry in terms of sustainability performance, are included in the DJSI. The process is repeated annually, and firms that fail to remain in the top 10 percent are deleted from the index.

We contend that the selection process of the DJSI quintessentially mimics a tournament based on relative performance, where the winner-takes-all prize is firm inclusion in the index. The selection process has several stages; the initial selection into the DJGTSM is based on market capitalization; only select firms from the DJGSTM are then invited to the next stage of completing the SAM questionnaires, which have industry specific questions. These responses determine which companies are then selected next for more in depth analyses and investigation. Finally, winners

who belong to the top 10 percent in each industry are included in the DJSI. For instance, a total of 3,300 firms were invited in 2013 for potential evaluation for inclusion in the DJSI, out of which 1,831 were chosen for further analyses, and only 80 companies were included in the final DJSI World Index. Figure 1 shows the average sustainability scores of the invited universe and the final winners that were included the DJSI World Index.

Figure 1: Comparison of the Sustainability Profile of the DJSI World Versus the Invited Universe, 2013



Source: DJSI Family, RobecoSAM, 2013.

Only the winners are disclosed without revealing individual company scores or overall rankings. The industry specific relative sustainability scoring controls for common systemic environmental uncertainty and the winner takes all feature mimic the incentive structure of a tournament. As a result, drawing on Rosen's model which predicts extra rewards for the winner of a tournament, we posit that stock market reactions to inclusion/exclusion from the DJSI provide an incremental amplified signal of investor perception of the value of CSP. While we hypothesize an amplified signal of investor perception, understandably we do not attempt to estimate the degree of amplification as there are no reliable empirical measures of the actual baseline average value of CSP.

In addition to the tournament effect, the increased awareness and monitoring effect due to winning such a tournament would also amplify market reactions. For example, if sustainability leadership is perceived to be value enhancing, inclusion in the DJSI would lead to increased scrutiny and monitoring of management by analysts and investors; and in turn management would respond with greater effort, leading to better future performance expectations; stock price movements will incorporate this indirect effect. On the other hand, winning the sustainability tournament may also be perceived as attracting increased scrutiny from other stakeholders and civil society organizations, and such increased monitoring may lead to 'over-commitment' to

environmental and social goals at the cost of shareholders, thereby amplifying the negative reactions.

Therefore, we propose the following hypothesis.

H1. *Firms added to the DJSI experience a non-zero change in their stock prices*

The direction of the change in stock prices will then reveal whether investors consider CSP to be value adding or not.

D. Firm Capital Structure and Sustainability Performance

While shareholders and bondholders both benefit from a rise in firm value, Black and Scholes (1973) show that when a firm makes riskier investments, shareholders may benefit at the expense of bondholders because stocks are analogous to call options (implicitly sold by the bondholders) on the underlying firm value. In other words, if investments in CSR are riskier, the changes in stock returns may just indicate the effect of a wealth transfer from bondholders to shareholders, and not necessarily be of benefit to the entire firm value, i.e., the sum of stock and debt values. Jensen and Meckling (1976) discuss moral hazard problems of risky investments when firms are financed by both debt and equity, and how these can be mitigated by the inclusion of various debt covenants in the indenture provisions, to control managerial behavior and to protect bondholders. However, Jensen and Meckling (1976) also recognize these covenants may limit management's ability to take optimal actions on certain issues and lower overall profitability, as the costs involved in writing such provisions and the costs of enforcing them would likely be non-trivial. Highly leveraged firms are likely to have more bondholder protections in the form of more stringent debt covenants that limit managerial action. Since investments in sustainability leadership tend to be risky, we draw on this stream of literature and posit that the stock market reactions to DJSI inclusion/exclusion are moderated by firm capital structure (the debt/asset ratio) and propose the following hypothesis.

H2*: Firm leverage (debt/asset ratio) will have a significant moderating effect on stock price reactions to firm inclusion in the DJSI.*

The direction of the moderating effect will reveal the net consequence of the wealth transfer effect and countervailing debt covenant restrictions.

E. DJSI Deletions

Extant literature has treated effects of DJSI addition and deletion as being theoretically symmetrical but opposite in direction, i.e. if addition to the DJSI is value adding and results in positive stock market response, then deletions from the DJSI should be value destroying, resulting in negative market responses and vice versa. Here we argue that expectation of such opposing symmetry of response is unjustifiable, because the event of deletion from the DJSI is conditional on initial inclusion in the DJSI. Once a firm has been added to the DJSI, it has already incurred the costs of attaining the 'sustainability' reputation, and expected future costs and benefits of such sustainability leadership are then incorporated into its stock price. When such a firm is

subsequently deleted from the DJSI, it will no longer be able to reap the potential future benefits from these prior reputation investments. These investments become sunk costs. Investors may hence perceive deletion as an indicator of a failed investment. Further, investors may also conclude that additional resources may be spent in damage control and trying to regain the reputation (i.e., getting back on the DJSI.) Hence we hypothesize that the stock market will negatively react to DJSI deletions. However, if the investors believe that the deletion is a temporary setback and expect the firm to get back on the DJSI without significant additional investments, the stock market reactions may not be strongly negative. In other words, while we hypothesize that initial inclusion in the DJSI may have either a positive or a negative effect on firm returns, we posit that subsequent deletion from the DJSI will always have a non-positive effect (i.e., either a negative or a statistically insignificant effect) on stock returns.

