
LEED certification and market value of the firm

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Abstract: This article extends signalling theory to research on voluntary green standards adoption and investigates the firm's value in green buildings. The study analyses the market valuation of investments in sustainable buildings, measuring the market reaction to three different types of leadership in energy and environmental design (LEED) announcements: 1) intent for application; 2) achievement of certification; 3) reinforcement of certification. The study hypothesises the market will react differently to intent, achievement and reinforcement signals. Empirical evidence shows a positive market reaction to LEED announcements in general, with positive but not statistically significant market reaction to the intent signals, and positive and statistically significant reaction to the achievement and reinforcement signals. Theoretical and practical implications are discussed.

Keywords: LEED certification; separating equilibrium; strategic management; signalling theory; standards; event study; market value; sustainable development; environment.

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1 Introduction

Over the last 30 years, numerous green practices and certifications have emerged in response to the market demand for an evaluation basis of corporate claims. Corporateregister.com boasts more than 74,000 corporate social responsibility reports from more than 13,000 firms. While many firms adopt different types of green standards, the market interpretation of these green signals is not clear. The green standard can be a signal for the unobserved quality of a firm. However, many firms adopt standards under customer pressure, taking a tactical approach of standard implementation, ending up with systems existing only on paper (Iossifova and Sinha, 2006). Standardisation helps to overcome the information asymmetry between the firm and the market. A firm may provide different signals over time regarding the standard implementation, hoping to differentiate itself from the competitors. The reporting of intent, achievement or reinforcement of a certification is a signal of the firm's intent, achievement or reinforcement of the market demand (Connelly et al., 2011). The award and subsequent reinforcement of the designation is a 'separating equilibrium', when the signal (intent) is confirmed through experience (Bergh et al., 2014).

This study seeks to join the literature on voluntary standard adoption and signalling theory to identify different signals for standard adoption and the market interpretation. The research question of this study is what the market reaction is to different signals regarding standards adoption.

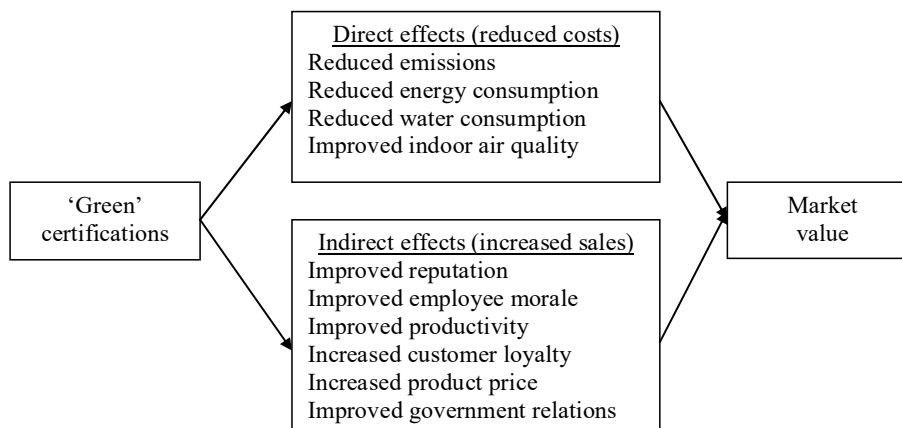
2 Theoretical background

2.1 Green standards and firm performance

Green practices effect performance in two ways:

- 1 direct effects, related to cost reduction
- 2 indirect effects, related to sales increase (Jacobs et al., 2010).

Figure 1 Theoretical model linking green certifications and market value of the firm



Direct effects include reduction in emissions, energy consumption (electricity, gas and oil), water consumption and improvement of indoor air quality (IAQ). Indirect effects include increased firm reputation, improved employee morale and productivity, increased customer loyalty, sales, product price, and improved relations with government. Figure 1 lists examples of direct and indirect effects. The following section focuses on prior research on leadership in energy and environmental design (LEED) and energy star (ES) certifications, but other green practices can also be included, such as ISO 14001, OHSAS 18001 and EMAS.

