

Adopting Occupational Health and Safety Management Standards: The Impact on Financial Performance in Pharmaceutical Firms in China

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Background and Purpose: In recent years, the frequent occurrence of occupational accidents, illness, and injuries has become a major issue in China. This study aims to investigate the relationship between the adoption of Occupational Health and Safety Management System (OHSMS) standards and financial performance, with a particular focus on the pharmaceutical firms in China.

Methods: The study is based on a sample consisting of 125 pharmaceutical firms listed on the Shanghai and the Shenzhen stock exchanges in China for the period 2010–2018. Each sample firm was evaluated by whether and when it is certified by an OHSMS standard depending on secondary data collected from an independent certification database. Panel-based regression models were employed to explore whether adoption of an OHSMS standard has had an impact on financial performance.

Results: The regression results reveal that the adoption of an OHSMS standard positively affects contemporaneous financial performance measured by return on assets (ROA), return on equity (ROE), and earnings per share (EPS). Mixed results were found when financial performance indicators were extended by two years, suggesting that ROE will increase in the second year after a firm is certified with the standard, but EPS will decline in the third year.

Conclusion: The study findings empirically show that adoption of an OHSMS standard contributes to better financial performance for pharmaceutical firms of China in the short term. However, executives of pharmaceutical firms need to be aware of the increased costs related to certification renewal and audit in the following periods and exercise their management discretion to achieve a win–win situation between OHSMS implementation and financial benefit.

Keywords: occupational health and safety management system, OHSAS 18001, ISO 45001, financial performance, pharmaceutical firm

Introduction

In recent years, Chinese firms have been pressured by the public and the government to properly manager occupational health and safety (OHS) issues because of the increasing number of occupational accidents, illness, and injuries.¹ There were 23,497 cases of occupational diseases reported in 2018, an increase of 103.98% compared with the number in 2006.² In particular, the manufacturing sector has a higher injury rate incurred because of relatively dangerous workplaces and hazardous production processes. In the Chinese context, the manufacturing sector has been

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found to account for the largest group of occupational illness and injury cases, representing approximately 66% of injuries in all sectors.¹ The details of the number of occupational disease cases and the death tolls from accidents related to workplace safety reported in China between 2006 and 2018 are shown in Table 1.

Belonging to manufacturing sector and with a focus on the promotion of well-being and public health, the pharmaceutical sector should do its best to contribute to corporate social responsibility (CSR)^{3,4} and to satisfy moral demands from multiple stakeholders, such as patients, employees, the community, and government.^{5,6} Despite pharmaceutical firms having realised the importance of corporate citizenship, there has still been a growing number of occupational injuries, illnesses, or even fatalities during the last decade, which has had a harmful impact on the image of the whole sector.⁷⁻⁹ Taking China as an example, in April 2019, 10 workers died and 12 workers were seriously injured by an explosion in a pharmaceutical firm in Shandong province of mainland China. Another severe OHS accident was reported in June 2017 in Hunan province, where two workers were killed by a fire in a tincture plant. Table 2 illustrates some serious accidents related to OHS in Chinese pharmaceutical firms between 2010 and 2019.

Pharmaceutical firms need to exercise OHS issues in a more careful manner, not only because dangerous

Table 1 The Number of Occupational Disease Cases and the Death Tolls from Accidents Related to Workplace Safety Reported in China, 2006–2018

Year	The Reported Numbers of Occupational Disease Cases	The Reported Death Tolls from Accidents Related to Workplace Safety
2018	23,497	34,672
2017	26,756	38,766
2016	29,420	41,902
2015	29,180	66,182
2014	29,972	68,061
2013	26,393	69,434
2012	27,420	71,983
2011	29,879	75,572
2010	27,240	79,552
2009	18,128	83,196
2008	13,744	91,172
2007	14,296	101,480
2006	11,519	111,822