H3*: Firms deleted from the DJSI experience a non-positive change in their stock prices.*

H4*: Firms that were deleted but have a longer history as DJSI members, or history of getting back on the DJSI, and those which have no significant worsening in their absolute sustainability performance will face less negative (i.e., muted) stock market reactions.*

III. Data and Methods

A. Event Study Method

We employ the event study method to analyze stock market reactions to changes in the DJSI status of firms. Event studies analyze abnormal returns arising from informational events, which are estimated based on market models such as the one factor capital asset pricing model or multiple factor based Fama and French (1993) models (MacKinlay, 1997). A number of event studies have analyzed stock market reactions to firm additions to and deletions from indices such as the S&P 500 Index. Various hypotheses have been proposed to explain the price reactions that include downward sloping demand curves, price pressures, investor information/search costs, signaling, and liquidity changes (Cheung and Roca, 2013; Shleifer, 1986; Harris and Gurel, 1986; Merton, 1987; Denis *et al*., 2003; Dhillon and Johnson, 1991; Hegde and Mcdermott, 2003). As mentioned previously, a few recent studies have analyzed stock market reactions to DJSI inclusions and exclusions using the event study method, which are summarized in Table 1. While our basic approach is similar to these studies, the differences and refinements in our methods are explicated in the following sections.

B. Defining the Event, Event Window, and Estimation Window

The events of interest are the annual announcements made by Dow Jones/SAM concerning the additions and deletions of the U.S. firms from the DJSI (World and North America) during the period from 2002 to 2011. There were a total of 196 addition and 133 deletion events in this period. These additions and deletions were based on a firm's relative sustainability performance. Changes in the DJSI's composition for other reasons, e.g., mergers, acquisitions, bankruptcy, etc., were announced separately during the quarterly updates to the index. The list of all the companies that were added to and deleted from the index was provided in a single announcement for years 2002 to 2005. However, post-2005, Dow Jones published a press release every September which only

listed the name of the top company from each sector and the total number of additions and deletions. The complete list was released on the date when the actual trading on the DJSI began. We define the date of the initial press release as the 'Announcement Date' (AD). The 'Effective Date' (ED) is the actual trading date when the new DJSI constituents started trading on the index. The time gap between the announcement and the effective date varied from 9 to 22 days. However, on the announcement day, all companies that had participated, received a mailing with the main results of their sustainability performance and were able to download their own scores/detailed results from a protected area. Many firms that had such private information about their inclusion into or exclusion from the DJSI, especially those firms that had been added to the DJSI, chose to disclose this information through their own press releases or announcements on their corporate websites before the effective date. In some cases, the information was leaked or revealed by newspapers. In other words, the information about the change in DJSI status could become publicly available either on the AD or on any day between the AD and the ED. We searched for all Dow Jones events since January 2002 on the LexisNexis Academic database to identify the earliest date on which the change of DJSI status of a firm became publicly available, which we label as the 'Actual date' (AcD).

Prior DJSI event studies recognize the AD and the ED and analyze stock market reactions with event windows defined around the AD or the ED (Robinson *et al.*, 2011; Cheung and Roca, 2013; Cheung, 2011; Detre and Gunderson, 2011) or a longer window that includes both the AD and the ED. For example, Robinson *et al*. (2011) and Cheung (2011) use a 60+ day event window and report significantly positive returns. However, it is well understood that longer event windows reduce the reliability of results because of other potential confounding events (McWillams and Siegel, 1997; McWillams *et al.*, 1999). Precise identification of the actual date on which the information about change in a firm's DJSI status first became publicly available is a key refinement in this study compared to prior DJSI event studies.

To demonstrate the difference the choice of event date makes, we choose different event windows around AD, ED, and AcD and present the results. However, we use estimates from the event windows around the more accurate actual date-AcD to test our hypotheses and to conduct additional analyses. We use an estimation period of 252 days preceding the event window for estimating the market models used for calculating the 'normal returns'. This choice is consistent with the estimation periods used in previous studies that range from 100 to 300 days (Peterson, 1989).

C. Estimation of Normal Return and Abnormal Return

Following prior research (e.g., Fama *et al.*, 1969; Peterson, 1989; MacKinlay, 1997), we employ the market model to estimate the expected or normal returns of the DJSI firms. This estimate is then used to calculate abnormal returns. The market model of expected returns used for the estimation is:

$$R_{it} = \propto_i + \beta_i R_{mt} + \varepsilon_{it} \qquad (1)$$

Where R_{it} is the return on security (firm) i for period (day) t, R_{mt} is the return on the benchmark market index for day t, ε_{it} the error term is assumed to be distributed with mean zero and variance σ_ϵ^2.

