The Economic Impact of ISO 14000: Some Preliminary Findings

Chris K. Y. Lo[1*], Andy C. L. Yeung[2], T.C.E. Cheng[2]
1 Institute of Textiles and Clothing
2 Department of Logistics and Maritime studies
The Hong Kong Polytechnic University, Hung Hom, Hong Kong
[*]EMAIL: tcclo@inet.polyu.edu.hk

Abstract: This study provides empirical evidence on the long-term economic impact of ISO 14000, an environmental management system, on manufacturing companies. We estimated abnormal changes in various financial performance measures, including return on assets (ROA), return on sales (ROS), and sales growth, in ISO 14000 adopting firms. Based on a sample of 317 active publicly listed manufacturing companies that adopted ISO 14000 between 1998 and 2007, we found that the adoption of ISO 14000 had a significant positive impact on ROA, ROS, and sales growth over a three-year period after ISO 14000 certification. Depending on the methods of calculating abnormal performance, the median increases in ROA and ROS ranged from 0.3% to 0.6% and 1.0% to 1.1%, respectively. The median increase in sales growth rate ranged from 0.8% to 1.3%.

Key words: ISO 14000, Empirical Analysis, Financial Performance

I. Introduction

ISO 14000, a voluntary international standard for environmental management systems (EMSs) developed by the International Organization for Standardization (ISO) in 1996, is a set of management processes and procedures requiring companies to identify, measure, and control their environmental impacts [1]. With the aim of improving the environmental performance of a firm, compliance with the standard is audited and certified by an independent, third-party certification body [2]. The initial version of ISO 14000 was a consolidation of various elements in BS 7750, a British environmental management standard, and European's Environmental Management and Audit Scheme (EMAS). Following the diffusion pattern of ISO 9000 [3], ISO 14000 has achieved great success since its launch and has become the most widely adopted EMS in the world.

The objective of this study is to extend earlier research on ISO 14000 in a number of significant ways. This is the first study that examines the impact of ISO 14000 on financial performance, including ROA, ROS, and sales growth, based on objective data. We attempt to investigate whether the market-gain pathway, the cost-saving pathway, or both confers the long-term economic benefit of ISO 14000, if any. Finally, we examine other pertinent factors at both firm-level and industry-level that moderate the impact of ISO 14000 on long-term abnormal returns in adopting firms.

II. Hypothesis Development

ISO 14000's Impact on Financial Performance

The objectives of ISO 14000 are to reduce unnecessary operating procedures, raw materials, packaging, energy consumption, and pollution. Waste and pollution are constantly monitored and corrective actions are taken in a timely manner. Accordingly, the effective implementation of ISO 14000 should enhance the adopting firm's utilization of resources. On the other hand, a proactive environmental management strategy based on ISO 14000 should lead to effective product or process re-designs and acquisition of new technologies. The new designs, technologies, and other new assets will create a competitive advantage to the adopting firm, enabling it to outperform organizations with equivalent assets [4]. If the implementation of ISO 14000 is fully integrated in the adopting firm's core operations, its return on assets should improve. To empirically test the effect of ISO 14000 on firm profitability, we focused on return on assets (ROA), which is taken as operating income (before depreciation, interest and taxes) divided by total assets.

H1: ISO 14000 adoption will lead to improved ROA

Klassen and McLaughlin [5] proposed an environmental management model for the linkages between environmental management and firm profitability. They suggested that firms profitability can be achieved through the cost-saving and market-gain pathways after the adoption of environmental management system. Based on similar logics in developing *H1*, we further develop the following hypotheses to investigate whether the adoption of ISO 14000 has an impact on the two suggested pathways:

H2: ISO 14000 adoption will lead to improved ROS (cost-saving)
H3: ISO 14000 adoption will lead to higher sales growth. (market-gain)

III. Sample Description and Methodology

In this research we focused on manufacturing companies (SIC code 2000-3999) because ISO 14000 is most commonly adopted in these industrial sectors. To generate our sample,

we identified ISO 14000 certified firms and their years of certification from ISO 14000 registration data through two online databases, namely Quality Digest and Who's Registered. Since each company could have multiple plants/sites certified, we followed the practice of previous research [6, 7] by focusing on the first ISO 14000 certification. After compiling the data from the online databases, we found that 317 active publicly listed manufacturing firms in the U.S.A. were ISO 14000 certified. Table 1 shows the distribution of the year when the sample firms obtained their first ISO 14000 certification.

Table 1 Distribution of the year when sample firms obtained the first ISO 14000.

	ISO 14000	
Year	**No. of firms**	**% of Firms**
1996	21	6.62%
1997	14	4.42%
1998	19	5.99%
1999	28	8.83%
2000	33	10.41%
2001	60	18.93%
2002	37	11.67%
2003	44	13.88%
2004	26	8.20%
2005	27	8.52%
2006	8	2.52%
	317	100.00%

To estimate the impact of ISO 14000 adoption on financial performance, we employed the event-study methodology. We followed the guidelines of Barber and Lyon [8] for detecting abnormal financial performance. The event year (year 0) is defined as the year of formal ISO 14000 certification. To pass the ISO audit, the average preparation time is 6-18 months prior to registration [6]. Therefore, year -2 is taken as the year before ISO 14000 implementation. We are interested in comparing the financial performance before ISO 14000 implementation and after ISO 14000 certification. As a result, the event period in this research is the time spanning the year of ISO 14000 implementation (year -2 to year -1), the year of certification (year -1 to year 0), and the year of post-certification (year 0 to year 1).

