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Does a legal penalty announcement matter?

An event study of various market reactions to legal penalty announcements

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Preface

This thesis is written as a part of our last destination on our Master of Science in Economics and Business Administration at the Norwegian School of Economics. Both writers are majoring in Finance and have a fascination with statistical analysis. It has been both challenging and interesting to investigate whether fines have an impact on stock returns. We want to convey our heartiest gratitude to our supervisor, Tommy Stamland. He has given us the right directions, endless motivation, with numerous questions and very insightful knowledge. We are also incredibly grateful for both the fast replies and the availability to ask questions Tommy has given us.

Finally, we want to express gratitude to each other. It was great working together, learning from each other, and applying for the learned courses in real life. We want to wish the best of luck to each other for the rest of the life journey.

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Abstract

This paper investigates whether the penalty announcements have any impact on the stock return of listed firms in some specific countries. The study is focused on observing if the abnormal return (AR) is negative on the event day, by conducting an event study approach suggested by MacKinlay (1997). By using the market model statistical method, our study finds that the cumulative abnormal return (CAR) is -0.7% when the event window is [-1,2]; one day before the announcement and two days after the announcement. For this event window, the returns are significant at a 95% level. We also discovered (in section 7.1, figure 3), that the average abnormal return for all companies decreases from 0.10 to -0.25 on the very next day after the penalty announcements. The study also finds that, when the penalty size relative to the market capitalization is larger, CAR changes significantly for most of the firms in our study. Unexpectedly, we find no substantial impact on abnormal returns while studying for different countries. From the cross-sectional analysis, we observe that the cumulative abnormal returns decline when the relative penalty size increases. The coefficient of -0.639 for Relative Penalty Size indicates that there is, indeed, a negative relationship between relative penalty size and the abnormal return. The intuition makes sense as the larger size of the penalty relative to the market capital points to a decrement in abnormal returns. Besides, no other event-specific variables are found significant in demonstrating cumulative abnormal return on various event windows in the cross-sectional analysis. To round off, we tested the robustness of our regression analysis and found no violation of OLS assumptions in our analysis.

***Keywords* -** CAR, Event study, Penalty Size, cross-sectional analysis, Robustness tests.

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1. Introduction

Corporate crimes and fraudulence have been occurring from the very beginning of the industrial revolution. According to Šikman (2013), firms commit business-related offenses or do commit small or big corporate crimes or illegal activities such as tax evasion, breach of regulations, biased financial reports, market manipulation, environmental pollution, violation of international laws, and so on.

Sometimes companies do not get any charges or penalties at all. In the study of Lund and Sarin (2020), crime by corporate firms and financial institutions is on the rise. Therefore, it is vital to penalize the companies and firms depending on the degree of their corporate crimes by the lawsuits or regulatory authorities. Arlen (1994), added in her study that the standard economic approach is optimal when there is a reform of corporate criminal liability, higher sanctions lead to lower numbers of crime by the companies. This thesis investigates the impact of penalty announcements against listed firms in different stock exchanges to see how the stock market reacts when companies get penalties.

Through the whole study, we try to find answers to three hypothesis questions. Firstly, if the legal penalty announcement generates a negative abnormal return. Secondly, if there is any relevancy of penalty size compared to the market capitalization of a listed company. Thirdly, finding the extent of penalty effects for different countries. To support our hypothesis, we pursue the Efficient Market Hypothesis following Fama (1970). The market model is employed by the methods introduced by MacKinlay (1997), to calculate the abnormal return by carrying out event study methodology by MacKinlay (1997). After that, we conducted a cross-sectional regression analysis of abnormal returns to explore if the observed returns are driven by various event characteristics.

For the analysis, we have a sample of 163 penalty announcements against 153 listed companies in Norway, the USA, the UK, China, and Japan from January 01, 2011, to November 30, 2021. The stock exchanges that are used in this research are the following: Oslo Stock Exchange, New York Stock Exchange, London Stock Exchange, Tokyo Stock Exchange, Osaka Stock exchange, Shanghai Stock exchange, and Shenzhen stock exchange. For the event study, we choose to study on four different event windows besides event day: [-1,1], [-1,2], [-2,5], and [-5,5], respectively. To find the determinants of abnormal returns, we use the previous study to find relevant factors. Intuitively, relative penalty size is assumed to be the primary variable.

