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Energy management systems and market value: Is there a link?

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Abstract:

This paper aims to advance in the knowledge of the economic impacts of ISO 50001 certification on firms' performance. The study hypothesizes that ISO 50001 is associated with improvements in market value of firms. We employ, on one hand, event study methodology for a sample of 40 companies listed on different stock exchanges. On the other hand, we use market reaction to the announcement of ISO 50001 as a proxy for changes in firm performance. We reveal that market reaction to the adoption of ISO 50001 is negative but statistically insignificant. However, this result is not suggesting that getting ISO 50001 is a bad investment, but rather that inflated expectations of financial performance improvement due to the adoption of ISO 50001 has still been unfounded.

JEL: G12; M14; Q56

Keywords: Energy Management Systems; ISO 50001; Market value; Event study

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1. Introduction

In recent years, commitment to the natural environment has become an important variable, which is strongly affecting purchase decisions of customers. The new consumption tendency is fuelling private and institutional investment decisions towards socially and environmentally responsible investing. This has been also illustrated by the introduction of several international environmental management systems (EMSs) to the manufacturing industry. Among the popular EMSs introduced to the manufacturing industry, ISO 14001, which is developed by International Organization of Standardization (ISO), is known as a generic management system standard being relevant to any firm seeking to improve its environmental performance. By implementing ISO 14001 an organization would improve environmental performance, but does not have to specify its procedure as a requirement. Together with ISO 14001, in June 2011 ISO released an Energy Management System (EnMS), ISO 50001, which is also suitable for any organization – whatever its size, sector or geographical location. The main objective of ISO 50001, which is modeled after the ISO 9001 (Quality Management System) and the ISO 14001, is to improve energy-related performance and energy efficiency continuously and to identify energy reduction opportunities. Until January 15th 2013, ISO 50001 has been adopted by 1312 companies around the world.²

Following the development in EMSs, a number of empirical studies have tended to investigate whether environmental investments penalize or reward firm performance. Methodologically, these studies use either common micro-econometric approaches (Ziegler et al., 2008) or event study approach (e.g. Cañón-de-Francia and Garcés-Ayerbe, 2009; or Oberndorfer et al., 2011), and measure firm's economic performance by the financial performance (notably profitability, cost efficiency and sales performance) or the market value. Despite the growing number of empirical studies, there are contradicting results regarding the relationship between firms' environmental management practice and their economic performance (e.g. Filbeck and Gorman, 2004; Ziegler et al., 2008; or Cañón-de-Francia and Garcés-Ayerbe, 2009). On the other hand, to the best of our knowledge, most recent quantitative researches have only focused on the benefits of adopting ISO 14001, but ignored the impacts of ISO 50001 certification that presents the latest international best practice in energy management. More importantly, despite being closely aligned to ISO 14001, ISO 50001 places more emphasis on the continual improvement of energy performance and is more appropriate than ISO 14001 in an organization where energy is a significant cost. In order to fill this research gap, we explore the shareholder value effects of energy performance by investigating the stock market reaction (abnormal returns) associated with the adoption of ISO 50001. In other word, we apply event study technique to resolve the question of whether ISO 50001 certification affects firms' market value.

² Data collected by Reinhard Peglau - German Federal Environment Agency

The paper is structured as follows. Section 2 provides a literature review considering environmental management, certification and economic performance. This is followed by a description of our sample and research methodology. Section 4 presents and discusses the main findings. Concluding remarks are in the last section.

2. Environmental performance versus Economic performance

In the literature, either theoretical or empirical, the relationship between environmental and financial performance has highly attracted academic interest. From a theoretical perspective, Walley and Whitehead (1994) initially suggest that instances where environmental efforts can improve firm performance are rare. Likely, Jaffe et al. (1995) question the optimism of environmental requirements and assume that environmental practices and initiatives involve costs and have few financial benefits. In contrast, according to Hart (1995), firms' related efforts in order to improve environmental performance can create more valuable resources and be a source of competitive advantage. In other works, the Porter Hypothesis initiated by Porter and Van der Linde (1995) and subsequently considered by Xepapadeas and Zeeuw (1999) stresses the "free-lunch" aspect in the possible relationship between firms' proactive environmental and financial. These authors suggest that responding to new environmental advocates by applying innovations allows firms to improve their overall operations and then to decrease their production costs or to increase their productivity. In the same vein, Elkington (1994) shows that improving environmental performance could result in a rise in demand from "green" customers, who appreciate the ecological products. Moreover, for any firm, pointing out good environmental initiatives allows making new opportunities for acquiring a high ecological reputation and benefiting from premium pricing and increased sales (Miles and Covin, 2000). On the other hand, firms may reduce costs and increase revenues through environmental management (Ambec and Lanoie, 2008). Ambec and Lanoie also point out four opportunities to reduce costs (risk management and relations with external stakeholders; cost of material, energy, and services; capital cost; and labor cost) and three opportunities to increase revenues (better access to certain markets; differentiating products; and selling pollution-control technology). Indeed, showing circumstances that it pays to be green, makes opportunities for reducing costs and for increasing revenues. Despite the inconclusiveness in theoretical results, the studies finding evidence that good environment performance results in improved financial performance are predominant.

