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OHSAS 18001 and Economic Sustainability:

Effects of Adoption Timing and Firm Characteristics

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Highlights

- The results indicate that early adopters enjoy significantly greater performance gains than do late adopters.
- We find that early adopters of OHSAS 18001 certification realize additional financial performance from the second year to the fourth year after adoption,
- Late adopters only benefit in the preparation year.
- Early adoption is more favorable to firms with high labor intensity and low internationalization level.

OHSAS 18001 and Economic Sustainability: Effects of Adoption Timing and Firm Characteristics

Abstract

Previous studies have shed light on the effects of the adoption of OHSAS (Occupational Health and Safety Assessment Series) 18001 certification on performance. One important factor that has been neglected so far is the adoption timing. The question of whether early OHSAS 18001 adopters achieve better financial performance than do late adopters (or vice versa) remains unanswered. Drawing on institutional theory, we develop hypotheses and then analyze the secondary longitudinal data of listed Chinese manufacturing firms by employing a rigorous event study approach and performing regressions. The results indicate that early adopters enjoy significantly greater performance gains than do late adopters. We find that early adopters of OHSAS 18001 certification realize additional financial performance from the second year to the fourth year after adoption, but late adopters only benefit in the preparation year. Moreover, early adoption is more favorable to firms with high labor intensity and low internationalization level. Thus, this study extends research in understanding the effects of OHSAS 18001 on financial performance and suggest new insights to the implementation of corporate social responsibility practices.

Keywords: OHSAS 18001, corporate social responsibility, adoption timing, institutional theory, event study

1. Introduction

In recent years, there has been increasing pressure from multiple stakeholders to manage occupational health and safety issues to improve health conditions at the workplace and reduce costs from work accidents (İnan et al., 2017). According to the Global Estimates of Occupational Accidents and Work-related Illnesses report (Hämäläinen et al., 2017), the estimated number of work-related deaths occurring annually across the countries rose from 2.33 million in 2014 to 2.78 million in 2017. Therefore, the adoption of OHSAS (Occupational Health and Safety Assessment Series) 18001 certification has been an important undertaking for many organizations and has contributed to achieving corporate social responsibility (CSR) (Godos-Díez, Fernández-Gago, & Martínez-Campillo, 2011; Zwetsloot, 2003)

Proponents of this certification suggest that it may improve working conditions and facilitate safety management, internal safety communication, and company image (Pheng and Pong, 2003; Karapetrovic and Casadesús, 2009; Nunhes et al., 2016; İnan et al., 2017). However, despite the widespread assumption that organizations benefit from OHSAS 18001 certification adoption, conflicting findings exist regarding its effects on financial performance. Some scholars have demonstrated the anticipated financial advantages (Fernándezmuñiz et al., 2009; Lo et al., 2014; Lafuente and Abad, 2018), while others have found no financial performance benefits associated with management certification (e.g., OHSAS 18001) (Lo et al., 2011). Meanwhile, other research has revealed that although improvements in sales growth resulted from OHSAS 18001 adoption, these benefits did not translate into financial performance improvements (Fan and Lo, 2012). Some authors even found negative results due to some

specific assumptions, for example, customer pressure (Lo et al., 2011). Previous studies have shed light on the effects of OHSAS 18001 certification adoption on financial performance, but few studies have been devoted to the moderators of their relationship, with one exception (Lo et al., 2014). One important factor that has been neglected so far is the adoption timing. Therefore, the question of whether early OHSAS 18001 adopters achieve better effects in performance compared with late adopters (or vice versa) remains unanswered. Although past studies have focused on the effect of adoption timing for other certifications (e.g., ISO 9000 and ISO 14001), we believe that OHSAS 18001 has its own characteristics that require separate attention.

Despite the mixed results on the performance benefits of OHSAS 18001 certification, firms continue to implement this standard (Ghahramani, 2016). In practice, the question that managers increasingly face is not whether they should adopt a new certification but when they should adopt it (Su et al., 2015). Early adopters enjoy certain first-mover advantages, such as early access to limited information and brand equity derived from positive customer perceptions of the firm (Jacobs et al., 2015). However, they may also face significant uncertainties and have less knowledge on when to implement it. The decisions on when to adopt OHSAS 18001 certification can significantly affect the firm's competitive standing and create advantages or disadvantages over competitors.

In this study, we view OHSAS 18001 certification as an innovative CSR initiative, similar to that of ISO 9000 and ISO 14000 (Ritchie and Melnyk, 2012). Referring to the literature describing the diffusion of innovations in contrasting the motivations of early and late adopters (e.g., Benner and Veloso, 2008; Russo, 2009; Jacobs et al., 2015) and the innovation adoption

curve provided by Rogers (2003), we believe that the benefits of OHSAS 18001 certification may vary depending on when firms decide to adopt it—that is, the effectiveness of implementation may be influenced by the adoption timing. On the other hand, drawing on institutional theory, we propose that adoption of OHSAS 18001 certification by firms is associated with higher performance benefits for early adopters and lower performance benefits for late adopters. Further, we hypothesize that certain characteristics of a firm may enhance or limit such benefits.

Therefore, our study provides further insights on the financial benefits of adoption timing and considers some contingencies that moderate these benefits. Specifically, this study seeks to answer the following research questions (RQs):

- RQ1. How does the adoption timing influence the effects of OHSAS 18001 certification adoption on financial performance?
- RQ2. What factors affect the different financial performance of early versus late OHSAS 18001 certification adopters?

To answer the two questions, we consider 356 listed Chinese manufacturing firms between 2002 and 2013. We examine the data up to 2013 because the analysis requires data in year t+4 (i.e., 2017) to perceive the firm's performance. We focus on China for three main reasons: (1) The manufacturing sector is the largest and most important sector in the Chinese economy, and China has become the largest manufacturer in the world (Zhang et al., 2014). (2) The general stakeholders are interested in the labor conditions in Chinese factories (Kortelainen, 2010). (3) Empirical evidence on the impact of OHSAS 18001 on Chinese firm performance is scant.

In this paper, we perform an event study analysis and compare changes in return on assets (ROA) of early and late OHSAS 18001 adopters with those of a portfolio of non-OHSAS 18001 control firms. The results show that early adopters of OHSAS 18001 experience significantly greater performance gains than do late adopters, suggesting that they may enjoy certain first-mover advantages that produce superior financial outcomes. Further, this study also shows that the advantages of early adopters tend to be moderated by certain characteristics of the firm. Namely, early adoption is more favorable for firms with high labor intensity and low internationalization level.

This study contributes to the management literature in three ways. First, our results highlight the importance of deciding when to adopt OHSAS 18001 certification. Second, the results advance former first-mover advantages literature by pointing out the specific beneficial period, that is, from the first year to the fourth year after the adoption. Third, we propose that certain key characteristics of a firm amplify the benefits for early adopters more than for late adopters. The advantages accrue more significantly for early adopters under certain circumstances. Further, our study has significant managerial implications. First and foremost, we help managers decide when to adopt the OHSAS 18001 certification by considering their firms' characteristics. Second, the results may be a guideline for them to adopt other management certifications.

The remainder of the paper is structured as follows. In Section 2, we conduct a literature review and then formulate hypotheses. Section 3 describes the dataset and the adopted methodology.

Section 4 presents the results, and Section 5 discusses the findings. Finally, conclusions are provided in Section 6.

2. Literature Review and Research Hypotheses

2.1. Early adopters versus late adopters

Although no previous paper has studied whether early OHSAS 18001 adopters realize better performance than do late adopters, the effect of adoption timing has been analyzed in a variety of other contexts, such as innovation practices, new market entry, new product development, adoption of a new information system or financial accounting standard, and mergers and acquisitions (Fosfuri et al., 2013; Zachary et al., 2015). We found 16 relevant papers in management-related journals that consider the effects of adoption timing of some major management practices (e.g., certifications such as ISO 9000 and ISO 14000, and well-known operation management practices such as Total Quality Management and Six Sigma) on performance.