2.1.1 Direct effects

With respect to impact on *emissions*, the results are mixed. Examining the ES approach to emission reduction, Boyd and Zhang (2013) estimate a 13% reduction in total source energy consumption. However, the results may be misleading due to poor performing plant closure or updates, minimising the difference between low and top performers. Newsham et al. (2009) report mixed results when investigating LEED certification impact on GHG emissions. The direct impact evidence of green practices on *energy* is also mixed. Scofield (2009) and Oates and Sullivan (2011) do not find evidence for reduction in energy consumption for LEED certified buildings. Issa et al. (2011) find evidence for reduction in gas consumption but increase in the electricity consumption for LEED certified buildings. While the energy consumption decreases, the rate is not enough to justify the investment. Scofield (2013) finds that gold level LEED buildings outperform silver level LEED buildings in energy consumption, however, the LEED buildings underperform the comparison group, resulting in no difference on average. Shreshtha and Kulkarni (2013) evaluate ES and non-ES certified homes and find that ES certified homes consume less gas and electricity. The difference becomes insignificant after controlling for equipment age, leading to the recommendation to upgrade periodically to newer equipment (certified or not certified). Reichardt (2014) investigates the relationship between lease costs and LEED certification. The certification only accounts for a portion of the rent premium and ES buildings have higher operating costs. Green practices direct impact on water consumption is limited. Menassa et al. (2012) observe reduced *water consumption*, but do not find support for reduction in electricity consumption for LEED certified buildings. Few studies investigate the direct impact on *air quality, safety and worker health*. Wells et al. (2015) compare the IAQ in 12 low-income single-family homes renovated to a deep energy retrofits (DER) or ES standard and find no differences in IAQ between DER and ES homes.

2.1.2 Indirect effects

According to the stakeholder theory (Freeman, 1984), CSR activities enhance brand name for customers, improve employees morale, increase retention rates and foster relationship with the government. Firms, associated with popular management trends, do not have higher performance, but they are more admired, perceived to be more innovative, and offer a higher pay to their chief executives (Staw and Epstein, 2000).

Leland et al. (2015) find a positive *perception* towards LEED and ES certifications with females being more favourable towards these certifications than males. Rajendran et al. (2009) find no LEED impact on *worker safety and health*. Altomonte and Schiavon (2013) do not find LEED impact on *occupants' satisfaction* with building

environmental quality. LEED certification improves *employees' morale and retention* (Von Paumgartten, 2003), improves *relationship with the government* (Corbett and Muthulingam, 2007), and increases the *buildings' rent* and the property value (Eichholtz et al., 2010). Devine and Chang (2015) find the LEED certified retail branches of the same bank have higher above-market-rate *deposit growth* and higher year over year deposit growth than non-LEED branches. Wiley et al. (2010) find higher rents and higher *occupancy rates* for 'green' buildings (ES and LEED-certified). Ward et al. (2011) find the consumers are willing to *pay* a premium for ES-labelled goods.

2.2 Research goal and hypotheses

The literature review reveals inconclusive and/or negative evidence for green practices direct effect. This leads some researchers to conclude the philanthropic efforts represent managerial discretion; others claim 'doing good' is competitiveness; yet others claim focusing on profit is the only thing necessary for the firm to fulfil its obligation (Karnani, 2011). However, the literature provides strong evidence for the green practices indirect effect on performance. Green practices have a positive effect on firm reputation and stakeholders by signalling the firm's intention to become more socially responsible (Corbett and Muthulingam, 2007).

This study proposes the green practices will have an indirect impact on market value. LEED is investigated as a proxy for green practice and firm's market value as a measure of performance. LEED certification signals increased performance and/or managerial attention to efficiency leading to performance. However, a mere intent to achieve LEED certification may be perceived as a weak signal, since the intent may not result in actual achievement. Further, LEED certification may not result in actual performance.

Two studies investigate the link between LEED and firm's market value. Lee and Heo (2009) find positive association between CSR (including LEED) initiatives and firm value, measured by Tobin's Q. Jacobs et al. (2010) perform an event study on green practices announcements (including LEED) and find positive market reaction to green announcements overall and positive but not statistically significant reaction to LEED announcements in particular, probably due to the small sample size (21 announcements only). The hypotheses for this study are:

- H1 LEED announcements, in general, will be positively associated with firm's market value.
- H2 Announcements on intention to apply for LEED certification will not be significantly associated with the firm's market value.
- H3 Announcements on achievement of LEED certification will be positively associated with the firm's market value.
- H4 Announcements on reinforcement of LEED certification will be positively associated with the firm's market value.

