

從產業觀點探討市場在下跌事件中 ESG 股票的價格行為

THE PRICE BEHAVIOR OF ESG STOCKS FROM AN INDUSTRIAL PERSPECTIVE AROUND THE EVENTS OF MARKET DECLINE

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摘要

本研究從產業角度分析台灣非金融與金融 ESG 類股，在市場下跌期間兩者的價格行為差異，著重研究 ESG 評等是否提供下行保護與股價韌性。採用事件研究法，分析 2017 年 12 月至 2022 年 12 月期間的六次市場重大下跌事件。運用市場模型，評估非金融與金融 ESG 類股的異常報酬（Abnormal Return, AR）和累積異常報酬（Cumulative Abnormal Return, CAR）。並透過縱橫資料迴歸模型檢驗各項假設，以深入探討 ESG 股票在市場下跌事件中的行為表現。研究結果發現：(1)在事件期間中，非金融 ESG 類股的交易活動顯著增強。(2)ESG 評等較高的非金融類股在市場低迷時期的股價跌幅較小，而金融類股則未觀察到類似現象。(3)非金融類股的 ESG 活動（Activities），在市場下跌事件中提供股價下行保護與韌性。(4)ESG 資訊是未來股價表現的良好指標。本研究對 ESG 文獻的邊際貢獻，在於發現非金融與金融類股在市場下跌期間，呈現不同的市場反應。投資者可將 ESG 評等作為未來投資標的篩選工具，而企業管理者與政策制定者，則可運用這些研究發現來更強化永續發展策略。

關鍵字：ESG 活動、產業角度、事件研究法、下行保護、韌性

ABSTRACT

Relative to the previous studies, this study uses a greater number of declining events and adopts an industrial perspective, non-financial and financial stocks, to examine the stock price behavior of the constituents of the Taiwan ESG Index. The study spans the period from Dec. 2017 (start of the ESG index) to Dec. 2022. Our research contributions to the literature include: (1) Trading activities of non-financial stocks intensify during the event period. (2) Firms with higher ESG ratings of non-financial stocks experience smaller stock price declines during market downturns, while such a phenomenon is not observed in financial stocks. (3) The ESG activities of non-financial stocks provide downside protection and resiliency around market decline events, whereas no such phenomena are observed for financial stocks. (4) Investors can consider ESG information as a signal of future stock performance during market decline.

Keywords: ESG, Industrial Perspective, Event Study, Downside Protection, Resiliency

1.Introduction

The term ESG (environmental, social, and governance) was introduced and popularized by the UN in its 2004 “Who Cares Wins” report. Since then, ESG investing, also known as SRI (socially responsible investment), has become a mainstream area of interest for asset managers.¹ According to a report by Bloomberg Intelligence in 2023, the global ESG assets exceeded \$41 trillion in 2022 and are expected to reach \$50 trillion by 2025, about one-third of the projected \$140.5 trillion in total global assets under management. In addition, the Taiwan Sustainable Investment Survey indicated that the total value of sustainable investment assets under management was approximately NT\$20 trillion in 2022, reflecting a 15.3% increase compared to the previous year's NT\$17 trillion.² These reports reveal that ESG investing or SRI is undergoing exponential growth, not only in global markets but also in Taiwan. Such investment practices are now recognized for their potential to enhance the performance of managed portfolios, leading to increased returns and reduced risk.

In recent years, academic researchers and investors have demonstrated a growing interest in examining the price behavior of ESG stocks during crisis events, particularly in mature or large stock markets. The evidence of Nofsinger and Varma (2014), for example, shows that an asymmetric return pattern of SRI funds is observed in US during the 2002 dot.com bubble burst and 2008 global financial crisis, i.e., SRI funds underperform conventional funds in normal periods but outperform in market crisis periods, providing downside protection mechanism for investors. Furthermore, some studies have noted that firms with high CSR (corporate social responsibility) ratings experience higher stock returns compared to their low CSR counterparts in the US during the 2008 global financial crisis (Lins, Servaes, & Tamayo, 2017 ; Buchanan, Cao, & Chen, 2018 ; Lins, Servaes, & Tamayo, 2019). Additionally, Albuquerque, Koskinen, Yang, and Zhang (2020) have also found that firms with higher ES (environmental and social) ratings not only earn higher returns but also exhibit lower return volatility than those with lower ES ratings in the US amid the Covid-19 crisis. In recent studies, findings by Broadstock, Chan, Cheng, and Wang (2021) and Beloskar and Rao (2023) also show that ESG scores provide downside protection during the Covid-19 pandemic and do not prove to be detrimental to investment performance during normal times in China and India, respectively. However, Takahashi and Yamada (2021) shows that there is no evidence that firms with high ESG ratings have high abnormal returns in Japanese stock markets during the Covid-19 outbreak period.

Obviously, the existing literature is providing some controversial findings regarding the relation between the ESG ratings and stock returns for developed or big stock markets around the events of market decline, where the concepts of CSR or ESG may be well developed. Consequently, it remains unclear whether these previous results can be extrapolated to emerging stock markets such as Taiwan. As noted above, the total volume of ESG investments under management has witnessed significant growth in Taiwan in recent years, and as highlighted by Huang, Li, Chan, Hsieh, and Lai (2023), Taiwanese companies and investors are displaying an increasing awareness of the significance of ESG investment. Based on the discussions, the relationship between ESG ratings and stock price behavior deserves to be examined for the Taiwan stock markets around the events of market decline, especially for a more comprehensive sampling, marking the first purpose of this study. Next, previous studies mainly focus on one crisis event in markets, such as the 2008 global financial crisis or Covid-19 global pandemic. Therefore, our study seeks a more comprehensive sample by selecting six declining events to examine the price behavior of the constituents of the Taiwan ESG Index throughout our study period, from December 2017 (start of the ESG index) to December 2022, forming the second purpose of this study.