Robustness tests for regression models; the Heteroskedasticity test and multicollinearity test, are conducted to validate our analysis.

The thesis consists of ten sections. The first section introduced the reader to our thesis. The second section presents related literature, which is followed by the research question and hypotheses development. Section four consists of an explanation of the market efficiency hypothesis by Fama French. In the fifth section, the reader will be presented with the methodology used to analyze the research question. In section six, the collection of data will be presented, as well as a justification of selection criteria and time horizon. Further, the data cleaning is explained before presenting the descriptive statistics. In section 7, we discuss the empirical outputs from our analysis. This section is divided into three parts, the analysis of the hypothesis, cross-sectional analysis of different variables and robustness test of the regressions. The analysis is followed by a discussion in the eighth section. In section 9, the limitations are argued, which is followed by the conclusion and recommendations for future research of our thesis.

2. Literature Review

This section depicts a discussion of relative research on our thesis topics as well as how this thesis fits into the studies and literature which are already published. In general, there are few studies on the legal penalty announcements in the past. Therefore, we have decided to extend the study to a new experiment and see how we could find any interesting outcomes. However, in this section, we tried to examine the existing research, give a view on already built practices in this research, and create a baseline outcome for which the findings of our thesis will be compared to. To the author's knowledge, there have been very few or no existing studies on the effect of legal penalty announcements on the stock markets in terms of different markets in different countries.

2.1 Market reaction to corporate illegalities

Davidson and Worrell (1988) investigated how the market reacted to allegations of corporate wrongdoing. This study also refers that the relationship between corporate social responsibility (CSR) and financial success had been equivocal. They offer three plausible explanations for why the results were inconclusive. The first reason was a lack of confidence in corporate social responsibility indices, the second was a poor assessment of financial measurements, and the third and last reason was a lack of statistical techniques. They employed disclosures of business illegalities as a surrogate for societal irresponsibility to investigate market reactions. Only companies linked to five blatant illegalities were selected, which were antitrust breaches, bribery, criminal fraud, tax evasion, and unlawful political contributions (Davidson and Worrell, 1988). In this investigation, the researchers discovered a substantial negative abnormal return of 0.87 percent one day before the announcement and no significant reaction on the day of the event. They claim that this is not surprising given that wire services often post news one day before newspapers.

Davidson, Worrell, and Lee (1994) expanded on the work of Davidson and Worrell (1988) by conducting more research on the subject. An event methodology was utilized, as in the prior study, however, this study contained a larger data sample. This study's findings reflect Davidson and Worrell's (1988) earlier finding that illegal actions are followed by a negative market reaction, but only for sorts of crimes. The abnormal return for the entire sample was not significant, but after categorizing the different events into types of crime, there was a significant negative abnormal return for crimes such as bribery, tax evasion, theft of trade secrets, financial reporting violations, violations of government contracts, and kickbacks. Price fixing, on the other hand, received statistical significance based on a positive abnormal return on the event day. In contrast to the study of Davidson and Worrell's (1988), there was no statistically significant abnormal return one day before the occurrence. This could be because of the data sample. The authors of this study used a wide range of obvious illegalities, not only five as in the study by Davidson and Worrell (1988).

From the studies of market reactions to announcements of corporate illegalities, it can indicate that the market only penalizes firms when the company is prosecuted for a severe criminal offense or if the company allegedly has done a severe crime.

2.2 Studies on reputational penalties

Karpoff and Lott (1993) studied measuring the value related to loss of reputation due to criminal fraud. In this study, the authors focus on consumer fraud but supplement those similar arguments that exist for fraud against other stakeholders as well. They find a statistically significant loss for the companies accused of fraud where the cost of illegality is imposed on a party the firm does business with. Further, they find that 6,5% of this loss can be associated with the expected legal penalties and that the remaining loss represents a loss in reputation. This reputational loss is imposed by the market, which is reflected in the stock return.