3 Methodology

3.1 Sample and data

Several sources are combined to generate the sample. First, a list of all LEED certified buildings is obtained from LEED.org. The registered organisations total 12,867, with 10,557 located in the USA and 947 being publicly traded. The key words ‘leadership in energy’ and the ‘firm’s name’ are used to search for announcements from the Lexus-Nexus database, including announcements in newspapers, as well firm’s profile in the database. The oldest announcement is from January 2002 and the most recent from July 2014. Announcements appearing in more than one publication are excluded and only the earliest publication announcement is retained. Market returns and firm characteristics data is obtained from Bloomberg terminal.

3.2 Control variables

Several control variables are incorporated in the analysis. The first group of control variables relate to the certification characteristics:

- 1 per building versus organisation
- 2 existing building versus new construction
- 3 early versus later versions of the certification
- 4 early versus late adopters.

Another control variable is the week day of the announcement. Berument and Kiyamaz (2001) find a week day effect on both volatility and returns, in particular, the highest and lowest returns are observed on Wednesday and Monday respectively.

3.3 Statistical methods

An event study methodology is applied to estimate the market reaction to LEED announcements or the gains to a particular stock, attributable to a specified event, controlling for the market impact (Brown and Warner, 1985). The ‘abnormal’ returns to the stock are the percentage change in firm’s stock price beyond the market movement at the time associated with the firm’s action. The theoretical base for the event study methodology is the market efficiency hypothesis, stating the gains or losses in stock market valuation are reflected instantaneously. The event impact is measured through the stock price observation over a short window. Hayward (2002) is able to demonstrate insignificant difference between a short announcement window and a longer announcement window. Jacobs et al. (2010) assume a linear relationship between the stock return and the market return over a given time period. The appreciation (depreciation) in the stock return is associated with the market gain (loss). The relationship between the stock and the market is represented as:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

where R_{it} represents a given stock return i at time t ; R_{mt} represents the market return of the same period; α_i represents the intercept; and, ε_{it} is the error term. The intercept, slope, and error term variance ε_{it} for each sample firm is computed, using ordinary least squares regression for the estimation period. The estimation period ranged from 120 to 11 days prior to the signal. The estimation period concludes ten days prior to the announcement to ensure the estimation is free from announcement effects. Abnormal returns for stock i are calculated as the difference between the estimated return and the actual return on a given day. Test for significance, test for outliers, and robustness checks are performed according to Jacobs et al. (2010).

4 Results

The final sample contains 714 announcements spanning 250 firms. Table 1 provides sample descriptive statistics.

Table 1 Descriptive statistics for the sample of 714 announcements

	<i>Market value</i> (\$M)	<i>Total assets</i> (\$M)	<i>Sales</i> (\$M)	<i>Net income</i> (\$M)	<i>Employees</i> (000s)
Mean	33,887.8	149,237.4	35,082.7	2,368.7	130,295.7
Median	13,146.7	17,861.0	12,287.0	882.0	44,900.0
Std. dev	50,508.1	400,120.6	64,725.9	4,909.2	266,590.2
Max.	283,438.5	2,668,796.3	469,162.0	27,918.8	2,200,000.0
Min.	2.5	6.9	0.0	-27,684.0	3.0

Notes: Sample statistics are based on the most recent fiscal year completed before the date of announcement.

Source: All data obtained from Bloomberg

To investigate the difference between different announcements, the sample is separated into seven subcategories:

- *intent for application*: firm announces its intent to apply for certification
- *application for certification*: firm announces an application for certification
- *pre-certification*: firm announces a pre-certification status achievement
- *certification*: firm announces certification achievement
- *post-certification*: firm announces a certification achieved at a prior period in time
- *outcome from certification*: firm announces LEED certification outcomes
- *collaboration*: announcement that relates to two firms collaborating to obtain LEED certification.

Panel A in Table 2 summarises the seven subcategories. Panel B of Table 2 presents announcement examples.

Table 2 LEED subcategories: sample sizes and example of announcements

<i>Panel A: LEED subcategories</i>	<i>Sample size 714</i>
Intent for application	323 (45.2%)
Application for certification	10 (1.4%)
Pre-certification	5 (0.7%)
Certification	84 (11.8%)
Post-certification	232 (32.5%)
Outcomes from certification	15 (2.1%)
Collaboration	18 (2.5%)
Missing	27 (3.8%)

<i>Panel B: Examples of LEED announcements</i>
‘Seagate builds up to get more space on drive’, The Mercury News (CA), 16 January 2006. Adobe is applying to the US Green Building Council for the highest-level ‘platinum’ certification under LEED – for leadership in energy and environmental design, the most commonly used rating to certify sustainable architecture.
‘San Rafael Target building receives LEED gold certification’, Marin Independent Journal (CA), 1 February 2014. The Target store that opened in October at the Shoreline Center off East Francisco Boulevard has attained leadership in energy and environmental design (LEED) gold certification from the US Green Building Council.
‘Putting delight and joy into air travel; San Francisco terminal aims for a California touch – green and fun’, The international Herald Tribune, 12 April 2011. American Airlines has built a dedicated lounge, which will seek LEED silver status.