Third, as observed in much of the literature, financial stocks are often excluded when investigating the relationship between ESG ratings and stock returns during crisis events. Next, financial firms such as banks, insurance companies, and securities firms primarily manage financial assets and tend to be more sensitive to changes in interest rates, exchange rates, market liquidity, and government regulations, distinguishing them from non-financial industries. Furthermore, our summary statistics of ESG scores for the constituents of the Taiwan ESG Index show that the average total ESG score of non-financial firms (67.87) is higher than that of financial firms (66.35). In addition, the average environmental (E), social (S), and governance (G) sub-scores for non-financial firms are 69.41, 72.95, and 62.70, respectively, all of which exceed the corresponding scores for financial firms, which are 67.83, 72.60, and 60.99, respectively.³ Based on the above discussion, a reasonable conjecture is that different return patterns may be observed for non-financial and financial stocks during periods of market decline, constituting the final purpose of this study.

The Taiwan ESG Index was designed to measure the performance of companies on the Taiwan Stock Exchange that meet the globally recognized ESG standards used by FTSE4Good Index Series in December 2017. The constituent stocks of the ESG index are used to examine the price behavior of six declining events from an industrial perspective,

non-financial and financial stocks, covering the period from December 2017 (start of ESG index) to December 2022. Several new findings or contributions to literature are shown in the following.

First, the event study shows AR (abnormal returns) of the full sample exhibits a significantly negative return on the event day ($t=0$), consistent with many literature works for the announcement of negative event. Next, the results of this study are that ESG and S scores of non-financial stocks are positively and significantly related to cumulative abnormal returns (CAR) on various windows, respectively. This suggests that non-financial firms with higher ESG and S scores experience smaller price declines during market downturns, consistent with previous studies. However, various ESG scores of financial stocks are insignificantly related to CAR on various windows, marking a new finding in the existing literature.

Third, this study examines the role of various ESG ratings for two industries around the events of market decline versus normal periods. For non-financial stocks, the regression coefficients of ESG and E scores during the event period (market downturn) are greater than those during the normal period. The results indicate that the roles of ESG and E scores of non-financial stocks are attenuated in normal period, i.e., ESG activities provide downside protection during the market downturns, consistent with prior literature. This phenomenon is explained by assertions in the literature suggesting that investors, in normal periods, accept a lower return as an insurance premium, with the expected benefit being market resilience during downturns (Lins et al., 2017 ; Engle, Giglio, Kelly, Lee, & Stroebel, 2020 ; Ding, Levine, Lin, & Xie, 2021 ; Broadstock et al., 2021). Contrastingly, the regression coefficients of various ESG scores for financial stocks during market downturns are not greater than those during normal periods, presenting a clear inconsistency with the patterns observed in non-financial stocks. This discrepancy serves as a novel finding in the existing literature. Finally, it is noteworthy that higher ESG-rated firms in both industries exhibit similarly lower stock return volatility around market decline events.

This paper proceeds as follows: Section 2 discusses literature review and hypotheses development. Data and methodology are stated in Section 3. Empirical results are presented in Section 4. Section 5 gives the conclusions.

2.Literature Review and Hypotheses Development

Previous ESG-related studies are briefly reviewed, and our five hypotheses are then developed in this section, respectively discussed in the following. Broadstock et al. (2021) have documented that trading activity for constituents of China's CSI 300 Index intensified, both in terms of volume and value of trades, during the Covid-19 period. When decomposing the sample into high and low ESG firms, both sub-samples experience heightened trade activity, especially among low-ESG firms. Recently, Beloskar and Rao (2023) have found that the abnormal trading volumes,⁴ both in terms of turnover and shares traded for low and high ESG stocks, are not significantly different from zero during the Covid-19 period, implying that the financial crisis does not lead to any significant increase or decline in the trading volumes of high and low ESG stocks during the crisis period. Based on the above discussion, trading activities between normal and crisis periods are examined for the full sample as well as for non-financial and financial stocks around the market decline events. The first hypothesis is proposed as follows.

H1: Trading volume, trading value, and the number of transactions during the crisis period are expected to be higher than those during the normal period for the full sample, as well as for non-financial and financial stocks, respectively.

An event study, invented by Ball and Brown (1968), is a popular method to assess the impact of the positive or negative event in the field of finance. Using the event study, many previous studies have explored the abnormal returns (AR) and cumulative abnormal returns (CAR) before and after the event date.⁵ The early study of Huang and Walkling (1987), for example, examines the target-firm announcement-period returns for the US markets, and their findings show that ARs are positive significance before the event date and most of CAR windows appear to be significantly positive. In addition, Vermaelen (1981, 1984) and Liao, Ke, and Yu (2005) investigate the stock price behavior during stock repurchase periods in the US and Taiwan stock markets, respectively, and their empirical results show that most of ARs and CARs windows appear negative significance before the event date, while most of those returns are positive significance after the event date.

Lins et al. (2017) have documented that non-financial firms with high social capital, as measured by corporate social responsibility (CSR) intensity, have stock returns that are four to seven percentage points higher than firms with low social capital during the 2008 global financial crisis. Moreover, Albuquerque et al. (2020) have examined the stock price behavior

during the initial Covid-19 outbreak for the US market, and the evidence shows that firms with high ES (environmental and social) ratings, neglecting the governance effect, earn an extra daily return of 0.45% from February 24 until March 17, 2020, relative to firms with low ES ratings, for a cumulative difference of 7.2%. Based on the above discussion, the market model is used to calculate AR and CAR of Taiwan ESG constituent stocks around the declining day in this study. The following hypothesis is proposed.

H2: The examination of ESG stocks are expected to exhibit negative AR and CAR before the market decline but show positive AR and CAR on and after event day.

Recently, the academic literature has focused much attention on the impact of ESG stocks on their return and volatility to the market crash. For example, the findings of Albuquerque et al. (2020) for the US markets show that stocks with higher ES ratings have higher significant returns and lower return volatility during the initial Covid-19 outbreak, consistent with two theories of ESG activities based on customer and investor preferences (Heinkel, Kraus, & Zechner, 2001 ; Bollen, 2007 ; Renneboog, Ter Horst, & Zhang, 2011 ; Albuquerque, Koskinen, & Zhang, 2019).