Note: The source of the data is the National Health Commission of China.²

Table 2 Serious OHS Accidents in Pharmaceutical Firms in China, 2010–2019

Year	Serious OHS Accident	Consequence
2019	An explosion at the freeze-drying plant in Qilu-tianhe Pharma in Shandong Province	Ten workers died and 12 workers were seriously injured
2019	An explosion at the glutamine production line in Shenhua Pharma in Jiangsu Province	Eight workers were injured and one worker died after being rescued
2018	A flash explosion within the catalyst removal process of hydrogenation in Yangzi Pharma in Jiangsu Province	One worker died and a loss of 1.4 million Chinese yuan was incurred
2017	A fire at the tincture plant in Hansen Pharma in Hunan Province	Two workers died and three workers were seriously injured
2017	A fire at the Neurontin-manufacturing plant in Tonghe Pharma in Jiangxi Province	One worker died and one worker received minor injuries
2015	A fire at the extraction plant in Livzon Pharma in Ningxia Autonomous Region	Four workers suffered burns; one of them suffered severe burns
2014	An explosion of the drying oven at the solid preparation plant in Huigu Pharma in Hainan Province	Four workers died and 10 workers were injured
2014	An explosion at the boiler in Huayi Pharma in Zhejiang Province	Three workers were injured, and the burned area was over 400 square meters
2013	An explosion of the hot air circulation oven in Tiancian Pharma in Shanxi Province	Five workers received minor injuries
2012	An explosion in the reaction cauldron in Ivyuan Pharma in Hubei Province	Two workers died and 26 workers were injured
2011	An explosion of the pressurised container in Hanpu Pharma in Guangdong Province	One worker died and four workers were seriously injured
2010	An explosion at the tablet plant in Quanxin Pharma in Yunan Province	Five workers died and eight workers were injured, including two workers who suffered moderate burns

Note: The source of the data is the National Health Commission of China.²

workplaces may physically threaten workers’ lives but also because chemical hazards and harmful discharges may potentially increase the risk to their health.¹⁰ The

protection of OHS is a basic human right that the public require from government.¹¹ Workplace safety is always regarded as a licence for a firm to operate sustainably in both legal and moral contexts.

Relevance of OHSMS for Institutions

To systematically reduce the number of lost workdays, the rates of accidents related to workplace safety, and costs related to occupational disease, some companies are likely to adopt an Occupational Health and Safety Management System (OHSMS).^{12–15} This system can effectively control OHS risks and improve safety management to such an extent that workers can better fulfil their duties with fewer safety concerns.^{16,17} The adoption of OHSMS may be triggered by pressure from various stakeholders involved in the firm.¹ According to the institutional theory, the external environment can affect the development of the structure and the operational activities of an organisation.¹⁸ At present, firms are required to not just pursue economic benefit but to also ensure that they conform to the social systems of norms, rules, values, and beliefs.¹⁹ Under growing pressure for OHS protection by employees, the public, and government, firms may adjust their strategies and behaviours, such as adopting OHSMS, to meet external demands and secure their legitimacy.²⁰

However, an OHSMS may lead to an “iron cage” for firms that adopt it if its implementation is driven by stakeholders’ legitimacy rather than for internal technical benefit.²¹ In fact, institutional theory also suggests that the managerial decision for OHSMS implementation is made under a take-it-for-granted position from stakeholder pressure, whereby firms’ internal efficiency and effectiveness may be hindered.¹⁸ Even so, some factors can facilitate the voluntary implementation of an OHSMS, closely linked to the introduction of a safety framework.²² Adopting firms can benefit from better control of occupational risk, reduction of accidents related to workplace safety, and decline of economic costs.^{23,24} They may also have reduced material losses and fewer interruptions in the production process.²⁵