Source: All data obtained from Lexus-Nexus dataset

The organisations are eager to announce their intent to obtain certification – 323 announcements (45.2%) as shown in Table 2. The second highest category is post certification or certification reinforcement, 232 announcements (32.5%). The third in size category is the actual certification, 84 announcements (11.8%). Intent is signalled more often than achievement, possibly because the organisations view the low cost benefits of announcing intent as greater than the achievement cost.

4.1 Analysis of market reaction to LEED signals

The full sample included 714 LEED announcements. Table 3 presents the market reaction for the period two days before and two days after the event. The abnormal returns are positive for all days but statistically different from zero only for day -1 and day $+1$. The median abnormal returns are positive except for day -2 ; however, they are not statistically significant. Generalised sign test for the percentage positive is statistically significant only for day -2 . The positive mean CARs for the three time windows: $(0, +1)$, $(-1, +1)$, and $(-2, +2)$ are all statistically significant. The median abnormal returns and the generalised test for the positive returns proportion are not significant for time window $(0, +1)$, but significant for the time windows $(-1, +1)$ and $(-2, +2)$. The market reaction to LEED announcements is positive and significant for time windows $(-1, +1)$ and $(-2, +2)$.

The results for the individual days around the event are not strong, because the market anticipates the announcement (Jacobs et al. 2010). To explore this further, the firm traits leading to the market anticipating the action are also examined. In prior event

studies, firm size has been found influential (e.g., Klassen and McLaughlin, 1996; Hendricks and Singhal, 2003). Smaller firms experience a stronger market reaction relative to larger firms due to the stronger relative impact of any one event on the firm's profit. In addition, institutional investors and analysts tend to follow larger firms. Thus, smaller firms experience a larger impact than their larger counterparts. To evaluate the difference in the firm size, the sample is segmented into quartiles by total assets. Market reactions are compared between firms in the lowest and highest quartiles.

Table 3 Event period abnormal returns for the 714 LEED announcements

<i>Event day/window</i>	<i>Mean AR/CAR (%)</i>	<i>t-statistic</i>	<i>Median AR/CAR (%)</i>	<i>Wilcoxon signed-rank Z-statistic</i>	<i>% AR/CAR positive</i>	<i>Generalised sign test Z-statistic</i>
Day -2	0.07	0.58	-0.10	-0.73	45.8	-2.20**
Day -1	0.16	2.90***	0.02	1.19	50.4	0.23
Day 0	0.05	0.49	0.04	0.54	50.6	0.30
Day +1	0.28	2.99***	0.09	1.62	51.0	0.60
Day +2	0.05	0.54	0.07	1.25	52.4	1.29
CAR (0, +1)	0.33	2.37***	0.00	1.46	50.3	0.15
CAR (-1, +1)	0.49	2.93***	0.27	2.68***	54.8	2.51**
CAR (-2, +2)	0.61	2.73***	0.40	2.99***	55.8	3.04***

Notes: All tests are one-tailed: **p ≤ 0.05, ***p ≤ 0.001.

Some firms have better reputation than others and the market reacts stronger to announcements of weak environmental performance firms, experiencing a higher surprise level (Jacobs et al., 2010). To test this assumption, data from Dow Jones World Sustainability Index (DJSI US) is collected at the announcement time. The DJSI uses economic, environmental, and social criteria to determine the best performers among publicly traded firms. DJSI includes firms with high score in the index, regularly publishing additions and subtractions from the index. The market reaction is compared between the firms listed and not listed in the DJSI on the announcement day.

T-test and Mann-Whitney Z-test are used to test for differences in the means and medians between the respective groups for firm size and environmental reputation. In each case, the differences are not statistically significant. Small firms have a mean (median) CARs for time window (-1, +1) of 0.30% (0.04%) compared to 0.36% (0.13%) for large firms. The mean (median) difference in CARs is -0.06% (-0.09%) but is insignificantly different from zero. Thus, the firm size and environmental reputation do not affect market reaction to LEED announcements.

