DOES BEING PLACED ON EPA WATCH LIST IMPACT A FIRM'S STOCK MARKET RETURNS?

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ABSTRACT

The paper examines the financial impact of the first time release of the Watchlist used by the Environmental Protection Agency to track companies that have seriously violated the Clean Air Act. We find that violating companies' stockholders experienced negative abnormal returns on the actual day of the announcement. We also find abnormal positive returns one day before and two days after the release of the list. This could be due to the delayed release of the list and the fact that some companies had already addressed the violations or commented on their appearance on the list before the disclosure. **JEL Classification**: Q58, Q53, G1

INTRODUCTION

Environmental information disclosure has been long used to improve public awareness of violations and to put pressure on polluters. Disclosing such information allows the public to make efficient decisions about environmental issues and personal consumption choices. It would also help the markets price the stocks of violating companies more accurately. The current study examines a one-time event that occurred in 2011, when a normally confidential watch list used by EPA internally to track "high priority violators" of the Clean Air Act (CAA) was released to the public on November 2. We examine the impact of this information disclosure on the stock market returns of the companies on the list. We find that there are abnormal positive returns for cited companies one day before and two days after the announcement. We argue that the reason for this is simple: the list was out-of-date in that it was referring to violations that occurred in previous months. Some companies, usually the ones that responded to the inquiry before the release of the list, had either corrected or addressed the violations in some other way; therefore, corporations responding to negative news promptly are perceived positively by the market. Using a post-event comparison period, we also find that significantly negative abnormal returns accrue to violating companies on the day the list was released. The negative returns are more emphatic for the stockholders of companies that commented on their appearance on the list.

Previous literature has examined how information disclosure can affect firms' financial performances. Hamilton (1995) was among the first to investigate stock market reaction to environmental information disclosure. He finds that when information on the firm release of toxic chemicals was first disclosed to the public through Toxics Release Inventory (TRI) database, firms reporting TRI experienced significant and negative abnormal returns in their stock values. Evans (2016) examines how firm compliance changes when being put on the EPA's watch list and how compliance changes when such lists are released to the public. She finds that compliance rate increased sustainably in both cases. For a sample period covering the period 1972-1991, Badarinath and Bolster (1996) find that stock market reaction to EPA judicial actions appears to reinforce the intent of EPA enforcement efforts. They find a significant decline of 0.43 percent in violator firm value during the week of settlement. Khanna, Quimio, and Bojilova (1998) examine the impact of toxics release information as a policy tool for environmental protection and find significant negative stock market returns during the one-day period following the disclosure. Another study that examined the impact of information as a regulatory tool was by Konar and Cohen (1997). They show evidence indicating that financial markets provide strong incentives for firms to change their environmental behavior following mandatory disclosure requirements.

Our motivation for this study stems from the above studies. It is obvious from their findings that stock markets do tend to punish companies which pollute the environment in their quest for maximizing stockholder wealth. We hypothesize that the inclusion in the watch list has a negative impact on the stock price of the companies that are serious violators of the CAA following the release of their names to the public for the first time. Agency theory exponents have long argued for consistency of the stockholder wealth maximization with interests of other stakeholders such as creditors, employees, and society in general. When corporations violate the environmental regulations, they tend to create a negative impression on the general public which could lead to potentially lower returns, indicating that the market penalizes them regarding their stock values.

The rest of the paper is organized as follows: We discuss the event and the sample in the next section. The empirical evidence is presented in section three, and we conclude in section four.

EVENT AND DATA

The watch list was created in 2004 by EPA to track significant violations of the CAA for enforcement purpose. The list has been confidential and for internal use only ever since. Company violation information has always publicly available at EPA's website. It is contained in a searchable database. However, the list of serious violations, or "high priority violators" was not available to the public. After a series of Freedom of Information Act requests on the watch list, EPA decided to release the watch list to the public for the first time in November 2011. On a fact sheet issued by EPA on November 2, 2011, it is stated that the watch list was available on EPA's website (EPA, 2011). Therefore, the list should be available by November 2, if not earlier. A few months later, EPA started posting the list on its website on a monthly basis. National Public Radio and the Center for Public Integrity are the major organizations

that had requested the list. On November 3, the Center for Public Integrity's *iWatch News* issued the list in its news titled "EPA's internal Clear Air Act 'watch list' (Morris, 2011). Then on November 7, NPR also released the list in its news "Secret 'Watch List' Reveals Failure to Curb Toxic Air" (Shogren, 2011). The first lists that were released were for July and September 2011, in which facilities deemed as significant violators of the CAA during the specified months were identified. The list comprised of a total of 464 facilities with names and locations. Subsequently, EPA has been updating the list on a monthly basis until August 2013, when EPA decided to end the watch list project.