Given the estimated market model parameters $\hat{\alpha}_i$ and $\hat{\beta}_i$, the abnormal return (AR) on event date *t* is :

$$AR_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt} \quad (2)$$

Abnormal returns capture the excess returns an investor would have earned over an event day if he invested in security *i*. The assumption is that the abnormal returns are associated with the event of interest, namely new information about the DJSI status of the firm.

The cumulative abnormal return (CAR) during an event window (τ_1,τ_2) is given by:

$$CAR_i(\tau_1, \tau_2) = \sum_{t=\tau_1}^{\tau_2} AR_{it} \quad (3)$$

We estimate the model (Equation 1) annually, for each of the 329 firms which were either added to or deleted from the DJSI during the period 2002 to 2011. Cumulative abnormal returns are calculated for different event windows around AD, ED, and AcD using an estimation window of 252 days prior to the event date.

Additionally, we also estimate normal and abnormal returns by employing the Fama and French (1993) three-factor model, and the four-factor model extension suggested by Carhart (1997) as the return generating processes. These results are discussed in detail in the section on additional analyses.

D. Hypotheses Testing

In order to test hypothesis H1, i.e. inclusion in the DJSI has a non-zero effect on stock prices, and the hypothesis H3, i.e., firms deleted from the DJSI experience a non-positive change in their stock prices, we test the statistical significance of the mean CARs separately for the samples of firms that were included in the DJSI and those that were excluded from the DJSI.

Under the assumption that the disturbance terms are independent and identically distributed *(iid)* normal across the sample and over time, the hypothesis that the CARs are significantly different from zero can be tested using the Patell test (Patell, 1976). However, *iid* assumptions are violated if there is either cross-sectional or serial correlation or heteroscadasticity in the firm return processes from which the prediction errors are estimated. We employ the modified version of the Patell test to account for a potential serial correlation of abnormal returns in the event window (Patell, 1976; Mikkelson and Partch, 1988). Further, to account for potential event-induced increase in volatility, we employ the two-step-test procedure suggested by Boehmer *et al*. (1991) to derive an event-induced variance robust test-statistic (BMP) that is distributed Student-t with N-1 degrees of freedom. In addition, we also use the sign Z test, which is a nonparametric test commonly used in event studies. The sign test judges the proportion of positive and negative abnormal returns against an assumed 50 percent split under the null hypothesis that there is no reaction to the event. Additionally, the sign test helps to verify that the parametric findings do not result from a few outliers, as nonparametric tests are less sensitive to outliers (Cowan, 1992; Cowan 2007).[1]

[1] Corrado (1989) reports that another nonparametric test, the rank test, accords more power to detect abnormal stock price changes than standard parametric tests. However, Cowan's (1992) simulation studies present several weaknesses of the rank test compared to sign test that include: misspecification under thin trading conditions and increased event induced variance, relatively lower power especially in multiple day event windows, and sensitivity to extreme abnormal return for a single stock.

To test hypotheses H2 and H4, we estimate a regression equation of the general form

$$CAR_{it} = \delta_0 + \delta_1 * Lev_{it} + \delta_2(Z_{it}) + \varepsilon_{it} \quad (4)$$

Where CAR_{it} is the cumulative abnormal return to stock of firm *i* for the event in year t, and Lev_{it} is leverage (debt/equity ratio) of firm *i* in year t, and Z_{it} is a vector of other explanatory and control variables. These regressions are estimated separately for the samples of firms that were included in the DJSI and those that were excluded. H2 predicts a nonzero coefficient δ_1, which is then tested. H4 predicts statistically significant coefficients for variables relating to firm DJSI history included in Z_{it}.

IV. Results

Tables 2, 3, and 4 present the results of the event studies in terms of cumulative abnormal returns where the event date is AD, ED, and AcD respectively. Panel A in each of these tables shows results for the firms that were added to the DJSI, while Panel B shows results for firms that were deleted from the DJSI. The CARs are reported for four different event windows. For example, (-1, +1) represents the CAR for the period from one day before the event date, to one day after the event. Table 4 reports the daily abnormal returns in addition to the results for the selected event windows for the AcD event date.

We can make the following observations from Tables 2-4. Comparing results in Panel A of each of the three tables indicates that the market generally reacts negatively to a firm's inclusion in the DJSI. Although the direction of the market reaction is similar, the magnitude and the statistical significance of CARs are sensitive to the choice of the event date. Both the absolute magnitude and the statistical significance of the average CARs are the lowest when announcement date is used as the event and the highest when the actual date is used. This observation is consistent with the way in which information about DJSI inclusions is released; information for only the top firms becomes available on announcement days, whereas information about other additions is released slowly through other means, and complete information about the entire list becomes public only on the effective day. As the market is likely to react most strongly when the information becomes publicly available for the first time, as expected, the market responses are larger and statistically most significant when the AcD is used as the event date. These results also support our initial conjecture that choosing an appropriate event date is important to assess the market effect of DJSI changes. This finding may also help explain the mixed and insignificant results reported in prior studies that used different or longer event windows.

