Journal of Civil Engineering and Architecture 11 (2017) 780-788
doi: 10.17265/1934-7359/2017.08.006

The Impact of Water Pollution Announcement on Stock Returns in Taiwan Textile Industry

Bi-Huei Tsai and Mu Yun Huang

Department of Management Science, Chiao Tung University, Hsinchu 300, Taiwan, R.O.C.

Abstract: The soccer teams of the World Cup wear the jerseys manufactured by Taiwanese textile companies which are the contractors of such brand corporations as Nike and Adidas. Because Taiwanese textile companies suffer water pollution events, this study verifies the market reactions to the two announcements of water pollution events from 2014 to 2015. The two events are as follows: first, Greenpeace International enabled 38 scientists to announce the ban on fluoride in Madrid; second, Greenpeace International has detected fluoride residues from the water in remote mountainous areas of Europe and concluded that Taiwanese jerseys composed of fluoride pollute the rivers or snows. The findings of the research indicate that the announcement of the ban on fluoride induces negative abnormal returns because fluoride is the main materials for Taiwanese jerseys. Most importantly, the announcement of the water pollution in Europe from Taiwanese manufactured jerseys induces negative abnormal returns. Both of the two events enable the stock investors scared about the decrease of future profit and market share for Taiwanese textile corporations. Consequently, investors sell the stocks of these corporations, inducing the negative abnormal returns during the announcement of water pollution of Taiwanese jerseys. Water polluted issues are critical of firm values.

Key words: Water pollution, environment, event study, Greenpeace International.

1. Introduction

This study verifies the investors' reactions to the announcement of three environment-related events, including the water pollution events, from 2014 to 2015. The three events are as follows: first, the soccer teams of the World Cup wear the jerseys composed of environmental protection materials and manufactured by Taiwanese textile companies; second, Greenpeace International enabled 38 scientists to announce the ban on fluoride in Madrid; third, Greenpeace International has detected fluoride residues from the water in remote mountainous areas of Europe and concluded that the Taiwanese jerseys composed of fluoride pollute the rivers or snows. This work chooses 14 listing company samples in Taiwan textile industry to test their market reactions during the three environmental events. The main motivation of this study is to examine the impact of the stock price changes in the Taiwan textile industry. This work utilizes the daily returns as the stock price changes criteria, since the rates of returns are equal to the daily price change dividend by the beginning price.

Nowadays, people all over the world raise environmental awareness. Trans et al. [1] estimated the multi-pollution sources in the Cau River Basin in Northern Vietnam. Luilo and Kabudi [2] stated the water legislations to deal with water pollutions. The prior research indicates the attentions of water pollutions all over the world. Previous study further emphasizes the relations between environmental protections and the performance of the company. Arya and Zhang [3] focused on the South African stock market and state that when the company promotes corporate social responsibility, company reputation can be improved so that the company's future performance will be identified by investors, thus a significant positive abnormal return will appear in the stock price. Surroca, Tribo, and Waddock [4] further advocated that when the relation between corporate social responsibility hypothesis and the performance of the

Corresonding author: Bi-Huei Tsai, professor, research field: accounting. E-mail: bhtsai@faculty.nctu.edu.tw.

company is discussed, intangible assets should be considered. The ability to protect environment and develop green supply chain control should be included. Hamilton [5], Konar and Cohen [6], and Khanna et al. [7] mentioned that on the day when the information of environment pollution in an enterprise is announced, stock prices are briefly decreased. Länsilahti [8] also supported stock prices have an interaction with corporate social responsibility information. However, in past researches, there was no analysis on the environmental event day related to the textile industry. Thus, this study cares about whether the international environment-related event will affect Taiwan's textile industry because one of the major polluting industries is the textile industry. Also, the market efficiency hypothesis, corporate social responsibility hypothesis and sustainable development hypothesis are examined.