According to the NPR news, the severity of violations that the watch list reflects varies. Some of the facilities are "worst of the worst," and some may have violated the regulations without imposing significant threats to the public or the environment. Further, some facilities may have appeared on the list just by mistake.

Before releasing the list, *iWatch News* and NPR has also inquired firms that owned these facilities on the list for comments about their appearance on the watch list. About 34% of the firms/facilities provided comments, and many of the facilities claimed they were not aware of the alleged violations or stated that they were included in the list by mistake. For example, the response from Williams Field Services, LLC states that "Williams Field Services, LLC is not aware of any violations at the Ute Facility. In fact, Williams has not received a notice of violation for the Ute E facility…" Some facilities acknowledged the violations and indicated that they had corrected the violations.

The release of the watch list to the public can be considered as a type of information disclosure. Information about a firm's environmental performance sends an important signal to shareholders when evaluating a specific firm. It also has a direct bearing on the market's perception of a firm. Thus, a firm's stock may react positively or negatively to it, depending on the types of information being disclosed. Also, the public may also pay attention to such information and put pressure on serious polluters. Therefore, such information may bring extra incentive for firms to improve environmental compliance due to pressure from the public, including their consumers and shareholders.

We obtained the July and September 2011 list from the link provided by *iWatch News* and NPR (Morris 2011 and Shogren 2011). By facility names and addresses, we were able to match 70 facilities to 43 companies that are publicly traded. These account for 15% of the total facilities on the list. The rest of the sample did not have publicly traded stocks. Seven of the companies stopped trading either before the event date or shortly after and thus had to be excluded from our analysis. Eventually, our sample included 36 publicly traded companies whose facilities appeared on the July or September 2011 watch list or both. Several of these companies have more than one facility appeared on the list. The actual size of dataset is 36 publicly traded companies representing more than 37 actual violations. It should also be noted that our sample is complete in that only these 36 companies of this type that are publicly traded for the entire period.

EMPIRICAL EVIDENCE

We obtained the stock prices for the 36 companies between January 5, 2009 (the first trading day in 2009) and December 31, 2015, from the Bloomberg database. We

calculated abnormal returns for the violating companies using the Fama and French (1992) three-factor model. We obtained the three commonly used factors from the homepage of Kenneth French at Dartmouth College. They are the value-weighted return of all CRSP stocks in the US, small-minus-big market capitalization factor return (SMB), and high-minus-low market equity factor return (HML).

We consider a [-3, 3] event window. In event studies, the estimation window is usually selected to be certain months before the event. However, the event examined in this paper occurs during a period when the US economy was still in the process of recovering from the 2007-2008 financial crises. An estimation window before the event day November 2, 2011, may not fully represent the normal performance of the stock market and thus may not provide sufficient comparisons. The market had suffered a serious downturn in the years prior due to the recession impacting stock market returns between 2009 and 2011. Also, Ahern (2009) argues that using post-event data for estimation can significantly reduce the positive small firm bias as well as the negative bias found in samples characterized by high prior returns. We, therefore, consider two estimation periods, a pre-event estimation window from January 1, 2009, to September 30, 2011, and a post-event estimation window from January 1, 2012, to December 31, 2015. Since NPR inquired companies for comments about their appearance on the list and some of the firms responded, we consider two samples in our event study, a sample of all public companies whose facilities appeared on the list and a subsample of companies that responded to NPR's inquiry.

We first obtain abnormal returns (AR) using the Fama and French (1992, 1993) three-factor model with the following specification.

$$R_{it} = \alpha_i + \beta_i R_t^e + \theta_i SMB_t + \delta_i HML_t + \varepsilon_{it}, \qquad (1)$$

where is the excess return (with respect to the risk-free rate) of stock *i* on day *t*, R^e_t is the value-weighted return of all CRSP stocks, SMB_t is the small-minus-big market capitalization factor return, HML_t is the high-minus-low market equity factor return, and is a white noise random error. All stock returns are in log terms by applying the natural log transformation,$R_{it} = 100\ \mathrm{Log}(1 + R_{it})$.

