

How does Thai stock market react to the environmental policy
announcements?



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This paper investigated the impact of environmental policy announcements to the stocks in the Stock Exchange of Thailand. The announcements are related to climate change in the world forum (Paris Agreement) and plastic waste management. Investors are aware of the environmental policy which could have an impact to firms. We found that 7 out of 8 announcements experienced significant cumulative abnormal returns (both positive and negative). In terms of industry, the only industry which reacted to all announcements is industrials. The majority of firms in the industrials industry are operators related to chemicals, automotive and general manufacturing which are more likely to be sensitive to the environmental issues than other industries.

We further investigated the impact of firms' environmental disclosure on the cumulative abnormal return. We proxied ESG disclosure and ESG score as one of the indicators for degree of environmental-friendly. The empirical results showed that ESG disclosure had negative impact on cumulative abnormal return at the first action of Thailand towards climate change (signing Paris Agreement) in 2016 (announcement no.2). In contrast, the ESG disclosure had

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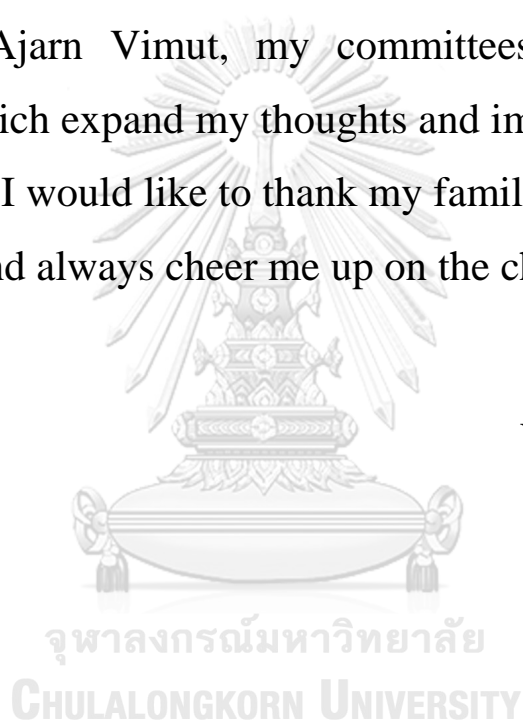


TABLE OF CONTENTS

	Page
.....	iii
ABSTRACT (THAI)	iii
.....	iv
ABSTRACT (ENGLISH).....	iv
ACKNOWLEDGEMENTS.....	v
TABLE OF CONTENTS.....	vi
1.Introduction.....	1
1.1. Background, Significance of the Problem.....	1
1.2 Objectives of this study	3
2. Literature review	4
2.1 Impact of environmental policies announcements on firms	4
2.2 Environmental, social, and corporate governance (ESG).....	6
3.Hypothesis development.....	8
4. Data and sample	9
5.Methodology	13
5.1 Event study	13
5.2 The market reaction, ESG and firms' characteristics	16
6. Empirical result and discussion	17
6.1 Event study result	17
6.2 Regression analysis on market reaction, ESG and firms' characteristics result	24
7. Conclusion	33
REFERENCES	35
VITA.....	38

1.Introduction

1.1. Background, Significance of the Problem

It is widely known that global warming, climate change, pollution and other environmental problems are caused mainly by human activities which lead to the dramatic impact in the forms of several natural disasters such as rising sea levels, ocean acidification, extreme weather events, droughts, floods, and waste. Environmental policies and regulations take the essential role to limit the exponential growth of these problems. Such enforcement of these policies and regulations are likely to have implications for the companies which are considered as big polluters. Activism has encouraged firms to concentrate on the environmental problem caused by themselves. Moreover, investors tend to have more awareness of the adverse environmental impact from the firm's operation. However, the economic and financial effects of environmental regulation become a controversial issue.

The literature documents two different perspectives on the impact of environmental regulation on firms. One view is that compliance with environmental regulation is likely to produce unfavourable outcomes for firms (Walley & Whitehead, 1994). Environmental protection could create higher costs for firms. Therefore, the cost of compliance with environmental regulation can lead to deterioration in firm performance and corporate financial indicators.

On the other hand, prior studies of environmental regulation find evidence for favourable outcomes from the adoption of high environmental standards and compliance with environmental regulation. Such higher standards could create management benefits, enhanced productivity, and improved employee morale (McGuire et al., 1988). The adoption of environmental-friendly standards improves

firms' overall performance (Klassen & McLaughlin, 1996). Moreover, Allen (1992) found that strong environmental performance tends to lower production costs (through waste reduction).

Regarding the efficient market theory, all stocks are assumed to trade at fair prices since the available information is already factored into the stock prices. We found that existing literature (Pham et al., 2019; Ramiah et al., 2013; 2016; Sam & Zhang, 2020), focus on the market reaction to the environmental policies announcement. These empirical studies used different data from various stock markets including the United Kingdom, China, Singapore and Australia. Each market reacts to the environmental policies announcement differently. Their findings are inconsistent due to individual market's perception.

Being smaller and less sophisticated, the Thai stock market has different characteristics from the prior studies. Moreover, Thai policy enforcement could be more challenging. This leads to the doubt on how the market would react to the announcements related to the environmental policies.

Thailand is one of the parties adopted to the Paris Agreement, its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. Not only climate change that Thailand is concerned, but also plastic waste and pollution. There are few announcements regarding single-used plastic ban by both government and corporates.

ESG become more widely-known during the past few years. The ESG disclosure and its components could indicate firms' ability towards the new environmental policies.

1.2 Objectives of this study

With the different societal norms, we'd like to explore how the Thai market would react to the announcements related to environmental policies in this study. Additionally, we further explore whether ESG and its components have impact on the market reactions at the environmental policy announcements.



2. Literature review

We separate our literature review into two parts: 2.1 Impact of environmental policies announcements on firms and 2.2 Environmental, social, and corporate governance (ESG).

2.1 Impact of environmental policies announcements on firms

There are mainly two outcomes from the existing empirical studies about the impact of environmental regulations or policies on firms: favourable and unfavourable outcomes to firms. Additionally, outcomes also vary across different countries. In one country, outcomes can be distinct among industries. The details are as follows;

2.1.1 Favourable outcomes

[Klassen and McLaughlin \(1996\)](#) used the event study methodology to examine the reaction of firms to announcements of toxic emissions and environmental achievement. Firms with higher environmental standard experience significant positive return, which is not the case for firms with a lower standard. The significant positive abnormal returns are observed from the environmental performance awards. [Dowell et al. \(2000\)](#) interpret this finding that recognition of environmental performance has a positive reputation and can increase firms value. In Singapore, [Pham et al. \(2019\)](#) found that the environmental regulation is likely to boost the performance of environmental-friendly industries (focusing on new renewable energy technologies) experienced positive reaction following the environmental regulation and carbon tax announcements.

2.1.2 Unfavourable outcomes

Environmental policies typically aim the targeted firms to comply with the policies made. According to [Stewart \(1992\)](#), firms operating in countries where

regulations are strongly enforced may incur much compliance costs. This would bring fines, liabilities, obligation administrative or legal actions against polluters. So, author believes that the environmental regulation should have a negative impact on firms due to arising competitiveness. [Ramiah et al. \(2013\)](#) had studied the market reaction from the announcement of green policies in Australian Stock Exchange. They found that there was no significant negative impact to big polluters. Plausible assumption is that polluters are passing (or capable of passing) higher costs to consumers. However, other industries that are not viewed as the biggest polluters experienced value destruction, with no compensation for these industries. Conversely, [Pham et al. \(2019\)](#) found that the environmental regulation seems to be effective in Singapore. They found that big polluters (including industrial metals and mining, forestry and papers, and electrical equipment) experienced negative abnormal returns when the environmental regulation and carbon tax announcements were made. The environmental regulation and especially the carbon tax are designed to punish those polluters and encourage firms to adapt themselves by utilizing cleaner energy or renewable energy. [Sam and Zhang \(2020\)](#) also found evidence in Shanghai and Shenzhen stock exchanges that polluting companies experience the decline of over \$29 billion in shareholder value, implying that capital market participants expect increased in regulatory costs for targeted companies. The announcement of loosened environmental regulations also has impact to the firms. There is evidence in the United States showing that the only industry that benefits from the loosened of environmental regulation was only coal industry which experienced positive abnormal return, while other industries experienced mixed or negative reactions ([Nerger et al., 2021](#)).