For the Chinese markets, Broadstock et al. (2021) also document that ESG ratings are positively and significantly related to cumulative raw returns (CRR) and CAR; meanwhile, ESG scores are negatively related to stock price volatility during the pandemic period, providing the empirical evidence consistent with the signaling role that ESG ratings might offer investors in terms of potential resilience against downside risk. In addition, they also explore the importance of individual E, S and G scores, and find that higher E and G scores are positively and significantly related to CRR and CAR, respectively; however, the S score is negatively and significantly related to CRR and CAR, respectively. Furthermore, the evidence of three sub-scores is insignificant to return volatility. In addition, Engelhardt, Krause, Neukirchen, and Posch (2021) analyze whether social trust and trust in a country's government among citizens affect stock market volatility during the Covid-19 pandemic, and their results show the stock markets' volatility to be significantly lower in high-trust countries (in reaction to Covid-19 case announcements) for 47 lead national stock market indices.

As noted above, financial stocks are often excluded when examining the relationship between ESG ratings and stock returns during crisis events in the existing literature. For example, Lins et al. (2017) demonstrate that US non-financial firms with high ESG ratings earn 4 to 7 percent higher excess returns during the 2008-2009 financial crisis. Nguyen, Hoang, and Tran (2022) have also found that stronger ESG practices improve the financial performance of non-financial S&P 500 firms, suggesting that ESG contributes to firm resilience and enhances firm value. The evidence of Liu, Wu, and Li (2025) shows that strong ESG performance enhances resilience to systemic tail risk among Chinese non-financial firms from 2007 to 2023. Next, the characteristics of the financial industry, such as high leverage and sensitivity to interest rates, exchange rates, and government regulatory changes, are significantly different from those of the non-financial industry. As shown in Table 3, non-financial firms exhibit a higher mean total ESG score (67.87) compared to financial firms (66.35). In terms of sub-scores, non-financial firms have average environmental (E), social (S), and governance (G) scores of 69.41, 72.95, and 62.70, respectively, all of which are higher than the corresponding sub-scores for financial firms, which are 67.83, 72.60, and 60.99.

Based on the above discussion, especially for total ESG and three individual sub-scores between two industries, the reasonable conjecture is that the different price return patterns are expected to be observed for non-financial and financial stocks during market decline period. Two hypotheses are respectively stated in the following.

H3: Given that the various ESG ratings of non-financial firms are higher than those of financial firms, it is expected that non-financial stocks will experience smaller price declines than financial stocks during market downturns.

H4: As the various ESG ratings of non-financial firms are higher than those of financial firms in our summary statistics, non-financial firms with higher ESG ratings are expected to experience lower stock return volatility compared to financial firms during market downturns.

As noted above, one of the main findings of Lins et al. (2017) is that firms with high CSR ratings outperform firms with low CSR ratings during the 2008 financial crisis, suggesting that the building of firm-specific social capital can be thought of as an insurance policy that pays off when investors and overall economy face a severe crisis of confidence. Next, the evidence of Engle et al. (2020) shows that their ESG-characteristic-based

mimicking portfolios procedure produces hedge portfolios that perform better than the alternatives in hedging innovations in climate risk. Furthermore, the results of Broadstock et al. (2021) show that high-ESG firms are more resilient in terms of stock price reaction to the Covid-19 crisis, and the similar phenomena for high-E and high-G firms are also observed, respectively, for the Chinese stock markets.

The above findings could be explained by that investors pay an insurance premium through lower returns in normal period, with the expected benefit of market resilience in market downturn, dubbed as insurance premium hypothesis or weak form of the immunity hypothesis (Lins et al. 2017 ; Engle et al. 2020 ; Ding et al. 2021 ; Broadstock et al. 2021).⁶ Based on these discussions, Hypothesis 5 in our study is stated in the following.

H5: As the various ESG ratings of non-financial firms are higher than those of financial firms in our summary statistics, it is expected that non-financial stocks will exhibit greater resilience during market declines compared to financial stocks.

3.Data and Methodology

Taiwan Stock Exchange Corporation and FTSE Russell jointly compiled the Taiwan ESG Index on December 17, 2017. Thus, the sample period of this study spans from December 17, 2017 to December 31, 2022. The selection criteria of the event day are: (1) The returns on Taiwan Weighted Stock Index (TAIEX) decline by more than 3%; (2) Any two periods of event study, including parameters estimation and event periods, do not overlap another. A total of six events meet the criteria within the sample period, shown in Table 1, which displays that the decline range of TAIEX is between -3.03% and -6.31%. As noted above, the constituents of Taiwan ESG Index are used to examine the price behavior during the six declining events. In addition, the data of daily return, ESG score, E, S and G sub-scores and other relevant variables are taken from Taiwan Economic Journal Data Bank (TEJ).

In order to explore the ESG stock price behavior during the event period when facing the market downturn (Hypothesis 2), this study uses a market model to conduct an event study analysis for ESG stocks. The parameters (regression coefficients) of this model are estimated using the 100 trading days before the event day ($t=0$). The estimated parameters,

of course, are used to calculate the abnormal returns (AR) and cumulative abnormal returns (CAR) for various windows. The market model is briefly introduced as follows:

$$AR_{it} = R_{it} - (a + bR_{Mt}) \quad (1)$$

In the above equation, AR_{it} represents the abnormal return of stock i on day t ; R_{it} and R_{Mt} are the realized returns on stock i and on the market on day t , respectively. Also, a (intercept term) and b (slope term) are obtained from estimation period.

Next, this study detects whether various ESG scores influence the stock price behavior during the event period (Hypothesis 3). Panel-data regression is suitable for our analysis. The dependent variable is the cumulative abnormal return (CAR) around the event day and the independent variables include the ESG, E, S and G scores. If the regression coefficients of ESG, E, S or G are positive and significant, implying that firms with higher ESG, E, S or G scores experience smaller stock price declines during market downturn. The regression equation is presented below.

$$CAR(t_1, t_2) = \alpha_0 + \alpha_1 ESG + \alpha_2 E + \alpha_3 S + \alpha_4 G + \alpha_5 Leverage + \alpha_6 \ln(MB) + \alpha_7 \ln(Size) + \varepsilon \quad (2)$$

In the above equation, the control variables include Leverage as the company's debt ratio, $\ln(MB)$ as the logarithm of the ratio of market value to book value, and $\ln(Size)$ as the logarithm of market value.