As a robustness check, we used Fama-French three-factor model to estimate the abnormal return and conducted the same tests; results are not significantly different from what's reported here.

The model is estimated using ordinary least-squares (OLS) method. The abnormal returns are then calculated as the difference between the realized and predicted returns for any stock *i* on day *t* in the event period. That is,

$$AR_{it} = R_{it} - (\hat{\alpha}_1 + \hat{\beta}_i R_t^e + \hat{\theta}_i SMB_t + \hat{\delta}_i HML_t) \qquad (2)$$

Daily average abnormal return (AAR) is calculated as

$$AAR_t = \frac{1}{n}\sum_{i=1}^{n} AR_{it}, \qquad (3)$$

where *n* is the total number of firms.

The summary statistics of our data are shown in Table 1. The stock returns of the

sample range from -0.123 to 0.043 and the average return is -0.003, with a standard deviation of 0.027. The next variable, *Response*, is a dummy variable that takes one if the company responded to inquiries by *iWatch News* and NPR about their appearance on the list and zero otherwise. About 66% of the publicly traded companies in our sample responded to the inquiries. The next three variables are the three factors used in calculating the abnormal return. The summary statistics for abnormal returns are separated into three periods for our two samples: the full sample and the subsample of firms responding to the inquiries. We also differentiate between the two estimation windows: the pre-event and post-event estimation windows. For the full sample, the AAR during the event window is 0.0003 and 0.0007 using the two estimation windows, respectively. The AAR is -0.0005 during the pre-event estimation window and 0.0003 during the post-event window. For the subsample of responding firms, the AAR during the event window is -0.0002 and 0.0004 using the two estimation windows, respectively. The AAR during the pre- and post-event estimation windows is -0.0005 and 0.00001, respectively.

To examine the effects of the release of the watch list on firms' stock market returns, we consider parametric tests as well as nonparametric tests. For parametric tests, we perform five different tests on the daily AAR.

We first employ the conventional t-test that assumes cross-sectional independence across firms, and the test statistic is given by

$$T = \frac{AAR_t}{S_{AAR}}, \tag{4}$$

where S_{AAR} denotes the estimated standard deviation of the average abnormal return during the estimation period. Next, we conduct the test on standardized abnormal returns proposed by Patell (1976). The standardized abnormal return is obtained using each abnormal return divided by its standard deviation, estimated over the estimation period. This ensures that each abnormal return has the same estimated variance of 1.

If there is event-induced variation during the event window, then standard deviation based on the non-event window (the estimation window) can underestimate the true standard deviation during the event window and thus lead to over rejection of the null hypothesis. Therefore, our third method is the standardized abnormal return test proposed by Boehmer et al. (1991) that uses the event day cross-sectional prediction error as the estimated standard deviation.

In our paper, the event date is the same across all firms. One concern in event study significance test under such situations is that there can be cross-sectional correlations among abnormal returns, which can lead to over-rejection of the null hypothesis when using the traditional methods. However, Brown and Warner (1980, 1985) show that when firms do not belong to the same industry, such correlation will be reduced (Dutta, 2014). Since firms in our sample do not belong to the same industry, the first three tests we used are still valid. However, to be cautious, we consider two more tests that control for the cross-sectional correlation, the crude dependence test (CDA) and the test proposed by Kolari and Pynnönen (2010) that controls for the cross-sectional correlation. In the CDA test, the standard deviation is estimated using the time series of the average abnormal returns over the estimation period. Kolari and Pynnönen (2010) modify the t-statistic of Boehmer, Musumeci, and Poulsen (1991) while controlling for cross-sectional correlations.

The parametric tests discussed above impose strong assumptions about the distribution of the abnormal returns. In comparison, nonparametric tests relax such assumptions. Therefore, we consider two nonparametric tests: the Cowan (1992) generalized sign test and the Corrado (1989) rank test. The sign test is a simple binomial test to examine if the frequency of positive abnormal residuals equals 50%. The generalized version allows for hypothesis tests of the frequency other than 50%. To implement the Corrado (1989) rank test, each firm's abnormal returns are first transformed in ranks over the estimation window and the event window. Each firm's rank is compared with the expected average rank under the null hypothesis of no abnormal returns (Serra 2002). We also conducted the rank test proposed by Corrado and Zivney (1992), and the results are very similar to the results reported below.