2.2 Environmental, social, and corporate governance (ESG)

The studies on relationship between firms' disclosure of ESG and their financial performance have shown mixed conclusions.

Wong et al. (2021) evidenced that the shareholders gain from firms pursuing ESG agenda. ESG rating has a positive impact on Malaysian firm value. Firms adopting ESG rating, on average, had lower cost of capital and higher Tobin's q. This is in line with the studies support positive view of the environmental disclosure in the developed economies. For example, Clarkson et al. (2013) and Plumlee et al. (2015) noted that firm value increased with proactive environmental disclosure in the US.

Another view is that pursuing ESG can be value destruction since the firms may overinvest in CSR. Some evidence showed that firms with higher CSR expenditures are associated with agency costs (Barnea & Rubin, 2010; Brown et al., 2006) and have a higher cost of equity (Richardson & Welker, 2001).

Further studies on ESG scoring, Benlemlih et al. (2018) mentioned that ESG disclosure is more likely to positively correlated with firm performance as promoting corporate transparency with ESG disclosure can build trust among shareholders. Yoo and Managi (2022) used Bloomberg score to represent 'Media disclosure' and found that it was crucial to firms' short-term profits. They also separately analyzed ESG scoring to see how each score is related to financial performance. The E score is positively related to all types of financial performance e.g., gross profits and Tobin's q. It is conjectured that E score directly affect financial performance because increasing environmental activities require operational costs of replacing manufacturing lines and materials. Therefore, the disclosure allows firms to make more informed economic decisions to their shareholders. While S and G scores show

mixed results because the S- and G-related activities may not cause direct impact on firms' performance, so the results can vary depending on firms' financial options.

Literature gap and contribution

Several studies have studied the impact of environmental policies announcements to large/developed stock markets e.g., Australia, US, UK, Singapore and China. The outcomes are varied by the perception of each market. To our knowledge, there is no empirical studies on the environment policies announcement in a small market like Thailand. Our study then aims to explore how the announcements affect the Stock Exchange of Thailand. We further investigate how ESG disclosure and firm's characteristics could affect the abnormal returns from these announcements. The empirical evidence from the Stock Exchange of Thailand is expected to provide a significant contribution to the literature.

3.Hypothesis development

Based on the prior literature, environmental policies announcements were noted to have impact on firms' value. The enforcement of policies or regulation have affected costs, revenues, growth and productivity of firms, which resulted in both outcomes: favourable (Dowell et al., 2000; Klassen & McLaughlin, 1996) and unfavourable (Stewart, 1992). Regarding the efficient market theory and the prior empirical studies showing that the announcements of environmental policies are informative and reflect in the stock price, this leads to our first hypothesis.

H1: If an environmental policy announcement has an impact on firms' value, the market will react to such announcement.

Refer to the positive view on firms' value in relation to environmental disclosure, Wong et al. (2021) noted that ESG is one of the indicators for degree of environmental-friendly, and firms' market value increase when they have ESG certification. Thus, pursuing ESG could be a positive impact to a firm's performance. Benlemlih et al. (2018) noted that the ESG disclosure has contributed to building firms' reputation and reduce the perceived risks of shareholders. Thus, higher ESG scores may help enhance a firm's market value (Cormier et al., 2009). Accordingly, we hypothesize the following:

H2: ESG disclosure and ESG scores has positive impact on cumulative abnormal return.

We measured ESG in 3 models as shown in **5.2 The market reaction, ESG and firms' characteristics**. The measurements include (1) ESG disclosure, (2) ESG score, and (3) individual E score, S score, and G score.

4. Data and sample

The daily data series is used to conduct the event study were extracted from Datastream over the period from 2015 to 2021. The variables include individual stock prices, SET index (as proxy for market), and 10-year government bond yield (as proxy for risk-free rate). Datastream classification standards are applied to construct industry portfolios that included 8 industries. We can then be able to sub-sample data by industry to test how the market reactions be in each industry.

Table 1 lists 8 important announcements on environmental policy collected from various institutional websites: UNFCCC, Thai Pollution Control Department, Thailand Ministry of Foreign Affairs, Thailand Secretariat of the Cabinet, Central Group and CP All. These events are considered as new requirements for firms to engage in environment management regarding global warming and plastic waste management. Firms are likely to ‘change’ in order to comply with the new policies. The investors will predict the firms’ decisions to change; for example, decide to invest in new technology for a change to cleaner production method, as well as predict how change will impact firms’ financial performances. Then the investors will make their investment decisions.

Moreover, our selected events are different in terms of ‘the announcer’ and ‘level of commitment’. For example, *Event 4* and *Event 7* were the announcements of proposing higher control over plastic usage by the Thai government. In contrary, *Event 5* and *Event 6* were announced to ban plastic bags by the two large retail companies. This will allow us to further explore whether the market reactions are related to the type of announcers. *Event 1,2,3, and 8* are the sequences of lower to

higher level of commitment to the global warming limitation plan; this will allow us to further explore when the market takes as important event and makes a decision.

Table 1. Selected announcements on environmental policy

Event	Announcement date	Description
1	12-Dec-15	COP21: Paris agreement, its goal is to limit global warming to well below 2 degrees Celsius, preferably to 1.5 degrees Celsius, compared to pre-industrial levels.
2	22-Apr-16	Thailand signed the Paris Agreement.
3	21-Sep-16	Thailand ratified the Paris Agreement.
4	17-Apr-18	Thai cabinet approved Plastic waste management Roadmap 2018-2030 - 2019 to Ban 3 types of plastic (Oxo, Cap seal, Microbead) - 2022 to Ban 4 types of plastic (Foam container, Plastic straw, Plastic bag <36-micron, Plastic cup <100-micron) - 2027 100% Circular Economy
5	28-May-19	No plastic bag announcement from Central Group
6	9-Oct-19	No plastic bag announcement from 7-Eleven
7	15-Feb-21	Thai cabinet approve phase 1 to ban Foam container, Plastic straw, Plastic bag <36-micron, Plastic cup <100micron in 2022
8	2-Nov-21	COP26: Thailand announced accelerated greenhouse gas mitigation targets by keeping the global temperature rise below 1.5 degree Celsius and aim to reach carbon neutrality by 2050, and net zero greenhouse gas emissions by or before 2065.

For regression analysis, we proxied cumulative abnormal returns (*CAR*) as market reaction. The variables that employed in the estimation of *CAR* are as follows;

ESG disclosures - It consists of four scores: an *E score* (environmental performances), an *S score* (social performances), a *G score* (corporate governance performances) and *ESG Score* (combined the 3 components). The score ranges from 0 to 100, and it increases if a firm discloses ESG activities. The data derived from Datastream.

Market Value (MV) - Large firms are likely to be more stable than smaller firms (Kabir et al., 2021; Klassen & McLaughlin, 1996). Larger firms may be more likely to have more resources to comply with the environmental policy. The data derived from Datastream.

Return on assets (ROA) is proxied as indicator for profitability of firms (Kabir et al., 2021). Firms with high ROA are perceived by investors and may generate more abnormal return. The data derived from Datastream.

Cost of capital – With higher cost of capital, the firms' value is expected to be deteriorated (Ambec & Lanoie, 2008). The data is calculated from weighted average cost of equity and cost of debt. The weights equal the percentage debt or equity in firm's total assets.

Cash flow volatility – Firm's cash flow uncertainty may cause an increase in firms' default risk (Kabir et al., 2021).

Leverage ratio is a proxy for capital adequacy of firms. A highly leverage increases the financial risk of firms and is expected to have a negative relationship with stock returns (Kabir et al., 2021). The data derived from Datastream.