Furthermore, this study examines the relationship between ESG scores and stock price volatility during the event period (Hypothesis 4). The dependent variable, Volatility, is computed as the standard deviation of daily stock returns during the event period, while ESG, E, S, and G scores are the independent variables. If the regression coefficient of ESG is negative and significant, it indicates that higher ESG firms experience lower volatility during a stock price decline. The panel-data regression equation is written in the following.

$$Volatility = \alpha_0 + \alpha_1 ESG + \alpha_2 E + \alpha_3 S + \alpha_4 G + \alpha_5 Leverage + \alpha_6 \ln(MB) + \alpha_7 \ln(Size) + \varepsilon \quad (3)$$

Table 1 The Dates of the Six Sharp Declines

Event	Event date	Return on TAIEX	Description of the Event
1	2018.10.11	-6.31%	US-China trade war at an impasse
2	2020.01.30	-5.75	Global outbreak of Covid-19
3	2020.08.20	-3.26	Announcement of economic recovery delayed by Covid-19, US Fed
4	2021.02.26	-3.03	Sharp rise yield rate of 10-year US T-bond to 1.6%
5	2022.03.07	-3.15	Rise of geopolitical risk between Russia-Ukraine conflict
6	2022.10.11	-4.35	A sharp fall of US stock markets and a 5.9% drop of TSMC's ADR

In the above equation, the definitions of three control variables, Leverage, $\ln(\text{MB})$ and $\ln(\text{Size})$, are the same as in Equation (2).

Finally, the phenomenon of downside protection is examined to check whether investors could have better confidence on higher ESG, E or G scores firms during the market decline period. The following panel-data regression is used to test the relationship various ESG scores and daily return during the market decline and normal periods, respectively.

$$R = \alpha_0 + \alpha_1 \text{Market} + \alpha_2 \text{Post} + \alpha_3 (\text{Market} \times \text{Post}) + \alpha_4 \text{ESG} + \alpha_5 (\text{ESG} \times \text{Post}) + \alpha_6 E + \alpha_7 (E \times \text{Post}) + \alpha_8 S + \alpha_9 (S \times \text{Post}) + \alpha_{10} G + \alpha_{11} (G \times \text{Post}) + \varepsilon \quad (4)$$

In Equation (4), R is the daily return of ESG stock i on day t , Market is the daily market return on day t , Post is a dummy variable that equals one during the market decline period, and 0 in the normal period, following the previous studies, the six event days are randomly selected in 2017, before the sample period. The main interest of the coefficient is to capture whether ESG activities can provide downside protection. If the coefficient is positive and significant, implying high ESG firms are more resilient in terms of stock price reaction to the market decline (Hypothesis 5). In addition, the coefficients of the other interaction terms, $E \times \text{Post}$, $S \times \text{Post}$, and $G \times \text{Post}$, of course, can capture the importance of individual sub-scores during the market declines.

4. Empirical Results

This section involves three subsections. Descriptive statistics of ESG-related variables for this study are shown in the first subsection. Abnormal returns (AR) and cumulative abnormal returns (CAR) around the event date are presented in the second subsection. Three parts are included in the final subsection: Panel-data regression is used to examine the relationship between various CAR and various ESG scores in the first part; the relationship between stock return volatility and various ESG scores is also examined in the second part; and the relationship between daily returns and various ESG scores is investigated in the third part.

4.1 Descriptive Statistics

Table 2 shows the average daily returns for the Taiwan ESG Index (ESG), Taiwan Capitalization Weighted Stock Index (TAIEX), and MSCI Emerging Markets Index (MSCIEMI) during our study period, respectively. The average daily returns of the ESG index are slightly higher than those of both the TAIEX and MSCIEMI, indicating the expenditure on ESG activities appears to be justified. However, the MSCIEMI exhibits a negative average daily return during the sample period, indicating that emerging markets seem to experience a slight decline during our sample period. In addition, the maximum and minimum returns on the ESG index are higher than those on both the TAIEX and MSCIEMI, respectively, implying that the ESG Index seems to be more resilient and stable than the other two indices during the sample period. Finally, there is little difference among the standard deviations of the three indices, i.e., the differences in their volatilities cannot be clearly distinguished.

Table 3 reports the summary statistics of various ESG scores and firm characteristics over the sample period from 2017 to 2022. As noted above, the characteristics of financial industry, such as high leverage and sensitivity to interest rate and exchange rate, are largely different from those of other industries. Therefore, the sample is divided into financial and non-financial stocks. In terms of ESG, E, S, and G scores, non-financial stocks exhibit higher than financial stocks, respectively, suggesting that non-financial firms perform well in areas such as environment, social responsibility, and corporate governance in our sample. Next, the debt ratio for non-financial stocks is, of course, significantly lower than that of financial stocks owing to business characteristics. For the mean market-to-book ratio (MB),

non-financial stocks have higher values than financial stocks, indicating that non-financial stocks have higher potential market value in the Taiwan stock market. Finally, the mean market value (Size) of non-financial stocks has a higher value compared to financial stocks, mainly because semiconductor companies have been growing rapidly in Taiwan in the later years such as Taiwan Semiconductor Manufacturing Company (TSMC).⁷

Table 4 shows the average trading activity of ESG stocks in event and normal periods.⁸ The results of Panel (a) of full sample show that there is a significant increase in trading volume, trading value, and number of transactions in the market decline period compared to in the normal period, indicating that trading activity of investors intensifies to avoid losses during the market decline period. The similar findings of non-financial and financial stocks are observed in Panels of (b) and (c), respectively, supporting the Hypothesis 1. In addition, non-financial stocks exhibit higher mean trading value, trading volume, and number of transactions in the event period compared to financial stocks, indicating that trading activity of non-financial sectors dominate in the Taiwan stock market. Generally, the trading value, trading volume, and number of transactions of non-financial stocks are different from those of financial stocks during market downturns.

4.2 AR and CAR around the Event Date

This section analyzes how stock prices are influenced by negative events in three periods of time. First, it examines the effect around the event date. Second, it investigates price behavior prior to the event. Finally, it analyzes price movement after the event.

According to the results of abnormal returns (AR) for six declining events with market model on Table 5, three of five days prior to the event day appear negative abnormal returns (AR), though being not significant, indicating that the information has been only a slightly leaked. On the event day ($t=0$), there is a significant negative return at 1% level, implying that the return on the event day is notably lower than the expected return.⁹ However, there is a tendency for the returns to shift from negative to positive at $t=1$ and $t=3$, and the return shifts from negative to significantly positive at $t=5$, which indicates an overreaction to the bad news before and on the event day, triggering a market rebound after the event day. Figure 1 again clearly demonstrates the AR (dotted line) behavior of ESG stocks around the market decline.