This study has the two purposes. First, we explored whether positive abnormal returns appear in textile industry when the events related to environmental protections is announced. The environmental protection event in Taiwan's textile industry we choose in this study is that Taiwan utilized the recycling environmentally friendly materials to manufacture World Cup soccer jerseys and these environmental protection behaviors are disclosed by French media "Figaro" on April 26, 2014. Second, we explored whether negative abnormal returns appear in textile industry when the two events related to water pollutions are announced. One of the two water pollution events in Taiwan's textile industry we choose in this study is that Greenpeace Organization appealed scientists from 38 countries and stated in Madrid that PFCs (per fluorinated compounds) used in Taiwan's textile industry should be prohibited in the future on May 1, 2015. The other event of the two water pollution events in Taiwan's textile industry we choose in this study is that on September 9, 2015, Greenpeace Organization found PFCs footprints polluted remote European mountains. Stock investors feel anxious about the PFCs originally used in the textile industry which should be replaced, they expect the operations of Taiwan's textile industry will become worse. Investors are likely to sell the stocks of these corporations, inducing the negative abnormal returns during the announcement of water pollutions of Taiwanese jerseys. This work is motivated to examine whether stock investors scared about the decrease of future profit and market share for Taiwanese textile corporations due to the PFC impact of water pollutions. The contribution of this study is to use event study to discuss whether the water pollutions or environment protections of Taiwan textile firms will affect the stock prices and market value in Taiwan textile industry. Our empirical results can remind enterprises of the importance of water and environmental protections.

2. Water Pollution Event Days

The sample of this study is the fourteen textile companies listed in Taiwan stock exchange and producing functional fabric. Rates of returns data are obtained from Taiwan economic news and Taiwan market observation post system. Three global major environmental related events from 2014 to 2015 are collected. The first day is April 26, 2014 when the recycling environmentally friendly materials made in Taiwan were adopted for World Cup soccer jerseys. In 2014 World Cup, there were 10 teams wearing green jerseys made in Taiwan. The cost of the environmental protection fabric made of recycling polyethylene terephthalate bottles is more expensive than the general fabric at 20%-30% but the jersey weight is lighter and the functions of moisture absorption and sweat exclusion are better. The use of such fabric can also help energy saving for the earth. Consequently, French media "Figaro" reported the global market share of Taiwan polyethylene terephthalate bottle fabric is up to 70% and praised the Taiwan's textile industry with the title of "Taiwan won the World Cup".

The second event day is May 1, 2015 when Greenpeace Organization appealed scientists from 38

countries and stated in Madrid that PFCs should be prohibited. PFCs, also known as environmental hormones, are anti-splashing agents used in functional fabric. PFCs, which are uneasily broken down, would affect species reproduction and cause permanent pollution on the environment. Through the Madrid statement, more than 200 scientists from 38 countries publicly stated their worry about PFCs, so they claimed strict management of the production and use restrictions of PFCs. Therefore, Greenpeace Organization appealed the major brands not to use PFCs immediately so as to stop PFCs contamination continuously spreading the world.

The third event day is September 9, 2015. Greenpeace Organization investigated and found PFCs footprints polluted remote European mountains. Greenpeace Organization made a transnational survey, finding harmful PFCs in rivers and snow in the mountains, showing the footprints have polluted the remote mountainous areas, including famous Swiss Alps, Italy Siberian Mountain, and Patagonia Highlands. PFCs are the materials of outdoor products, such as mountaineering clothes and camping tents, which were left behind in the environment. Because Taiwan's textile enterprises utilize PFCs to produce functional sports clothes, stock investors feel anxious about the PFCs originally used in the textile industry which should be replaced, they expect the operations of Taiwan's textile industry will become worse. This work investigates whether investors sell the stocks of these corporations, inducing the negative abnormal returns during the announcement of water pollutions of Taiwanese jerseys.

3. Methods

This work utilizes event study method to test abnormal returns in the use of statistical methods so as to understand whether the event affects company stock prices and whether securities prices reflect all available published information. Event study was first proposed by Ball and Brown [9] and used to understand the relevance between stock prices and specific environmental events [10, 11]. If the event is significant, the company's stock price will fluctuate substantially. The event study method focuses on the impact of the occurrence of the event on stock prices.