Several extant studies have investigated OHSMS implementation in different geographic contexts. Using a sample of 131 firms from Spain, Fernández-Muñiz et al²⁶ found that OHSMS adoption is driven by the prevention of work accidents, the promotion of employees’ well-being, and firms’ strategic needs. Similarly, Abad et al²⁵ examined 149 Spanish firms and suggested that adopting firms have increased labour productivity. Based on data from

seven manufacturing firms in Taiwan, Chen et al²⁷ concluded that the factors of OHSMS adoption consist of internal decisions regarding corporate image and of external customer demand. In the Chinese context, Qi et al²⁸ empirically examined OHSMS adoption from the management perspective and found that whether being publicly listed in the stock market is a significant driver for OHSMS adoption. Wang et al²⁹ looked at 73 Chinese manufacturing firms during 2009–2012 to examine the association between OHSMS adoption and the efficiency of sustainability goals and concluded that firms adopting an OHSMS gain a higher triple-bottom-line efficiency score. Based on a sample of 211 US-listed firms in the manufacturing sector between 1999 and 2011, Lo et al³⁰ found that adopting firms have better operating performance in terms of safety, sales’ growth, labour productivity, and profitability.

OHSMS Standards and Their Adoption

To provide guidance for OHSMS adoption, some international bodies and institutions have published various OHSMS standards, such as ILO-OHS-2001, BS 8800, OHSAS 18001:2007 and ISO 45001:2018.^{25,31,32} Today, the Occupational Health and Safety Assessment Series (OHSAS) 18001:2007 and the ISO 45001:2008 are the two most commonly used standards in terms of OHS issues.^{32–36} The OHSAS 18001 has received considerable recognition worldwide, with approximately 90,000 adopting companies in 127 different countries, but it has been gradually replaced since Mar 2018 by a new OHS standard developed by the International Organization for Standardization (ISO), namely, the ISO 45001.³⁷

Formulated in 1999, the OHSAS 18001 aims to promote good practice of OHS on the basis of a structured management system established in an organisation.³⁸ It mainly addresses aspects of OHS without covering other health or sustainability issues like welfare programmes and cleaner manufacturing. Another prevailing OHSMS standard in recent years is the ISO 45001, which applies the common high-level structure of all ISO Management System Standards, like ISO 9001:2015 and ISO 14001:2015. The ISO 45001 utilises a continuous improvement cycle, such as the PDCA (Plan-Do-Check-Act) cycle, to develop OHS goals, evaluate OHS risks, monitor implemented OHS activities, and constantly improve OHS performance.³⁷ It was initially developed on 12 March 2018, with a transition period of 36 months. Therefore, the existing OHSAS 18001 would not be valid

after 11 March 2021, and all audits after then should be performed according to the requirement of the ISO 45001.³⁹

In general, both the OHSAS 18001 and the ISO 45001 provide instructions for companies to manage OHS risks and improve OHS performance.^{35–38} Even so, some differences still exist between standards. For instance, the ISO 45001 places greater emphasis on both internal and external factors related to OHS issues. Moreover, the ISO 45001 requires firms to take action to address OHS risks and opportunities that may both positively and negatively influence the capacity of an OHSMS. It also has a stronger focus on the role of top management in effectively exercising an OHSMS.

Nevertheless, the number of certified firms is growing rapidly around the world, the debate about whether the adoption can bring about benefits remains open, and researchers still claim that further study is needed to clarify the pros and cons of adoption of an OHSMS standard.^{23,30,31,40} One of the featured advantages for standard adoption is the organisational legitimacy gained from related stakeholders, including employees, customers, suppliers, and government.^{25,41,42} When OHS is promoted, adopting firms may have a greater possibility to retain and attract key personnel and, therefore, have increased labour productivity.^{20,25} Adopting firms can also charge premium prices for socially concerned customers,⁴³ possibly resulting in expanded sales and better marketing performance.^{24,44} However, previous studies have determined that the adoption may lead to internal inefficiency and ineffectiveness. It can hardly result in superior performance when the pressures for standard adoption derive mainly from stakeholders, rather than from internal technical demands.^{24,30} Taken together, the abovementioned arguments are still inconclusive and need further justification.

Research Question

The research question of this paper lies in whether the adoption of an OHSMS standard could impact the financial performance of Chinese pharmaceutical firms. To the best of the authors' knowledge, very few studies have shed light on OHSMS standard adoption in the Chinese context, meaning that this study contributes to filling the research gap with empirical evidence of a country where firms have increasingly implemented an OHSMS. We also focus on the pharmaceutical industry, and few papers have addressed OHS issues in this particular sector. Another concern relates to the dominant amount of past studies relying on the use of

subjective data (eg, surveys) in the empirical analysis.^{24,45} To overcome this bias, we measure adoption of an OHSMS standard objectively by using secondary data collected from an independent database.