Table 2 Daily Returns for Taiwan ESG Index (ESG), Taiwan Capitalization Weighted Stock Index (TAIEX) and MSCI Emerging Markets Index (MSCIEMI) during the Sample Period

	ESG	TAIEX	MSCIEMI
Mean	0.034%	0.031	-0.005
Median	0.074	0.075	0.040
Min	-6.140	-6.313	-6.710
Max	6.710	6.367	5.730
St'd Dev.	1.112	1.090	1.119
Observations	1,232	1,232	1,232

Note: ESG, TAIEX and MSCIEMI represent the Taiwan ESG Index, Taiwan Stock Exchange Capitalization Weighted Stock Index and MSCI Emerging Markets Index, respectively.

Table 3 Summary Statistics of ESG Scores and Firm Characteristics during the Sample Period

	Mean	Max	Min	St'd	N
(a) Full sample					
ESG ¹	67.52	82.43	48.52	6.74	442
E	69.33	89.31	32.52	12.58	442
S	72.94	91.00	38.27	8.89	442
G	62.34	80.62	37.72	8.47	442
Leverage ²	59.41	97.42	7.35	23.90	442
MB	2.23	22.29	0.39	2.40	442
Size	411,090	15,713,811	16,470	1,430,435	442
(b) Non-financial stocks					
ESG	67.87	82.43	48.52	6.98	341
E	69.41	89.31	32.52	12.64	341
S	72.95	91.00	46.19	9.15	341
G	62.70	80.62	38.25	8.64	341
Leverage	49.73	85.13	7.35	17.99	341
MB	2.58	22.29	0.39	2.63	341
Size	454,031	15,713,811	16,470	1,623,676	341

Continued the following Table

Continued Table 3

(c) Financial stocks					
ESG	66.35	79.27	49.35	5.72	101
E	67.83	87.53	34.11	12.83	101
S	72.60	86.31	48.56	7.93	101
G	60.99	77.47	37.72	8.12	101
Leverage	92.11	97.42	70.01	4.39	101
MB	1.07	2.06	0.45	0.31	101
Size	266,110	846,416	21,445	180,208	101

Note:

- (1) ESG is the overall risk rating, where E represents environmental risk score, S represents social responsibility risk score, and G represents corporate governance risk score.
- (2) Leverage represents the debt ratio, MB stands for the ratio of market value to book value, and Size represents the company's market capitalization (in million New Taiwan Dollars).

Table 6 presents the cumulative abnormal returns (CAR) during the event, pre-event and post-event periods. In the Panel (a), the CARs around the declining event are reported. The results indicate that three of the five CARs experience significantly negative, at the 1%, 5% or 10% level, respectively, during the event windows. Our study further analyzes the behavior of stock prices in the periods prior to and subsequent to the declining event. In the Panel (b), all CARs in the pre-event windows, except CAR (-5, -4) window, are negative but insignificant. The CARs at the bottom of table show the days on and after the declining event. The CARs for (0, 1), (0, 2), (0, 3) and (0, 4) windows are -2.065, -2.404, -1.884 and -2.159%, respectively. All of these results are negative and statistically significant at the 1% or 5% level, indicating that the negative CARs in the post-event window support the view that a decline in stock price conveys unfavorable information to the market. And from Figure 1, it is observed that the CAR (orange line) experiences the largest decline on the event day ($t=0$), and the CAR demonstrates a gradually ascending trend after the event day, implying that the market is starting to reverse gradually. In short, the findings of AR and CAR apparently support our conjecture in Hypothesis 2.

Table 4 The Average Trading Activity of ESG Stocks in Event and Normal Periods

	Trading volume ¹	Trading value	No. of transaction
(a) Full sample			
Normal period	752,667	35,079,917	221,894
Event period ²	1,458,463	96,813,465	564,605
Difference ³	-705,796	-61,733,548	-342,711
t-statistic	-3.25*** ⁴	-3.36***	-3.38***
(b) Non-financial stocks			
Normal period	507,028	30,341,776	167,254
Event period	1,097,608	88,490,167	452,517
Difference	-590,580	-58,148,391	-285,262
t-statistic	-3.06***	-3.34***	-3.29***
(c) Financial stocks			
Normal period	245,638	4,738,141	54,640
Event period	360,855	8,323,298	112,089
Difference	-115,216	-3,585,157	-57,449
t-statistic	-2.95***	-3.10***	-3.09***

Note:

- (1) Trading volume is the total number of ESG stocks that is traded during the event or normal period (in thousands of shares), and trading value is the total dollar value of ESG stocks that is traded during the event or normal (in thousands of New Taiwan Dollars).
- (2) Following the previous studies, such as Broadstock et al. (2021), the normal period (day) is randomly selected in 2017, prior to our sample period.
- (3) The difference is the subtraction between the two periods.
- (4) *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

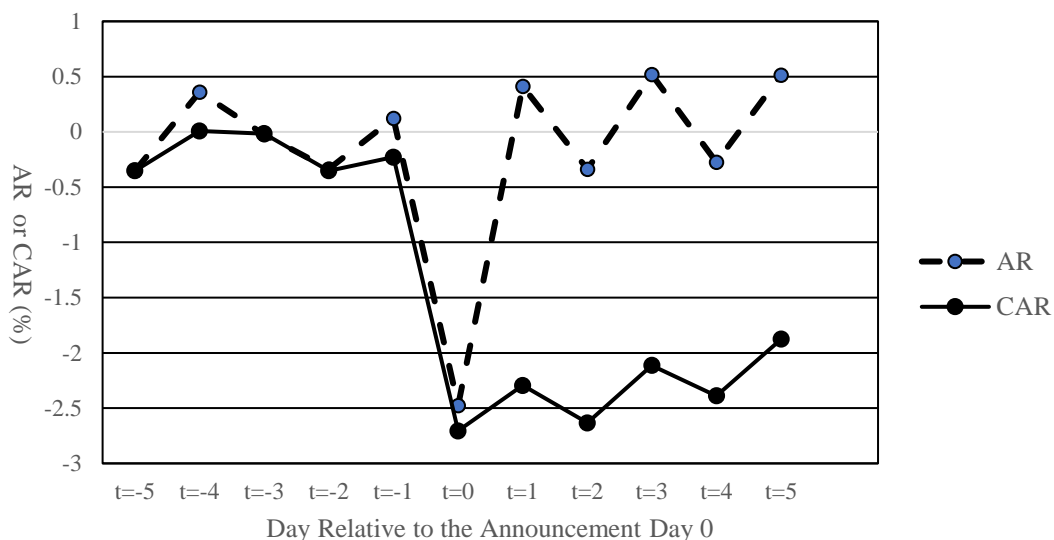


Figure 1 Abnormal Returns (AR) and Cumulative Abnormal Returns (CAR) around the Event Date