From Table 4, Panel A, it can be observed that firms that were added to the DJSI had negative reactions beginning four days before the event and lost 0.41 percent on the event date, and had a CAR of -1.36 percent over the event window (-5, +2). There was some recovery on the third and fourth day after the event. These findings indicate that there was some information leakage and adjustment prior to the public availability of the information, and markets reacted relatively strongly and negatively on the event date. There was also some adjustment as the information was processed by market participants.

The results overall suggest that investors perceive a firm's addition to the DJSI and winning such sustainability leadership tournaments as shareholder value destroying. That is, considerations such as the potential additional constraints on production technology, over-compliance resulting in competitive disadvantage, and diversion of managerial attention and resources from productivity improvement overshadowed considerations of the potential avenues through which

sustainability efforts can add to firm value. Alternatively, investor planning horizons may be potentially too short, wherein a long term value proposition of sustainability leadership would be dwarfed by perceived short term costs and disadvantages.

Table 2: Cumulative Abnormal Returns (CARs) for Announcement Date (AD) Event Study

Panel A: Index Inclusions (N=196)						**Panel B:** Index Exclusions (N=133)				
Window	Mean Returns (%)	Percentage Negative	Patell Z	BMP *t*-test	Sign Z	Mean Returns (%)	Percentage Negative	Patell Z	BMP *t*-test	Sign Z
CAR(-1,+1)	-0.36	56	-1.45*	-1.76**	-1.25	0.22	52	-0.14	-0.15	-0.07
CAR(-2,+2)	-0.16	49	-0.30	-0.30	-0.11	0.07	49	-0.71	-0.77	-0.41
CAR(-3,+3)	-0.12	48	-0.12	-0.13	0.32	-0.16	53	-0.48	-0.52	-0.41
CAR(-5,+2)	-0.36	56	-1.38*	-1.69**	-0.82	-0.06	60	-0.80	-0.87	-0.24

Table 3: Cumulative Abnormal Returns (CARs) for Effective Date (ED) Event Study

Panel A: Index Inclusions (N=196)						**Panel B:** Index Exclusions (N=133)				
Window	Mean Returns (%)	Percentage Negative	Patell Z	BMP *t*-test	Sign Z	Mean Returns (%)	Percentage Negative	Patell Z	BMP *t*-test	Sign Z
CAR(-1,+1)	-0.52	61	-3.37***	-3.38***	-2.67***	0.16	48	-0.66	-0.40	0.80
CAR(-2,+2)	-0.76	58	-3.21***	-3.21***	-1.96**	0.21	50	-0.43	-0.31	0.28
CAR(-3,+3)	-0.36	51	-1.28	-1.40*	0.04	-0.04	49	-0.62	-0.55	0.46
CAR(-5,+2)	-0.97	61	-3.19***	-3.20***	-2.67***	-0.51	48	-0.77	-0.62	0.80

Table 4: Abnormal Returns and Cumulative Abnormal Returns for Actual Date (AcD) Event Study

Panel A: Index Inclusions (N=196)						**Panel B:** Index Exclusions (N=133)				
Window	Mean Returns (%)	Percentage Negative	Patell Z	BMP *t*-test	Sign Z	Mean Returns (%)	Percentage Negative	Patell Z	BMP *t*-test	Sign Z
CAR(-1,+1)	-0.88	61	-4.28***	-4.42***	-3.16***	-0.08	52	-0.86	-0.56	-0.11
CAR(-2,+2)	-1.08	60	-3.90***	-3.83***	-2.59***	-0.32	52	-1.27	-1.02	-0.11
CAR(-3,+3)	-0.87	58	-2.63***	-2.74***	-1.88**	-0.93	59	-2.12**	-2.06**	-1.84**
CAR(-5,+2)	-1.36	62	-3.88***	-3.79***	-3.16***	-1.25	61	-2.02**	-1.80*	-2.19**
AR(-4)	-0.06	56	-0.98	-0.87	-1.16	0.03	49	0.28	0.24	0.58
AR(-3)	-0.16	54	-1.45*	-1.66**	-0.73	-0.53	57	-2.14**	-1.59	-1.32
AR(-2)	-0.05	51	-0.52	-0.43	-0.01	0.17	52	0.20	0.18	-0.11
AR(-1)	-0.31	55	-1.41*	-1.12	-1.02	0.02	47	-0.18	-0.13	1.10
AR(0)	-0.41	65	-4.45***	-4.10***	-3.73***	0.00	56	-0.47	-0.39	-1.15
AR(1)	-0.16	60	-1.54*	-1.87**	-2.45***	-0.10	49	-0.81	-0.72	0.58
AR(2)	-0.15	52	-1.85**	-1.56*	-0.16	-0.40	57	-1.57	-1.22	-1.32
AR(3)	0.38	45	3.38***	2.83***	1.70**	-0.09	53	-0.61	-0.61	-0.46
AR(4)	0.25	45	1.97**	1.63*	1.55*	-0.01	50	-0.08	-0.06	0.23

A. Factors Influencing CAR in Index Inclusions

Hypothesis H2 posits that firm leverage (debt/asset ratio) will have a significant moderating effect on stock price reactions to a firm's inclusion in the DJSI.