The existing literature has pointed out that the impact of adoption of an OHSMS standard on financial performance is a gradual process because most OHSMS standards fall into a continuous improvement concept.^{24,25,29} In this vein, it is necessary to make a distinction between immediate and long-run effects of standard adoption. The institutional theory mentioned earlier leads us to deduce the hypotheses of this study. At a glance, adoption is financially burdensome because firms need to pay costly certification and audit expenses and may capitalise more funds to purchase safety facilities.^{46,47} However, employees could be also motivated to achieve better quality performance with fewer safety concerns.¹⁶ Under a sound OHS environment, accidents in the workplace can be also prevented to some extent.⁴⁸ As indicated above, the adoption of an OHSMS standard may either positively or negatively impact financial performance in the short term. The first hypothesis is constructed as follows:

H1. The adoption of an OHSMS standard impacts contemporaneous financial performance among Chinese pharmaceutical companies.

In the long term, the adoption of an OHSMS standard may progressively foster a safer working climate where workers may carefully deal with production and inspection processes at a slower speed. Past studies have also concluded that an OHSMS standard could not serve as a strong marketing tool to attract customers.²⁴ Nevertheless, previous studies have suggested that managers would perceive an OHSMS standard to be a strategic tool because, in the long-run, the adoption can provide competitive advantage and improve a firm's reputation.²⁷ In this respect, the impact of OHSMS standard adoption on future financial performance still presents mixed results.^{25,49} Accordingly, the second hypothesis is defined as follows:

H2. The adoption of an OHSMS standard impacts subsequent financial performance among Chinese pharmaceutical companies.

Research Methods

Sample Selection

The sample in this study is pharmaceutical firms currently listed on either the Shanghai or the Shenzhen stock exchanges, which are two main stock markets in mainland

China. The sampling procedure consists of four stages. First, we identified 346 firms with a unique identification code of “Pharmaceutical Manufacturing” based on the “Industry Classification Guideline” published by the China Securities Regulatory Commission (CSRC). Second, we excluded those firms labelled as “Special Treatment (ST)” under CSRC’s regulation between 2010 and 2018 because of the abnormality of their financial performance in consecutive years. Third, we removed firms with no prior certification records of any management system standard (eg, ISO 9001, ISO 14001 or OHSAS 18001) in a specialised certification database, namely the National Certification and Accreditation Information Public Service Platform (CAIPSP), during the analysed period. The reason for this exclusion was the difficulty of confirming whether a firm without past certification records would be included fully and in a timely fashion by the CAIPSP due to either renaming of the firm or other factors. Last, we eliminated firms with incomplete data of performance indicators.

The abovementioned sampling procedure finally resulted in a total of 125 pharmaceutical firms with 1,125 observations over a nine-year period from 2010 to 2018. [Table 3](#) reveals the stratification of sample firms by ownership structure and number of employees. In general, there is a significantly larger proportion of private pharmaceutical firms than of state-owned enterprises in the sample. Additionally, more than half of the sample firms have 1001 to 5000 employees. The full list of sample firms included in the study is shown in [Appendix Table A1](#).

The data of OHSMS standard adoption for sample firms were obtained from the CAIPSP developed by the Certification and Accreditation Administration of the People’s Republic of China (CNCA). This is an exclusive

database in China providing whether either a company or a specific type of product has been certified by a particular management system standard. Detailed information, such as the year of being certified and the agency granting the certification, can also be found in the database. Given that the CAIPSP has records for all adopting firms, we were able to manually evaluate whether and when a sample firm was certified by an OHSMS standard over the analysed period. Regarding the data of financial performance indicators, the source is the CSMAR (China Stock Market and Accounting Research) database, which is a leading capital market information provider offering extensive financial data of Chinese enterprises for academia.