Table 5 Abnormal Returns during the Event Period

Event day	AR ¹	Standard error	t-statistic
-5	-0.3524%	0.2994	-1.1770
-4	0.3604	0.2847	1.2657
-3	-0.0238	0.2310	-0.1029
-2	-0.3363	0.2314	-1.4532
-1	0.1227	0.2165	0.5667
0	-2.4759	0.4952	-4.9996*** ²
1	0.4107	0.3897	1.0539
2	-0.3387	0.3908	-0.8666
3	0.5199	0.3378	1.5389
4	-0.2749	0.2423	-1.1344
5	0.5130	0.2809	1.8265*

Note:

(1) AR refers to average abnormal returns, and event day refers to t=0.

(2) *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 6 Cumulative Abnormal Returns (CAR) around the Event Day

	CAR ¹	Standard error	t-statistic
(a) Event period			
CAR (-1, 1)	-1.943%	0.4527	-4.291 ^{***2}
CAR (-2, 2)	-2.618	0.7392	-3.541 ^{**}
CAR (-3, 3)	-2.121	0.9298	-2.282 [*]
CAR (-4, 4)	-2.036	1.1367	-1.791
CAR (-5, 5)	-1.875	1.1494	-1.632
(b) Pre-event period			
CAR (-5, -4)	0.008	0.2030	0.039
CAR (-5, -3)	-0.016	0.3427	-0.046
CAR (-5, -2)	-0.352	0.3346	-1.052
CAR (-5, -1)	-0.229	0.3750	-0.612
(c) Post-event period			
CAR (0, 1)	-2.065	0.3641	-5.672 ^{***}
CAR (0, 2)	-2.404	0.5644	-4.259 ^{***}
CAR (0, 3)	-1.884	0.6506	-2.896 ^{**}
CAR (0, 4)	-2.159	0.6613	-3.265 ^{***}
CAR (0, 5)	-1.646	0.8458	-1.946

Note:

(1) CAR is the abbreviation of cumulative abnormal returns.

(2) *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

4.3 Results of Panel-data Regression

Table 7 uses the panel-data regression to examine the relationship between CAR and various ESG scores after controlling leverage, market-to-book and firm size. The regression results for full sample are shown in Panel (a). From models (1) to (4), the results show that ESG scores are positively and significantly related to CAR at the 5% or 10% level, indicating that firms with higher ESG scores experience smaller stock price declines around market decline events. These findings are similar to the results of Broadstock et al. (2021). In the results of regression models (6) to (8), it is observed that the coefficient of the social

sub-score (S) is positive and significant at the 10% level, suggesting that firms with higher social sub-scores are more resilient during market declines. In terms of environmental sub-scores (E) and corporate governance sub-scores (G) variables, their regression coefficients are all positive in models (5) to (8), however, and most of them are not statistically significant.

Regression results for non-financial stocks are shown in Panel (b), it can be observed that ESG scores are positively and significantly related to CAR at 5% or 10% level in models (1), (3) and (4), also implying that firms with higher ESG ratings experience smaller stock price declines during a market decline. In the results of regression models (5) to (7), the coefficient of social sub-score (S) is positive and significant at 10% level, suggesting that firms with higher social sub-scores also get more resilient during a market decline, which findings are similar to those of full sample. The results for financial stocks, shown in Panel (c), present that almost all the coefficients for ESG, E, S, and G are insignificant in all models, totally different from the findings of non-financial stocks. The first explanation for these results is that total ESG scores and individual ESG scores of non-financial firms are all higher than those of financial firms. According to news reports, the Covid-19 pandemic, which occurred during our study period, caused significant losses for major financial and insurance corporations in Taiwan. This provides a second possible explanation for our findings.¹⁰ Our results from the non-financial industry apparently support Hypothesis 3, while those financial industry do not. In other words, the stock price behavior of the two industries shows a clear difference.

Table 8 shows the findings of the relationship between stock return volatility and various ESG variables during a market decline. Volatility is measured as the standard deviation of daily returns for event window, (-5, 5). The results display that ESG scores are significantly and negatively related to volatility for full sample, non-financial and financial stocks, indicating that firms with higher ESG scores tend to lead to lower stock return volatility during the event of market decline. In addition, the results of the social sub-scores (S) for full sample, non-financial and financial stocks, which is similar to those of ESG variables. In short, these results contribute to a better understanding of the relationship between various ESG scores and stock return volatility, emphasizing the importance of considering ESG scores in investment decisions and corporate management; and the evidence also supports the assertion of Hypothesis 4.

Table 7 The Impact of ESG Index on Cumulative Abnormal Returns (CAR) to the Market Decline