To test this hypothesis, we first estimate separate regression equations with the CAR for the event windows (-1, +1) and (-2,+5) as the dependent variables for the sample of all DJSI inclusion firms. The shorter window (-1, +1) is used to measure immediate short term response, while the longer window (-5,+2) is expected to capture potential information leakage and slow dissemination effects. The estimated equation is of the form:

$$CAR_{it} = \delta_0 + \delta_1 * Debt/Asset_{it} + \delta_z(Z_{it}) + \varepsilon_{it} \quad (5)$$

Where *Debt/Asset* is the debt to asset ratio for the firm and Z_{it} are other explanatory/control variables, that include firm specific factors like size *(log(asset))*, profitability *(ROA)*, capital efficiency (*asset turnover* ratio), international operations (*international-ops* measured as share of total taxes paid abroad), number of years the firm was in the DJSI previously (*DJSI years*), and industry controls (*Industry1*, a dummy variable that takes the value 1 if the firm belongs to pollution intensive industries such as chemicals, fuels, and basic materials, and *Industry2* is a dummy variable if the firm was directly marketing to consumers). We also include a time trend variable (*Trend*) to see if the market response to DJSI inclusion had systematically changed over time. The estimated results are shown in Panel A of Table 5.

Table 5: Robust Regression with CAR as Dependent Variable - Without KLD Variables

Dependent Variable	**Panel A:** DJSI Inclusions (N=193)				**Panel B:** DJSI Exclusions (N=129)			
	CAR(-1,+1)		CAR(-5,+2)		CAR(-1,+1)		CAR(-5,+2)	
Exp Variable↓	Coeff	*t*-stat	Coeff	*t*-stat	Coeff	*t*-stat	Coeff	*t*-stat
Debt/Asset	-0.0347	-2.77***	-0.0339	-2.26**	-0.0110	-0.95	-0.0200	-1.43
Log (asset)	-0.0009	-0.50	-.0031	-1.57	-0.0041	-1.94*	-0.0005	-0.21
ROA	0.00030	0.01	-0.0009	-0.02	-0.0282	-0.96	-0.0355	-1.00
Trend	0.0020	2.18**	0.0029	2.71***	-0.0003	-0.30	0.0010	0.77
DJSI years	0.00037	0.33	0.0004	0.31	0.0072	1.11	0.0057	0.73
Industry1	-0.0099	-1.23	-0.0385	-3.99***	-0.0022	-0.20	-0.0113	-0.84
Industry2	-0.0007	0.11	-0.0120	-1.59	-0.0104	-1.20	-0.0109	-1.05
Asset-turnover	0.0008	0.33	-0.0012	-0.42	-0.0029	-0.94	-0.0036	-0.94
International ops	-0.0018	0.57	-0.0018	0.48	0.0116	0.59	0.0130	0.55
FirstTimeDeleted					-0.0033	-0.26	-0.0055	-0.35
FTD*DJSI years					-0.0054	-0.81	-0.0029	-0.36
Constant	-0.0008	-0.04	0.0266	1.13	0.0468	1.72*	0.0077	0.24
Overall F stat	1.87*		3.76***		1.21		1.09	

***=P<0.01, **=P<0.0 5, *=P<0.1.

As shown, the estimated coefficient on the Debt/Asset ratio is negative and statistically significant in both regressions, indicating that highly leveraged firms that were included in the DJSI faced stronger negative market reactions. This supports the hypothesis that bondholder protections in the form of more stringent debt covenants that limit managerial action are perceived as constraining and counteracting the potential advantages of sustainability leadership. In other words, sustainability leadership efforts by highly leveraged firms are viewed more unfavorably. Highly leveraged firms already have higher risk and constraints on managerial discretion. Under these circumstances, inclusion in the DJSI is perceived to further increase the firm's risks and future cost outflows. The dummy variable Industry1 has a significant negative coefficient indicating that DJSI inclusion of firms in pollution intensive industries such as chemicals, fuels, and basic materials are viewed more negatively by investors. It also suggests that although these firms may be top performers within their industry sectors, the upside from such sustainability leadership is perceived to be lower than other industries. Due to the unavoidable pollution intensity of the industry, investors perceive that these firms face higher risk of future regulations and stakeholder distrust. Interestingly, the time Trend variable has a positive significant coefficient, which indicates that over time, inclusion in the DJSI has had an increasingly positive reaction from investors and that the positive reputation of DJSI is growing.