Measurements of Variables

The Adoption of an OHSMS Standard

The adoption of an OHSMS standard is the independent variable of this study. To measure whether a particular pharmaceutical firm adopts either the OHSAS 18001 or the ISO 45001, a dummy variable was developed by assigning the value of 1 if the sample firm is certified with the standard, and 0 otherwise. We also measured maximum two-year lagged terms of the independent variable because the sustaining impact of standard adoption on subsequent financial performance would be examined.

Financial Performance and Control Variables

Financial performance constitutes the dependent variables of this study. Orlitzky et al⁵⁰ categorised three types of measure as accounting-based, market-based, and perpetual-based. We have not considered a perpetual-based measure as it is based on respondents’ subjective perception of performance of a firm rather than on actual firm performance. Even though an accounting-based and market-based indicator is more objective, past studies have proved that focusing solely on a single type of measure may result in individual bias.⁵¹ For instance, the accounting-based measure is subject to past financial information, and the market-based measure may be easily affected by macroeconomic fluctuations.⁵² To overcome bias, we employed both accounting-based and market-based measures to comprehensively evaluate financial performance.

In terms of the accounting-based measure, we used return on assets (ROA) and return on equity (ROE), which have been commonly applied to measure profitability and included in studies related to adoption of a management system standard.^{24,41,53-55} Given that all sample firms in the study are listed on the stock exchange, Earnings per Share (EPS) is

Table 3 The Stratification of Sample Firms by Ownership Structure and Number of Employees

	Number (%) of Sample Firms
Ownership structure	
Private	87 (69.60)
State-owned	35 (28.00)
Other (Privatising stated-owned)	3 (2.40)
Number of employees	
Less than 1,000	18 (14.40)
Between 1,001 and 5,000	73 (58.40)
Between 5,001 and 10,000	21 (16.80)
More than 10,000	13 (10.40)

Table 4 Constructs of the Variables

Variables	Measurement
OHSMS	A dummy variable 1 for firms adopting an OHSMS standard; 0 for firms without adoption
ROA	Return on assets = net income/total average assets
ROE	Return on equity = net income/total average equity
EPS	Earnings per share = (net income - preferred dividends)/weighted average shares outstanding
LNTA	Natural logarithm of total assets

proxied as a market-based measure because it can evaluate a listed firm’s profit per outstanding share of stock. EPS is also frequently used in studies regarding management system standards and labour issues.^{56,57} Concerning the control variable, the natural logarithm of total assets is selected to modulate the size of the sample. The summary of variable measurements is shown in Table 4.

Model Specification

Panel data analysis is the main econometric approach we have used, as the study sample consists of a combination of time series and cross-sectional data. The Hausman specification test was initially run to determine the most appropriate statistical technique.⁵⁸ Unlike previous studies of OHSMS standard adoption, where the random effects model was utilised directly,²⁵ the independent variable of this study is a time-variant factor, in which no other time-invariant variables are simultaneously involved. As such, the use of either the random effects or fixed effects model was dependent on the result of the Hausman specification test. The main model is proposed as follows:

$$Financialperformance(ROA, ROE, EPS)_{i,t} = \beta_0 + \beta_1 OHSMS_{i,t-m} + \beta_2 LNTA_{i,t} + \epsilon_{i,t} \quad (1)$$

where *Financialperformance*_{*i,t*} denotes the three equations related to ROA, ROE, and EPS of firm *i* in year

t. *OHSMS*_{*i,t-m*} stands for the adoption of an OHSMS standard by firm *i* in year *t-m*, and *m* = 1, *m* = 2, representing the time frame for the subsequent effect of standard adoption on financial performance indicators. *LNTA*_{*i,t*} is the natural logarithm of the total assets of firm *i* in year *t*, and $\epsilon_{i,t}$ is the disturbance term.

As the results of the empirical models could be incorrectly affected by collinearity, we initially computed the Variance Inflation Factor (VIF) to test whether parameter estimates in each regression model are amplified by correlations across the independent variables. The results of the diagnostic test revealed that the VIFs for all independent variables are under the commonly applied threshold of ten and, therefore, our models are workable without multicollinearity problems.