(a) Full sample								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	CAR (0, 1)	CAR (-3, 3)	CAR (-4, 4)	CAR (-5, 5)	CAR (0, 1)	CAR (-3, 3)	CAR (-4, 4)	CAR (-5, 5)
Intercept	-5.3798***	-8.5310**	-7.6326**	-6.9047*	-5.2652***	-9.2058***	-7.9114**	-7.1401*
ESG	0.0340* ¹	0.0554*	0.0842**	0.0933**				
E					0.0130	0.0240	0.0237	0.0287
S					0.0190	0.0482*	0.0469*	0.0525*
G					0.0006	0.0030	0.0311	0.0508*
Leverage	-0.0042	-0.0161	-0.0254**	-0.0333**	-0.0045	-0.0169	-0.0257**	-0.0338**
Ln(MB)	-0.1679	-1.7603**	-1.6958**	-1.2036	-0.0336	-1.5152**	-1.5528*	-1.1146
Ln(SIZE)	0.1486	0.2008	-0.1943	-0.5586	0.0993	-0.0084	-0.3904	-0.7939
(b) Non-financial stocks								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	CAR (0, 1)	CAR (-3, 3)	CAR (-4, 4)	CAR (-5, 5)	CAR (0, 1)	CAR (-3, 3)	CAR (-4, 4)	CAR (-5, 5)
Intercept	-2.5075	-3.3361	-0.7828	1.3157	-2.8113	-4.5841	-1.7481	0.4794
ESG	0.0337* ¹	0.0525	0.0754*	0.0873*				
E					0.0137	0.0234	0.0130	0.0044
S					0.0247*	0.0538*	0.0615*	0.0582
G					-0.0030*	0.0004	0.0315	0.0707*
Leverage	-0.0142*	-0.0345	-0.0483***	-0.0513**	-0.0141	-0.0347**	-0.0462**	-0.0486**
Ln(MB)	-0.1146	-2.0480	-1.9176**	-1.6685	0.0024	-1.8485**	-1.7500*	-1.6358
Ln(SIZE)	-0.3170	-0.6519	-1.2977*	-1.7852**	-0.3502	-0.8400	-1.5646**	-2.1612**
(c) Financial stocks								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	CAR (0, 1)	CAR (-3, 3)	CAR (-4, 4)	CAR (-5, 5)	CAR (0, 1)	CAR (-3, 3)	CAR (-4, 4)	CAR (-5, 5)
Intercept	-9.560* ¹	10.691	19.421	22.733**	-7.534	13.807*	21.373**	24.440**
ESG	0.018	0.009	0.015	-0.008				
E					-0.022* ¹	-0.014	-0.016	-0.018
S					0.002	-0.009	-0.012	-0.026
G					-0.018	-0.038	0.019	0.034
Leverage	0.251*** ¹	0.339***	0.341**	0.363**	0.227***	0.317**	0.344**	0.374**
Ln(MB)	2.790	12.347***	19.730***	22.419***	3.115	12.109***	20.075***	22.818***
Ln(SIZE)	-3.602**	-9.277	-11.170***	-11.841***	-2.866*	-8.555***	-11.307***	-12.353***

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

Table 8 The Impact of ESG Scores on Stock Volatility during the Event Period

Variables	Full sample		Non-financial stocks		Financial stocks	
Intercept	4.0678***	3.8272***	3.1020***	3.3332***	2.7889*	2.5584*
ESG	-0.0132*		-0.0210**		-0.0161**	
E	0.0013		-0.0008		0.0018	
S	-0.0141**		-0.0181***		-0.0098**	
G	-0.0068		-0.0104		0.0082*	
Leverage	-0.0164***	-0.0174***	-0.0087***	-0.0098***	-0.0457**	-0.0386**
Ln(MB)	0.0876	0.0362	0.0587	0.0063	0.3934	0.3348
Ln(SIZE)	-0.0535	-0.0019	0.1246	0.2048	0.7869**	0.4887

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

Finally, an empirical asset pricing model is used to examine the role of various ESG scores in the declining versus normal periods. As noted above, our six declining events are selected during the periods from December 17, 2017 to December 31, 2022. Following the previous studies, six random samples are drawn from the period of January to November 2017, which is regarded as the normal period. The dummy variable, therefore, is used to capture the stock price behavior during the declining and normal periods in panel-data regression analysis. The dummy variable (Post) is set to 1 for the six declining periods and 0 for the six normal periods. The dependent variable is the daily returns of ESG constituent stocks for declining and normal periods, and the independent variables include the Market (return on TAIEX), ESG, E, S, and G variables and their respective interactions with Post variable. The regression results for full sample, non-financial stocks, and financial stocks are presented in Panels (a), (b), and (c) of Table 9, respectively. Their findings are discussed as follows.

Table 9 ESG Scores and the Impact of Declining Event on Stock Returns

(a) Full sample					
	(1)	(2)	(3)	(4)	(5)
	Ret ¹	Ret	Ret	Ret	Ret
Intercept	0.054	-0.024	-0.050	-0.036	0.138
Post	-0.849** ²	-0.371*	-0.641**	-0.024	-0.870*
Market	1.181***	1.178***	1.182***	1.178***	1.181***
Market×Post	-0.512***	-0.509***	-0.513***	-0.508***	-0.512***
ESG	-0.003				
ESG×Post	0.013**				
E		-0.002			-0.002
ExPost		0.006*			0.006*
S			-0.002		-0.002
S×Post			0.009**		0.010**
G				-0.003	-0.001
G×Post				0.001	-0.003
(b) Non-financial stocks					
	(1)	(2)	(3)	(4)	(5)
	Ret	Ret	Ret	Ret	Ret
Intercept	0.379	0.148	-0.033	0.124	0.510
Post	-1.143**	-0.682**	-0.687*	-0.096	-1.221**
Market	1.294*** ¹	1.289***	1.294***	1.287***	1.291***
Market×Post	-0.576***	-0.570***	-0.575***	-0.568***	-0.573***
ESG	-0.009*				
ESG×Post	0.018**				
E		-0.005*			-0.005
ExPost		0.011**			0.011**
S			-0.003		-0.003
S×Post			0.010*		0.007*
G				-0.006	-0.004
G×Post				0.002	-0.004

Continued the following Table

Continued Table 9

(c) Financial stocks					
	(1)	(2)	(3)	(4)	(5)
	Ret	Ret	Ret	Ret	Ret
Intercept	-0.394	-0.120	-0.200	0.042	-0.331
Post	-0.468	0.145	0.061	-0.592	-0.414
Market	0.864***	0.862***	0.863***	0.863***	0.862***
Market×Post	-0.358**	-0.357**	-0.358**	-0.357**	-0.356**
ESG	0.006				
ESG×Post	0.006				
E		0.003			0.004
E×Post		-0.003			-0.003
S			0.003		0.004
S×Post			-0.002		-0.003
G				-0.001	-0.004
G×Post				0.009	0.013*

Note:

(1) The daily returns of ESG constituent stocks are taken from the (-2, 2) window for the declining and normal periods, respectively.