In order to test if sustainability performance ratings from other sources such as KLD affect these market reactions, we included two additional variables in the regressions, namely SusStrength and SusConcern. These variables respectively are the number of sustainability strengths and sustainability concerns listed in KLD ratings for each of the firms in the event year. These results are shown in Panel A of Table 6. As shown, the number of observations declines

since KLD ratings information was not available all firms. The estimated coefficient for SusStrength is positive and significantly different from zero (P<0.1) but only in the shorter event window. This weakly supports the hypothesis that inclusion in the DJSI of firms with prior strong sustainability reputation is viewed positively by investors.

Table 6: Robust Regression with CAR as Dependent Variable with KLD Variables

Dependent Variable	**Panel A** DJSI Inclusions (N=165)				**Panel B** DJSI Exclusions (N=110)			
	CAR(-1,+1)		CAR(-5,+2)		CAR(-1,+1)		CAR(-5,+2)	
Exp Variable↓	Coeff	*t*-stat	Coeff	*t*-stat	Coeff	*t*-stat	Coeff	*t*-stat
Debt/Asset	-0.0364	-2.31**	-0.0346	-1.75*	-0.0072	-0.57	-0.0163	-1.15
Log(asset)	-0.0018	-0.72	-0.0042	-1.36	-0.0033	-1.08	-0.0002	-0.07
ROA	-0.0106	-0.28	-0.0072	-0.15	-0.0354	-1.11	-0.0243	-0.67
Trend	0.0021	2.01**	0.0035	2.69***	-0.0008	-0.65	0.0004	0.31
DJSI years	-0.0002	-0.18	-0.0003	-0.20				
SusStrength	0.0014	1.66*	0.0010	0.88	-0.0012	-0.99	0.0006	0.48
SusConcern	-0.0002	-0.21	-0.0009	-0.68	-0.0014	-0.83	-0.0021	-1.07
Indutry1	-0.0069	-0.74	-0.0348	-2.98***	-0.0092	-0.68	-0.0241	-1.56
Industry2	0.0033	0.44	-0.0069	-0.72	-0.0137	-1.30	-0.0166	-1.39
Asset-turnover	0.0038	1.42	0.0004	0.12	-0.0058	-1.64	-0.0069	-1.73*
International ops	-0.0018	-0.42	-0.0017	-0.42	0.0083	0.37	0.0016	0.06
FirstTimeDeleted					-0.0201	-1.77*	-0.0224	-1.73*
FTD*DJSI					0.0028	1.50	0.0031	1.44
Constant	0.0286	0.85	0.0286	0.85	0.0603	1.81*	0.0347	0.92
Overall F stat	1.68*		2.47***		1.22		1.24	

***=P<0.01, **=P<0.0 5, *=P<0.1.

B. Results for DJSI Deletions

Panel B in Tables 2, 3, and 4 presents the results of the event study for firms that were deleted from the DJSI where the event dates are AD, ED, and AcD respectively. As in the case of index inclusions, the statistical significance of the results improves when the actual date (AcD) is used as the event date. This finding indicates that choosing an appropriate event date can improve the reliability of the results.

From Table 4, Panel B, it can be observed that firms that were deleted from the DJSI generally had negative market reactions. While the negative reactions are not statistically significant for shorter event windows of ±2 days, they are significantly negative for longer windows of (-3,+3) and (-5,+2) days. The CAR is -1.25 percent over the event window (-5, +2). Observation of the daily abnormal returns reveals that these daily negative reactions were small starting from the event date but cumulatively significant, suggesting that the market processed the information gradually. The asymmetric reaction, i.e., negative market reactions for both index

inclusions and deletions, supports our hypothesis that since firm deletion from the DJSI is conditional on its previous addition to the DJSI, investors perceive deletion mainly as an indicator of a failed investment in sustainability leadership strategy, and they react negatively regardless of the initial reaction to the DJSI additions.

Panel B in tables 5 and 6 reports estimation results for regression equations analyzing factors influencing the CARs for index deletions, similar to Panel A results for index additions. However, to test hypothesis H4, we include two additional explanatory variables, *FirstTimeDeleted* and *FTD*DJSI*, where *FirstTimeDeleted* is a dummy variable taking the value of 1, if the firm was deleted for the first time from the DJSI, and *FTD*DJSI* is an interaction variable between *FirstTimeDeleted* and the number of years that the firm had been in the DJSI previously *(DJSI year).* H4 predicts a negative coefficient for *FirstTimeDeleted,* suggesting that firms that were deleted for the first time face strong negative reactions, and a positive coefficient on *FTD*DJSI* suggesting that this negative reaction is muted if the firm has a long prior tenure on the DJSI, hinting that the deletion is likely a temporary setback. The estimation results shown in Panel B, Table 6 confirm the predicted statistically significant (P<0.10), negative coefficient for *FirstTimeDeleted*. The coefficient on the interaction term *FTD*DJSI* is positive as predicted, but it is not statistically different from zero. These findings partially support H4.