These papers are summarized in Table 1. They are classified into three clusters according to the different viewpoints on the effect of adoption timing. Most research supports the notion that early adopters have first-mover advantages, and they tend to use institutional theory as the underpinning theoretical framework. However, research has not consistently borne out the first-mover advantages. For example, Jacobs et al. (2015) focus on Six Sigma adoption and find that late adopters enjoy significantly greater performance gains than do early adopters. A third viewpoint is that there is no guarantee that performance improvement belongs to early or late

adopters, while learning is a more important factor than timing in explaining the certification performance (Naveh et al., 2004).

In sum, the effect of adoption timing has been analyzed in a variety of contexts. However, previous studies have shown conflicting results on the different financial performance of early versus late adopters. We think this may be due to the different characteristics of these certifications and practices. Some certifications are private standards, such as ISO 9000, whose primary benefit is expected to accrue for the firms that adopt them (Ni et al., 2016). Others are public standards, such as C-TPAT, whose primary benefits are for the public at large rather than for the firms that adopt them (Ni et al., 2016). Another process management practice, that is, Total Quality Management, can be regarded as an innovation practice that offers a definite economic payoff (Ritchie and Melnyk, 2012). Six Sigma, which typically requires major reassignments of tasks, may be expensive and disruptive to adopt (Jacobs et al., 2015). OHSAS 18001 is similar to other externally certified management systems such as ISO 9000 and ISO 14000; however, it differs from these other systems and may influence performance differently (Lo et al., 2014). One important difference is that ISO 9000 and ISO 14000 certifications are often driven by customer demand, while most firms have been managing safety issues for decades (Lo et al., 2014). Hence, considering the specificities of OHSAS 18001, caution is necessary to generalize the results of the aforementioned studies to this context.

Insert Table 1 Here

2.2. Early adopters versus late adopters of OHSAS 18001

Institutional theory provides a useful lens to explain such first-mover advantages. The theory shows that there is a meaningful difference between early and late adopters of management practice because these two groups face dissimilar pressures from the environment, which may lead to different results of implementing the practice (Tolbert and Zucker, 1983; Dimaggio and Powell, 1983). The first movers adopt management practices because they react to normative pressure and are mainly interested in the internal efficiency gains of a practice (Iatridis et al., 2016). Normative pressures refer to societal expectations toward organizations to behave in accordance with societal norms, beliefs, and values (Schaefer, 2007). They may lead firms to accept that OHSAS 18001 certification is necessary to enhance their corporate reputation in the market (Prajogo et al., 2012). In this context, firms might adopt this certification, for example, as a statement of integrating occupational health and safety issues into their business strategy. In contrast, late adopters are more subject to coercive and mimetic motives (Iatridis et al., 2016). They are more prone to apply this practice symbolically or superficially, that is, without integrating the requirements of the standard in their own operations (Naveh and Marcus, 2004). In such cases, firms may not truly seek the spirit of continuous improvement and may not pursue all the opportunities for learning (Silva et al., 2017).

From this view, early adopters of OHSAS 18001 certification may enjoy greater benefits because they are aware of more opportunities for economic gain by adopting this certification and are free from coercive and mimetic pressure. They are more inclined to spare their efforts to commit to the practice's requirements and implement it substantially (Montiel and Husted,

2009). As a result, they adopt this certification on the basis of their unique social concerns and obtain the benefits by showing their commitment to occupational health and safety issues before their competitors. It is instead reasonable to speculate that late adopters are motivated by legitimacy considerations rather than social concerns, and their adoption is more likely to be compromised.

Even though the later adopters are economically motivated, timing is a critical concern (Benner and Veloso, 2008) because late adopters of the certification only further increase homogeneity with the early adopters (Su et al., 2015). As most firms in an industry adopt a certification, it will be increasingly difficult to translate it into sustainable relative advantages of financial performance because most firms make the same improvements (Porter, 1996). Ritchie and Melnyk (2012) also propose that the financial benefits are greatest for those who adopt the innovation first because a greater number of firms implement similar generic practices later. Thus, although early adopters of innovation may have limited knowledge about a new practice, confront more challenges, and face greater uncertainties, we suggest that early adoption in OHSAS 18001 offers more first-mover advantages than those for late adopters.

We develop the following hypothesis:

Hypothesis 1. The improved post-certification financial performance of early adopters of OHSAS 18001 certification is significantly greater than that of late adopters.

2.3. Factors affecting adoption timing effects of OHSAS 18001

In this part, we choose two factors that not only closely relate to the institutional environment of China but also may have an influence on the relationship between OHSAS 18001 adoption timing and financial performance.

2.3.1. Labor intensity

Firms with high labor intensity have more variable and complex operations (Swink and Jacobs, 2012). Exposure to more complex and mechanized production processes increases occupational risks in manufacturing businesses (Abad et al., 2013). Labor-intensive firms' production processes are often complicated and non-automated; therefore, these firms rely heavily on workers in their operations (Lo et al., 2014). As a production system becomes more dependent on people, the necessity for a formalized process to reduce labor accidents and minimize accident risks becomes increasingly important. Introducing OHSAS 18001 certification can help labor-intensive firms better manage their safety production processes. However, for a low labor-intensive firm, there is less room for further improvement in the safety production processes because it has a higher level of automation. Hence, because of the characteristics and greater benefits of this certification, early adopters with high labor intensity are more suitable and likely to adopt it. They will also adapt and update their safety standards more frequently than will adopters with low labor intensity.

There is an additional factor favoring early adopters of OHSAS 18001 certification with high labor intensity. In some cases, OHSAS 18001 certification can be conditional for recruiting higher quality employees who are in high demand in the labor market (Santos et al., 2013)

because these workers have more power to bargain for better welfare and working conditions (Cahuc et al., 2006). Thus, early adopters with high labor intensity may have more high-quality employees. These human resources are vital in financial performance improvement.

Taken together, we suggest that early adopters with high labor intensity are more likely to benefit from OHSAS 18001 certification than are early adopters with low labor intensity. Hence, we develop the following hypothesis:

Hypothesis 2. The differential financial performance associated with early adoption of OHSAS 18001 certification is greater for organizations with high labor intensity than for those with low labor intensity.

2.3.2. Internationalization level

Internationalization not only enables firms to leverage their existing resources across countries (Kaleka, 2012) but also enhances firm capabilities through a learning-by-exporting process, which means exporting firms may increase their knowledge base by learning from involvement in foreign markets (Martins and Yang, 2009; Vendrell-Herrero et al., 2016). Firms with high internationalization level have greater opportunity to learn because they are exposed to new and different ideas from diverse national contexts and various social, cultural, and environmental challenges (Ayuso et al., 2016). Participation in foreign markets can bring firms into contact with international best practices on occupational health and safety issues, thereby helping to foster new organizational capabilities to implement OHSAS 18001 certification.

Early adopters with low internationalization level have fewer chances and resources to avail themselves of emergent practices such as OHSAS 18001. In contrast, early adopters that have high internationalization level can leverage knowledge acquired in different jurisdictions and develop a set of best practices based on their collective learning (Ayuso et al., 2016). They can take full advantage of codified adoption experiences from foreign organizations, consulting, and other available knowledge stocks. For these reasons, we develop the following hypothesis:

Hypothesis 3. The differential financial performance associated with early adoption of OHSAS 18001 certification is greater for organizations with high internationalization level than for those with low internationalization level.