Results

Table 5 shows the number of sample firms certified with an OHSMS standard over the analysed period. In general, a growing number of Chinese pharmaceutical firms adopted the OHSAS 18001 standard between 2010 and 2017. Since 12 June 2018, some of the firms have been transiting from the OHSAS 18001 to the ISO 45001.

The descriptive statistics of all variables are shown in Table 6. The mean value and the median value of OHSMS are 0.413 and 0 out of 1, respectively, indicating that less than half of the observations show an OHSMS standard adoption between 2010 and 2018. All financial performance indicators, including ROA, ROE, and EPS, have negative signs in the minimum value, revealing that some of the firms experienced losses over the analysed period.

The correlation matrix for the dependent variables and independent variables is shown in Table 7. The results demonstrate that the variables of financial performance proxied by ROA, ROE, and EPS are all positively correlated with OHSMS at the 0.01 significance level. The

Table 5 The Number of Sample Firms Adopting an OHSMS Standard (Certified with the OHSAS 18001 and the ISO 45001), 2010–2018

Indices	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of sample firms with the OHSAS 18001 certification	23	25	37	53	68	82	88	89	89 (5 firms transited to the ISO 45001 since 12 June 2018)
Number of sample firms with the ISO 45001 certification									

Table 6 Descriptive Statistics

Variables	No. of Observations	Median	Mean	Min.	Max.	SD	Skewness
OHSMS	1125	0.000	0.413	0.000	1.000	0.709	0.1.937
ROA	1125	0.074	0.068	-0.459	0.354	0.084	0.047
ROE	1125	0.109	0.077	-0.393	1.357	0.147	3.969
EPS	1125	0.595	0.516	-0.610	3.021	0.583	1.307
LNTA	1125	21.304	21.101	19.016	23.558	0.930	0.184

Table 7 Correlation Analysis

	ROA	ROE	EPS	LNTA	OHSAS
ROA	1				
ROE	0.903***	1			
EPS	0.676***	0.695***	1		
LNTA	0.037 *	0.292***	0.570***	1	
OHSMS	0.452***	0.288***	0.324***	0.275***	1

Notes: *** $p < 0.01$; * $p < 0.10$.

coefficients fall into the range between 0.275 and 0.452, indicating that Chinese pharmaceutical firms with better financial performance may adopt an OHSMS standard more frequently.

In the following panel-based regression models, we examined whether adoption of an OHSMS standard affects contemporaneous financial performance and has a subsequent impact on future financial performance. The Hausman specification test was first implemented to examine whether fixed effects exist. We found statistically significant results between OHSMS with ROA and OHSMS with EPS; thus the fixed effects models are applicable. We also found insignificant results between OHSMS with ROE; therefore, we have used the random effects model.

Table 8 shows the impact of OHSMS standard adoption on contemporaneous financial performance. The empirical results demonstrate that over the analyzed period and between firms, the coefficients between OHSMS and financial performance indicators were significantly positive. To be specific, ROA was found to increase by 2.37 percentage points when firms adopt an OHSMS standard, whereas ROE experienced a relatively higher increase, of 6.15 percentage points. EPS was enhanced by 3.59 percentage points for those firms that adopted the standard. This suggests that in the context of China, pharmaceutical firms adopting an OHSMS standard have better financial performance, and so H1 is supported. Our findings are in line with previous studies conducted for enterprises in Spain²⁵ and manufacturing companies in the U.S.,³⁰ but they are contrary to those of a study of US

Table 8 Regression Models: Effect of OHSMS on Contemporaneous Financial Performance

	Dependent Variables		
	ROA	ROE	EPS
Independent variable			
OHSMS	0.0237***	0.0615**	0.0359**
Control variable			
Size	0.0359	-0.0019	0.5764**
Constant	0.1316***	0.0075	0.0578**
Adjusted R ²	0.3958	0.0102	0.6026
F-statistics	6.4340***	3.853	8.5542***
Durbin-Watson	1.7091	2.8329	1.8371
Hausman specification test	25.6841 ***	1.952	23.972 ***
Observations	1125	1125	1125

Notes: *** $p < 0.01$; ** $p < 0.05$; The 95% CI: ROA as dependent variable (0.0196,0.0279), ROE as dependent variable (0.0493,0.0738), EPS as dependent variable (0.0151,0.0567).