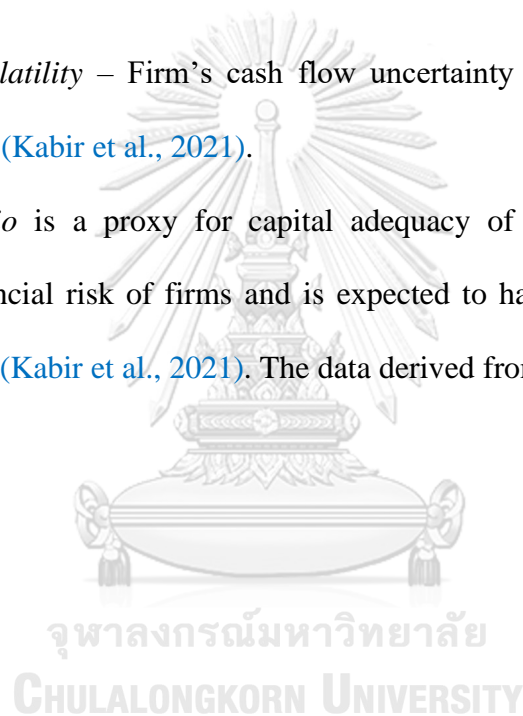


Table 2. Explanatory variables employed in the estimation of Eq. (8) – (17)

Variables	Description	Unit of measurement	Source
$ESG_{i,q}$	A dummy variable equals to 1 for firm with ESG score in the announcement year, and zero otherwise.	N/A	Datastream
$ESG\ Score_{i,q}$	ESG score for the year before event q which is a proxy of indicators that disclose about firms' degree of environmental-friendly level.	1-100 points	Datastream
$E\ Score_{i,q}$	Environmental performance score for the year before event q	1-100 points	Datastream
$S\ Score_{i,q}$	Social performance score for the year before event q	1-100 points	Datastream
$G\ Score_{i,q}$	Governance performance score for the year before event q	1-100 points	Datastream
$MV_{i,q}$	We measure firms' size by using Market Value at the date of announcement.	Billion Baht	Datastream
$ROA_{i,q}$	Net income divided by total assets for the year before event q .	% per annum	Datastream
$WACC_{i,q}$	Cost of capital is calculated from weighted average cost of equity and cost of debt. The weights equal the percentage debt or equity in firm's total assets. As the equation below: $WACC_{i,q} = \left(\frac{Debt_{i,y-1,q}}{Capital_{i,y-1,q}} \times K_{Debt,i,y-1,q} \right) + \left(\frac{Equity_{i,y-1,q}}{Capital_{i,y-1,q}} \times K_{Equity,i,y-1,q} \right)$ where; $Debt_{i,y-1,q}$ is total debt of stock i at the end of year before the year of announcement of event q , $Equity_{i,y-1,q}$ is total equity of stock i at the end of year before the year of announcement of event q , $Capital_{i,y-1,q} = Debt_{i,y-1,q} + Equity_{i,y-1,q}$, $K_{Debt,i,y-1,q}$ is cost of debt of stock i at 1 year before the year of announcement of event q , and $K_{Equity,i,y-1,q}$ is cost of equity proxied by CAPM = $R_{f,y-1,q} + \beta_{i,y-1,q} \times (R_{m,y-1,q} - R_{f,y-1,q})$ where, $R_{f,y-1,q}$ is risk-free rate proxied by 10-year government bond yield at end of year before the announcement of event q , $R_{m,y-1,q}$ is year-on-year market return rate proxied by SET index, and $\beta_{i,y-1,q}$ is beta of stock i at 1 year before the announcement of event q .	% per annum	Datastream and self-calculation
$CFvol_{i,q}$	Standard deviation of annual cash flow from operating activities to total assets over the 10-year period before the announcement.	% per annum	Datastream and self-calculation
$Levi,q$	Leverage is total debt/ total capital at the end of year before event q . A proxy for how leveraged a firm to its total capital.	%	Datastream

5. Methodology

5.1 Event study

Event study methodology of [Brown and Warner \(1985\)](#) was adopted in this study to examine the effect of environmental policies announcement on the stock market. Since it can examine the how the stock markets react to the new information i.e. announcements. In addition, this methodology has been widely used in several studies in the environmental event study ([Pham et al., 2019](#); [Ramiah et al., 2013](#); [2016](#)).

The first hypothesis tests whether such environmental policy announcements have impact on stock return. According to the efficient market hypothesis (EMH), the market participants react immediately to new information. If stock price reflects all available information, abnormal returns on the first day of trading can be observed. However, opponents of the EMH (for example, the proponents of behavioral finance) argue that market participants may adjust slower which leads to the delayed interactions. As the market may experience a delayed reaction, continue to react or predict such environmental announcement (in other words, EMH simply fails), we calculate cumulative abnormal returns of 5 days before the event date and 5 days after the event date to capture these reactions (Announcement window).

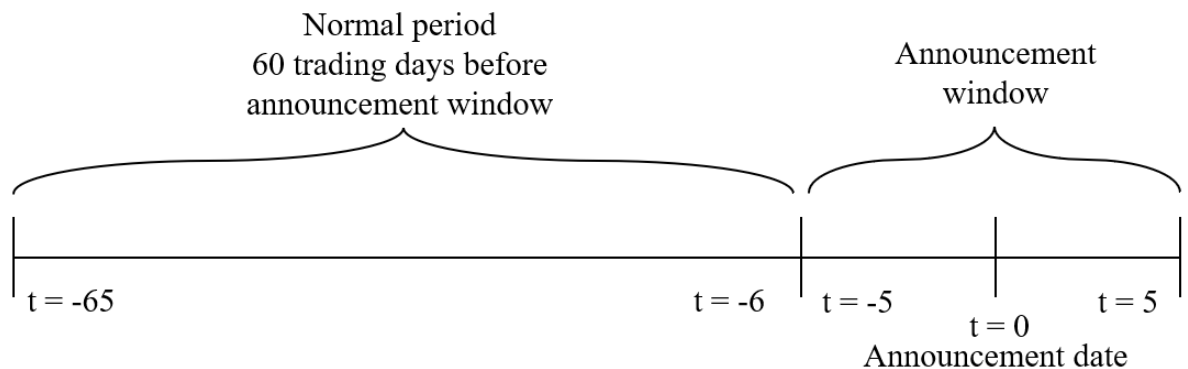


Figure 1: Event period

Step 1: Obtain $\hat{\alpha}$ and $\hat{\beta}$ by running a ‘single index model’ regression over the Normal period (60 trading days before announcement window of event q in **Figure 1**) using **Equation (1)**:

$$R_{i,t,q} - R_{f,t,q} = \alpha_{i,q} + \beta_{i,q}(R_{m,t,q} - R_{f,t,q}) + \varepsilon_{i,t,q} \quad (1)$$

where $R_{i,t,q}$ is return of stock i at time t for the Normal period of event q , $R_{f,t,q}$ is risk-free rate at time t for the Normal period of event q , and $R_{m,t,q}$ is stock market return at time t for the Normal period of event q .

Step 2: Take the $\hat{\alpha}$ and $\hat{\beta}$ in **Step 1** and apply them to the data from the announcement window of event q ($t=-5, t=5$) using **Equation (2)** to calculate expected returns $E(R_{i,t,q})$ during the announcement window of event q :

$$E(R_{i,t,q}) = R_{f,t,q} + \hat{\alpha}_{i,q} + \hat{\beta}_{i,q}(R_{m,t,q} - R_{f,t,q}) + \varepsilon_{i,t,q} \quad (2)$$

Step 3: Compute abnormal return ($AR_{i,t,q}$) as the difference between the actual daily return and the expected return on a given day t for the announcement window of event q using **Equation (3)**.

$$AR_{i,t,q} = DR_{i,t,q} - E(R_{i,t,q}) \quad (3)$$

where $DR_{i,t,q}$ is actual daily return for stock i at time t for the announcement window of event q , computed as follows:

$$DR_{i,t,q} = \ln \left(\frac{P_{i,t,q}}{P_{i,t-1,q}} \right) \quad (4)$$

where;

$P_{i,t,q}$ is the stock price index for stock i at time t for the announcement window of event q

$P_{i,t-1,q}$ is the stock price index for stock i at time $t-1$ for the announcement window of event q

Step 4: Calculate the cumulative abnormal return ($CAR_{i,q}$) for an individual stock, the abnormal return of each stock is aggregated over the announcement window of event q ($t=-5, t=5$).

$$CAR_{i,q} = \sum_{t=-5}^{t=5} AR_{i,t,q} \quad (5)$$

Step 5: The abnormal returns are categorized into industries (Datastream standard) to obtain average industry S abnormal returns at time t ($AR_{S,t}$) as well as cumulative abnormal return ($CAR_{S,q}$).

$$AR_{S,t,q} = \frac{1}{N} \sum_{i=1}^N AR_{i,t,q} \quad (6)$$

$$CAR_{S,q} = \sum_{t=-5}^{t=5} AR_{S,t,q} \quad (7)$$

Step 6: The standard t statistic for $AR_{S,t,q}$ and $CAR_{S,q}$ are computed to find out if it is statistically different from zero, giving rise to three possible outcomes: negative abnormal return, positive abnormal return and no abnormal return. Noted that we also explore $AR_{S,t,q}$ to study the daily patterns of market reaction during the event period.