3. Research Method

3.1. Dataset and sample

We used data from the China Stock Market and Accounting Research (CSMAR) and the WIND Economic Database, which are widely regarded as the most authoritative data sources in China and have been used in recent studies (Sun et al., 2017). We focused on A-share market-listed manufacturing companies in China on the Shanghai and Shenzhen Stock Exchanges[1].

As there is no publicly available database containing the full list of OHSAS-certified firms, data on OHSAS 18001 certification were collected from four sources: a certification and accreditation unified business information search platform (CNCA; http://cx.cnca.cn/), official company websites, annual reports, and media reports. The CNCA platform, supported by the Certification and Accreditation Administration of the People's Republic of China, has

been used in some recent certification-related studies (e.g., Wang et al. 2016; Lo et al. 2017). We conducted the research through a multi-step process. First, one member of the research team searched each of the 2172 listed manufacturing firms in the A-share market on the CNCA search platform and recorded the certification year. Second, a different team member randomly chose several companies to check the results. Third, for firms that were not found on the CNCA platform, we examined their official websites and their annual reports and entered their names (together with a set of keywords related to OHSAS certification) in the Baidu search engine (i.e., the top search engine in China). If there was still no information on OHSAS 18001 certification, this firm was considered a non-adopter. OHSAS 18001 certification is a facility-specific certification; thus, a firm with multiple facilities may obtain multiple certifications. We followed the practice of Lo et al. (2014) and focused only on the first OHSAS 18001 certification.

Out of the 2172 listed manufacturing firms, 844 firms had obtained OHSAS 18001 certification between 2000 and 2013. Of the 844 sample firms, we dropped 488 firms that had insufficient financial data in the period of OHSAS 18001 certification because, for example, they had obtained certification prior to listing on the stock exchange. Finally, 356 firms were included in our analysis.

The frequency of OHSAS 18001 adoption by year is presented in Table 2. We matched them to the widely cited innovation adoption curve provided by Rogers (2003), which categorizes subjects into innovators (2.5%), early adopters (13.5%), early majority (34%), late majority

(34%), and laggards (16%). We then further re-categorized the five groups into two types: early (innovators, early adopters, and early majority) and late adopters (late majority and laggards).

Insert Table 2 Here

3.2. Event study

We used an event study method recommended by Barber and Lyon (1996) and Jacobs et al. (2015) regarding the timeframe to measure the OHSAS 18001 certification effects on financial performance. We defined the event year (year t) as the year when the firm first acquired the certification and year t-2 as the base year. In this study, we measured the abnormal performance over the 5 years from year t-2 to year t+3. We focused on ROA, which is calculated as operating income/total assets, as the dependent variable. As with Lo et al. (2014), we then matched the sampled firms with a set of control firms by matching the industry[2], firm size (calculated as the natural logarithm of the total assets, 50–200%), and ROA (90–110%) in year t-2.

During the matching process, we excluded 65 observations from the 356 that could not be matched with any non-certification firms or had only one firm to match (following Lo et al., 2014); eventually, 291 firms remained (early adopters: 145; late adopters: 146). On average, each sample firm was matched with 3.2 control firms, allowing us to minimize performance fluctuations that might occur in a particular control firm. Next, we performed two non-parametric tests for the two subsamples separately: the Wilcoxon signed ranks (WSR) test and the sign test. We also reported the results of the parametric *t*-test to further confirm our findings.

3.3. Ordinary least squares regression

To further test Hypothesis 1, we used the ordinary least squares (OLS) methodology adopted by other studies (e.g., Jacobs et al., 2015).

We used the abnormal ROA as the outcome, which was obtained from the analysis made in the previous paragraph. *Early* had a value of 1 if firms were OHSAS-certified in 2010 or earlier and a value of 0 if the firms were certified in 2011 or later. Labor intensity (LI) was measured as the ratio of a firm's employee number to its total sales (Swink and Jacobs, 2012). Internationalization level (Int) was measured as the ratio of foreign sales to total sales and indicates the extent to which a firm's business comes from foreign versus domestic markets (Chakrabarty and Wang, 2012).

To ensure the rigor of our model, we included five control variables in the analysis. First, because more profitable firms may have more resources to achieve higher profitability in the future, we controlled their ROA (PP_k). Second, because larger firms may have more resources, they may also have more difficulty coordinating employees when implementing OHSAS 18001 (Lo et al., 2014). Hence, we controlled the firm size ($FSize_k$). Third, one industry-level control variable was also included. We used the mean number of total assets in the same sector in year t ($ISize_{kh}$) as the industry-level control variable. Fourth, adopting OHSAS 18001 certification can be regarded as one of the tools used to facilitate the achievement of corporate social responsibility ( ) goals, and has become a significant element of the CSR effort (Mežinska et al., 2015). If the firm already has CSR reporting, it may exert positive effects on the implementation of occupational health and safety management practices. Thus, we also

controlled whether the firm already had CSR reporting before OHSAS 18001 certification. CSR was coded as 1 if firms had CSR reporting before certified OHSAS 18001; otherwise, we coded it as 0. Fifth, OHSAS 18001 relies on its strong compatibility with ISO 9001 and ISO 14001 management systems, so we also controlled the two ISO certification experiences by considering them dummy variables, indicating whether the firm had received ISO 9001 or ISO 14001 certification during the same event study period (Lo et al., 2014). The dummy variable was coded 0 for firms without ISO 9001/14001 and 1 for firms with ISO 9001/14001. We then summed them up to form the $ISO\ experience_k$. The adoption years of ISO 9000 and ISO 14000 certifications were obtained in the same way as OHSAS 18001 certification. CSR reporting data were collected from CSMAR, and the remaining data were from WIND.

Hence, combining the hypothesized variables with the control factors yields the following model 1 to further test Hypothesis 1:

$$\text{Model 1: } AP_k = \beta_0 + \beta_1(Early) + \beta_2(PP_k) + \beta_3(FSize_k) + \beta_4(ISize_{kh}) + \beta_5(CSR_k) + \beta_6(ISO\ experience_k) + \beta_7(LI_k) + \beta_8(Int_k) + e_k$$

To test the certification adoption period differential impacts of the contextual factors proposed in Hypotheses 2 and 3, we used the interaction terms between the factors and the *Early* adoption variable. The expanded model 2 is:

$$\text{Model 2: } AP_k = \beta_0 + \beta_1(Early) + \beta_2(PP_k) + \beta_3(FSize_k) + \beta_4(ISize_{kh}) + \beta_5(CSR_k) + \beta_6(ISO\ experience_k) + \beta_7(LI_k) + \beta_8(LI_k) \cdot Early + \beta_9(Int_k) + \beta_{10}(Int_k) \cdot Early + e_k$$

where AP_k denotes the abnormal performance from t-2 to t+3, *k* refers to the kth sample firm, and *h* refers to the hth industry in which the kth firm operates.

4. Results

4.1. Impact of OHSAS 18001 adoption timing on financial performance

Table 3 presents the results for abnormal changes in ROA in single-year and multi-year periods for the early adopters and late adopters. Because our base year to establish control firms is year t-2, we present the five yearly changes in abnormal ROA starting with the change from year t-2 to t-1 and continue through the change from year t+2 to t+3. For aggregate measures, we compute the changes in abnormal ROA for four multiple-year periods: from year t-2 to t+3, t-1 to t+3, t to t+3, and t+1 to t+3. To consider the multiple-testing problem, the false discovery rate methodology by Benjamini and Hochberg (1995) is applied.

First, we consider the results of single-year abnormal changes in ROA. For early adopters, the changes are significantly positive from year t-2 to t-1, from t+1 to t+2, and from t+2 to t+3, while the significantly positive results for late adopters only appear from year t-1 to t. The evidence suggests that late adopters of OHSAS certification experience significant benefits from pre-adoption efforts. However, early adopters experience significant benefits 1 year after adoption.