4.2 Analysis of market reaction to LEED announcement subcategories

Market reaction is tested for three different announcements: intent, certification, and post-certification. The other categories are excluded from the analysis as they have small sample size.

In the subcategory *intent for LEED certification* (Table 4), the mean abnormal return and the mean cumulative return are positive and statistically significant only for day +1 and for time window (-1, +1). The two non-parametric tests, however, do not support the results. The market does not react to the announcements related to the intent to achieve

LEED certification. The differences are compared in the means and medians between small and large firms and firm size does not affect market reaction to LEED announcements for intent.

Table 4 Event period abnormal returns for the 323 LEED announcements – intent for certification

<i>Event day</i>	<i>Mean AR (%)</i>	<i>t-statistic</i>	<i>Median AR (%)</i>	<i>Wilcoxon signed-rank Z-statistic</i>	<i>% AR positive</i>	<i>Generalised sign test Z-statistic</i>
-2	0.00	-0.01	-0.05	-0.33	51.7	0.78
-1	0.18	1.20	0.00	0.58	48.6	0.17
0	0.02	0.14	0.05	0.17	49.2	0.22
1	0.23	1.78**	0.10	1.27	48.3	0.56
2	0.01	0.09	0.04	0.41	47.4	0.67
(0, 1)	0.26	1.25	0.04	0.79	49.2	0.22
(-1, +1)	0.44	1.70**	0.13	1.32	48.0	0.67
(-2, +2)	0.45	1.49	0.29	1.36	45.8	1.45*

Notes: All tests are one-tailed: * $p \leq 0.10$, ** $p \leq 0.05$.

In the subcategory *LEED certification* (Table 5), the actual certification achievement, the mean (median) abnormal return is positive and statistically significant for day -1. In addition, 40.5% of the abnormal returns are positive and significantly higher than the percent of positive abnormal returns during the estimated period. The mean (median) CARs are positive and statistically significant for time window (-1, +1). In addition, 41.7% of the CARs are positive and significantly higher than the percent of positive cumulative abnormal returns during the estimated period. The results suggest a strong positive market reaction to announcements for LEED certification. Jacobs et al. (2010) find only moderate support for the positive market reaction to the ‘achievement’ announcements. The means and medians are compared between small and large firms and firm size does not affect market reaction to LEED announcements for certification.

Table 5 Event period abnormal returns for the 84 LEED announcements – certification

<i>Event day</i>	<i>Mean AR (%)</i>	<i>t-statistic</i>	<i>Median AR (%)</i>	<i>Wilcoxon signed-rank Z-statistic</i>	<i>% AR positive</i>	<i>Generalised sign test Z-statistic</i>
-2	-0.18	-0.90	-0.22	-1.33*	57.1	1.20
-1	0.52	2.80***	0.36	2.34***	40.5	1.64**
0	-0.18	-0.99	-0.10	-0.82	56.0	1.10
1	0.30	0.95	0.00	0.24	47.6	0.11
2	0.19	0.85	0.15	0.85	39.3	1.56*
(0, 1)	0.12	0.35	-0.03	0.30	51.2	0.11
(-1, +1)	0.64	1.91**	0.54	1.92***	41.7	1.42*
(-2, +2)	0.64	1.29*	0.26	1.00	46.4	0.55

Notes: All tests are one-tailed: * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.001$.

In the subcategory *LEED post-certification* (Table 6), the mean abnormal return is positive and statistically significant for day +1. However, the median is insignificantly different from zero. In addition, only 47.4% of the abnormal returns are positive and insignificantly higher than the percent of positive abnormal returns during the estimated period. The mean (median) CARs are positive and statistically significant for the all three time windows (0, +1), (-1, +1) and (-2, +2). However, the non-parametric tests are significant only for time windows (-1, +1) and (-2, +2). The median abnormal returns are positive and significantly different from zero. In addition, 44.4% and 39.8% of the cumulative abnormal returns for both periods are positive and significantly higher than the percent of positive cumulative abnormal returns during the estimated period. The results suggest a strong positive market reaction to the announcements for LEED post-certification. The means and medians are compared between small and large firms and firm size does not affect market reaction to LEED announcements for post-certification.