A negative abnormal return implies wealth deteriorated by the environmental policy announcements. A positive abnormal return indicates wealth creation for firms. A zero abnormal return implies that there is no significant changes in performance.

Step 7: We further explore how the market reactions are related to the type of announcements by sub-sampling as follows:

- (1) Announcements related to climate change
- (2) Announcements related to plastic waste management

5.2 The market reaction, ESG and firms' characteristics

ESG is one of the indicators that disclose about firms' degree of environmental-friendly to the investors. If ESG is a good source of information to let investors know about firms' value, we should observe the significant association between firms value and their choice to disclose ESG. Moreover, firms with higher ESG scores may or may not have higher abnormal returns at the environmental policies announcements. Therefore, we extend our study by using the sample from our first hypothesis to test whether there is any association between firms' value and ESG disclosure.

To test our H2, we examine through regression analysis modelled as below:

$$CAR_{i,q} = \beta_0 + \beta_1 ESG_{i,q} + \beta_2 MV_{i,q} + \beta_3 ROA_{i,q} + \beta_4 WACC_{i,q} + \beta_5 CFvol_{i,q} + \beta_6 Lev_{i,q} + \varepsilon_{i,q} \quad (8)$$

$$CAR_{i,q} = \beta_0 + \beta_1 ESG\ Score_{i,q} + \beta_2 MV_{i,q} + \beta_3 ROA_{i,q} + \beta_4 WACC_{i,q} + \beta_5 CFvol_{i,q} + \beta_6 Lev_{i,q} + \varepsilon_{i,q} \quad (9)$$

$$CAR_{i,q} = \beta_0 + \beta_1 E\ Score_{i,q} + \beta_2 S\ Score_{i,q} + \beta_3 G\ Score_{i,q} + \beta_4 MV_{i,q} + \beta_5 ROA_{i,q} + \beta_6 WACC_{i,q} + \beta_7 CFvol_{i,q} + \beta_8 Lev_{i,q} + \varepsilon_{i,q} \quad (10)$$

where $CAR_{i,q}$ represents the cumulative abnormal returns of an individual stock i as calculated in **5.1 Event study**. For the measurement of explanatory variables for **Equation (8)-(10)**, see in **Table2**.

6. Empirical result and discussion

6.1 Event study result

Refer to Efficient Market Hypothesis (EMH), market instantly react to new information. However, market might react in advance of the announcement or delayed react (in case EMH fails). To capture potential pre-announcement reactions or delayed reactions, we estimate the cumulative abnormal return (CAR) over the 5 days before the event date and 5 days after the event date to capture these reactions.

We categorized by type of announcement which are climate change announcements and plastic waste management. Result of the market reaction from the environmental policies announcement on The Stock Exchange of Thailand (SET) as reflected in cumulative abnormal returns (CAR) for each industry and for all stocks in SET.

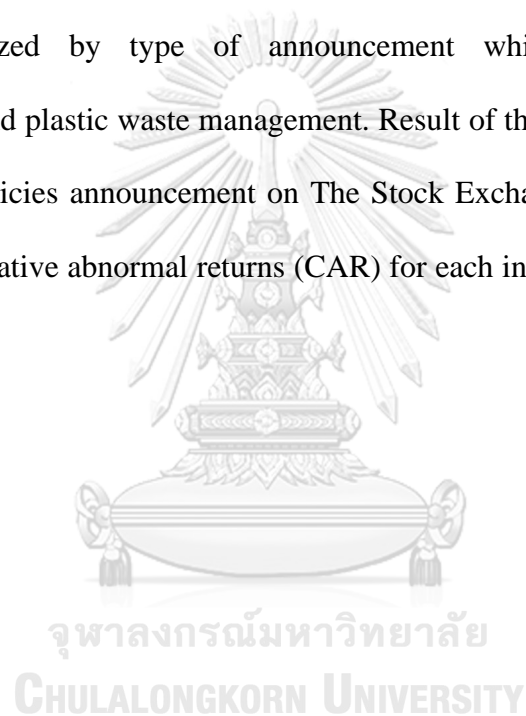


Table 3. Market reaction (CAR) to announcements related to climate change

Announcement no. Date Industry	1 12-Dec-15		2 22-Apr-16		3 21-Sep-16		8 2-Nov-21	
	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat
Industrial	-1.65% **	-2.13	2.21% ***	2.86	1.48% **	2.49	-3.16% ***	-4.56
Resources	-0.46%	-0.43	3.27% ***	3.18	1.41% *	1.77	-5.37% ***	-6.28
Property & Construction	-0.50%	-0.78	0.19%	0.31	1.48% ***	3.10	-3.41% ***	-6.39
Services	0.43%	0.58	-0.65%	-0.90	2.81% ***	5.02	-0.11%	-0.18
Agro & Food Industry	-0.42%	-0.41	-0.45%	-0.46	1.30% *	1.72	-2.51% ***	-2.92
Financials	-0.53%	-0.56	0.14%	0.15	0.65%	0.90	-0.15%	-0.18
Technology	-2.06% *	-1.76	-1.03%	-0.89	3.00% ***	3.31	-0.03%	-0.03
Consumer Products	-3.53% ***	-2.92	-1.57%	-1.31	0.35%	0.38	-2.43% **	-2.26
All stocks	-0.82% ***	-2.63	0.36%	0.94	1.64% ***	6.91	-2.23% ***	-8.22

6.1.1 Market reaction to the announcements related to climate change

- Negative reaction

The market negatively reacted to the announcement no. 1 (Paris Agreement was announced to limit global temperature rising in the COP meeting in 2015) and no.8 (Thailand committed to lower temperature rising in the COP meeting in 2021).

For the announcement no. 1, the following industries resulted in negative market reaction: industrial, technology and consumer products.

For the announcement no. 8, the following industries resulted in negative market reaction: industrials, technology and consumer products: industrial, resources, property & construction, agricultural & food industry, and consumer products.

The announcement no.8, Thailand announced accelerated greenhouse gas mitigation targets by keeping the global temperature rise below 1.5 degree Celsius which is more challenging compared to the required level of the Paris Agreement from the announcement no.1 at 2 degrees Celsius.

The unfavorable result implied that the market believes that, in order to comply with the requirements following the announcements, the above industries need to adapt themselves into the higher standard or make a change to its business. As a result, they would incur additional costs (Walley & Whitehead, 1994).

- Positive reaction

The market positively reacted to the announcement no. 2 (Thailand signed the Paris Agreement in 2016) and the announcement no.3 (Thailand ratified the Paris Agreement in 2016).

For the announcement no. 2, following industries resulted in positive market reaction: industrial and resources.

For the announcement no. 3, following industries resulted in positive market reaction: industrial, resources, property & construction, services, agricultural & food industry, and technology.

The ratification in the announcement no. 3 means that Thailand was legally bound to achieve the goal of the Paris Agreement. In contrast with announcement no. 2, the signing is not legally bound to do so. Therefore, the market has stronger reactions to the ratification (announcement no. 3) as we can see that 6 out of 8 industries experienced positive CAR. Whereas only 2 out of 8 industries experienced positive CAR following the signing (announcement no. 2).

Plausible reason of the positive market reaction is that investors tend to have more concerns in environmental awareness. Entering into the Paris Agreement (signing and ratification) could be a good signal to the investors that that Thailand have the awareness and ability to comply with the new environmental standards.