The results from parametric and nonparametric tests using the pre-event estimation window are given in Tables 2-5. The parametric tests on abnormal returns for all companies show consistently negative returns on Day -2 according to four parametric tests in Table 2. We also found negative returns on Day 1, which is significant based on the t-test. While this appears to indicate that the market reacted negatively before and after EPA released the list, it is also clear that there are positive and significant abnormal returns for the sample companies on Day -1 and Day 2. The non-parametric tests for the same sample are given in Table 3. The returns for Day -1 are positive and significant, consistent with the results in Table 2. The returns on the rest of the days are no longer significant.

We next look at the mean abnormal returns for companies that responded to the inquiry by *iWatch News* and NPR, reported in Tables 4-5. Consistent with the results in Table 2, we find that there are negative abnormal returns on Day -2 and positive ones on Day -1, according to the parametric tests. The only consistent pattern in both Table 2 and Table 4 is Days -2 and -1. We next examine nonparametric tests on the abnormal returns of the sample companies that responded to the inquiries in Table 5. As with the results in Table 3, the non-parametric tests show that abnormal returns on Day -1 are positive and highly significant, at 5% according to the rank test and 1% according to the sign test. It is interesting to note that the abnormal returns on Day -2, although still negative, are no longer significant according to the nonparametric tests. Based on the results of the pre-event estimation period from Tables 2-5 above, it is obvious that the only consistent pattern is that the abnormal returns are positive and significant on Day -1 both across the overall sample and the responding sample. This is consistent with both parametric and non-parametric tests.

Tables 6-9 report the results using the post-event estimation window. These tables show the abnormal returns during the event window based on the estimation window from January 1, 2012, to December 31, 2015. This post-event estimation window is important for several reasons: the markets were more stable, and it was mostly during an expansion period and therefore contrasts with the recession period that was part of the pre-event estimation window. Table 6 shows the parametric test results based on the mean abnormal returns for the whole sample. We find that significant and negative abnormal returns show up on Day -2 in three tests, Day 0 in two tests, and Day 1 in one test, although the level of significance varies. In particular, the negative return on Day -2 is highly significant across three tests. Significant and positive abnormal returns are found on Days -3, -1 and +2. When we check the nonparametric test for the post-event estimation window, we find the results are relatively consistent with the pre-event estimation window. For the entire sample, we find that Day -1 has positively

significant returns according to both tests. Also, Day 0 has negative returns and Day 2 has positive returns that are significant at the 10% level in one of the nonparametric tests.

Tables 8 and 9 show the results of the subsample of the companies that responded to the inquiries. In Table 8, we see that the mean abnormal returns are negative and significant on Day -2 in three tests, and on Day 0 in four tests. Also, we find positive and significant abnormal returns on Day -1 in five tests and on Day 2 in two tests. When we examine the same sample using the non-parametric tests, we find the abnormal returns to be negative and significant on Day 0 in the two tests (Table 9), which is consistent with the result in Table 8. The returns on Day -1 remain positive and significant, consistent with previous findings. As suggested by the results of the post-event estimation period in Tables 6-9, the tests on abnormal returns become more significant when a post-event estimation window is adopted. In addition to the consistent positive and significant results on Day -1, we also find negative and significant abnormal returns on Day 0, which is consistent in both parametric and non-parametric tests. Such negative returns provide certain evidence in support of the hypothesis that companies appeared on the list experienced stock market loss due to the information disclosure.

Overall, the abnormal returns are found to be positive and highly significant in Days -1 and +2 consistently in most test settings. When post-event window is used, the negative abnormal returns on Day 0 become significant according to both parametric and nonparametric tests. When comparing the analysis using all companies and the analysis using the subsample of companies that responded, tests based on pre-event window turned from being significant in the days before the event to insignificant following the release when the subsample was considered. Also, tests became more significant using the post-event estimation window, suggesting that variation of abnormal returns is smaller during the post-event estimation window. This could imply that the variation of abnormal returns is relatively higher when the economy is in the process of recovery and changes in stock prices become more frequent. We conclude based on the results of these tests in the next section.