(2) *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

In Panel (a), the coefficients of Post are almost significant and negative in all models, resulting in the intercept of each model shifts downward except for Model (4), indicating that the negative event has a strong impact on the market. Next, the coefficients of Market and Market×Post are significantly positive and negative, respectively, in all models, implying that the system risk is higher during normal period than during market decline. In Model (1), although the coefficient of ESG is insignificant, the fact that the coefficient of ESG×Post is significant and positive at 5% level still indicates that high-ESG firms are more resilient in terms of stock price reaction to the periods of market decline. The similar phenomena for high-E and high-S firms are also observed in Models (2) and (3), respectively. As literature evidence, these findings indicate that ESG activities provide downside protection during market decline.

As in Panel (a), the results of coefficients of Post for non-financial stocks, shown in Panel (b), also present that intercept of each model shifts downward except for Model (4). Next, the results of coefficients of Market and Market×Post still show that the system risk of non-financial stocks is higher during normal period than during market decline. In Models (1) and (2), the coefficients of ESG×Post and E×Post are significant and positive at 5% level, respectively, and the coefficients of ESG and E are significant and negative at 10% level, respectively. These results indicate that high-ESG and/or high-E scores of non-financial stocks are also more resilient in terms of stock price reaction to market downturns. As noted above, the explanations of our findings are that investors pay an insurance premium through lower returns in normal period, with the expected benefit of market resilience in market downturn, supporting the assertions of Lins et al. (2017) ; Engle et al. (2020) ; Ding et al. (2021) ; Broadstock et al. (2021) in Hypothesis 5.

In Panel (c), the coefficients of Post for financial stocks are insignificant in all models, resulting in the intercept of each model does not shift for all model specifications. Next, the results of coefficients of Market and Market×Post also display that the system risk of financial stocks is higher during normal period than during market downturn. In Model (1), the coefficients of ESG×Post and ESG are insignificant, indicating that ESG scores do not influence the stock returns in normal and downturn periods, totally different from the findings of financial stocks. That is, ESG activities do not provide downside protection for financial industry during market decline, a marginal contribution of our study. The similar phenomena for three sub-scores are also observed in Models (2), (3) and (4), respectively; and these findings, of course, do not support Hypothesis 5.

In short, our findings regarding the resiliency of ESG stocks for the full sample are consistent with the research of Albuquerque et al. (2020) ; Broadstock et al. (2021), while the findings for non-financial stocks are consistent with the evidence of Lins et al. (2017). In addition, our findings for financial stocks indicate that ESG activities do not provide downside protection during market declines, apparently different from the results of non-financial stocks, which is, to the best of our knowledge, the main contribution of our study.

5. Conclusion

Relative to the previous studies, this study uses six declining events and from an industrial perspective to examine the stock price behavior of the constituents of the Taiwan ESG Index, covering the period from Dec 2017 (start of ESG index) to Dec 2022. Different and similar findings of non-financial and financial stocks are summarized as follows.

- (1) The evidence of two industries shows that there is a significant increase in trading volume, trading value, and number of transactions in the market decline period compared to the normal period, indicating that trading activity of investors intensifies to avoid losses during the market decline period.
- (2) The patterns of AR and CAR of full sample indicate an overreaction to the bad news before the event day and a market quickly rebound after event day.
- (3) Non-financial firms with higher ESG and S scores generally experience smaller price declines during market downturns, but the phenomena are not observed in financial firms.
- (4) The role of ESG and S scores of non-financial stocks are attenuated in normal times, implying that ESG activities provide downside protection during the market declines, however, the similar phenomena of ESG activities for financial industry cannot be found around the event of market decline.
- (5) Higher ESG firms for the two industries experience the similar lower volatility during stock price declines.

Finally, future research can focus on some interesting and important topics. First, future research could be extended to include scenarios of rising and flat market conditions, which findings can be used to compare the return patterns of ESG stocks in different market conditions. Next, from 2023 to 2025, international financial markets have faced several systemic shocks, including rising geopolitical risks, such as the conflict between Israel and Hamas, and policy changes, such as the US's 2025 announcement of "reciprocal tariffs" on several nations. Extending the sample period would enable researchers to obtain more stable results. Finally, future research, based on different industry characteristics, could partition non-financial stocks into traditional and high-tech industries, which can examine whether the price behaviors of ESG stocks of different industries are the same.

FOOTNOTES

1. There is no clear consensus on the meaning of sustainable finance or CSR (corporate social responsibility), ESG and SRI in the academic field, so these terms are used interchangeably in this study. In addition, the interested readers for ESG investment trends can consult the article of Norton (2023).
2. The related data are taken from the report of Huang et al. (2023). In addition, Taiwan government not only has started to promote the company to publish the corporate social responsibility (CSR) report in 2015, and passed the Climate Response Act in 2023, regulating the preparation and CSR or ESG reports by listed companies.
3. Refer to Table 3 of this study in detail, which may provide convincing evidence to examine whether the different price behavior exists between non-financial and financial stocks during the market decline period. The authors are grateful to the anonymous reviewer for the valuable suggestion.
4. Beloskar and Rao (2023) calculate their abnormal daily trading volumes by using a mean-adjusted model as explained by Tripathi (2017).
5. Market model or market model of GARCH (1, 1) is often used to calculate AR and CAR.
6. Two theories of ESG activities, based on customers and investors preferences, are also used to explain this phenomenon in the literature. Interested readers can consult the studies of Heinkel et al. (2001) ; Albuquerque et al. (2019) ; Albuquerque et al. (2020).
7. As of January 2024 TSMC has a market cap of \$592.28 billion, the world's 11th most valuable company by market cap.
8. Following the previous studies, such as Broadstock et al. (2021), the normal period (day) is randomly selected in 2017, prior to our sample period.
9. The significantly negative abnormal returns appear only on the event day, not before the event day, the reason may be that some of the bad news in this study tends to be sudden and dramatic, such as when the U.S. Department of Commerce suddenly announced a new round of embargoes on semiconductor exports to China on 10/7/2022, causing the sixth sharp decline in the Taiwan stock market.

10. According to a CNA news report, since the launch of Covid-19 insurance policies in 2020, Taiwan's property insurance industry has paid out claims totaling approximately NT\$300 billion. See: <https://www.cna.com.tw/news/afe/202304300016.aspx>.

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