Table 4. Market reaction (CAR) to announcements related to plastic waste management

Announcement no. Date	4 17-Apr-18		5 28-May-19		6 9-Oct-19		7 15-Feb-21	
	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat
Industrial	1.22%*	1.70	1.30%**	2.37	-1.66%***	-2.77	-1.49%*	-1.69
Resources	2.33%***	2.59	0.13%	0.19	-0.42%	-0.55	-0.64%	-0.58
Property & Construction	1.04%*	1.85	0.27%	0.64	-0.20%	-0.44	-1.37%**	-1.99
Services	1.74%***	2.70	-0.49%	-1.00	-1.95%***	-3.63	-1.26%	-1.62
Agro & Food Industry	0.15%	0.16	1.53%**	2.21	-0.59%	-0.78	0.54%	0.49
Financials	0.90%	1.02	1.10%	1.64	-1.15%	-1.56	-0.75%	-0.70
Technology	3.91%***	3.65	-0.11%	-0.13	-1.22%	-1.34	-2.93%**	-2.18
Consumer Products	0.07%	0.07	-0.30%	-0.34	-0.83%	-0.89	-1.67%	-1.21
All stocks	1.36%***	4.86	0.41%*	1.95	-1.01%***	-4.32	-1.17%***	-3.45

6.1.2 Market reaction to the announcements related to plastic waste management

- Positive reaction

The market negatively reacted to the announcement no. 4 (Thai cabinet approved Plastic waste management Roadmap) and no.5 (No plastic bag announcement from Central Group).

For the announcement no. 4, the following industries resulted in positive market reaction: industrial, resources, property & construction, services and technology.

For the announcement no. 5, the following industries resulted in positive market reaction: industrial and agricultural & food industry.

The roadmap for plastic waste management is the policy which will enforce in the future (2018-2030). Central group is the first corporate who follow the roadmap by announcing to stop giving free plastic bags to their customers. Having roadmap and cooperated by corporate could be a good signal for investors that Thai market was ready to improve their awareness to the plastic waste management.

- Negative reaction

However, the market negatively reacted to the announcement no. 6 (No plastic bag announcement from 7-Eleven in 2019) and no.7 (Thai cabinet approve to ban 4 types of plastic in 2021).

For the announcement no. 6, the following industries resulted in negative market reaction: industrial and services.

For the announcement no. 7, the following industries resulted in negative market reaction: industrial, technology and consumer products: industrial, property & construction and technology.

7-Eleven is a convenience store chain under CP Group and also known as the biggest player in the Thai market. Stop giving free plastic bag by 7-Eleven could decreased the demand for plastic in Thai Market. Moreover, the Thai government announced to ban 4 types of plastics including plastic bag which will be effective in 2022. Changes in market demand for plastic could have an impact to those plastic producers and also its upstream suppliers. As well as the enforcement, suppliers could be struggling transform themselves by adapting their product lines i.e. incur additional capital expenditures (Stewart, 1992).

Refer to Table 3 and Table 4, we can see that, on average, market reacted to 7 out of 8 environmental policy announcements. The industrials industry reacted to all announcements. The majority of firms in the industrials are operators related to chemicals, automotive and general manufacturing which are viewed as polluters. These firms are more likely to be sensitive to the environmental issues than other industries (Pham et al., 2019; Ramiah et al., 2013). On the other hand, the Financials industry isn't sensitive to the environmental policy announcements. Other industries reacted differently at each announcement.

Cumulative abnormal return (CAR) trend

We adopt the EMH that market should react instantly to the new information. However, we also captured both pre-announcement reactions and post-announcement reactions (Figure 2).

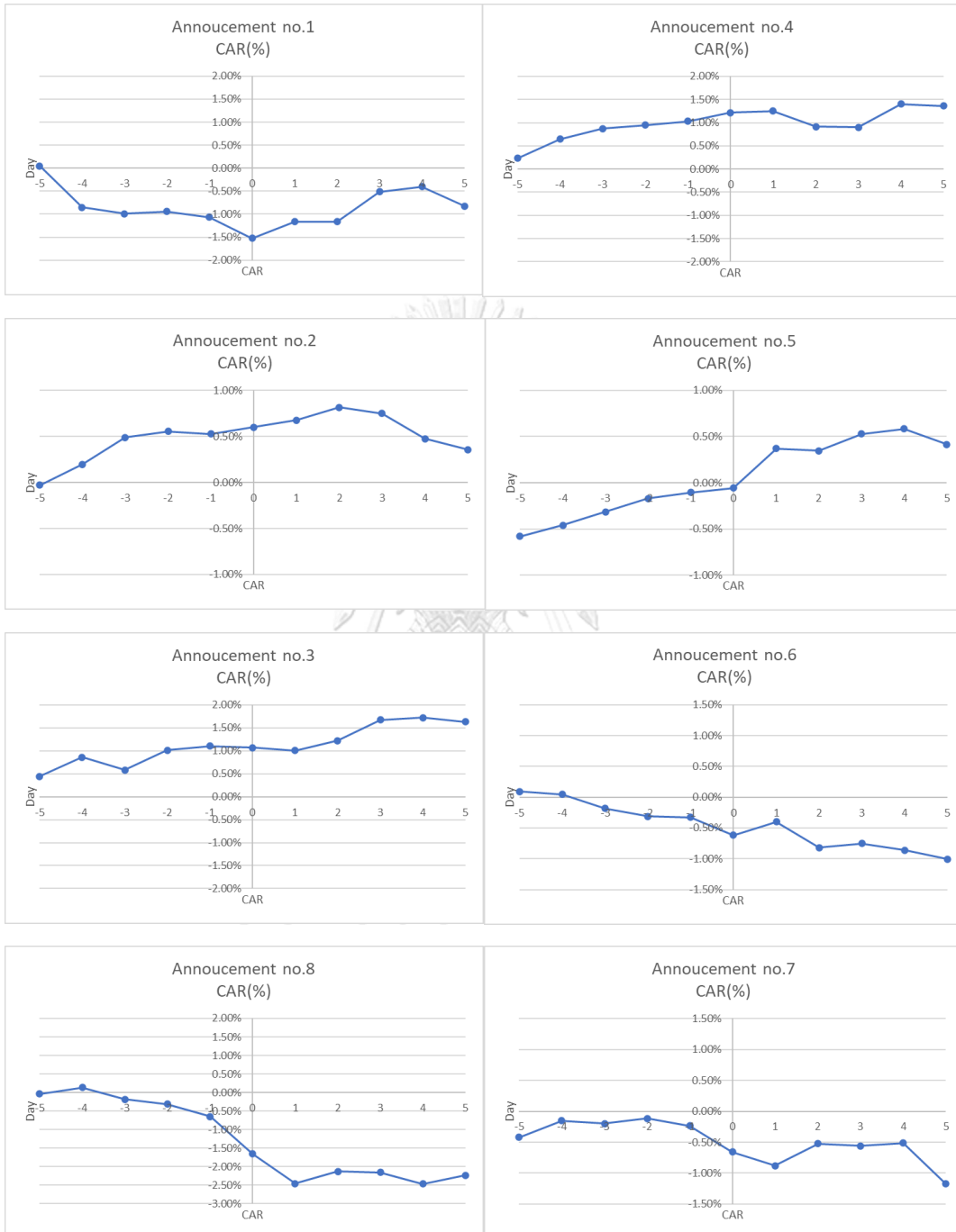
Pre-announcement market reactions - For most of the announcements, we can see that the CAR was observed before the announcement date. This implied that there might be some information leakage before the announcement.

Post-announcement market reactions - The increase or decrease in CAR post-announcement were still observed. However, the CAR trend post-announcement was more stable compared to pre-announcement.

Figure 2 : Cumulative abnormal return (CAR) trend

Climate change

Plastic waste management



6.2 Regression analysis on market reaction, ESG and firms' characteristics result

We examined the implication of ESG to the market reaction through regression analysis modelled as in **Equation (8)-(10)** for each announcement.

6.2.1 Regression analysis of CAR to the firm's ESG disclosure and ESG score (CAR to announcements related to climate change).

- In Part A of Table 5.1, we examine the impact of firms' ESG disclosure to the CAR of each announcement of environmental policies related to climate change. At the Paris Agreement signing date (announcement no.2), the firms with ESG disclosure can negatively affected CAR as compared to the firms without ESG disclosure. However, when Thailand committed to mitigate global warming at the more challenging level (announcement no.8), the firms with ESG disclosure positively reacted. After we exclude the financial services industry from the samples, the results are robust as shown in Part A of Table 5.2.