To examine the price change during the announcement of water pollution and environmental protects periods, this study employs the market model to analyze the abnormal returns and cumulative abnormal returns accruing to a stockholder consequence to these events in Taiwan's textile firms. The rates of returns are defined as the price change divided by the beginning prices, so the positive rates of returns are derived from price increases and negative rates of returns are derived from price declines. This paper uses the rate of returns to indicate the price changes during the environment event announcement periods.

Fig. 1 exhibits the framework of event study. This study sets the event day as Day 0 for each environmental event. Negative days represent days prior to the environmental event date and positive days represent days subsequent to the environmental event date. The estimation interval is the period from Day -260 to Day -11 and the forecast interval is the period from Day -10 to Day 10. For each firm *i*, the market model parameters, $\hat{\alpha}_i$ and $\hat{\beta}_i$, are estimated by regressing each firm's stock returns against the return on market over an estimation period (250 days in length, ending 11 days before event day) written as Eq. (1):

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + e_{i,t} \quad (1)$$

where, $R_{i,t}$ and $R_{m,t}$ are the rates of returns on Day t for the *i*th firms. $\hat{\alpha}_i$ and $\hat{\beta}_i$ in Eq. (1) are estimated using the data during the estimation interval, so we can use Eq. (1) to figure out the expected returns in the forecast interval. Then, the abnormal returns are calculated as the actual minus expected returns in Eq. (2):

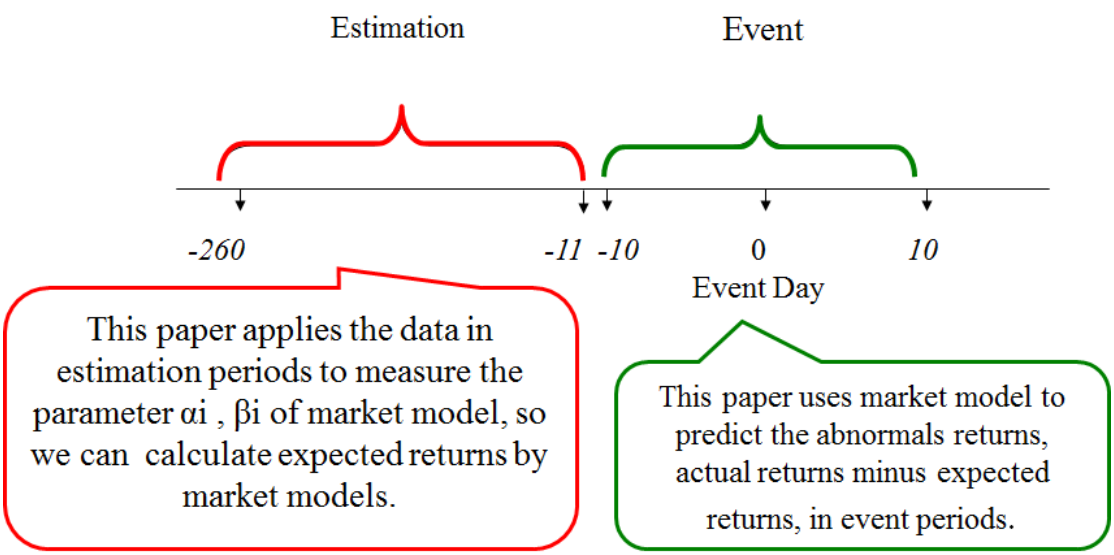

Fig. 1 The framework of event study.

$$AR_{i,t} = R_{i,t} - (\hat{\alpha}_i + \hat{\beta}_i R_{m,t}) \quad (2)$$

In Eq. (2), we compute the abnormal return on Day t ($AR_{i,t}$) by comparing the actual return on Day t, $R_{i,t}$ to the predicted returns $(\hat{\alpha}_i + \hat{\beta}_i R_{m,t})$. Next, cumulative abnormal returns from the 10 day prior to environmental event day to Day T_1 (T_1 = -10, -9, -8,…, 9, 10) can be expressed as Eq. (3):

$$CAR(-10, T_1) = \sum_{\tau=-10}^{T_1} AR_{i,t} \quad (3)$$

In order to explore whether there are statistically significant abnormal returns on the day when major international environmental and water pollutions events occur, this study based on the event day and used the parametric traditional, cross-sectional and sign test *T*-statistics.