Regarding to empirical works, the results seem to be more inconclusive and even contradictory, highlighting such a complex relationship between environmental and financial performance (Corbett and Klassen, 2006). A large number of studies have replaced the traditional assumption about a trade-off relationship between environmental and financial performance by the novel

hypothesis “It pays to be green”. These studies confirm the existence of a positive effect of environmental performance on economic performance, which is measure by a set of indicators, such as returns on assets, sales and equity (e.g. Hart and Ahuja, 1996; or Russo and Fouts, 1997) or by the intangible asset (e.g. Konar and Cohen, 2001). Other studies (e.g. Klassen and Mclaughlin 1996; or Konar and Cohen, 1997) find evidence that the positive impacts of green performance result from positive market reaction to firms’ improved environmental responsibility. Unlike these listed studies, the relationship between environmental and financial performance is inconclusive or even negative in other empirical works. According to Telle (2006), the positive impact of environmental performance on economic performance, which is concluded in the studies using pooled regression, become statistically insignificant in the studies applying panel econometric techniques, in which the data heterogeneity is controlled. Lately, Ziegler et al. (2008) consider a two-dimensional sustainability performance: the average sustainability performance of the industry in which a corporation operates; and the relative sustainability performance of a corporation within a given industry. They find that whereas the industry’s average environmental performance positively affects the stock performance, the average social performance of the industry has a significantly negative influence. A negative relationship between environmental and stock performance of a firm is also previously concluded in Filbeck and Gorman (2004).

Complementary to the studies exploring economic benefits of environmental performance, there are several researches looking for the relationship running from financial performance to environmental performance. For instance, Wagner et al. (2002) support the positive influence of financial performance on firms’ environmental management. Accordingly, a good financial performance allows a firm to allocate more resources to prevention-oriented technologies and initiatives. Using Japanese data, Nakao et al. (2007) also reveal that firms’ financial performance has a positive impact on firms’ environmental performance.

Together with a large number of researches studying the possible impact of environmental performance on economic performance, there are few empirical studies examining the relationship between EMSs captured by the adoption of ISO 14001, and financial performance of a firm. For instance, Watson et al. (2004) tend to resolve the question of whether there is a difference in financial performance between firms that had introduced a certified EMS and firms that had not. The authors find no significant difference between them across different economic sectors. In the same light, Cañón-de-Francia and Garcés-Ayerbe (2009) analyze whether ISO 14001 certification is interpreted by the capital market as a sign of environmental responsibility by using a sample of 80 large Spanish firms from 1996 to 2002. They find that adopting ISO 14001 has a negative effect on the market value of certain firms. This negative effect seems to be confirmed only in the case of less polluting and less internationalized firms. However, in the case of more polluting and more

internationalized firms, there is no clear evidence supporting this negative relationship. Unlike the previous studies, Jacobs et al. (2010) conclude that attainment of ISO 14001 certification results in statistically significant positive market reaction. Similarly, de Jong et al. (2014) assess the short-term and long-term impact of the ISO 14001 certification on financial performance by using a comprehensive dataset including a majority of ISO 14001 certifications in the United States. The authors provide clear evidence that the ISO 14001 certification process can help firms develop firm-specific capabilities, which will have a significant impact on the profitability of the certified firms. Differentiating from the above cited studies Inaki et al. (2011) try to explore the possible bi-directional relationship between ISO 14001 certification and financial performance. Employing a multivariate panel data analysis, the authors find that firms with better average performance have a greater propensity to pursue accreditation but there is no evidence that improvements in performance follow certification.