We noted that the investors viewed that ESG was a value destruction i.e., firms overinvest in ESG-related expenditures associated with agency costs before the proactive environmental disclosure (Barnea & Rubin, 2010; Brown et al., 2006). Less than 40 firms disclosed ESG information during 2016-2019. However, Thailand became more active on the ESG after 2020. We can see that the number of firms with ESG disclosure in the Refinitiv Datastream increased from less than 40 firms during 2016-2019 to 89 firms in 2021. After the ESG is widely-known and become more active in Thailand, ESG then is viewed as a firm value creating (Benlemlih et al., 2018). To sum up, the firms with ESG disclosure recently are likely to be better at the

adaptation to new environmental policies. Thus, their firms' value is expected to improve.

- In Part B of Table 5.1, we examine the impact of firms' ESG score level (combined the 3 components) to the CAR of each announcement of environmental policies related to climate change. The results show that the ESG score level has no impact to the firms' CAR.

- In Part C of Table 5.1, we examine the impact of firms' ESG score level (in a separate score component) to the CAR of each announcement of environmental policies related to climate change. The firms with higher environmental performances (*E Score*) earn negative returns when Thailand committed to mitigate global warming at the more challenging level (announcement no.8). Refer to [Yoo and Managi \(2022\)](#), in order for the firms to achieve higher E Score, the firms incur operational costs of improving their manufacturing processes and materials. Such higher operational costs that firms with higher E Score have a negative impact to CAR at the announcement no.8. The market may expect the additional operational costs for the adaptation of new policy. However, the result is not robust after we exclude the financial services industry from the sample, as shown in Part C of Table 5.2.

Table 5.1 Regression result for all industries

Regression analysis of CAR to the firm's ESG disclosure and ESG score (CAR to announcements related to plastic waste management). Results from OLS regressions of Eq. (8) for ESG disclosure are reported in Part A.

Results from OLS regressions of Eq. (9) for ESG score are reported in Part B.

Results from OLS regressions of Eq. (10) for E score, S score, and G score are reported in Part C.

In all events, the dependent variable is the firm's CAR at each event announcement.

All explanatory variables are defined in Table 2.

t-statistics are reported in parentheses, while ***, ** and * refer to statistical significance at 1%, 5% and 10% levels, respectively.

Announcement no. Announcement Date Explanatory variables	Climate change											
	Part A			Part B			Part C					
	1 12-Dec-15	2 22-Apr-16	3 21-Sep-16	8 2-Nov-21	1 12-Dec-15	2 22-Apr-16	3 21-Sep-16	8 2-Nov-21	1 12-Dec-15	2 22-Apr-16	3 21-Sep-16	8 2-Nov-21
ESG	1.830 (0.81)	-4.389** (-2.45)	-0.508 (-0.33)	2.815*** (2.68)	-0.0551 (-0.66)	-0.0825 (-0.91)	0.00459 (0.10)	-0.0475 (-1.48)	-0.0986 (-1.01)	-0.128 (-1.49)	-0.0297 (-0.68)	-0.0694* (-1.93)
ESG Score												
E Score												
S Score												
G Score												
MV	-0.00700 (-0.87)	0.0108* (1.87)	-0.00825* (-1.78)	0.000389 (0.10)	0.00764 (0.95)	0.0136* (1.93)	-0.00758** (-2.39)	0.00256 (0.79)	0.0114 (1.25)	0.0149* (2.07)	-0.00726** (-2.16)	0.00330 (1.01)
ROA	-0.0102 (-0.20)	-0.0655* (-1.78)	0.0269 (0.84)	0.0582 (1.21)	-0.596** (-2.45)	0.151 (0.72)	0.112 (1.09)	0.186* (1.70)	-0.789** (-2.56)	0.0309 (0.13)	0.0976 (0.84)	0.169 (1.51)
WACC	0.271** (2.33)	0.233** (2.23)	0.328*** (3.61)	-0.395 (-1.5)	0.320 (0.29)	2.154** (2.16)	-1.004* (-2.06)	0.617 (0.88)	0.374 (0.33)	2.192** (2.19)	-0.956* (-1.88)	0.639 (0.91)
Cfvol	-0.0394 (-0.62)	0.174*** (3.24)	-0.0314 (-0.67)	-0.0635 (-1.26)	-0.0407 (-0.13)	-0.148 (-0.48)	-0.0136 (-0.09)	0.0385 (0.33)	-0.0565 (-0.18)	-0.183 (-0.56)	0.0132 (0.08)	0.0405 (0.35)
Lev	2.081 (1.19)	1.958 (1.22)	4.677*** (3.36)	-1.561 (-0.93)	-13.90 (-0.85)	28.29** (2.47)	-15.23** (-2.72)	5.115 (1.19)	-14.76 (-0.88)	27.95** (2.43)	-15.48** (-2.66)	5.936 (1.37)
Constant	-3.516** (-2.58)	-3.057*** (-2.66)	-1.343 (-1.34)	-1.199 (-0.95)	8.934 (0.57)	-26.75** (-2.22)	13.93** (2.36)	-3.373 (-0.75)	-3.503** (-2.34)	-28.88** (-2.35)	13.53** (2.17)	-4.673 (-1.00)
No. of observations	363	369	369	451	26	29	29	89	26	29	29	89
Adjusted R-squared	0.002	0.056	0.042	0.028	0.215	0.135	0.333	0.028	0.178	0.138	0.285	0.049

Table 5.2 Regression result for all excluded Financials industry
 Regression analysis of CAR to the firm's ESG disclosure and ESG score (CAR to announcements related to plastic waste management).
 Results from OLS regressions of Eq. (8) for ESG disclosure are reported in Part A.

Results from OLS regressions of Eq. (9) for ESG score are reported in Part B.

Results from OLS regressions of Eq. (10) for E score, S score, and G score are reported in Part C.

In all events, the dependent variable is the firm's CAR at each event announcement.

All explanatory variables are defined in Table 2.

t-statistics are reported in parentheses, while ***, ** and * refer to statistical significance at 1%, 5% and 10% levels, respectively.

Announcement no. Announcement Date Explanatory variables	Climate change											
	Part A				Part B				Part C			
	Financials industry is excluded				Financials industry is excluded				Financials industry is excluded			
	1	2	3	8	1	2	3	8	1	2	3	8
	12-Dec-15	22-Apr-16	21-Sep-16	2-Nov-21	12-Dec-15	22-Apr-16	21-Sep-16	2-Nov-21	12-Dec-15	22-Apr-16	21-Sep-16	2-Nov-21
<i>ESG</i>	1.715 (0.66)	-3.701* (-1.87)	0.0315 (0.02)	2.479** (2.14)								
<i>ESG Score</i>					-0.0314 (-0.32)	-0.0964 (-0.93)	-0.000306 (-0.01)	-0.0496 (-1.47)				
<i>E Score</i>									-0.0960 (-0.90)	-0.144 (-1.43)	0.00494 (0.11)	-0.0571 (-1.41)
<i>S Score</i>									-0.0152 (-0.13)	0.0511 (0.36)	-0.0317 (-0.50)	0.0352 (0.74)
<i>G Score</i>									0.103 (1.27)	0.0473 (0.54)	0.0141 (0.37)	-0.0320 (-1.00)
<i>MV</i>	-0.00775 (-0.87)	0.00856 (1.39)	-0.00802 (-1.61)	0.000129 (0.03)	0.0108 (1.22)	0.0123 (1.58)	-0.00642* (-2.09)	0.00165 (0.51)	0.0187 (1.75)	0.0131 (1.62)	-0.00574 (-1.72)	0.00210 (0.63)
<i>ROA</i>	-0.00560 (-0.10)	-0.0612 (-1.60)	0.0333 (1.00)	0.0539 (1.03)	-0.546 (-1.70)	0.174 (0.63)	0.0566 (0.49)	0.105 (0.90)	-0.839* (-2.17)	0.0718 (0.25)	0.0408 (0.32)	0.0942 (0.78)
<i>WACC</i>	0.290** (2.31)	0.249** (2.28)	0.335*** (3.49)	-0.322 (-1.15)	-0.0988 (-0.08)	2.322* (2.07)	-1.083** (-2.28)	0.530 (0.75)	-0.240 (-0.19)	2.342* (2.05)	-1.095** (-2.17)	0.561 (0.79)
<i>Cfval</i>	-0.0663 (-0.85)	0.226*** (3.54)	-0.0117 (-0.21)	-0.129** (-2.26)	-0.701 (-0.90)	-0.115 (-0.18)	-0.118 (-0.45)	0.00307 (0.02)	-0.758 (-0.98)	-0.0244 (-0.04)	-0.192 (-0.63)	-0.0130 (-0.09)
<i>Lev</i>	2.012 (1.01)	2.450 (1.38)	4.749*** (3.05)	-2.173 (-1.18)	-18.95 (-0.99)	30.85*** (2.36)	-16.93*** (-3.06)	0.762 (0.16)	-25.04 (-1.28)	29.83*** (2.25)	-16.73** (-2.85)	1.699 (0.36)
<i>Constant</i>	-3.503** (-2.34)	-3.675*** (-3.00)	-1.503 (-1.40)	-0.901 (-0.66)	15.05 (0.87)	-28.28* (-2.11)	16.48** (2.90)	-0.819 (-0.17)	17.86 (1.02)	-31.73** (-2.23)	17.72** (2.82)	-1.660 (-0.34)
No. of observations	328	335	335	400	21	24	24	74	21	24	24	74
Adjusted R-squared	0.002	0.066	0.036	0.029	0.269	0.087	0.367	-0.007	0.271	0.073	0.301	-0.009