Next, we focus on the results for the multiple-year periods. For early adopters, the abnormal changes in ROA are all significantly positive during the four multiple-year periods. In contrast, none is significant for late adopters.

In summary, the results show that OHSAS certification generates significantly greater positive effects on ROA for early adopters compared with late adopters, which provides support for Hypothesis 1.

Insert Table 3 Here

4.2. Additional tests

To determine whether the benefits of OHSAS 180001 certification adoption timing endure in the longer term (e.g., t+4), we conducted the same event study again. We can see from Table 4 that tests for late adopters still are not significant to t+4 under the false discovery rate (Benjamini and Hochberg, 1995). In addition, the early adoption advantages do not appear up to the fourth year after adoption. These results clearly show that financial performance for early adopters cannot always stay ahead in the long run.

Insert Table 4 Here

4.3. Relating timing effects of OHSAS certification to firm characteristics

Tables 5 provides descriptive statistics and correlation of the variables in a regression analysis. Table 6 presents the estimated standardized regression coefficients for the two models. First, we focus on the results for model 1 to observe the main effects. The *F*-value is 4.052, significant at the 1% level, and the adjusted R^2 is 7.8%. As hypothesized, the coefficient for Early is significantly positive (at the 1% level), which further indicates that OHSAS 18001 certification adoption benefits are greater for early adopters.

Insert Table 5 Here

Insert Table 6 Here

The moderating effect of the two variables (labor intensity and internationalization level) can be observed from model 2. The simple effect of labor intensity is negative and insignificant, while the interaction coefficient with Early is positive and significant (at the 10% level). This result indicates that early-adopting firms with high labor intensity experience greater performance impacts from OHSAS 18001 certification than do early-adopting firms with low labor intensity, but the improved performance of early versus late adopters is significantly greater for high labor intensity firms than for low labor intensity firms. Hypothesis 2 is therefore supported by our findings.

The simple effect of internationalization level is positive and insignificant, while its interaction with Early is negative and significant (at the 5% level). These coefficients indicate that the improved performance of early versus late adopters is greater for firms with low internationalization level. Hypothesis 3 is therefore not supported by our findings. These results are further supported by the plots in Fig. 1.

Insert Fig. 1 Here

5. Discussion

5.1. Early OHSAS 18001 adopters versus late adopters

Lo et al. (2014) only consider adoption timing as a control variable. Our research builds on their study and goes one step further by exploring the effects of adoption timing on financial performance. Our findings suggest that institutional theory provides a useful theoretical

framework to explain adoption timing outcomes for OHSAS 18001 certification. The ultimate performance improvement belongs to the early adopters because they implement a practice that fits their needs, which they believe to be the correct course of action. Late adopters implement the practice because others do so, which reduces the employees' motivation to use OHSAS 18001 in practice. The misdirected reasons for OHSAS 18001 certification adoption lead to a lack of benefits for late adopters (Yeung et al., 2003).

Our results are consistent with the previous findings of Benner and Veloso (2008) and Russo (2009), in which first-mover advantages exist in certification adoption. Further, our study highlights how the adoption timing influences the effects of certification adoption on financial performance. Specifically, early adopters of OHSAS 18001 certification realize greater financial performance at least 1 year after certification adoption, but late adopters benefit in the preparation year. Additionally, the early adoption advantages for this certification last until t+3, and the benefits disappear in the year t+4.

A potential explanation may be that early adopters face a critical challenge because they have limited or no knowledge about the characteristics and benefits of a practice (Meyer et al., 2009); thus, they enter a weak institutional context with high information asymmetries and increased costs of doing business (Ritchie and Melnyk, 2012). Confronted with these challenges, they continuously optimize the implementation process and strive to learn. Hence, the financial performance gain is not significant in the first year after adoption because they are still in the initial exploratory stage. As time passes, they come to understand such practices and develop new capabilities suitable for coping with related problems. In this stage, the financial benefits

appear gradually. However, the early adopters' experience can be easily transferred to other firms (Benner and Veloso, 2008). It is not easy for early adopters to achieve long-term competitive advantages.

Late adopters, as Jacobs et al. (2015) suggest, can use the experiences of others, often captured in an existing knowledge infrastructure, to design more efficient implementation processes. Thus, in the preparation year (1 year before adoption), they may have obvious improvement in financial performance. However, process innovation, such as OHSAS 18001, may be more difficult to copy because it tends to be hidden within the organization rather than discernible through reverse engineering (Naveh et al., 2004). Late adopters may face some internal or external difficulties in the following years, which they need to manage themselves. Further, their adoption comes from extrinsic motivation; thus, they do not want to resolve these problems in a radical way. This behavior is reflected in the financial performance, which does not significantly improve for late adopters after adoption.

Although Wang et al. (2016) and Iatridis et al. (2016) also support the first-mover advantages in certifiable management standard adoption, they take three standards (ISO 9001, ISO 14001, and OHSAS 18001) into account simultaneously. This type of analysis is based on a precondition that firms are likely to exhibit similar patterns of behavior when implementing all of these standards. If this assumption does not stand, the results are invalidated.

5.2. Firm characteristics affecting the benefits of OHSAS 18001 early adopters

The related papers (Table 1) that we mentioned that analyze the adoption timing are affected by either the internal (e.g., resources and dynamic capability) or the external (e.g., institution)

factors of a firm. Our study considers the internal and external factors at the same time. The external factors (e.g., dissimilar pressure from the institutional environment) are used to explain the first-mover advantages, while internal factors are identified (e.g., labor intensity and internationalization level) that may amplify or reduce the potential advantages of early adoption.

5.2.1. Labor intensity

Consistent with Hypothesis 2, the results suggest that positive labor intensity does have a synergistic effect on performance with early adoption (see Fig. 1a). As we discussed before, the workforce of labor-intensive firms is vulnerable to workplace injuries. Protecting employees from injuries is one of the priorities for the management. OHSAS 18001 is designed to enable organizations to control occupational health and safety risks and improve their performance (Rajaprasad and Chalapathi, 2015). The increased number of workers who are injured or die affects the mood and motivation of the whole workforce negatively, which leads to qualitative and quantitative decreases in production (Uysal and Kesim, 2015). Hence, labor-intensive firms adopting the certification early standardize the production process earlier than do late adopters to reduce unsafe practices for employees. Especially China, which was a labor-abundant and low-cost developing country a decade ago, attracts many foreign firms to produce labor-intensive products in mainland China, and these firms transport the products back to their home countries (Liu et al., 2004; Buckley et al., 2007). Under such circumstances, firms with high labor intensity that have adopted OHSAS 18001 certification may better meet the standards of foreign firms, which leads to more orders and improves the financial performance

of these Chinese firms. However, from the 2010s onwards, the number of young workers in the labor force ceased to rise and has now fallen (Thoburn, 2017). Moreover, in the institutional environment during this time, China's FDI strategy has moved away from mature labor-intensive industries toward higher technology industries (Thoburn, 2017). As a result, the labor costs are no longer as inexpensive as before, so many foreign firms transfer the labor-intensive work to even lower labor cost markets, such as Vietnam or Bangladesh. In this case, Chinese firms with OHSAS 18001 certification gain fewer advantages than those without, especially high labor intensity industries.

In contrast, for late adopters, firms with low labor intensity benefit more than do firms with high labor intensity. One explanation may be that low labor intensity indicates an advanced stage of mechanization. By learning from others' experiences, late adopters with low labor intensity can continually adjust their traditional behaviors to adapt to the new certification more easily than can those with high labor intensity. However, high labor intensity may reduce managerial inefficiency (Tzelepis et al., 2006). The result in Fig. 1b shows that the slope for the high labor intensity line is greater than that for low labor intensity, which means that labor intensity amplifies the benefits of OHSAS 18001 certification between early and late adopters.