Research hypothesis

Released 15 years after the introduction of ISO 14001, ISO 50001 has considered as the latest international best practice in energy management. Whereas ISO 14001 helps an organization to systematically identify and manage all environmental impacts in the broadest sense, ISO 50001 helps an organization to specify, develop and implement energy management system requirements in order to form an energy policy. Specifically, ISO 50001 allows an organization to identify its objectives, targets, and action plans related to significant energy use, which are intended to lead to reductions in greenhouse gas emissions, energy costs, and other related environmental impacts through systematic management of energy consumption. In fact, ISO 50001 can either be used in conjunction with ISO 14001, to help an organization to point out further opportunities for energy savings, or as a stand-alone management system standard for any organization in which energy use is a significant consideration from either an environmental or cost perspective. Despite several advantageous points (as displayed in Figure 1), ISO 50001 has not really attracted much attention of either firms or academic field. For instance, after 3 years of release, ISO 50001 has been adopted by only 1312 companies around the world, comparing to 14106 certifications of ISO 14001 from 1997 to 1999 (ISO). More importantly, at the time of writing, the impact of ISO 50001 adoption on financial performance investigated in any academic work. Therefore, the aim of our paper is to fill this research gap by shedding light on whether better financial performance of a firm, which is measured by the market value improvement, is due to the beneficial effects of adopting ISO 50001. In other words, our main research hypothesis is that adopting ISO 50001 allows a firm to realize a cost-saving production model and then improves its business benefits.

<Insert Figure 1>

3. Methodology and Data

3.1. Event study

In this paper, we use event study methodology that allow us to evaluate the effects of ISO 50001 by examining the response of the stock price around the announcement of this event, which is displayed in as follows:

<Insert Figure 2>

The main assumption of event study methodology is that market processes information about the event in an efficient and unbiased manner. According to event study, the event affecting a firm's valuation may be: i) within the firm's control; and ii) outside the firm's control. Adoption of ISO 50001 is considered as an event within the firm's control. Event study was initially applied for stock splits by Fama et al. (1969). Campbell et al. (1997) outline steps for the typical event study: (1) define the event and establish the event window; (2) establish firm selection criteria; (3) calculate normal and abnormal returns for securities in the sample set; (4) estimate model parameters using data in an estimation window; (5) test whether the abnormal return is statistically different from zero.

In this study, we estimate the model using data over a period of 120 days, which includes from day -139 to day -20 prior to the date of ISO 50001 certification. The estimation period ending 20 days before the ISO 50001 announcement allows us to exclude abnormal returns probably due to this announcement. Moreover, MacKinlay (1997) suggests that 120 trading days as commonly implemented in event studies for the estimation period. To translate calendar days into event days, we consider the announcement day of ISO 50001 as Day 0. On the other hand, we use (-1; +1) day event window, which is also recommended by MacKinlay (1997) as most accurate since it allows for spillover effects in surrounding days and does not weaken the test's power. McWilliams and Siegel (1997) also show that using a long event window can complicate the control of confounding effects, and then reduce the power of statistical tests as well as result in false conclusions about the event's significance. Accordingly, a three-day window will be long enough to capture the significant effect of the event of interest.

In order to obtain estimated abnormal returns, we can use one of four models of normal returns suggested by Brown and Warner (1980) as follows:

- *Mean Adjusted Returns*: The normal return for a security equals a constant K_i . In this model, the abnormal return for the security is: $\varepsilon_{it} = R_{it} - K_i$ with R_{it} is the period-t return of security i.

- *Market Adjusted Returns:* The normal return for a security at a given point in time equals the market return for that period. Accordingly, the abnormal return is: $\varepsilon_{it} = R_{it} - R_{mt}$ with R_{mt} is the period-t return of the market portfolio security.
- *Market and Risk Adjusted Returns:* Normal returns are assumed to be generated by a single index model, in which security returns are linearly related to market returns through stock betas. The Abnormal returns is determined as: $\varepsilon_{it} = R_{it} - \beta_i(R_{mt} - r_{ft})$ with r_{ft} is the period-t risk-free rate and β_i is the period-t stock beta, which is estimated over firm estimation periods.
- *Multiple Index Model Adjusted Returns:* Normal returns for are assumed to be driven by multiple factors, such as market return, industry returns, firm size or other characteristics. The estimation model of abnormal returns is: $\varepsilon_{it} = R_{it} - \alpha_i - \beta_{i1}F_{i1} - \dots - \beta_{im}F_{im}$ with F_{im} are different factors affecting the security i.