6.2.2 Regression analysis of CAR to the firm's ESG disclosure and ESG score (CAR to announcements related to plastic waste management).

- In Part A and B of Table 6.1, we examine the impact of firms' ESG disclosure or ESG Score to the CAR of each announcement of environmental policies related to plastic waste management. The results show that the ESG disclosure has no impact to the firms' CAR.

- In Part C of Table 6.1, we examine the impact of firms' ESG score level (in a separate score component) to the CAR of each announcement of environmental policies related to plastic waste management. At the Central Group's no plastic bag announcement (announcement no.5), the firms with higher corporate governance performances (G Score) earn negative returns. However, after we exclude the financial services industry from the sample, the coefficient of G Score at the announcement no.5 becomes insignificant while the coefficient of G Score at the announcement no.4 becomes statistically positive. We interpret that the G-related activities may or may not cause direct impact to firms' performance (Yoo & Managi, 2022). Therefore, the impact of firms with *G Score* to the CAR can vary depending on firms' financial options at different period of time.

Table 6.1 Regression result for all industries
 Regression analysis of CAR to the firm's ESG disclosure and ESG score (CAR to announcements related to climate change).
 Results from OLS regressions of Eq. (8) for ESG disclosure are reported in Part A.

Results from OLS regressions of Eq. (9) for ESG score are reported in Part B.

Results from OLS regressions of Eq. (10) for E score, S score, and G score are reported in Part C.

In all events, the dependent variable is the firm's CAR at each event announcement.

All explanatory variables are defined in Table 2.

t-statistics are reported in parentheses, while ***, ** and * refer to statistical significance at 1%, 5% and 10% levels, respectively.

Announcement no. Announcement Date	Part A							Part B							Part C						
	All industries							All industries							All industries						
	4	5	6	7	4	5	6	7	4	5	6	7	4	5	6	7	4	5	6	7	
	17-Apr-18	28-May-19	9-Oct-19	15-Feb-21	17-Apr-18	28-May-19	9-Oct-19	15-Feb-21	17-Apr-18	28-May-19	9-Oct-19	15-Feb-21	17-Apr-18	28-May-19	9-Oct-19	15-Feb-21	17-Apr-18	28-May-19	9-Oct-19	15-Feb-21	
Explanatory variables																					
ESG	0.651 (0.38)	-0.472 (-0.38)	0.295 (0.21)	0.394 (0.32)													-0.0996 (-1.35)	0.00168 (0.06)	0.0328 (0.80)	0.0139 (0.30)	
ESG Score					-0.0353 (-0.38)	0.00897 (0.24)	-0.0276 (-0.56)	0.0474 (1.17)													
E Score																					
S Score																					
G Score																					
MV	-0.00317 (-0.84)	-0.00211 (-0.67)	0.00155 (0.43)	-0.000590 (-0.12)					-0.00462 (-0.99)	-0.00132 (-0.56)	0.00161 (0.53)	-0.00148 (-0.36)					-0.00136 (-0.28)	-0.00296 (-1.26)	0.00159 (0.50)	-0.00151 (-0.36)	
ROA	-0.0728 (-1.52)	-0.0164 (-0.41)	-0.0142 (-0.31)	-0.00147 (-0.03)					0.350 (1.06)	0.249* (2.04)	0.344** (2.15)	0.0943 (0.68)					0.183 (0.55)	0.375*** (2.93)	0.342* (1.90)	0.0915 (0.63)	
WACC	0.00547 (0.06)	0.0804* (1.74)	-0.00597 (-0.11)	-0.640** (-2.05)					0.815 (1.05)	-0.176 (-0.90)	-0.163 (-0.64)	-2.552*** (-2.85)					1.057 (1.33)	-0.249 (-1.32)	-0.146 (-0.56)	-2.537*** (-2.79)	
Chol	0.301*** (4.77)	-0.00296 (-0.07)	-0.00157 (-0.03)	-0.174*** (-2.93)					0.361 (1.19)	-0.00147 (-0.01)	-0.0626 (-0.40)	0.0107 (0.07)					0.0228 (0.07)	0.0799 (0.67)	-0.0639 (-0.38)	0.0202 (0.13)	
Lev	-0.792 (-0.45)	0.542 (0.43)	-2.270 (-1.58)	-4.673** (-2.36)					-2.533 (-0.22)	5.869 (1.47)	5.721 (1.10)	-6.191 (-1.14)					2.273 (0.19)	6.448 (1.70)	6.164 (1.16)	-6.249 (-1.11)	
Constant	0.0582 (0.05)	-0.0232 (-0.03)	-0.535 (-0.52)	3.507** (2.34)					-5.091 (-0.4)	-3.244 (-0.80)	-2.900 (-0.55)	5.683 (0.99)					-0.409 (-0.32)	-3.950 (-1.00)	-1.161 (-0.21)	5.074 (0.84)	
No. of observations	357	375	375	451	32	36	36	89	32	36	36	89	32	36	36	89	32	36	36	89	
Adjusted R-squared	0.063	-0.001	-0.008	0.023	-0.031	0.044	0.005	0.088	-0.028	0.143	-0.021	0.071	0.028	0.143	-0.021	0.071	0.028	0.143	-0.021	0.071	

Table 6.2 Regression result for all excluded Financials industry
 Regression analysis of CAR to the firm's ESG disclosure and ESG score (CAR to announcements related to plastic waste management).
 Results from OLS regressions of Eq. (8) for ESG disclosure are reported in Part A.

Results from OLS regressions of Eq. (9) for ESG score are reported in Part B.

Results from OLS regressions of Eq. (10) for E score, S score, and G score are reported in Part C.

In all events, the dependent variable is the firm's CAR at each event announcement.

All explanatory variables are defined in Table 2.

t-statistics are reported in parentheses, while ***, ** and * refer to statistical significance at 1%, 5% and 10% levels, respectively.