We created appropriate sample-control matched pairs. We matched sample and control pairs based on specific matching criteria to minimize the effects of confounding factors in a particular industry or the effects of the overall state of the economy. Barber and Lyon [8] suggested that matching pre-event performance is the most critical factor for event studies. They found that matching industry type and 90%-110% pre-event performance create the most appropriate matching groups between sample and control firms. Following Hendricks and Singhal [9], we developed two matching groups, namely *performance-industry-matched* and *performance-industry-size-matched* comparison groups. We did not create the *performance-size-matched* comparison group, which excludes the control for industry type. This is because the impact of an environmental management system is likely to be industry specific.

IV. Results

Year-to-Year Changes in Abnormal Performance

We begin our discussion by examining abnormal operating performance on a year-to-year basis. These results provide insights on the pattern of abnormal performance over time. Table 2 presents the results for the *performance-industry-matched* and *performance-industry-size-matched* comparison groups. The period year -2 to year -1 represents the year of ISO 14000 implementation. The abnormal performance in ROA of the *performance-industry-matched* group in this year was positive and significant ($p < 0.05$ for both the median and mean). However, the results for the *performance-industry-size-matched* comparison group were insignificant ($p > 0.1$ for both the median and mean). One possible explanation is that the impact of ISO 14000 on performance during the implementation stage is limited. More consistent results were found in the year of ISO 14000 certification. From year -1 to year 0, the results for both the *performance-industry-matched* and *performance-industry-size-matched* groups were consistently positive and significant. The median (mean) abnormal changes for the *performance-industry-matched* and *performance-industry-size-matched* groups were 0.6% (0.7%) and 0.7% (1.2%), which were significant at 10% (10%) and 10% (5%) levels, respectively. Similar positive results on ROA were found in the year post-certification (i.e., year 0 to year 1). The median (mean) abnormal changes in ROA for the two matching groups were 0.6% (1.4%) and 0.8% (2.0%), which were significant at 10% (5%) and 10% (5%) levels, respectively. Overall, ISO 14000 implementation led to higher profitability in terms of ROA starting in the year of certification (i.e., year -1 to year 0).

Similarly positive results were found for ROS, which represents cost efficiency. Although the changes in ROS were not significant for the *performance-industry-matched* group the year of implementation (year -2 to year -1), the changes became significant in the year of certification (year -1 to year 0). Since year 0 is the time of certification, the adopting firms must have fully complied with the standard by that time. The median (mean) abnormal changes from year -1 to year 0 for the *performance-industry-matched* and *performance-industry-size-matched* groups were 0.6% (1.0%) and 0.7% (1.6%), which were significant at 10% (5%) and 10% (10%) levels, respectively. There were also positive changes in sales growth in the year of certification (year -1 to year 0). The median (mean) changes in sales growth for the

performance-industry-matched and *performance-industry-size-matched* groups were 0.98% (4.54%) and 5.03% (9.84%), which were significant at 10% (5%) and 5% (5%) levels, respectively.

Three-Year Cumulative Abnormal Performance

The cumulative results of three-year changes provide a more complete picture on the impact of ISO 14000 adoption on financial performance (Table 3). From the year of ISO 14000 implementation (year -2) to the year post-certification (year 1), the median (mean) cumulative changes in ROA for the *performance-industry-matched* and *performance-industry-size-matched* groups were 0.3% (1.3%) and 0.6% (2.38%), which were significant at 10% (5%) and 5% (5%) levels, respectively. We also found a strong impact of ISO 14000 on ROS based on three-year cumulative abnormal changes. The median (mean) abnormal changes for the *performance-industry-matched* and *performance-industry-size-matched* groups were 1.1% (3.6%) and 1.0% (3.2%), which were highly significant at 1% (1%) and 5% (1%) levels, respectively. Based on both estimation methods, about 58% of the sample firms experienced positive changes in ROS, which was significantly higher than 50% ($p < 0.05$). The results consistently suggest that ISO 14000 adoption leads to significantly higher cost efficiency. The median (mean) changes in sales growth for the *performance-industry-matched* and *performance-industry-size-matched* groups were 1.3% (5.2%) and 0.8% (6.4%), which were significant at 10% (5%) and 10% (1%) levels, respectively.

Overall, the results on three-year cumulative changes in performance provide strong evidence that ISO 14000 adoption affects long-term operating performance. We observe that the abnormal changes in ROA, ROS, and sales growth rate were positive and statistically significant over the three-year period. This suggests that the adoption of ISO 14000 helps the certified firm to gain abnormal profitability over its competitors. The improvement in profitability can be explained mainly by the cost-saving pathway (supported by the strong abnormal changes in ROS), and for the market-gain pathway. Our findings provide empirical support for Klassen and McLaughlin's [5] environmental management model, which proposes that the linkage between environmental management and firm profitability is connected by the cost-saving and market-gain pathways.