Table 6 Event period abnormal returns for the 232 LEED announcements – post-certification

<i>Event day</i>	<i>Mean AR (%)</i>	<i>t-statistic</i>	<i>Median AR (%)</i>	<i>Wilcoxon signed-rank Z-statistic</i>	<i>% AR positive</i>	<i>Generalised sign test Z-statistic</i>
-2	0.17	0.69	-0.16	0.62	54.3	1.45*
-1	-0.04	-0.26	-0.08	0.26	51.7	0.53
0	0.19	1.13	0.08	1.42*	45.3	1.06
1	0.33	2.17**	0.04	1.17	47.4	0.40
2	0.07	0.45	0.08	1.12	47.6	0.46
(0, 1)	0.52	2.35**	-0.01	1.33*	50.0	0.00
(-1, +1)	0.48	1.92**	0.27	1.49*	44.4	1.64*
(-2,+2)	0.71	2.14**	0.79	2.57**	39.8	3.03**

Notes: All tests are one-tailed: * $p \leq 0.10$, ** $p \leq 0.05$.

4.3 *Analysis for the control variables*

4.3.1 *Buildings versus organisation certifications*

To determine whether the market reacts differently to announcements made for certifications awarded per organisation versus per building, the difference is tested in the overall market reactions to LEED certifications. Using a one-tailed test, the means (medians) are insignificantly different from each other in the market reaction. Thus, the market does not react differently to the announcements made for certifications awarded per buildings versus these awarded per organisation.

4.3.2 *Market reactions to announcements made during different days of the week*

To determine whether the market reacts differently to announcements made during different week days, the differences are tested in the overall market reactions to LEED certifications. A one-tailed test shows the means (medians) are insignificantly different

from each other in the market reaction. Thus, the market does not react differently on the announcements made during different days of the week.

4.3.3 Market reactions to LEED announcements for different rating systems

To determine whether the market reacts differently to LEED announcements for two different rating systems (existing building and new construction), the difference is tested in the market reactions to LEED certifications. A one-tailed test shows the mean (median) returns for the two groups are not significantly different from each other. Thus, the market does not react differently on the announcements made for the two different rating systems.

4.3.4 Market reactions to LEED announcements for different certification versions

To determine whether the market reacts differently to LEED announcements for different certifications versions, the differences are tested in the market reactions to LEED certifications. The sample is separated into two groups: one for the early versions, published before 2008 (e.g., v. 1, v. 2, v. 2.1 and v.2.2) and another for the newer versions, published in or after 2008 (e.g., v. 2008 and v. 2009). A one-tailed test shows the means (medians) for the newer versions are significantly higher than for the older versions for time window (-1, +1). Thus, the market reacts stronger to announcements made for newer versions.

4.3.5 Market reactions to LEED announcements for early versus late announcements

To determine whether the market reacts differently to LEED announcements over time, the sample is separated into quartiles by the announcement date. The early announcements (below 25th percentile) are compared to the late announcements (above 75th percentile). A one-tailed test shows the means (medians) are insignificantly different from each other. Thus, the market does not react differently to announcements made earlier or later in time.

5 Discussions

These findings have several managerial implications. First, the market reacts positively to the LEED announcements, consistent with the findings of Klassen and McLaughlin (1996), von Paumgarten (2003), Corbett and Muthulingam (2007), and contrary to Jacobs et al. (2010). Next, the market reaction to the announcements related to intent to obtain LEED certification is positive but not significant. These results are consistent with the prior results in literature (Jacobs et al., 2010), because self-disclosed initiatives may not measure actual environmental performance (Ullman, 1985).

The market reaction to the announcements related to obtaining certification is positive and significant, consistent with Jacobs et al. (2010). The market reacts positively to post-certification announcements. The market reacts more favourably to achievement rather than mere intent claim. These findings support the *signal confirmation* concept

(Spence, 2002), suggesting stronger market reaction when the expected signal quality is realised through experience. The average cumulative abnormal return for announcements related to actual certification is 0.64% and for the post-certification announcements is 0.48%. The market values initial certification announcements higher than post-certification ones.

Contrary to prior research, market does not react differently to announcements for certifications granted per building versus certifications granted per organisation. Jacobs et al. (2010) expect a limited market reaction to the announcements, as LEED certifications are awarded for individual buildings. We do not find any difference in market reaction to announcements for different version of LEED certification or for different days of the week.