5.2.2. Internationalization level

Although we propose that the internationalization level may amplify the advantages of early adopters, the empirical analysis shows the opposite. We can see from Fig. 1b that for early adopters, firms with low internationalization level benefit more than do those with high internationalization level, while firms with high internationalization level demonstrate the

advantages for late adopters. We believe one of the explanations is that in China, economic activities and business operations are mainly controlled by the government, so the state's regulatory regimes exert considerable influence on the firms (Li and Ding, 2013). In terms of internationalization, governments in China actively encourage and support domestic firms in moving abroad through policies and regulations (Luo et al., 2010). In the past, the internationalization strategy taken by many Chinese firms might have been a response to institutional pressure from the Chinese government rather than actual economic rationales (Li and Ding, 2013). Further, firms in developing countries such as China tend to lack international experience, competitive technologies, and international market knowledge, which results in them gaining fewer resources and fewer competitive advantages than those of firms in developed markets (Xiao et al., 2013). In addition, most firms in the early period export low-tech and low-priced products to foreign markets, which brings minimal profit in return (Xiao et al., 2013). Hence, the firms that adopt OHSAS 18001 certification early not only must spend money on their workers but also have to attempt to adapt to international market rules. Internationalization increases the environmental complexity and adds more competition to firms. A Chinese firm with the certification does not necessarily have an advantage because many firms also adopt this certification in international markets. The certification may be helpful when they enter a new market, but the overall effects are poorer than those for low internationalization level firms.

On the contrary, firms that focus on the domestic market have some advantages. The Chinese government issued the first OHSMS requirements as part of the national standards in 2001, which were formally implemented in 2002. After this year, firms in China began to adopt this

certification. In the first few years of development of OHSAS 18001 in China, few firms adopted it. Hence, firms that focused on adopting OHSAS 18001 had advantages over their competitors. However, after 10 years of development, the requirements established by the Chinese government underwent a major adjustment in 2011. The new version emphasized the importance of 'health', proposed new requirements for occupational health and safety planning, and made the requirements more compatible to quality and environment management systems. This change prompted different types of enterprises to adjust their occupational health and safety management systems. Thereafter, an increasing number of firms adopted OHSAS 18001 in the domestic market, and competitive advantages in the domestic market weakened gradually. Thus, as Elango et al. (2013) point out, firms in the early stages of entry into a foreign market may lack knowledge, but late adopters with high internationalization level may be exposed to know-how and technologies not available in domestic markets by frequently interacting with foreign agents, customers, suppliers, competitors, or collaborators (Salomon and Shaver, 2005; Dimitratos et al., 2014). Hence, such experience can help internationalized firms further implement occupational health and safety practices in a better way.

Conclusions

This study extends existing knowledge on OHSAS 18001 certification by exploring two questions that have been under-explored in prior studies. We examine how adoption timing influences the effects of OHSAS 18001 certification adoption on financial performance and how some contextual factors affect the different financial performance of early versus late OHSAS 18001 certification adopters.

Our empirical analyses support the hypothesis—grounded in institutional theory—that early adopters of OHSAS 18001 certification perform better financially than do late adopters. The first-mover advantages appear at least 1 year after certification adoption; 2 years after adoption, the advantages become more significant, while after 4 years of adoption, the advantages disappear. Further, the benefits of early adoption in t-2 to t+3 can be amplified or reduced depending on the firm's characteristics. Specifically, early adopters tend to experience greater differential financial performance gains when they have high labor intensity and low internationalization level.

Contribution to theory

First, we highlight the importance of deciding when to adopt OHSAS 18001 certification. Scholars have studied the safety and financial performance benefits of implementing OHSAS 18001 certification; however, they have not explored the importance of deciding when to implement it by comparing the performance changes between early and late adopters. Given that this certification seeks to achieve a certain degree of isomorphism between firms, the timing decision is crucial. By incorporating a time dimension into the analysis, ours is the first study to show that early adopters of OHSAS 18001 obtain more performance benefits than do late adopters. This study thus echoes the suggestion of Aguinis and Glavas (2012) that highlights the importance of explaining under what conditions the relationship between a CSR practice and its outcomes change.

Second, we extend previous literature on the effects of adoption timing of other certifications (e.g., ISO 9001 and ISO 14001) by indicating the time periods when the first-mover advantages

are more significant. We find that early adopters of OHSAS 18001 certification gain additional financial performance at least 1 year after certification adoption and that the advantages disappear after 4 years, but late adopters only benefit in the preparation year. These findings are significantly richer and different from those of other adoption timing studies (e.g., Wang et al. 2016; Iatridis et al., 2016).

Third, we also discuss some key characteristics of a firm that may affect the benefits for early adopters in comparison with late adopters. Specifically, early adopters tend to experience greater differential financial performance gains if they have high labor intensity and low internationalization level. First-mover advantages that benefit early adopters more tend to dominate financial performance outcomes in these circumstances. To the best of our knowledge, our study may be the first to explore the moderators that affect the relationship between adoption timing and financial benefits gleaned from this certification adoption.

5.3. Contribution to practice

Our research also contributes to management practice. Managers often deliberate when to adopt a new certification such as OHSAS 18001. Our research addresses this question and suggests that early adopters capture more lasting financial benefits than do late adopters, while late adopters benefit only for a short time. When to adopt OHSAS 18001 certification depends on the managers' willingness to gain short-term or long-term interest. Managers should also consider their firms' labor intensity and internationalization level when making decisions. These factors may provide important insights for practitioners to identify and exploit their

motivational advantages. Further, our results can also serve as a guideline for firms to adopt other certifications that improve their CSR.

5.4. Limitations and future research

The results of our study should be viewed in light of some limitations. First, we only explore certain internal and external (institutional) factors of an organization. Other external factors may also be important, such as environmental munificence, environmental dynamism (Goll and Rasheed, 2004), industry innovativeness (Mackelprang et al., 2015), and industry competitiveness (Lo et al., 2013). Second, we include only listed Chinese manufacturing firms in our sample. Caution is necessary to generalize the findings to non-Chinese manufacturing firms. Therefore, we recommend that future studies include certified firms from a broader range of countries and conduct cross-country comparisons.

Notes

[1] We excluded B-shares and H-shares because they are bought and sold in different currencies (Casalin et al., 2017).

[2] We used the industry classification criteria issued by the China Securities Regulatory Commission (CSRC) (2012 revision), which consists of an English letter (denoting the industry class) and a two-digit number (denoting the specific industry sector).

References

Abad, J., Lafuente, E., and Vilajosana, J. (2013). An assessment of the OHSAS 18001 certification process: Objective drivers and consequences on safety performance and labour productivity. Safety Science 60, 47–56.

Aguinis, H., & Glavas, A. (2012). What we know and don't know about corporate social responsibility: A review and research agenda. *Journal of Management* 38(4), 932-968.

Ayuso, S., Roca, M., Arevalo, J. A., and Aravind, D. (2016). What determines principle-based standards implementation? Reporting on global compact adoption in Spanish firms. Journal of Business Ethics 133(3), 553–565.

Barber, B. M. and Lyon, J. D. (1996). Detecting abnormal operating performance: The empirical power and specification of test statistics. Journal of Financial Economics 41(3), 359–399.

Benjamini, Y. and Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. Journal of the Royal Statistical Society 57(1), 289–300.

Benner, M. J. and Veloso, F. M. (2008). ISO 9000 practices and financial performance: A technology coherence perspective. Journal of Operations Management 26(5), 611–629.

Buckley, P. J., Wang, C., and Clegg, J. (2007). The impact of foreign ownership, local ownership and industry characteristics on spillover benefits from foreign direct investment in China. International Business Review 16(2), 142–158.