It is also notable that the coefficients on *Debt/Asset* ratio are consistently negative, but not significantly different from zero for the DJSI deletion sample, as compared to the DJSI addition sample which has negative and significant coefficient estimates. This asymmetric reaction also supports our conjecture that DJSI deletion is viewed as a conditional event and a failed sustainability investment, and not as an opposite equivalent of a DJSI addition event.

C. Additional Analyses

We also used the Fama and French (1993) three-factor model as the return generating process to estimate normal and abnormal returns. The Fama French three-factor model for normal return is:

$$R_{it} = \propto_i + \beta_i R_{mt} + \gamma_i SMB_t + \partial_i HML_t + \varepsilon_{it} , \quad (6)$$

where R_{it} is the return on security (firm) *i* for period (day) *t*, R_{mt} is the return on the benchmark market index for day *t*, SMB_t is the average on small market capitalization portfolios minus the average return on three large market portfolios; HML_t is the average return on two high book to market equity portfolios minus the average return on two low book to market equity portfolios; ε_{it} the error term is assumed to be distributed with mean zero and variance σ_ϵ^2. See Fama and French (1993) for a detailed description of SMB_t and HML_t. We estimate Equation 6 separately for each firm in our sample for each year, using an estimation window of 252 days prior to the event date. The abnormal return model is:

$$AR_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt} - \hat{\gamma}_i SMB_t - \hat{\partial}_i HML_t. \quad (7)$$

The results of the event study with actual date (AcD) and the Fama-French three-factor model are shown in Table 7. It can be observed that the three-factor model results for DJSI additions are similar to simple market model results, showing statistically significant negative CARs for all

windows. For DJSI deletions, the CARs for all windows are negative as expected, but not statistically different from zero, which is consistent with our prediction.

We also used the four-factor model suggested by Carhart (1997), which augments the Fama and French (1993) three-factor model with an additional momentum factor which is the difference between average return on two high prior return portfolios, and two low prior return portfolios. The results of the four-factor model event study were very similar to results with the three factor model and are shown in Table 8.

Table 7: Fama-French Three-Factor Model (Actual Dates)

	Panel A: Index Inclusions (N=196)				**Panel B: Index Inclusions (N=133)**			
Window	Mean Returns (%)	Percentage Negative	CDA *t*-test	Rank Z	Mean Returns (%)	Percentage Negative	CDA *t*-test	Rank Z
CAR(-1,+1)	-0.86	64	-3.22***	-3.66***	-0.17	48	-0.42	-0.68
CAR(-2,+2)	-1.07	62	-3.12***	-2.94***	-0.46	55	-0.88	-1.25
CAR(-3,+3)	-0.88	57	-2.17**	-1.65*	-1.11	55	-1.81	-1.6
CAR(-5,+2)	-0.97	59	-2.23**	-2.08**	-1.18	52	-1.80	-0.84

Table 8: Fama-French Four-Factor Model (Actual Dates)

Panel A: Index Inclusions(N=196)					**Panel B: Index Exclusions (N=133)**			
Window	Mean Returns (%)	Percentage Negative	CDA *t*-test	Sign Z	Mean Returns (%)	Percentage Negative	CDA *t*-test	Sign Z
CAR(-1,+1)	-0.83	62	-3.19***	-3.22***	0.01	46	0.02	1.07
CAR(-2,+2)	-0.98	63	-2.92***	-3.37***	-0.08	49	-0.15	0.21
CAR(-3,+3)	-0.81	59	-2.05**	-2.37**	-0.38	52	-0.59	-0.31
CAR(-5,+2)	-1.01	57	-2.38**	-1.65**	-0.75	49	-1.09	-0.13

D. Exploring Potential Alternative Hypotheses

It can be argued that these stock market reactions are not in response to sustainability leadership efforts, but simply from trading effects resulting from the inclusion in or the exclusion from a commonly used market index. We explore several hypotheses proposed in the literature regarding market reactions to index changes and their applicability to our results below.

The downward sloping demand curve hypothesis (Shleifer, 1986) predicts that subsequent to the announcement of the inclusion, a substantial portion of the firm's shares are bought by index funds attempting to mimic the return on the index. Such buying represents a long-term outward shift of the demand curve for the firm's equity, resulting in a share price increase at the announcement of the inclusion. However, very few index funds try to mimic the DJSI currently. The DJSI had only 26 licensees worldwide in 2013, a decline from 31 licensees in 2012,[2] and the

[2] Sources: http://www.sustainability-indices.com/images/review-presentation-2012.pdf and http://www.sustainability-indices.com/images/review-presentation-2013.pdf.

global investment tracking the DJSI indices was estimated at around $8 billion in 2011[3]. As a result, shift in demand arising from indexing is unlikely to explain the observed results. Moreover, we find that the market reacted negatively to DJSI inclusion, which is contrary to the predictions from downward sloping demand hypotheses. Also additions and deletions should have symmetric but opposite reactions if demand curves are downward sloping, which is also not observed.