6 Conclusions

This paper analyses market reaction to LEED announcements. The analysis of 714 announcements on intent, achievement, and post-certification, demonstrates positive market reaction. The market does not value the intent but rather the actual achievement. This may be because announcing the intent to achieve LEED certification is perceived as a weak signal, due to no penalties or risk associated with the announcement, whereas the actual award signals the intent for further commitment. Market reacts differently to the early versus the late versions of the certification, because early versions are unknown and awareness has to be developed. Also, later versions require actual performance but earlier, point-based, versions do not require actual performance.

The market reaction to other categories: collaboration, outcomes, and pre-certification, is positive but not statistically significant, however, the results can become significant with a higher number of observations. This suggests the need for more research on market reaction to environmental certifications.

This study has two limitations. First, the results are limited only to publicly traded firms and cannot be generalised to private firms. Second, the results focus on short-term market reaction and does not include long-term performance. Short-term performance does not imply any long-term effects. A long-term upswing in market valuation may correlate to the acquisition of LEED certification, not because of the effect of publicising the LEED certification, but because firms that are doing better are more willing to invest in current and less profitable initiatives. That is why an interesting future research project may be to compare direct measures, such as waste reduction, energy consumption, and emissions, before and after the certification. Another future research effort may look at the certification impact on work quality, facility ergonomics, employees' relations, and customer satisfaction.

References

- Altomonte, S. and Schiavon, S. (2013) 'Occupant satisfaction in LEED and non-LEED certified buildings', *Building and Environment*, Vol. 68, pp.66–76.
- Bergh, D.D., Connelly, B.L., Ketchen, D.J. and Shannon, L.M. (2014) 'Signaling theory and equilibrium in strategic management research: an assessment and a research agenda', *Journal of Management Studies*, Vol. 51, No. 8, pp.1334–1360.

- Berument, H. and Kiyamaz, H. (2001) 'The day of week effect on stock market volatility', *Journal of Economics and Finance*, Vol. 25, No. 2, pp.181–193.
- Boyd, G. and Zhang, G. (2013) 'Measuring improvement in energy efficiency of the US cement industry with the energy star energy performance indicator', *Energy Efficiency*, Vol. 6, No. 1, pp.105–116.
- Brown, S.J. and Warner, J.B. (1985) 'Using daily stock returns: the case of event studies', *Journal of Financial Economics*, Vol. 14, No. 1, pp.3–31.
- Connelly, B.L., Certo, S.T., Ireland, R.D. and Reutzel, C.R. (2011) 'Signaling theory: a review and assessment', *Journal of Management*, Vol. 37, No. 1, pp.39–67.
- Corbett, C.J. and Muthulingam, S. (2007) *An Empirical Investigation of the Depth of Adoption of the LEED Green Building Standards*, Working Paper, UCLA.
- Devine, A. and Chang, Q. (2015) *Does a Green-Certified Storefront Mean More Income? Estimating Financial Benefits of Certification for Space Users*, Social Sciences Research Network [online] https://papers.ssrn.com/sol3/papers2.cfm?abstract_id=2590168 (accessed 15 February 2017).
- Eichholtz, P., Kok, N. and Quigley, J.M. (2010) 'Doing well by doing good? Green office buildings', *American Economic Review*, Vol. 100, No. 5, pp.2492–2509.
- Freeman, R.E. (1984) *Strategic Management: A Stakeholder Approach*, Prentice Hall, Englewood Cliffs, NJ.
- Hayward, M.L.A. (2002) 'When do firms learn from their acquisition experience? Evidence from 1990 to 1995', *Strategic Management Journal*, Vol. 23, No. 1, pp.21–39.
- Hendricks, K.B. and Singhal, V.P. (2003) 'The effect of supply chain glitches on shareholder wealth', *Journal of Operations Management*, Vol. 21, No. 5, pp.501–522.
- Iossifova, A. and Sinha, K.K. (2006) 'When less is more – the role of the consultant in ISO 9000 and ISO 14000 implementation processes', *Quality Progress*, Vol. 39, No. 12, pp.49–54.
- Issa, M.H., Attalla, M., Rankin, J.H. and Christian, A.J. (2011) 'Energy consumption in conventional, energy-retrofitted and green LEED Toronto schools', *Construction Management and Economics*, Vol. 29, No. 4, pp.383–359.
- Jacobs, B.W., Singhal, V.R. and Subramanian, R. (2010) 'An empirical investigation of environmental performance and the market value of the firm', *Journal of Operations Management*, Vol. 28, No. 5, pp.430–441.
- Karnani, A. (2011) 'Doing well by doing good: the grand illusion', *California Management Review*, Vol. 53, No. 2, pp.69–86.
- Klassen, R.D. and McLaughlin, C.P. (1996) 'The impact of environmental management on firm performance', *Management Science*, Vol. 42, No. 8, pp.1199–1214.
- Lee, S. and Heo, C.Y. (2009) 'Corporate social responsibility and customer satisfaction among US publicly traded hotels and restaurants', *International Journal of Hospitality Management*, Vol. 28, No. 4, pp.635–637.
- Leland, S.M., Read, D.C. and Wittry, M. (2015) 'Analyzing the perceived benefits of LEED-certified and energy star-certified buildings in the realm of local economic development', *Economic Development Quarterly*, Vol. 29, No. 4, pp.363–375.
- Menassa, C., Mangasarian, S., Asmar, M.E. and Kirar, C. (2012) 'Energy consumption evaluation of US Navy LEED-certified buildings', *Journal of Performance of Constructed Facilities*, Vol. 26, No.1, pp.46–53.
- Newsham, G.R., Mancini, S. and Birt, B.J. (2009) 'Do LEED-certified building save energy? Yes, but...', *Energy and Buildings*, Vol. 41, No. 8, pp.897–905.
- Oates, D. and Sullivan, K. (2011) 'Post-occupancy energy consumption survey of Arizona's LEED new construction population', *Journal of Construction Engineering and Management*, Vol. 138, No. 6, pp.742–750.