Following some recent empirical studies (e.g. Gupta and Golda, 2005; Dasgupta et al., 2006; or Cañón-de-Francia and Garcés-Ayerbe, 2009) we apply the market model to estimate abnormal return. This model supports a linear relationship between the return on a stock and the market return over a given time period (Sharpe 1964). Accordingly, the asset returns are given by:

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

with $E(\varepsilon_{it}) = 0$ and $Var(\varepsilon_{it}) = \sigma_{\varepsilon_i}^2$

where t is the time index, $i = 1, 2, \dots, N$ stands for security, R_{it} and R_{mt} are the returns on stock i and the market portfolio respectively during period t , α_i is the intercept of the relationship for stock i ; β_i is the slope of the relationship for stock i with respect to the market return, and ε_{it} is the error term associated with stock i and the time index t .

As mentioned above, Equation (1) is generally estimated over a period of 120 days, which includes from day -139 to day -20 prior to the date of ISO 50001 certification. The event window is defined as the period from 1 day prior to the event to 1 day after the event. From Equation 1, the estimated values $\hat{\alpha}_i$ and $\hat{\beta}_i$ of α_i and β_i respectively allow one to predict a normal return during the days covered by the event window. The prediction error or estimated abnormal return \widehat{AR}_{it} for stock i on day t (the difference between the actual return and the predicted normal return), is then calculated as:

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

If we have more than one event in our sample, we can aggregate the abnormal returns across a number of events. Hence, the mean abnormal return for day t within the event window is given by:

$$\widehat{MAR}_t = \frac{1}{N} \sum_{i=1}^N \widehat{AR}_{it} \quad (3)$$

where N is the number of announcements in the sample. On the other hand, if an event period consists of more than one day, we can estimate the cumulate abnormal returns over the period T₁-T₂ as follows:

$$\widehat{CAR}_i(T_1, T_2) = \sum_{t=T_1}^{t=T_2} \widehat{AR}_{it} \quad (4)$$

The next step is to test whether the abnormal returns are statistically different from zero. To do so, we use the traditional parametric t test developed by Brown and Warner (1985) and the nonparametric tests described by Corrado (1989).

First, the Brown-Warner test assumes that the mean abnormal returns are normally distributed independently and identically. Consequently the test statistic for any given day is given as:

$$Z = \sqrt{N} \frac{\widehat{AR}_t}{\sigma} \sim N(0,1) \quad (5)$$

In Equation 5, the standard deviation of the residuals estimated from the estimation period is used as estimator of σ . With the assumption that the residuals in Equation 1 or the abnormal performance are uncorrelated between the stocks $Var(\varepsilon_{it}) = \sigma_{\varepsilon_i}^2$, the abnormal performance standard deviation is based on the standard deviation of each stock performance measure of the sample in the estimation period. Accordingly, while T indicates the length of the estimation period, the test statistics on day 0 is given as:

$$t_{stat} = \frac{\frac{1}{N} \sum_{i=1}^N AR_{i0}}{\frac{1}{N} \sqrt{\sum_{i=1}^N \frac{1}{\sum_{t=1}^T (AR_{it} - \sum_{i=1}^T \frac{AR_{it}}{T})^2}} \quad (6)$$

where (T-1) degrees of freedom and Student's t distribution. In the Brown-Warner test, calculating the standard deviation of the residuals from the estimation period allows one to solve a probable cross-sectional dependence problem.

Second, the nonparametric test, the Corrado rank test, does not require the symmetrical cross sectional distribution of the excess returns and takes the excess returns' magnitude into consideration. In the Corrado test, all the time series observations of each stock are used. When the rank of the abnormal returns is shown by $K_{it} = \text{rank}(AR_{it})$, the rank statistics at day 0 is as follows:

$$C_{rank} = \frac{1}{N} \sum_{i=1}^N \left(\frac{K_{i0} - \frac{m+1}{2}}{s(K)} \right) \quad (7)$$

where m is the number of total observations in the estimation period and event period. The standard deviation is as:

$$s(K) = \sqrt{\frac{1}{m} \sum_{t=1}^T \left[\frac{1}{N} \sum_{i=1}^N \left(K_{it} - \frac{m+1}{2} \right)^2 \right]} \quad (8)$$

Under the null hypothesis of no abnormal returns, the rank of the excess returns on day 0 turns into uniform distribution. Boehmer et al. (1991) suggest that Corrado's rank statistics based on median is more resistant against the event-induced variance on day 0, and has a better

performance than the Brown-Warner traditional test.