Abbreviations: ROA, return on assets; ROI, return on equity; EPS, earnings per share; LNTA, natural logarithm of total assets; CI, confidence interval.

fashion and textile companies where OHSMS standard adoption was found to be negatively related to ROA.²⁴

Table 9 shows the influence of OHSMS adoption on subsequent financial performance. For one-year lagged OHSMS, mixed empirical results were obtained because there was a positive coefficient with ROE at the 5% significance level, but there was no significant relationship with both ROA and EPS. Over the analysed period and between firms, one-year subsequent ROE will increase by 2.75 percentage points as firms adopt an OHSMS standard. A two-year lagged OHSMS had a negative association with EPS at the 5% significance level, but it had no significant effect on both ROA and ROE. To be specific, firms with OHSMS standard adoption may experience a decrease in EPS by 2.96 percentage points in the third year after certification and experience no significant change in other financial performance indicators. In light of the above results, OHSMS standard adoption by pharmaceutical firms has an impact on subsequent financial performance, so H2 is also confirmed.

Table 9 Regression Models: Effect of OHSMS on Subsequent Financial Performance

	Dependent Variables					
	ROA	ROE	EPS	ROA	ROE	EPS
Time Lag	t-1			t-2		
Independent variable						
OHSMS _{t-1}	0.0194	0.0275**	-0.0605			
OHSMS _{t-2}				-0.0318	-0.0193	-0.0296**
Control variable						
Size	0.0315	0.0194*	0.2691***	0.0194	0.0258	0.4740***
Constant	0.1052	0.0957	-0.1335***	0.0498	0.0057	-0.2887***
Adjusted R ²	0.3817	0.0012	0.5679	0.3919	0.0003	0.5957
F-statistics	4.1328***	1.6739	8.0195***	4.6072***	1.0683	8.734***
Durbin-Watson	1.6475	1.9726	1.5903	1.8140	1.3847	1.9522
Hausman test	38.4104***	2.8505	35.2367***	38.3893***	2.7424	39.9602***
Observations	1125	1125	1125	1125	1125	1125

Notes: ***p < 0.01; **p < 0.05; *p < 0.10; The 95% CI: t-1 model, ROA as independent variable (0.0017,0.0372), ROE as independent variable (0.0095,0.0456), EPS as independent variable (-0.1508,0.0297); t-2 model, ROA as independent variable (-0.1076,0.0440), ROE as independent variable (-0.0234,-0.0152), EPS as independent variable (-0.0718,0.0125).

Abbreviations: ROA, return on assets; ROI, return on equity; EPS, earnings per share; LNTA, natural logarithm of total assets; CI, confidence interval.

As a summary, we conclude that firms with either the OHSAS 18001 or the ISO 45001 certification will have better financial performance proxied by ROA, ROE, and EPS. When extending financial performance indicators by a year, only ROE is significantly and positively related. Nevertheless, a negative and statistically significant coefficient for EPS is found when financial performance indicators are extended by two years.

Discussion

This research aims to provide empirical evidence of the impact of OHSMS standard adoption on the financial performance of pharmaceutical firms in China. From the cost-effectiveness point of view, the pros may outweigh the cons because all financial performance indicators of the year will increase as the firm successfully certifies with an OHSMS standard. These revealing findings are reinforced by the institutional theory, which suggests that adopting an OHSMS standard helps firms improve their relationship with employees and both retain and attract key personnel.²⁰ When employees feel safe and stay healthy, they can be actively motivated and have better job performance. Employees' higher satisfaction in relation to the workplace and increased wellbeing may directly lead to greater labour productivity.¹⁶ The adoption of an OHSMS standard also leads to lower rate of working accidents, fewer interruptions of the production process, and less wasted effort.⁴⁸ Therefore, the adoption may positively

affect the financial performance over the year through the improvement of operating efficiency.⁵⁴

In terms of whether OHSMS standard adoption will sustainably influence subsequent financial performance, only ROE shows a statistically significant increase in the second year after the firm is certified. We argue that to some extent, gaining legitimacy through the standard adoption could provide a better opportunity for pharmaceutical firms to attract customers and improve their corporate image and, thus, gradually achieve better future financial performance. However, EPS may decrease in the third year after certification. The possible reason for the statistically significant decline in this performance indicator is that the certification must be renewed every three years.⁴¹ This will inevitably incur more costs related to renewal and audit, potentially detracting from firms' valuable financial resources.