CONCLUSIONS AND IMPLICATIONS

The study examines the impact of the EPA's watch list on the stock prices of listed companies when such list is released to the public. Contrary to expectations, we find that positive abnormal returns accrue to companies one day before the release of the list by EPA and two days after the event. We also find negative returns on the day of the release, using a post-event estimation period. Some of the sample companies responded to the inquiry by media about their violations and appearance on the list. The stockholders of this subset of companies which responded to NPR's inquiry had positive returns one day before the release but not after. Instead, the negative abnormal returns are more significant on the day of the release than that of the full sample when using a post-event estimation period. The study has implications for regulatory agencies, corporations, and market watchers.

The first major implication is for regulatory agencies. The watch list was first released in November. However, the list was referring to serious violations in July and September. It is entirely possible that some of the facilities may have already

addressed the violations. An example is a response provided by Westlake PVC Corp.; it indicated that "all alleged violations have been addressed and resolved within the State of Kentucky." In the current information age where markets are very efficient, they respond very quickly to any news. A response like the above may be perceived more as a positive message for the corporation than a violating offense by the market. To a certain extent, this explains the positive response of the market to being placed on the list. Companies that responded to the inquiry of NPR had obviously felt that they were placed on the list despite the measures they took to address the situation, and therefore the market rewarded them with positive returns rather than negative returns. If the purpose of releasing the list is to get corporations to better comply with environmental regulations, it would perhaps be better for the list to be released at the same time the violations occur. Corporations respond more to falling stock prices, and by revealing serious violating corporations to the public on time, EPA can force them to amend their ways more quickly.

Our results show that corporations that responded to NPR's inquiry about their violations received higher stock returns during the seven-day period surrounding the announcement. This makes it evident that it is important to respond to inquiries by the press. Some corporations had addressed the violations by the time the list was released. When they responded to the inquiry they managed to turn potential bad news into the actual good news. In effect, their quick response to the slower nature of the release of information by *iWatch News* and NPR ensured that their stockholders received positive returns. This also has implications for Agency theory, in that corporations responded to negative news quickly are perceived as positive by the market. One of the major findings of the study is that using the post-event comparison period; we find that there are significantly negative returns on the actual day of the release. This is more emphatic for companies that have commented on their appearance on the list. This shows that the market still considered companies not socially responsible even if they either denied the allegation or have addressed the violations. This leaves no doubt that being placed on the list, albeit even temporarily, leads to negative stockholder returns when compared with a comparison period that does not include recession years.

For market watchers, the study has several implications. First, it shows that markets reward companies that respond proactively to perceived violations. Second, companies that do not respond to violation announcements may not be perceived the same way. Finally, it shows that the markets are efficient in the semi-strong form. When violations occurred in July and September, and the list was released in November, the market had already priced in the violation. This explains the positive returns to a large extent.

One limitation of the study is that the total number of publicly traded companies on the list is relatively small despite that we include the full sample of such companies. That said, we present nonparametric tests in addition to parametric tests to address the concern. Future studies can look into other forms of Agency theory as it relates to the environment. In addition, future research may explore the differential responses between large firms and small firms as well as heterogeneous responses across firms with different characteristics. This would provide more insights into policy implications.

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TABLE 1 SUMMARY STATISTICS

Variable	Mean	Standard Deviation	Minimum	Maximum
Returns	-0.003	0.027	-0.123	0.043
Response	0.657	0.475	0	1
MKT	0.0006	0.012	-0.07	0.069
SMB	0.00007	0.006	-0.021	0.036
HML	-0.00008	0.006	-0.042	0.043
Abnormal Return (all firms)				
Event window using pre-event estimation window	0.0003	0.0235	-0.199	0.249
Event window using post-event estimation window	0.0007	0.0239	-0.199	0.273
Pre-event estimation window	-0.0005	0.019	-0.252	0.272
Post-event estimation window	0.0003	0.0235	-1.989	0.249
Abnormal Return (responded firms)				
Event window using pre-event estimation window	-0.0002	0.016	-0.119	0.063
Event window using post-event estimation window	0.0004	0.016	-0.119	0.057
Pre-event estimation window	-0.0005	0.018	-0.211	0.28
Post-event estimation window	0.0000	0.014	-0.208	0.208