4. Empirical Results

4.1 Positive Abnormal Returns of Environmental Protection Events

The results show a significant positive abnormal rate of return when French media reported that Taiwan textile firms use recycling and environmentally friendly materials to produce the World Cup jersey on April 26, 2014 (event Date 0). Especially, Table 1 shows that seven of our sample firms are the contractors of such brand corporations as Nike and Adidas and their average positive abnormal return is 2.8937%. The traditional *T*-statistics achieves a significant level of 1%, cross-sectional *T*-statistics achieves a significant level of 5%, and the sign test to 10% of the significant level. The finding of the research indicates that announcement of the uses of Taiwanese jerseys in World Cups causes the positive abnormal returns in Taiwanese textile industry, especially for firms with connection with Nike and Adidas supply chains.

Fig. 2 shows that when French media reported Taiwan textile firms used environmentally friendly materials to produce the World Cup jerseys, both the abnormal return rate and the cumulative abnormal return rate of the seven international brand related textile firms began to increase rapidly. It represents investors were encouraged by this information and it was fully reflected on the stock prices of that day. The results support the efficiency market hypothesis. The pattern of CARs (cumulative abnormal returns) experiences a constant increase and displays the apparent price rise during the environmental protection announcement. The positive abnormal

Table 1 Abnormal returns and statistics results of Taiwan's seven international brand related firms as French media announced World Cup soccer teams use Taiwan's jerseys.

Day	Abnormal return	Traditional *T*-statistics	Cross-sectional *T*-statistics	Sign test
-1	0.2584	0.3232	0.7701	-0.3780
0	2.8937	3.6189***	2.8960**	1.8898*
1	0.0802	0.1003	0.0834	0.3780
2	1.3508	1.6893	1.3475	-1.1339

*Significant at the 10% level;
**Significant at the 5% level;
***Significant at the 1% level.

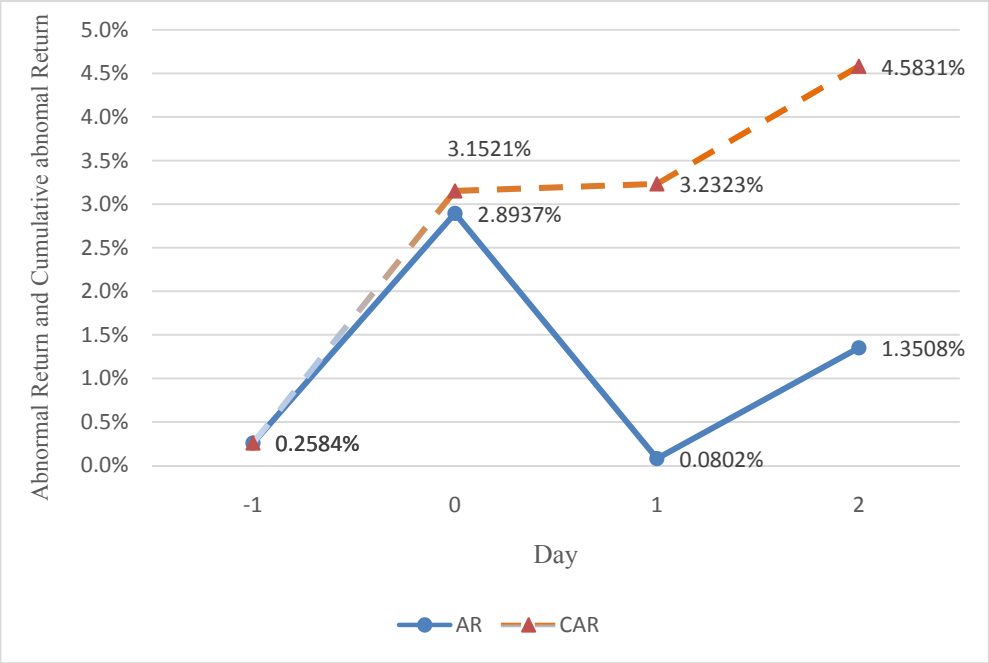

Fig. 2 Abnormal returns and cumulative abnormal returns of seven Taiwan's international brand related firms when French media announced that World Cup soccer teams use Taiwan's jerseys on April 26, 2014 (Day 0).