3.2. Data setting

As mentioned above, our empirical analysis uses the database provided by Reinhard Peglau - German Federal Environment Agency, which includes the date of adopting ISO 50001 for 1312 companies around the world until June 15, 2013. From this list, we can only select a sample of 40 companies, which are listed on the stock exchanges. The study will be carried out with 40 companies from several sectors and countries (Table 1).

The data on stock prices is collected from Bloomberg Database. On the other hand, in order to eliminate the possible unexpected effects of data heterogeneity, we introduce in our model two control variables. The first one is the standard error of market index controlling for the volatility of market portfolio. The second one is per capita financial consumption expenditure that allows us to control for the different consumption levels of each country having firms in our research list.

<Insert Table 1>

4. Empirical results

Table 2 presents the market reaction during the period of ISO 50001 announcement, including the day preceding the announcement (Day -1), the day of the announcement (Day 0), the day following the announcement (Day +1). The first column shows the estimated average cumulative abnormal returns \widehat{CAR} derived from adopting ISO 50001 for each event window. It also provides the estimated mean abnormal returns \widehat{MAR} for the day preceding/following the announcement (Day -1 / +1) as well as for the day when ISO 50001 is granted (Day 0). The Brown-Warner and Corrado tests are presented in the second and third column. The last column shows the percentage of negative abnormal returns in each window.

As shown in Table 2, the mean abnormal returns for each event period [-1, +1], [0, +1], and [-1, 0] are all negative (-0.83%, -0.80%, and -0.37%, respectively). Similarly, during our reference event period [-1, +1], the abnormal returns for the Day +1, 0, and -1 are also negative but very small (-0.0007%, -0.0088%, and -0.0118%, respectively). Additionally, the percentage of negative abnormal returns in each window is very important (at least 69%). However, according to the tests of Brown-Warner and Corrado, the empirical results are not statistically significant. These results lead us to accept the null hypothesis of no abnormal returns due to the announcement of ISO 50001. In other words, the results indicate that the market reaction to ISO 50001 adoption is marginally negative but statistically insignificant.

<Insert Table 2>

One possibility for the lack of a strong market reaction to the announcement of ISO 50001 could be due to the data heterogeneity in macroeconomic environment of each country, in firm size, in firm

reputation and firm initial financial performance. For instance, the significant impacts of firm size have been concluded in several event studies (e.g. Klassen and McLaughlin, 1996; Hendricks and Singhal, 2003). The fact is that a smaller firm has the greater impact of any event on its profit than a larger firm. Additionally, the announcement of any event is more important and remarkable for a small firm than a big firm which novel information is not rare. Following this consideration Jacobs et al. (2010) test for the dependence of market reaction on American firm size. They find that the dependence is in the theorized direction but statistically insignificant, implying that firm size does not influence the market reaction to any environmental initiative announcement. Consequently, in the literature, the dependence of market reaction on firm size is still inconclusive. For this reason, we will not divide the full sample into different subsample basing on the firm size. Indeed, dividing our data in different subsamples by firm size is not feasible due to the data unavailability and such a small number of considered firms.

On the other hand, it is plausible that market reaction could differ by country subsample. The market reaction may be positive, negative or insignificant, depending on macroeconomic conditions of each country. So that, by grouping all different firms in a single full sample, the average market reaction could be insignificantly different from zero. To overcome this issue, we should divide our full sample into different subsample basing on country characteristics. However, a small full sample of 40 companies, once again, would not allow us to do so. For this reason, we can only redo event study analysis for a subsample of 14 German companies. The empirical results are presented in Table 3.

As showed in Table 3, the empirical results for German firm sample are, by and large, similar to those for the full sample in terms of sign and significance, but the magnitudes are different as would be expected. In other words, the abnormal returns are generally negative but statistically insignificant, and the percent negative abnormal returns are insignificantly different than the percent abnormal returns during the estimation period. The result suggests that the market does not react significantly to the ISO 50001 announcement also in the case of German companies.

Overall, our findings on the relationship between environmental performance and financial performance are different from those reported in the literature.