TABLE 2. PARAMETRIC TESTS OF ALL COMPANIES USING PRE-EVENT ESTIMATION WINDOW (N=36)

Event Day	Mean Abnormal Return	T test		Patell (1976)		Boehmer et al (1991)		CDA Test		Kolari and Pynnonen (2010)	
		Test Stat	P-Value	Test Stat	P-Value	Test Stat	P-Value	Test Stat	P-Value	Test Stat	P-Value
-3	0.006	1.808*	0.071	0.996	0.319	0.835	0.404	1.212	0.226	0.483	0.629
-2	-0.008	-2.368**	0.018	-2.699***	0.007	-2.870***	0.004	-1.590	0.112	-1.660*	0.097
-1	0.008	2.535**	0.011	2.003**	0.045	2.350**	0.019	1.702*	0.089	1.359	0.175
0	0.004	1.334	0.183	0.098	0.922	0.079	0.937	0.895	0.371	0.046	0.963
1	-0.008	-2.424**	0.016	-1.405	0.160	-1.521	0.129	-1.626	0.104	-0.880	0.379
2	0.007	2.149**	0.032	2.017**	0.044	2.188**	0.029	1.439	0.151	1.266	0.206
3	0.001	0.213	0.831	0.496	0.620	0.884	0.377	0.143	0.886	0.512	0.609

Note: ***, **, and * significant at the 1%, 5%, and 10% levels, respectively.

TABLE 3. NONPARAMETRIC TESTS OF ALL COMPANIES USING PRE-EVENT ESTIMATION WINDOW (N=36)

Event Day	Corrado Rank Test		Cowan Generalized Sign Test	
	Test Stat	P-Value	Test Stat	P-Value
-3	0.788	0.431	0.677	0.499
-2	-1.217	0.224	-0.659	0.510
-1	1.678*	0.093	2.346**	0.019
0	-0.117	0.906	0.343	0.732
1	-0.623	0.533	-1.327	0.185
2	1.514	0.130	1.344	0.179
3	0.491	0.623	0.677	0.499

Note: ***, **, and * significant at the 1%, 5%, and 10% levels, respectively.

TABLE 4. PARAMETRIC TESTS OF RESPONDING COMPANIES USING PRE-EVENT ESTIMATION WINDOW (N=23)

Event Day	Mean Abnormal Return	T test		Patell (1976)		Boehmer et al (1991)		CDA Test		Kolari and Pynnonen (2010)	
		Test Stat	P-Value	Test Stat	P-Value	Test Stat	P-Value	Test Stat	P-Value	Test Stat	P-Value
-3	0.001	0.274	0.784	-0.310	0.757	-0.244	0.807	0.210	0.834	-0.165	0.869
-2	-0.007	-1.838*	0.067	-1.908*	0.056	-1.982**	0.048	-1.410	0.159	-1.345	0.179
-1	0.009	2.298**	0.022	2.103**	0.035	3.071***	0.002	1.763*	0.078	2.083**	0.038
0	-0.004	-1.105	0.269	-1.185	0.236	-1.450	0.148	-0.847	0.397	-0.984	0.326
1	-0.002	-0.607	0.544	-0.318	0.751	-0.461	0.645	-0.465	0.642	-0.313	0.755
2	0.004	1.010	0.313	0.599	0.549	0.692	0.489	0.773	0.440	0.470	0.639
3	-0.001	-0.214	0.830	-0.014	0.989	-0.024	0.981	-0.164	0.870	-0.016	0.987

Note: ***, **, and * significant at the 1%, 5%, and 10% levels, respectively.

TABLE 5. NONPARAMETRIC TESTS OF RESPONDING COMPANIES USING PRE-EVENT ESTIMATION WINDOW (N=23)

Event Day	Corrado Rank Test		Cowan Generalized Sign Test	
	Test Stat	P-Value	Test Stat	P-Value
-3	-0.015	0.988	0.033	0.973
-2	-0.844	0.398	0.033	0.973
-1	2.281**	0.023	2.956***	0.003
0	-0.747	0.455	-0.802	0.423
1	-0.129	0.897	0.451	0.652
2	0.790	0.429	0.033	0.973
3	0.018	0.986	0.033	0.973

Note: ***, **, and * significant at the 1%, 5%, and 10% levels, respectively.