returns are accompanied by the environmental protection events. Investors regard the event as good news and purchase the stock of Taiwanese textile companies substantially; thus, we find the abnormal positive returns for Taiwanese textile companies.

4.2 Negative Abnormal Returns of Water Pollution Events

The first water pollution event in our study is that Greenpeace Organization appealed scientists from 38 countries and stated in Madrid that PFCs should be prohibited on May 1, 2015. Table 2 shows -1.8505%, a significantly negative rate of returnfor all our sample firms on May 1, 2015 (event Day 0). The traditional *T*-statistics achieves a significant level of 1%, cross-sectional *T*-statistics achieves a significant level of 1%, and the sign test to 5% of the significant level. The announcement of the ban on PFCs induces negative abnormal returns because PFCs are the main material for Taiwanese jerseys. This water pollution event enables the stock investors to scare about the decrease of future profit and market share for Taiwanese textile corporations. Consequently, investors sell the stocks of these corporations, inducing the negative abnormal returns during the announcement of water pollutions of Taiwanese jerseys.

The abnormal returns and cumulative abnormal

Table 2 Abnormal returns and statistics results of Taiwan's textile firms as Greenpeace Organization stated that PFCs should be prohibited.

Day	Abnormal return	Traditional *T*-statistics	Cross-sectional *T*-statistics	Sign test
-1	1.1773	2.3431**	2.0389**	2.1381**
0	-1.8505	-3.6830***	-2.8789***	-2.1381**
1	0.7257	1.4443	1.1751	0.5345
2	-0.1557	-0.3099	-0.3416	-1.0690

*Significant at the 10% level;
**Significant at the 5% level;
***Significant at the 1% level.