The findings of this section complement the extant literature, suggesting the following two key points: first, in the context of the pharmaceutical sector of China, the adoption of an OHSMS standard could contribute to better financial performance; second, as OHSMS standards fall into a continuous improvement concept, standard adoption will constantly affect subsequent financial performance indicators. We also infer that the positive impact of the adoption may either gradually weaken or even vanish, probably due to the increasing costs of certification renewal, auditing, or other activities in the

third year after the firm is certified. This finding further justifies Fan et al's study,²⁴ which proposed that the adoption of an OHSMS standard may create some operational and financial constraints, potentially deteriorating firms' profitability in the long run.

Conclusions

To summarise, this study contributes to an inconclusive yet popular debate regarding the impact of the adoption of an Occupational Health and Safety Management System (OHSMS) standard on financial performance. We test whether contemporaneous and subsequent firm performance can benefit from standard adoption in the context of the Chinese pharmaceutical industry. By using a sample of 125 listed pharmaceutical firms over a sample period from 2010 to 2018, the positive effect of OHSMS standard adoption on contemporaneous return on assets, return on equity (ROE), and earnings per share (EPS), as the proxies of financial performance, is confirmed. However, we obtain mixed results are found when we extend financial performance indicators by two years, suggesting that ROE will increase in the second year after the firm is certified, but EPS will decline in the third year. Our study adds to the extant literature as it not only provides empirical evidence of a country in which related research efforts have been scarce but also uses secondary data to objectively examine the impact of OHSMS standard adoption over time.

Some companies would hesitate to adopt an OHSMS standard, as managers may consider the certification to be a waste of valuable financial resources and to lead to technical inefficiency due to the increased complexity of internal processes. Especially for the pharmaceutical sector, firms may feel financial pressure to carry out corporate social responsibility and occupational health and safety practices because R&D and medication promotional activities are always emphasised.⁶ Nevertheless, the empirical findings of this study suggest that executives of pharmaceutical firms need to realise the importance of OHS and exercise their management discretion to achieve a win-win situation between OHSMS implementation and financial benefit. Policy makers also need to set out some initiatives to increase firms' contributions towards OHS issues.

We acknowledge some limitations of this study. First, as the empirical models cover only two-year lagged terms, the time frame for the subsequent effect of standard adoption is insufficiently long because the certification renewal

process would be carried out every three years. Second, the financial performance indicators used in this study are not sufficient to broadly measure all economic aspects of a firm. Future research could consider the operating perspective of performance measures like innovation and growth capacity and expand to include different industry sectors and other emerging economies.

Abbreviations

OHS, Occupational Health and Safety; OHSMS, Occupational Health and Safety Management System; CSR, Corporate Social Responsibility; OHSAS, Occupational Health and Safety Assessment Series; ISO, International Organization for Standardization; PDCA, Plan-Do-Check-Act; CAIPSP, National Certification and Accreditation Information Public Service Platform; CNCA, Certification and Accreditation Administration of the People's Republic of China; CSMR, China Stock Market and Accounting Research; CSRC, China Securities Regulatory Commission; ST, special treatment; ROA, return on assets; ROE, return on equity; EPS, earnings per share; VIF, variance inflation factor; CI, confidence interval.

Data Sharing Statement

The dataset analysed and used to support the findings of this study is available from the authors upon request.

Ethical Approval

This study does not require ethical approval, because we used secondary data that are freely accessible.

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Disclosure

The authors report no conflicts of interest in this work.

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