Similar to the downward sloping demand curve, the price pressure hypothesis also postulates a downward sloping demand curve, but only in the short term. (Harris and Gurel, 1986; Blouin *et al*., 2000). The upward price pressure from momentary excess demand from indexing activity drives up prices and encourages premature selling. But once the momentary demand is satisfied, the prices fall. Under this hypothesis, prices are expected to rise in the short run, but these gains are expected to reverse shortly thereafter. The market response should be symmetrically opposite for deleted firms. Our results are not consistent with these predictions.

Cheung and Roca (2013) hypothesize that investors may derive utility from expression of their moral or ethical beliefs over and above the utility from financial returns from their stock holdings of sustainable firms. Such investor utility from sustainability is posited to result in positive stock market reactions to DJSI inclusions (corporate sustainability taste hypothesis). The alternative hypothesis termed the "redundancy hypothesis" predicts a negative effect on stock prices following inclusion in the DJSI, due to the imposition of additional sustainability constraints on firm optimal choices. While the direction of the effect on stock prices differs under these two hypotheses, both predict symmetrically opposite reaction to DJSI deletions as compared to DJSI additions.

Merton's (1987) information and search cost hypothesis posits that investors may be aware of only a subset of all firms in their portfolio decisions, and the inclusion of a particular stock in an index increases investor awareness and reduces their search or shadow costs, resulting in positive price responses to index inclusions. Denis *et al*. (2003) suggest that the cause and effect may run the other way, that is inclusion in an index leads to increased monitoring of the management by analysts and investors; and in turn the management responds with greater effort leading to better future performance expectations. They find that investors' earnings expectations increased for stocks that were included in the S&P500 index relative to comparable benchmark stocks. Chen *et al.* (2004) draw on the information hypotheses to explain observed asymmetric price responses to S&P 500 additions compared to deletions. That is, while firms included in the index see a permanent price increase, there is no permanent decline for deleted firms, because investors do not become 'unaware' of a firm when it is deleted from the index. Robinson *et al*. (2011) draw on the investor awareness hypothesis to explain their finding significant positive 60-day CARs for DJSI additions and non-significant changes following deletions. The investor awareness hypothesis is useful in explaining asymmetry reactions, i.e., a positive reaction to index additions and relatively weaker negative reaction to index additions and deletions respectively. However, it cannot explain our finding of negative reactions to both additions and deletions.

[3] Source: Press release: http://www.sustainability-indices.com/images/110228-ishares-etf-uk.pdf

V. Summary and Conclusions

We use the tournament theory to examine market reactions to firms' sustainability efforts. We use the inclusion or exclusion of a firm in the DJSI as a proxy for sustainability effort. We argue that the DJSI selection process is effectively a relative performance evaluation tournament and as a result creates amplified sustainability valuation signals. The DJSI status change conveys value relevant information to the stock market, and as a result, stock prices react to the DJSI status changes. We hypothesize asymmetric reactions to DJSI inclusions and deletions. Our results indicate that signaling sustainability leadership by winning a tournament like DJSI membership is perceived as value destroying on average by the market, resulting in negative CARs around the DJSI addition event. However, the market reactions are sensitive to the choice of the event date. A more nuanced definition of the event based on when the information actually became publicly available for the first time results in stronger and more reliable estimates of the market reactions. The information value of DJSI membership appears to be increasing over time, as indicated by a significant trend effect on CARs. Abnormal returns were also found to be influenced by the debt/asset ratio indicating that sustainability leadership by highly leveraged firms is viewed more negatively. With respect to DJSI deletions, as predicted, the market reactions were negative. This supports our hypothesis that markets perceive DJSI deletions, which are conditional on the firm being included in the DJSI previously, primarily as failed investments/strategy. As predicted, firms that were deleted for the first time from the DJSI faced stronger negative reactions. Our key theoretical insight that markets do not perceive DJSI additions and DJSI deletions as equivalent but opposite events, but rather as asymmetric events, is empirically supported. Our study thus contributes to this literature by addressing the limitations of extant studies, presenting new theoretical insights that help reconcile conflicting results in prior studies.

In the current environment where there is considerable high profile attention by the business press on firms' ability to not only be financially successful, but also to focus on other aspects such as the environment and the broader society, sustainability should be an important nonfinancial metric. Therefore, on the face of it, an important nonfinancial signal such as inclusion in or exclusion from the DJSI should have positive (inclusion) or negative (exclusion) effects. However, our results showing a negative reaction to both DJSI inclusion and exclusion indicates that the market assesses the benefits of sustainability efforts only in the context of the costs that such efforts impose on other aspects of the firm's performance. Inclusion is viewed negatively because it signals that sustainability efforts are costly, without commensurate financial benefits. Exclusion indicates a failure to maintain the chosen strategy focus. Market reactions are even more negative to highly leveraged firms, indicating that perhaps the market perceives a cognitive dissonance for firms that undertake environmental/social sustainability efforts but are financially less sustainable.

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