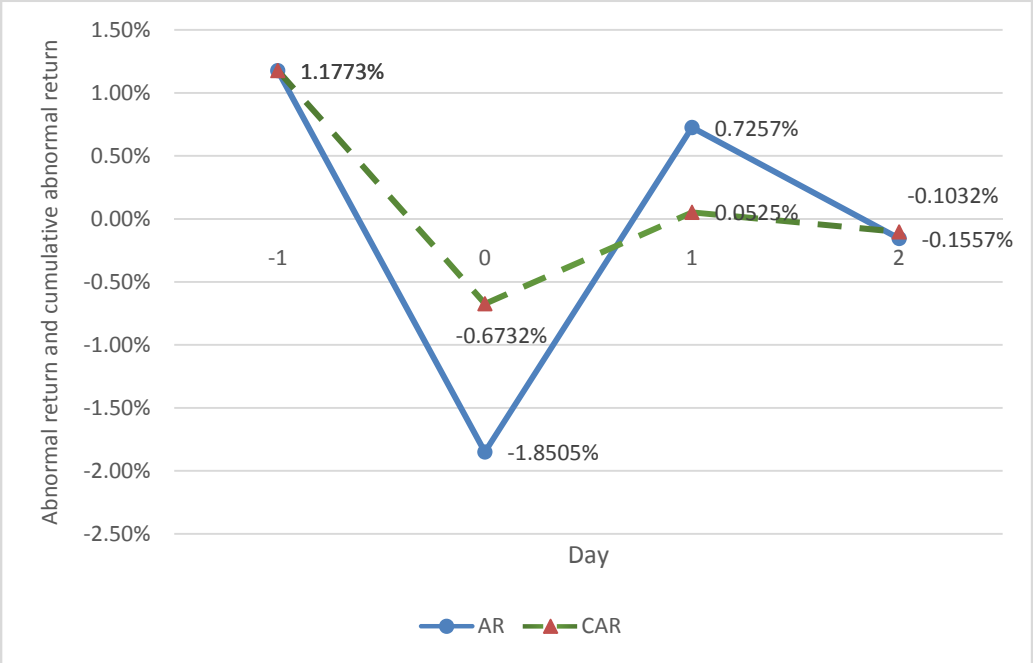

Fig. 3 Abnormal returns and cumulative abnormal returns of Taiwan's textile firms when Greenpeace Organization stated that PFCs should be prohibited on May 1, 2015 (Day 0).

returns of Taiwanese textile firms from one day prior to this water pollution event to the subsequent two day are presented in Fig. 3. The average abnormal return declines substantially only on water pollution event day, May 1, 2015. The pattern of abnormal return experiences a drop exactly on the event day and the negative cumulative abnormal returns are accompanied by the water pollution events. The reaction time is merely one day, which supports efficient market efficiency theory. After the scientists from 38 countries stated PFCs should be prohibited in use in Madrid, both the abnormal return rate and the cumulative abnormal return rate in the textile industry began to decrease rapidly. The pattern of cumulative abnormal return -0.00103% experiences a decline from one day prior to this water pollution event to two day subsequent to this event day. It represents investors feel anxious about the PFCs originally used in the textile industry which should be replaced due to water repellent treatment; thus, investors' anxiety was fully reflected on the stock prices of that day.

The second water pollution event in our study is that Greenpeace Organization found PFCs footprints polluted remote European mountains on September 9, 2015. Table 3 shows a significantly negative rate of return -2.3721% for all the sample firms. The traditional *T*-statistics, cross-sectional *T*-statistics and the sign test all achieves a significant level of 1%.

Table 3 Abnormal returns and statistics results of Taiwan's textile firms as Greenpeace Organization found PFCs footprints polluted remote European mountains on September 9, 2015.

Day	Abnormal return	Traditional *T*-statistics	Cross-sectional *T*-statistics	Sign Test
-1	0.0549	0.0922	0.0708	-1.6036
0	-2.3721	-3.9843***	-7.0171***	-3.2071***
1	0.7791	1.3086	1.5816	1.0690
2	-1.0987	-1.8454*	-2.1736**	-1.0690

*Significant at the 10% level;
**Significant at the 5% level;
***Significant at the 1% level.