Cahuc, P., Postel-Vinay, F., and Robin, J.-M. (2006). Wage bargaining with on-the-job search: Theory and evidence. Econometrica 74(2), 323–364.

Chakrabarty, S. and Wang, L. (2012). The long-term sustenance of sustainability practices in MNCs: A dynamic capabilities perspective of the role of R&D and internationalization. Journal of Business Ethics 110(2), 205–217.

Dimaggio, P. J. and Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rational in organizational fields. American Sociological Review 48(2), 147–160.

Dimitratos, P., Amorós, J. E., Etchebarne, M. S., and Felzensztein, C. (2014). Micro-multinational or not? International entrepreneurship, networking and learning effects. Journal of Business Research 67(5), 908–915.

Elango, B., Talluri, S., and Hult, G. T. M. (2013). Understanding drivers of risk-adjusted performance for service firms with international operations. Decision Sciences 44(4), 755–783.

Fan, D. and Lo, C. K. Y. (2012). A tough pill to swallow? The impact of voluntary occupational health and safety management system on firms' financial performance in fashion and textiles industries. Journal of Fashion Marketing and Management: An International Journal 16(2), 128–140.

Fernándezmuñiz, B., Montespeón, J. M., and Vázquezordás, C. J. (2009). Relation between occupational safety management and firm performance. Safety Science 47(7), 980–991.

Fosfuri, A., Lanzolla, G., and Suarez, F. F. (2013). Entry-timing strategies: The road ahead. Long Range Planning 46(4–5), 300–311.

Ghahramani, A. (2016). Factors that influence the maintenance and improvement of OHSAS 18001 in adopting companies: A qualitative study. Journal of Cleaner Production 137, 283–290.

Godos-Díez, J. L., Fernández-Gago, R., & Martínez-Campillo, A. (2011). How important are CEOs to CSR practices? An analysis of the mediating effect of the perceived role of ethics and social responsibility. Journal of Business Ethics 98(4), 531-548.

Goll, I. and Rasheed, A. A. (2004). The moderating effect of environmental munificence and dynamism on the relationship between discretionary social responsibility and firm performance. Journal of Business Ethics 49(1), 41–54.

Hämäläinen, P. Takala, J., and Kiat, T. B. (2017). Global Estimates of Occupational Accidents and Work-related Illnesses 2017. WSH institute.

Iatridis, K., Kuznetsov, A., and Whyman, P. B. (2016). SMEs and certified management standards: The effect of motives and timing on implementation and commitment. Business Ethics Quarterly 26(1), 67–94.

İnan, U. H., Gül, S., and Yılmaz, H. (2017). A multiple attribute decision model to compare the firms' occupational health and safety management perspectives. Safety Science 91, 221–231.

Jacobs, B. W., Swink, M., and Linderman, K. (2015). Performance effects of early and late Six Sigma adoptions. Journal of Operations Management 36, 244–257.

Kaleka, A. (2012). Studying resource and capability effects on export venture performance. Journal of World Business 47(1), 93–105.

Karapetrovic, S. and Casadesús, M. (2009). Implementing environmental with other standardized management systems: Scope, sequence, time and integration. Journal of Cleaner Production 17(5), 533–540.

Kortelainen, K. (2010). Global supply chains and social requirements: Case studies of labour condition auditing in the People's Republic of China. Business Strategy and the Environment 17(7), 431–443.

Lafuente, E. and Abad, J. (2018). Analysis of the relationship between the adoption of the OHSAS 18001 and business performance in different organizational contexts. Safety Science 103, 12–22.

Li, F. and Ding, D. Z. (2013). The effect of institutional isomorphic pressure on the internationalization of firms in an emerging economy: Evidence from China. Asia Pacific Business Review 19(4), 506–525.

Liu, X., Wang, C., and Wei, Y. (2004). Causal links between foreign direct investment and trade in China. China Economic Review 12(2), 190–202.

Lo, C. K. Y., Pagell, M., Fan, D., Wiengarten, F., and Yeung, A. C. L. (2014). OHSAS 18001 certification and operating performance: The role of complexity and coupling. Journal of Operations Management 32(5), 268–280.

Lo, C. K. Y., Wiengarten, F., Humphreys, P., Yeung, A. C. L., and Cheng, T. C. E. (2013). The impact of contextual factors on the efficacy of ISO 9000 adoption. Journal of Operations Management 31(5), 229–235.

Lo, C. K. Y., Yeung, A. C. L. and Cheng, T. C. E. (2011. Meta-standards, financial performance and senior executive compensation in China: An institutional perspective. International Journal of Production Economics 129(1), 119–126.

Lo, C., Tang, C. S., Zhou, Y., Yeung, A. C. L., and Fan, D. (2017). Environmental incidents and the market value of firms: An empirical investigation in the Chinese context. *Available online: https://ssrn.com/abstract=2987976 (accessed on 16 June 2017).*

Luo, Y., Xue, Q., and Han, B. (2010). How emerging market governments promote outward FDI: Experience from China. Journal of World Business 45(1), 68–79.

Mackelprang, A. W., Habermann, M., and Swink, M. (2015). How firm innovativeness and unexpected product reliability failures affect profitability. Journal of Operations Management 38, 71–86.

Martins, P. S. and Yang, Y. (2009). The impact of exporting on firm productivity: A meta-analysis of the learning-by-exporting hypothesis. Review of World Economics 145(3), 431–445.

Meyer, K. E., Estrin, S., Bhaumik, S. K., and Peng, M. W. (2009). Institutions, resources, and entry strategies in emerging economies. Strategic Management Journal 30(1), 61–80.

Mežinska, I., Lapiņa, I. and Mazais, J. (2015). Integrated management systems towards sustainable and socially responsible organisation. Total Quality Management and Business Excellence 26(5–6), 469–481.

Montiel, I. and Husted, B. W. (2009). The adoption of voluntary environmental management programs in Mexico: First movers as institutional entrepreneurs. Journal of Business Ethics 88(2), 349–363.

Naveh, E. and Marcus, A. A. (2004). When does the ISO 9000 quality assurance standard lead to performance improvement? Assimilation and going beyond. IEEE Transactions on Engineering Management 51(3), 352–363.

Naveh, E., Marcus, A., and Moon, H. K. (2004). Implementing ISO 9000: Performance improvement by first or second movers. International Journal of Production Research 42(9), 1843–1863.

Ni, J. Z., Melnyk, S. A., Ritchie, W. J., and Flynn, B. F. (2016). Why be first if it doesn't pay? The case of early adopters of C-TPAT supply chain security certification. International Journal of Operations and Production Management 36(10), 1161–1181.

Nunhes, T. V., Ferreira Motta, L. C., and De Oliveira, O. J. (2016). Evolution of integrated management systems research on the Journal of Cleaner Production: Identification of contributions and gaps in the literature. Journal of Cleaner Production 139, 1234–1244.

Pheng, L. S. and Pong, C. Y. (2003). Integrating ISO 9001 and OHSAS 18001 for construction. Journal of Construction Engineering and Management 129(3), 338–347.

Porter, M. E. (1996). What is strategy? Harvard Business Review 74(6), 61–78.

Prajogo, D., Tang, A. K. Y., and Lai, K.-H. (2012). Do firms get what they want from ISO 14001 adoption: An Australian perspective. Journal of Cleaner Production 33, 117–126.

Rajaprasad, S. V. S. and Chalapathi, P. V. (2015). Factors influencing implementation of OHSAS 18001 in Indian construction organizations: Interpretive structural modeling approach. Safety and Health at Work 6(3), 200–205.

Ritchie, W. J. and Melnyk, S. A. (2012). The impact of emerging institutional norms on adoption timing decisions: Evidence from C-TPAT—A government antiterrorism initiative. Strategic Management Journal 33(7), 860–870.