V. Discussions and Summary

This study analyzed the economic impact of ISO 14000 adoption by measuring the abnormal changes in ROA, ROS, and sales growth in manufacturing firms. We found that the improvement in the profitability (i.e., ROA) of ISO 14000 certified firms can be explained by the cost-saving pathway through improving their profit margins (i.e., ROS) and the market-gain pathway through improving their sales growth rate. Table 2 shows that the abnormal changes in ROA and ROS were largely consistent in both "year -1 to year 0" and "year 0 to year 1" periods. Compared between the results of the three indicators in table 2 and table 3, we found that the adoption of ISO 14000 has the most significantly impact on cost efficiency over the three-year period.

This study provides empirical evidence on the economic impact of ISO 14000 adoption. Based on 317 active ISO 14000 certified publicly listed manufacturing firms in the U.S.A., we found that ISO 14000 adoption had a statistically significant positive impact on ROA, ROS, and sales growth. Depending on the methods used to estimate the abnormal performance, the median abnormal improvement in ROA ranged from 0.3% to 0.6% over a three-year period. The median improvement in ROS ranged from 1.0% to 1.1%. The median improvement in sales growth rate ranged from 1.3% to 4.2%. Overall, ISO 14000 led to higher profitability primarily through the cost-saving pathway and market-gain pathway.

Acknowledgment

This paper was supported in part by research grant number G-U715 and

1-ZV6T**.**

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Table 2 Abnormal financial performance of sample firms for the year of ISO 14000 implementation (year -2 to year -1), the year of certification (year -1 to year 0), and the year of post-certification (year 0 to year 1), based on *performance-industry-matched* and *performance-industry-size-matched* matching. $p < 0.1$*; $p < 0.05$**; $p < 0.01$***; [a] in percentage.

	Performance-Industry-Matched											
Measures	From year - 2 to year - 1				From year - 1 to year 0				From year 0 to year 1			
	N	**Mean**	**Median**	**% Positive**	*N*	**Mean**	**Median**	**% positive**	*N*	**Mean**	**Median**	**% positive**
ROA	193	0.009	0.002	52.850	189	0.007	0.006	52.910	178	0.014	0.006	53.370
		(2.242) **	(1.837) **	(0.720)		(1.575) *	(1.550) *	(0.727)		(2.187) **	(1.347) *	(0.824)
ROS	193	0.014	0.004	53.370	189	0.010	0.006	57.670	178	0.028	0.005	53.930
		(2.31) **	(1.185)	(0.846)		(1.945) **	(1.581) *	(2.037) **		(2.538) ***	(2.217) **	(0.974)
Sales growth[a]	140	3.818	-1.841	47.860	139	4.539	0.975	53.240	138	2.369	1.116	55.070
		(1.298) *	(-0.108)	(-0.423)		(2.267) **	(1.554) *	(0.679)		(0.747)	(0.426)	(1.107)
	Performance-Industry-Size-Matched											
	N	**Mean**	**Median**	**% Positive**	*N*	**Mean**	**Median**	**% positive**	*N*	**Mean**	**Median**	**% positive**
ROA	152	0.006	0.000	50.660	142	0.012	0.007	55.630	137	0.020	0.008	56.200
		(1.193)	(0.605)	(0.081)		(1.908) **	(1.427) *	(1.259)		(2.03) **	(1.529) *	(1.367) *
ROS	152	0.010	-0.004	47.370	142	0.016	0.007	59.860	137	0.014	0.003	57.660
		(0.087)	(-0.664)	(-0.568)		(1.406) *	(1.315) *	(2.266) **		(1.210)	(1.060)	(1.709) **
Sales growth rate[a]	132	5.121	-0.150	50.000	131	9.842	5.028	58.780	130	3.322	0.156	50.000
		(1.683) **	(-0.620)	(0.000)		(2.569) **	(1.367) **	(2.017) **		(0.969)	(0.103)	(0.000)

Table 3 Three-year cumulative abnormal changes in ROA, ROS, and sales growth rate from year -2 to year 1

Performance measure		*Performance-Industry-Matched* From year - 2 to year 1		
	N	**Mean**	**Median**	**% positive**
ROA	178	0.013	0.003	51.120
		(2.191)**	(1.327)*	(0.225)
ROS	178	0.036	0.011	58.430
		(2.540)***	(2.762)***	(2.174)**
Sales growth rate[a]	138	5.176	1.295	51.450
		(2.072)**	(1.604)*	(0.255)
		Performance-Industry-Size-Matched		
	N	**Mean**	**Median**	**% positive**
ROA	137	0.238	0.006	57.660
		(1.929)**	(1.677)**	(-1.709)**
ROS	137	0.032	0.010	57.660
		(2.552)***	(1.771)**	(-1.709)**
Sales growth rate[a]	130	6.440	0.765	51.540
		(2.379)***	(1.367)*	(0.263)

$p < 0.1$*; $p < 0.05$**; $p < 0.01$***; [a] in percentage