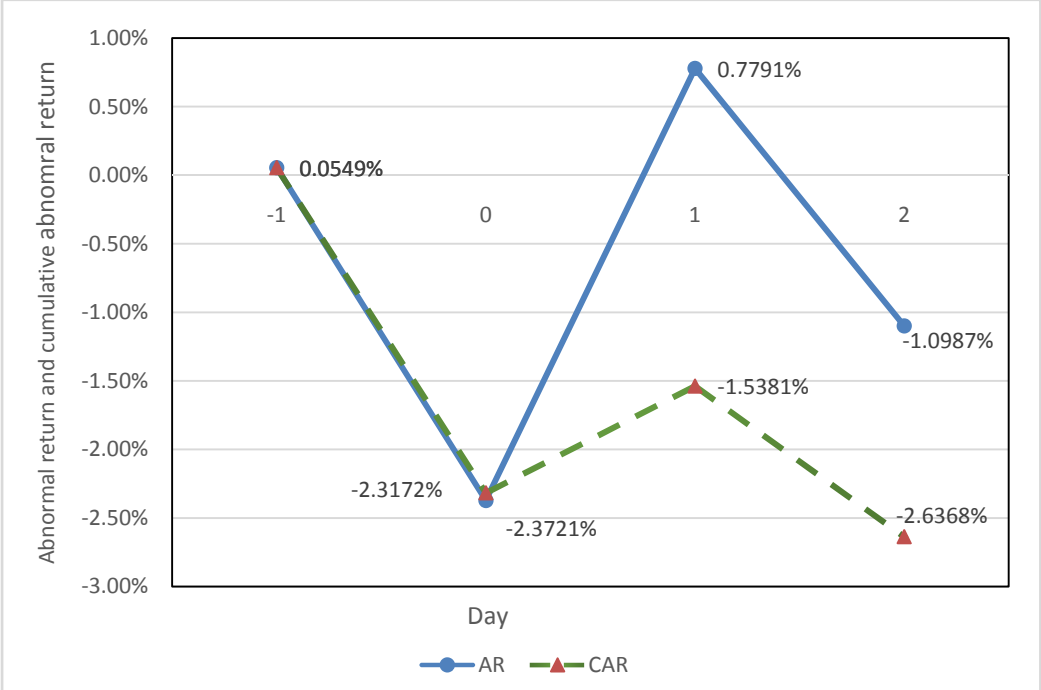

Fig. 4 Abnormal returns and cumulative abnormal returns of Taiwan's textile firms when Greenpeace Organization found PFCs footprints polluted remote European mountains on September 9, 2015 (Day 0).

Greenpeace's investigation of the PFCs footprints in the western part of the European mountainous area causes the stock prices of Taiwan's textile firms began to decline sharply. The investors feel anxious about the water pollutions of Taiwan's made sports clothing in European mountainous areas, so they fully reflected their anxiety in the daily stock price; thus, the negative abnormal return occurs.

The abnormal returns and cumulative abnormal returns of Taiwanese textile firms from one day prior to this water pollution event to the subsequent two day are presented in Fig. 4. Fig. 4 shows that the announcement of the water pollutions in Europe from Taiwanese manufactured jerseys induces negative abnormal returns. The pattern of cumulative abnormal returns around this period -2.6368% experiences a decline. This event enables the stock investors scared about the decrease of future profit and market share for Taiwanese textile corporations. Consequently, investors sell the stocks of these corporations, inducing the negative abnormal returns during the announcement of water pollutions of Taiwanese jerseys. The reaction time is merely one day, which supports efficient market efficiency theory. Regardless of positive or negative international environment-related event, they all affect the stock

price of textile industry and lead to abnormal returns, which reveal that environment and water polluted issues are critical of firm values.

5. Conclusions

Considering the rise of global environmental consciousness on corporate social responsibility and sustainable operation, this study verifies the market reactions to the announcement of three environment-related events, including the water pollution event, from 2014 to 2015. The three events are as follows: first, the soccer teams of the World Cup wear the jerseys composed of environmental protection materials and manufactured by Taiwanese textile companies which are the contractors of such brand corporations as Nike and Adidas. Second, Greenpeace International enabled 38 scientists to announce the ban on fluoride in Madrid. Third, Greenpeace International has detected fluoride residues from the water in remote mountainous areas of Europe and concluded that the Taiwanese jerseys composed of fluoride pollute the rivers or snows.

This work chooses fourteen listing company samples in Taiwan textile industry to test their market reactions during the three environmental events. The finding of the research indicates that announcement of the uses of Taiwanese jerseys in World Cups causes the positive abnormal returns in Taiwanese textile industry. Investors regard the event as good news and purchase the stock of Taiwanese textile companies substantially; thus, we find the abnormal positive returns for Taiwanese textile companies. On the other hand, the announcement of the ban on fluoride induces negative abnormal returns because fluoride is the main material for Taiwanese jerseys. Most importantly, the announcement of the water pollutions in Europe from Taiwanese manufactured jerseys induces negative abnormal returns. Both of the two events enable the stock investors scared about the decrease of future profit and market share for Taiwanese textile corporations. Consequently, investors sell the stocks of these corporations, inducing the negative abnormal returns during the announcement of water pollutions of Taiwanese jerseys. The reaction time is merely one day, which supports efficient market theory. Regardless of positive or negative international environment-related event, they all affect the stock price of textile industry and lead to abnormal returns, which reveal that environment and water polluted issues are critical of firm values.

Acknowledgments

The authors would like to thank Ministry of Science and Technology of the Republic of China, for partially supporting this research under Contract No. MOST 106-2410-H-009 -026.

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