<Insert Table 3>

The difference between the previous results and ours could be explained in two ways. *First*, while the environmental performance of a firm is captured by the adoption of ISO 14001 in previous empirical studies (e.g. Filbeck and Gorman, 2004; Cañón-de-Francia and Garcés-Ayerbe, 2009; Jacobs et al., 2010), this paper considers the adoption of ISO 50001 as an improvement in environmental or energy performance of a firm. Indeed, to our knowledge, we are the first to study the impact of ISO 50001 certification on firms' market value. While in the previous studies,

in response to ISO 14001 adoption, the market may react positively (e.g. Jacobs et al., 2010) or negatively (e.g. Filbeck and Gorman, 2004; Cañón-de-Francia and Garcés-Ayerbe, 2009), we find no evidence on the link between energy performance and firms' market value. This lack of consensus concerning the relationship between green performance and economic performance has also been justified in the literature. For instance, Telle (2006) suggests that the sign of this relationship strongly depends on the applied analytical method. In an earlier analysis, King and Lenox (2001) reveal that the link between lower pollution and higher financial valuation may be derived from firms' fixed characteristics. These authors also believe that the nature of the relationship between environmental and financial performance depends on the conditions in which environmental measures are implemented. On the other hand, Filbeck and Gorman (2004) suggest that the impacts of environmental performance on financial performance are such complicate due to regulation requirements. *Second*, the lack of market reaction to the adoption of ISO 50001 concluded in our analysis may be due to the increasing frequency of such certifications over the time. Methodologically, one condition for applying event study is that the event (here, ISO 50001 announcement) must be novel information for the market. However, all 40 firms considered in our sample have ISO 14001 or other environmental awards and certifications before adopting ISO 50001. Thus, it is reasonable to consider that comparing to the announcement of preceding certifications, particularly the first environmental certification, the information on the adoption of ISO 50001 is less concerned, which in turn could not lead to any significant market reaction. Besides, while the first initiative for improving environmental performance (notably, the adoption of ISO 14001) may positively influence financial performance of a firm (e.g. Jacobs et al., 2010), subsequent initiatives (notably, the adoption of ISO 50001) may result in costly environmental management and then a reduction in firm's benefit. This argument partially supports our evidence on a negative but insignificant relationship between market reaction and the adoption of ISO 50001.

5. Conclusion

Unlike a large number of studies focusing on the link between environmental and economic performance, the economic impact of environmental certifications has been underdeveloped in the literature. Furthermore, the existing works have only attempted to advance in the knowledge of the economic effects of ISO 14001. To the best of our knowledge, we are the first to empirically verify the economic impacts of ISO 50001 on the firm market value.

Based on an event study, the empirical results lead us to reject the hypothesis that ISO 50001 certification generates positive abnormal returns in firms' market value. Typically, we find that the market reaction to ISO 50001 is negative but statistically insignificant. The lack of significant

impact of ISO 50001 on firms' market value could be due to two main reasons. The first one is that the link between environmental (captured by ISO 50001) and economic performance is quite complicate as mentioned in Guenster et al. (2011), the financial performance related to environmental performance is not evidence in itself. Thus, we need more time and a larger data sample to completely verify such a complicate relationship. The second one is that compared to other environmental certifications, in particular ISO 14001, ISO 50001 is lately released. This late release, on one hand, has not really attracted firms' registration. That is why, after three year of implement, there are only 1312 companies adopting ISO 50001. On the other hand, for investors, the announcement of ISO 50001 is much less interesting than that of the first environmental certification - ISO 14001. The market, therefore, may react weakly or not at all to the adoption of ISO 50001.

Although we are the first to provide an empirical analysis about the relationship between ISO 50001 and firm's financial performance, there are some limitations in our work. The first one is to consider the market reaction to the announcement of ISO 50001 as a proxy for changes in financial performance, which could be measured by other alternative indicators. Second, although event study is a well-known technique to examine the possible economic impacts of any event in financial economics literature, this method is only applied for the traded firms. Third, due to data availability, our sample including 40 companies around the world is not large enough to further develop the empirical study. Given the relevance of these limitations, our future research should continue to investigate the economic consequences of environmental or energy management system certification by employing other econometric methods, using other financial performance indicator, or developing our empirical analysis also for non-traded companies.

To conclude, the lack or the link between energy and financial performance is not suggesting that adopting ISO 50001 is a bad investment, but rather that the expected role of ISO 50001 in improving firms' financial performance has been unfounded. In this regard, "How does it pay to be green?" seems to be a more important question than "Does it pay to be green?". In other words, our empirical finding suggests a novel question of how a firm pays to be green in order to improve its business benefits.

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