TABLE 6. PARAMETRIC TESTS OF ALL COMPANIES USING POST-EVENT ESTIMATION WINDOW (N=36)

Event Day	Mean Abnormal Return	T test		Patell (1976)		Boehmer et al (1991)		CDA Test		Kolari and Pynnonen (2010)	
		Test Stat	P-Value	Test Stat	P-Value	Test Stat	P-Value	Test Stat	P-Value	Test Stat	P-Value
-3	0.007	2.184**	0.029	2.192**	0.028	1.559	0.119	1.611	0.108	0.860	0.390
-2	-0.007	-2.096**	0.036	-2.795***	0.005	-2.567**	0.010	-1.554	0.120	-1.417	0.157
-1	0.010	2.793***	0.005	3.265***	0.001	2.781***	0.006	2.079**	0.038	1.535	0.125
0	0.003	0.749	0.454	-1.878*	0.060	-1.840*	0.066	0.556	0.579	-1.015	0.310
1	-0.006	-1.803*	0.072	-0.618	0.536	-0.628	0.530	-1.332	0.183	-0.346	0.729
2	0.008	2.463**	0.014	3.683***	0.000	3.077***	0.002	1.816*	0.070	1.698*	0.090
3	0.000	0.017	0.987	0.077	0.939	0.097	0.923	0.012	0.990	0.054	0.957

Note: ***, **, and * significant at the 1%, 5%, and 10% levels, respectively.

TABLE 7. NONPARAMETRIC TESTS OF ALL COMPANIES USING POST-EVENT ESTIMATION WINDOW (N=36)

Event Day	Corrado Rank Test		Cowan Generalized Sign Test	
	Test Stat	P-Value	Test Stat	P-Value
-3	1.163	0.245	1.147	0.251
-2	-1.326	0.185	-0.853	0.393
-1	2.389**	0.017	3.148***	0.002
0	-1.249	0.212	-1.854*	0.064
1	0.015	0.988	0.147	0.883
2	1.717*	0.086	1.481	0.139
3	-0.070	0.944	-0.520	0.603

Note: ***, **, and * significant at the 1%, 5%, and 10% levels, respectively.

TABLE 8. PARAMETRIC TESTS OF RESPONDING COMPANIES USING POST-EVENT ESTIMATION WINDOW (N=23)

Event Day	Mean Abnormal Return	T test		Patell (1976)		Boehmer et al (1991)		CDA Test		Kolari and Pynnonen (2010)	
		Test Stat	P-Value	Test Stat	P-Value	Test Stat	P-Value	Test Stat	P-Value	Test Stat	P-Value
-3	0.003	1.027	0.305	0.817	0.414	0.538	0.591	0.722	0.470	0.330	0.741
-2	-0.006	-2.106**	0.035	-2.115**	0.034	-1.813*	0.070	-1.489	0.137	-1.113	0.266
-1	0.011	3.693***	0.000	3.855***	0.000	4.131***	0.000	2.620***	0.009	2.537**	0.011
0	-0.006	-2.241**	0.025	-2.451**	0.014	-2.854***	0.004	-1.584	0.114	-1.753*	0.080
1	-0.001	-0.377	0.706	-0.307	0.759	-0.275	0.784	-0.266	0.791	-0.169	0.866
2	0.005	1.831*	0.067	1.718*	0.086	1.552	0.121	1.287	0.198	0.954	0.341
3	-0.001	-0.313	0.755	-0.381	0.703	-0.487	0.627	-0.220	0.826	-0.299	0.765

Note: ***, **, and * significant at the 1%, 5%, and 10% levels, respectively.

TABLE 9. NONPARAMETRIC TESTS OF RESPONDING COMPANIES USING POST-EVENT ESTIMATION WINDOW (N=23)

Event Day	Corrado Rank Test		Cowan Generalized Sign Test	
	Test Stat	P-Value	Test Stat	P-Value
-3	0.508	0.611	0.308	0.758
-2	-0.988	0.323	-0.526	0.599
-1	2.951***	0.003	3.228***	0.001
0	-1.858*	0.063	-2.611***	0.009
1	0.259	0.795	1.143	0.253
2	0.963	0.335	0.308	0.758
3	-0.386	0.700	-0.526	0.599

Note: ***, **, and * significant at the 1%, 5%, and 10% levels, respectively.