Rogers, E. (2003). Diffusion of innovations. Free Press, New York, NY.

Russo, M. V. (2009). Explaining the impact of ISO 14001 on emission performance: A dynamic capabilities perspective on process and learning. Business Strategy and the Environment 18(5), 307–319.

Salomon, R. M. and Shaver, J. M. (2005). Learning by exporting: New insights from examining firm innovation. Journal of Economics & Management Strategy 14(2), 431–460.

Santos, G., Barros, S., Mendes, F., and Lopes, N. (2013). The main benefits associated with health and safety management systems certification in Portuguese small and medium enterprises post quality management system certification. Safety Science 51(1), 29–36.

Schaefer, A. (2007). Contrasting institutional and performance accounts of environmental management systems: Three case studies in the UK water & sewerage industry. Journal of Management Studies 44(4), 506–535.

Silva, S. A., Carvalho, H., Oliveira, M. J., Fialho, T., Guedes Soares, C., and Jacinto, C. (2017). Organizational practices for learning with work accidents throughout their information cycle. Safety Science 99, 102–114.

Su, H. C., Dhanorkar, S., and Linderman, K. (2015). A competitive advantage from the implementation timing of ISO management standards. Journal of Operations Management 37, 31–44.

Sun, S. L., Peng, M. W., and Tan, W. (2017). Institutional relatedness behind product diversification and international diversification. Asia Pacific Journal of Management 34(2), 339–366.

Swink, M. and Jacobs, B. W. (2012). Six Sigma adoption: Operating performance impacts and contextual drivers of success. Journal of Operations Management 30(6), 437–453.

Thoburn, J. (2017). China's economy: What everyone needs to know, by Arthur R. Kroeber/Developing China: The remarkable impact of foreign direct investment, by Michael J. Enright. Journal of the Asia Pacific Economy 22(2), 353–356.

Tolbert, P. S. and Zucker, L. G. (1983). Institutional sources of change in the formal structure of organizations: The diffusion of civil service reform, 1880–1935. Administrative Science Quarterly 28(1), 22–39.

Tzelepis, D., Tsekouras, K., Skuras, D., and Dimara, E. (2006). The effects of ISO 9001 on firms' productive efficiency. International Journal of Operations & Production Management 26(10), 1146–1165.

Uysal, H. T. and Kesim, E. (2015). Correlation analytics of blue-collar employees' organizational levels in coal mining. Open Journal of Business and Management 3(1), 83–95.

Vendrell-Herrero, F., Gomes, E., Mellahi, K., and Child, J. (2016). Building international business bridges in geographically isolated areas: The role of foreign market focus and outward looking competences in Latin American SMEs. Journal of World Business 52(4), 489–502.

Wang, X., Lin, H., and Weber, O. (2016). Does adoption of management standards deliver efficiency gain in firms' pursuit of sustainability performance? An empirical investigation of Chinese manufacturing firms. Sustainability (Switzerland) 8(7), 694.

Xiao, S. S., Jeong, I., Moon, J. J., Chung, C. C., and Chung, J. (2013). Internationalization and performance of firms in China: Moderating effects of governance structure and the degree of centralized control. Journal of International Management 19(2), 118–137.

Yeung, A. C. L., Lee, T. S., and Ychan, L. (2003). Senior management perspectives and ISO 9000 effectiveness: An empirical research. International Journal of Production Research 41(3), 545–569.

Zachary, M. A., Gianiodis, P. T., Payne, G. T., and Markman, G. D. (2015). Entry timing: Enduring lessons and future directions. Journal of Management 41(5), 1388–1415.

Zhang, L., Wang, T. N., and Fung, H. G. (2014). Market reaction to corporate social responsibility announcements: Evidence from China. China & World Economy 22(2), 81–101.

Zwetsloot, G. I. (2003). From management systems to corporate social responsibility. Journal of Business Ethics 44(2-3), 201-208.

Figure(s)

Table 1: Adoption timing-related papers

	Paper	Theory	Method	Management practices	Outcomes	Adoption timing moderators
First viewpoint: First-mover advantages						
1	Nehrt (1996)	no	T	Environmental investment	Financial performance	no
2	Westphal et al. (1997)	IT	T	Total quality management	Firm's efficiency	Institutional factors
3	Christmann (2000)	RBV	T	Environmental strategies	Cost advantage	Process innovation and implementation capability
4	Sinha and Noble (2008)	no	T	Radical manufacturing technologies	Firm survival	no
5	Benner and Veloso (2008)	no	T	ISO 9000	Financial performance	no
6	Russo (2009)	DCT	T	ISO 14001	Environmental performance	no
7	Corredor and Goñi (2011)	IT	T	Total quality management	Financial performance	no
8	Bose and Pal (2012)	no	T	Green supply chain management initiatives	Stock prices	no
9	Su et al. (2015)	no	T	ISO 14001	Financial performance	ISO 9001 certification and competitive intensity
10	Iatridis et al. (2016)	IT	T	Certifiable management standards (ISO 9001, ISO 14001, and OHSAS 18001)	Motivation and commitment to the standards requirements	no

11	Wang et al. (2016)	DCT	T	Management practice standards (ISO 9001, ISO 14001, and OHSAS 18001)	Firm efficiency	no
12	Bhimani et al. (2016)	NIT	T	CSR reporting	CSR embeddedness	no
Second viewpoint: Second-mover advantages						
1	Ritchie and Melnyk (2012)	IT	T	Customs Trade Partnership Against Terrorism (C-TPAT)	Competitive advantage	no
2	Luan et al. (2013)	IT	T	Environmental policies	Financial performance	Action on the policy of green culture and on the policy of quality management
3	Jacobs et al. (2015)	no	T	Six Sigma	Financial performance	Technological velocity, B2B and B2C markets, prior performance, and organization size
Third viewpoint: none of them						
1	Naveh et al. (2007)	IT	T	ISO 9000	Operational and business improvement	Learning

Notes: IT, institutional theory; NIT, neo-institutionalist view; RBV, resource-based view; DCT, dynamic capability theory; T, empirically tested hypothesis.

Table 2: Adoption year frequency for the 356 sample firms with OHSAS 18001 certification years prior to 2014

Year	Frequency of OHSAS 18001 adoption years				Rogers (2003) group	
	Frequency	Cum	Cum %	Group %		
2002	5	5	1.40	3.09	Innovators (2.5%)	Early (49.4%)
2003	6	11	3.09			
2004	14	25	7.02	15.45	Early adopters (13.5%)	
2005	21	46	12.92			
2006	20	66	18.54			
2007	23	89	25.00	30.90	Early majority (34%)	
2008	30	119	33.43			
2009	28	147	41.29			
2010	29	176	49.44			
2011	52	228	64.04	34.83	Late majority (34%)	Late (50.6%)
2012	72	300	84.27			
2013	56	356	100.00	15.73	Laggards (16%)	

Table 3: Annual abnormal changes in ROA for year t-2 through t+3 for all sample firms