Announcement no. Announcement Date Explanatory variables	Part A							Part B							Part C						
	Financials industry is excluded							Financials industry is excluded							Financials industry is excluded						
	4	5	6	7	4	5	6	7	4	5	6	7	4	5	6	7	4	5	6	7	
ESG	1.081 (0.58)	-0.469 (-0.34)	0.770 (0.50)	0.789 (0.63)	0.00351 (0.03)	0.0148 (0.35)	-0.0276 (-0.5)	0.0492 (1.06)	-0.102 (-1.18)	0.0205 (0.53)	0.0553 (1.09)	-0.00627 (-0.11)	0.0157 (0.13)	0.0346 (0.64)	-0.0911 (-1.26)	0.0444 (0.66)	0.0179* (1.76)	-0.0589 (-1.54)	-0.0125 (-0.25)	0.0246 (0.55)	
ESG Score																					
E Score																					
S Score																					
G Score																					
MV	-0.00326 (-0.83)	-0.00210 (-0.63)	0.000734 (0.20)	-0.00000 (0.00)	-0.00537 (-1.04)	-0.00128 (-0.50)	0.000966 (0.3)	-0.000744 (-0.17)	-0.00170 (-0.32)	-0.00305 (-1.15)	0.000827 (0.24)	-0.000505 (-0.11)	0.322 (0.76)	0.451*** (2.93)	0.414* (2.02)	0.0694 (0.41)	0.134 (1.34)	-0.287 (-1.38)	-0.155 (-0.56)	-2.704*** (-2.72)	
ROA	-0.0695 (-1.42)	-0.0217 (-0.5)	0.00383 (0.08)	0.0479 (0.84)	0.464 (1.07)	0.368** (2.48)	0.348* (1.82)	0.0828 (0.51)	0.0907 (1.07)	0.907 (2.17)	-0.249 (-0.54)	-0.147 (-0.34)	-2.710*** (-2.77)	0.565 (1.34)	0.104 (0.99)	0.129 (0.51)	0.108 (0.46)	0.104 (0.50)	0.129 (0.56)	0.108 (0.46)	
WACC	-0.0155 (-0.16)	0.0933* (1.92)	-0.00347 (-0.06)	-0.898*** (-2.93)	0.007 (1.07)	-0.249 (-1.17)	-0.147 (-0.54)	-2.710*** (-2.77)	0.907 (1.07)	0.907 (1.07)	-0.249 (-1.17)	-0.147 (-0.54)	-2.710*** (-2.77)	0.565 (1.34)	0.104 (0.99)	0.129 (0.51)	0.108 (0.46)	0.104 (0.50)	0.129 (0.56)	0.108 (0.46)	
Chol	0.404*** (5.42)	-0.0211 (-0.46)	0.00908 (0.18)	-0.168*** (-2.69)	0.854 (1.63)	-0.0353 (-0.18)	0.106 (0.41)	0.0955 (0.51)	0.854 (1.63)	0.854 (1.63)	-0.0353 (-0.18)	0.106 (0.41)	0.0955 (0.51)	0.565 (1.34)	0.104 (0.99)	0.129 (0.51)	0.108 (0.46)	0.104 (0.50)	0.129 (0.56)	0.108 (0.46)	
Lev	-0.824 (-0.43)	0.606 (0.43)	-1.539 (-0.97)	-4.168*** (-2.07)	-1.672 (-1.00)	7.167 (1.65)	6.308 (1.12)	-6.393 (-1.00)	3.609 (1.27)	3.609 (1.27)	7.168 (1.68)	7.203 (1.68)	-6.257 (-0.95)	3.609 (1.27)	3.609 (1.27)	7.168 (1.68)	7.203 (1.68)	7.168 (1.68)	7.203 (1.68)	-6.257 (-0.95)	
Constant	-0.409 (-0.32)	-0.0736 (-0.08)	-0.923 (-0.84)	3.674** (2.46)	-11.68 (-0.76)	-4.695 (-1.00)	-3.937 (-0.65)	6.060 (0.93)	-19.15 (-1.30)	-4.654 (-1.01)	-4.654 (-1.01)	-2.623 (-0.43)	4.947 (0.73)	-19.15 (-1.30)	-4.654 (-1.01)	-2.623 (-0.43)	4.947 (0.73)	-19.15 (-1.30)	-4.654 (-1.01)	-2.623 (-0.43)	
No. of observations	327	340	340	400	27	30	30	74	27	30	30	74	27	30	30	74	27	30	30	74	
Adjusted R-squared	0.084	0.000	-0.013	0.036	-0.009	0.104	-0.029	0.084	0.079	0.146	-0.037	0.062	0.079	0.146	-0.037	0.062	0.079	0.146	-0.037	0.062	

6.2.3 *The control variables:*

The results are mixed. Some signs are as expected but some are not; as follows:

MV - At the Paris Agreement signing date (announcement no.2), the larger firms react positively at the announcement. This is as we expected that larger firms more likely to have more resources to comply with the environmental policy (Kabir et al., 2021; Klassen & McLaughlin, 1996). However, at the ratification (announcement no.3), the larger firms turned to negatively react to such announcement to legally abide with the Paris Agreement. During the two announcements, the larger firms may show some signal that they are struggle to adopt the new policy. Thus, they have negative returns at the later announcement.

WACC - The prior studies concluded that higher cost of capital could deteriorate firm value. Thus, the firms with higher cost of capital react negatively at some announcements e.g. at the cabinet approval of foam and plastic ban (announcement no.7). With higher cost of capital, the firms would have higher costs of fund to improve themselves when adopting the new environmental policies. However, we also found that firms with higher WACC have positive impact to CAR at the environmental policy announcements. This fact indicates that the investors positively react to these firms at the announcements because they may forseen that these firms' adoption of the announcements would improve the firm value. This is in line with Wong et al. (2021) who noted that the firms' adoption e.g. decide to disclose ESG rating had lower cost of capital than before the disclosure. The positive returns are seen in several announcements related to climate change e.g. announcement no.1, no.2 and no.3.

ROA - For announcement no. 5,6 and 8, *ROA* positively affected *CAR*. The higher *ROA* and *ESG* disclosure indicate profitability of firms. Profitable firms with *ESG* score tend to be highly valued by the stock market (Kabir et al., 2021). On the other hand, for the announcement no.1 and 2, firms the higher *ROA* negatively impacted *CAR*. At the few first announcements, investors may foresee the opportunities that low *ROA* firms may adapt to the new policy which may improve the firm value and generate higher *ROA* in the future (Wong et al., 2021).

CFvol - For the announcement no.2 and 4, market positively react to firms with high *CFvol* which is inconsistent with the literature. Plausible reason is that high *CFvol* may indicate that firms are in growth stage and easy to adapt themselves to the new policies which could be attractive for investors. Only announcement no.7 that *CFvol* negatively impacted *CAR* which inline with Kabir et al. (2021) documented that High *CFvol* indicate high default risk.

Lev is negative for announcement no.3 and 7. As firms need to finance and invest more to comply with the environmental policy. With low leverage it is easier to access to the capital market which in line with (Kabir et al., 2021). On the other hand, firms with higher *Lev* positively reacted to the announcement no.2. If firms with higher *Lev* adapt to the new policy they may have easier access to the capital (Ambec & Lanoie, 2008).

7. Conclusion

The objective of this study is categorized into 2 parts. First, this study examined the market reactions to the environmental policies announcement which measured by cumulative abnormal returns (CAR) of stocks in the Stock Exchange of Thailand. Second, we examined the impact of ESG disclosure on the cumulative abnormal return.

First hypothesis, in terms of market reaction for all stocks, significant cumulative abnormal returns (CAR) were observed in 7 out of 8 announcements. In terms of industry level, industry differently reacted to each announcement. Only industrials industry was observed to have mixed reactions to every announcement, while no reaction from financials industry was observed. It can be concluded that the investors are aware of the impact of environmental policy announcements that may improve or deteriorate firms' value especially firms in the industrials industry.

Second hypothesis, we investigated the impact of ESG disclosure to the CAR and found that the results are mixed. Two announcements which are related to the climate change policy announcement were observed that ESG disclosure had impact on CAR. At the first action of Thailand towards Paris Agreement in 2016 (announcement no.2), ESG disclosure had negative impact on the CAR. However, in 2021 Thailand announced to commit at more challenging level to limit global warming (announcement no.8), ESG disclosure had positive impact on CAR.

We noticed that Thailand became more active on the ESG after 2020 as we can see that the number of firms with ESG disclosure in the Refinitiv Datastream almost tripled (less than 40 firms during 2016-2019 to 89 firms in 2021). Thus, the results in

2016 imply that the investors viewed that ESG was a value destruction i.e., firms overinvest in ESG-related expenditures associated with agency costs before the proactive environmental disclosure. However, in 2021, after the ESG is widely-known and become more active in Thailand, ESG then is viewed as a firm value creating. In other word, the firms with ESG disclosure recently are likely to be better at the adaptation to new environmental policies. Thus, their firms' value is expected to improve. Additionally, among the firms with ESG disclosure, ESG score and its components don't have impact on cumulative abnormal return.



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