- Rajendran, S., Gambatese, J.A. and Behm, M.G. (2009) 'Impact on green building design and construction on worker safety and health', *Journal of Construction Engineering and Management*, Vol. 135, No. 10, pp.1058–1066.
- Reichardt, A. (2014) 'Operating expenses and the rent premium of energy star and LEED certified buildings in the central and eastern U.S.', *Journal of Real Estate Finance and Economics*, Vol. 49, No. 3, pp.413–433.
- Scofield, J.H. (2009) 'Do LEED-certified buildings save energy? Not really...', *Energy and Buildings*, Vol. 41, No. 12, pp.1386–1390.
- Scofield, J.H. (2013) 'Efficacy of LEED-certification in reducing energy consumption and greenhouse emission for large New York City office buildings', *Energy and Buildings*, Vol. 67, pp.517–524.
- Shrestha, P.P. and Kulkarni, P. (2013) 'Factors influencing energy consumption of energy star and non-energy star homes', *Journal of Management in Engineering*, Vol. 29, No. 3, pp.269–278.
- Spence, M. (2002) 'Signaling in retrospect and the informational structure of markets', *American Economic Review*, Vol. 92, No. 3, pp.434–459.
- Staw, B.M. and Epstein, L.D. (2000) 'What bandwagons bring: effects of popular management techniques on corporate performance, reputation, and CEO pay', *Administrative Science Quarterly*, Vol. 45, No. 3, pp.523–556.
- Ullman, A.E. (1985) 'Data in search of a theory: a critical examination of the relationships among social performance, social disclosure, and economic performance of US firms', *Academy of Management Review*, Vol. 10, No. 3, pp.540–557.
- Von Paumgarten, P. (2003) 'The business case for high-performance green buildings: sustainability and its financial impact', *Journal of Facilities Management*, Vol. 2, No. 1, pp.26–34.
- Ward, D.O., Clark, C.D., Jensen, K.L., Yen, S.T. and Russell, C.S. (2011) 'Factors influencing willingness-to-pay for the energy star label', *Energy Policy*, Vol. 39, No. 3, pp.1450–1458.
- Wells, E.M., Berges, M., Metcalf, M., Kinsella, A., Foreman, K., Dearborn, D.G. and Greenberg, S. (2015) 'Indoor air quality and occupant comfort in homes with deep versus conventional energy efficiency renovations', *Building and Environment*, Vol. 93, Part 2, pp.331–338.
- Wiley, J., Benefield, J. and Johnson, K. (2010) 'Green design and the market for commercial office space', *Journal of Real Estate Finance and Economics*, Vol. 41, No. 2, pp.228–243.

Websites

- http://www.ec.europa.eu/environment/emas/tools/faq_en.htm
- <http://www.energystar.org>
- <http://www.iso.org>
- <http://www.usgbc.org/leed>