	Start year	Median	% Positive	Mean	P value (WSR)	P value (sign test)	P value (*t*-test)
Early adopters (2010 or earlier) N = 145							
Single-year periods	t-2 to t-1	0.005	60.00	0.006	0.022**	0.020**	0.231
	t-1 to t	0.003	53.79	0.003	0.246	0.406	0.632
	t to t+1	0.001	54.48	0.000	0.987	0.319	0.991
	t+1 to t+2	0.003	62.07	0.002	0.161	0.005***	0.694
	t+2 to t+3	0.011	66.21	0.014	0.001***	0.000***	0.002***
Multi-year periods	t-2 to t+3	0.015	67.59	0.025	0.000***	0.000***	0.000***
	t-1 to t+3	0.015	65.52	0.018	0.001***	0.000***	0.006**
	t to t+3	0.011	64.14	0.015	0.000***	0.001***	0.001***
	t+1 to t+3	0.011	66.21	0.015	0.000***	0.000***	0.000***
Late adopters (2011 or later) N = 146							
Single-year periods	t-2 to t-1	0.000	50.00	-0.004	0.381	1.000	0.227
	t-1 to t	0.005	60.96	0.009	0.026	0.010*	0.105
	t to t+1	0.005	58.90	0.000	0.170	0.039	0.962
	t+1 to t+2	-0.001	47.95	-0.002	0.147	0.679	0.653
	t+2 to t+3	0.000	49.32	-0.006	0.395	0.934	0.213
Multi-year periods	t-2 to t+3	-0.001	48.63	-0.003	0.741	0.804	0.489

t-1 to t+3	0.004	54.79	0.001	0.674	0.282	0.781
t to t+3	-0.002	46.58	-0.008	0.558	0.456	0.169
t+1 to t+3	-0.002	43.84	-0.008	0.125	0.159	0.050

Notes: *, **, and *** denote significance at the 0.1, 0.05, and 0.01 levels, respectively (Benjamini and Hochberg, 1995 false discovery rate correction).

Table 4: Additional tests for annual abnormal changes in ROA to t+4 for all sample firms

Start year	Median	% Positive	Mean	P value (WSR)	P value (sign test)	P value (*t*-test)
Early adopters (2010 or earlier) N = 145						
t-2 to t+4	0.000	50.68	0.005	0.399	0.934	0.331
t-1 to t+4	0.006	54.48	0.016	0.266	0.319	0.206
t to t+4	0.004	52.41	0.013	0.454	0.618	0.258
t+1 to t+4	0.006	56.55	0.013	0.309	0.135	0.230
Late adopters (2011 or later) N = 146						
t-2 to t+4	0.005	57.24	0.022	0.042	0.097	0.046
t-1 to t+4	0.006	54.79	0.009	0.092	0.282	0.112
t to t+4	0.003	52.05	0.000	0.920	0.679	0.956
t+1 to t+4	0.001	52.05	-0.001	0.823	0.679	0.912

Table 5: Descriptive statistics and correlation of the variables in regression analysis

		Mean	Std Dev	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Abnormal performance	(1)	0.011	0.050	1								
Early	(2)	0.498	0.501	.270**	1							
Pre ROA	(3)	0.050	0.045	-.127*	-.139*	1						
Firm size	(4)	21.450	0.947	-0.096	-0.024	0.005	1					
Industry size	(5)	21.997	0.682	-.196**	-.378**	.126*	.163**	1				
CSR	(6)	0.168	0.375	-0.065	-.357**	0.046	.262**	.218**	1			
ISO experience	(7)	1.179	0.744	0.028	0.047	-0.028	-.149*	0.042	0.090	1		
Labor intensity	(8)	0.000	0.000	0.095	.185**	-.143*	-.328**	-.216**	-.119*	0.075	1	
Internationalization level	(9)	0.125	0.195	-0.079	-.139*	0.094	-0.085	-0.112	0.004	0.089	.128*	1

Note: N = 291. * and ** significant at the 0.05 and 0.01 levels, respectively.

Table 6: Estimated coefficients from regressions of abnormal ROA change from t-2 to t+3

	Model 1	**Model 2**
Early	0.233***	0.181*
Pre ROA	-0.077	-0.071
Firm size	-0.095	-0.107*
Industry size	-0.104	-0.113*
CSR	0.070	0.067
ISO experience	0.004	0.010
Labor intensity	0.003	-0.184
Internationalization level	-0.060	0.050
Labor intensity *Early		0.264*
Internationalization level *Early		-0.172**
F value	4.052***	3.932***
R^2	0.103	0.123
Adjusted R^2	0.078	0.092

Note: N = 291. Standardized regression coefficients are reported. *, **, and *** significant at the 0.1, 0.05, and 0.01 levels, respectively.

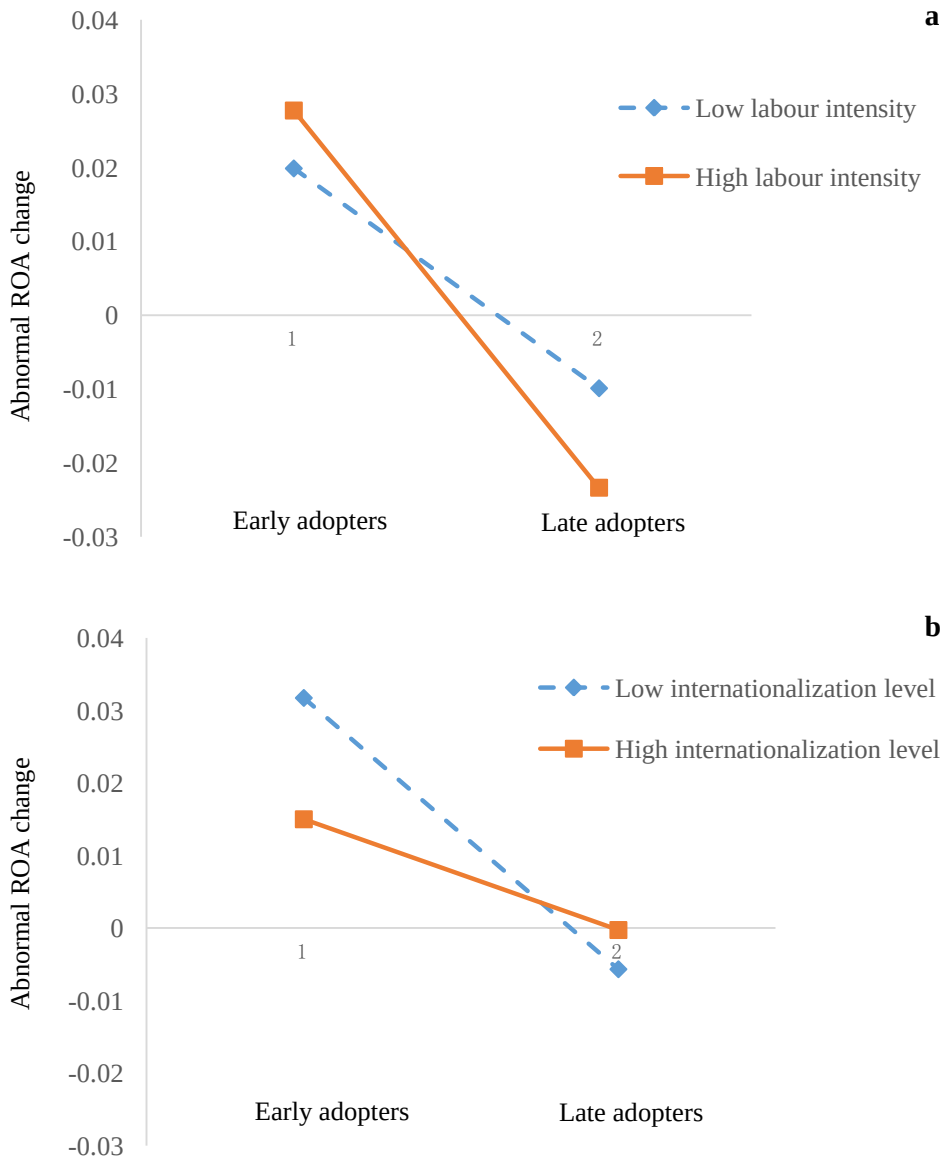

Figure 1: Significant interaction effects between hypothesized variables (panel a, labor intensity; panel b, internationalization level) and period of OHSAS 18001 certification adoption on abnormal changes from t-2 to t+3 in ROA for all sample firms.