Alexander (1999) studies the reputational penalties which are imposed after a corporate crime. This study adds to the same literature as Karpoff and Lotts (1993). While Karpoff and Lott focus more on related parties of the company of fraud, Alexander sheds light on the third party of a corporate crime. Argumentation for imposing a third party in this study is that corporate crime includes a substantial number of third parties compared to fraud. The findings of this study coincide with Karpoff and Lotts (1993) studies. In terms of loss of shareholders' wealth, related party crimes (in this case, contract-related) have an average abnormal return significantly different from zero of -3,06%, while third-party crime (such as violation of environmental law) has an average positive return of 0,44% of no significance.

Above, there has been literature of market reactions to related-party crimes. A more recent study by Karpoff, Lott, and Wehrly (2005) measures if reputational penalties, due to environmental law violation, impose significant costs on the market value. This is a third-party crime. Their findings are that announcements of alleged violations have an average abnormal return of -1,69%, while an announcement of prosecution due to violations has an average abnormal return of -1,58%. They also find that these losses reflect the size of the legal penalty which was given. Hence, they concluded that environmental violation, which can be used as a proxy to third-party crime, is disciplined through legal penalties and not reputational sanctions.

Klein and Leffler (1981) argued that it is possible to analyze the cost of damage to companies` reputations. For this reason, it is sensible to observe the actual impacts of penalty announcements on firms' returns and prices. A methodology of abnormal return is being used in our research by getting motivation from the model depicted by Armour, Mayer, and Polo (2017), where they determined how the firms return changes due to sanctions issued by governmental bodies or any other financial authorities. They found that the penalty announcements or the announcements of misconduct or sanctions generated at least an intraday abnormal negative return of 1.26%.

From previous studies on reputational penalties, which is the market’s reaction to an event, it is implied that only illegalities affecting a related party will be penalized by the market with a reputational penalty reflected in stock price. While offenses with a related third party will not affect shareholders' wealth.

2.3 Optimal penalty theory

Both Karpoff and Lott (1993) and Alexander (1999) set Beckers (1968) studies as a baseline of optimal penalty theory. Becker (1968) shows that the more damaging a crime is, the more severe a penalty is. They added that the degree of any penalties highly affects the degree of social losses. The social losses can be found due to corporate crimes or offenses conducted by the firms. Becker also concluded that demonstrating an optimal policy or penalty for an illegal behavior of the company or any other parties can be an optimal allocation of the resources and can have some direct or indirect impression on a firms’ economic performance. Therefore, it is optimal to consider the size of the penalty while we are measuring the extent of the penalties to the company returns.

2.4 Studies on sanction announcement

Djama (2013) studied which part the French Commission of Values (AMF) has in the quality control of the revelation of financial information. He uses an event study to study three hypotheses, where two of which relate to legal penalties. Hypothesis number two in this study is if an announcement of opened investigation by the AMF hurts stock prices, while the third hypothesis is if the announcement of sanctions by the AMF has any negative impact on stock prices. The findings of Djama (2013) are that the market reacted negatively to the opening of an investigation by the AMF, while announcements of sanctions had no effect. He concludes that it is the announcement of investigation which affects the company's reputation and value.

A related study to Djama is the study of Armour, Mayer, and Polo (2017). They studied the impact of regulatory sanction announcements in the UK and used an event study to conduct this. In contrast to AMF in Djama (2013), the UK financial regulatory system only has one public announcement in the enforcement process, and that is only when the investigation is completed. Their finding is that penalized firms experience the statistically significant abnormal return of which is almost nine times the penalty size, also here this abnormal return is referred to as "reputational loss." Coinciding with other literature presented, Armour, Mayer, and Polo find that reputational loss is restricted to crimes that affect related parties.

2.5 Contribution to literature

From the literature review, we have seen that Davidson and Worrell (1988) and Davidson, Worrell, and Lee (1994) have studied market reactions of corporate illegalities, while Karpoff and Lott (1993), Alexander (1999), Karpoff, Lott, and Wehrly (2005) and Klein and Leffler (1981) studied how the corporate crime affected the reputation of the company. Furthermore, Djama (2013) studied how the market reacts both to investigation announcements and sanction announcements, and Armour, Mayer, and Polo (2017) studied sanction announcements as well. However, we do not find any explicit studies on how firms react to announcements of fines. Therefore, our contribution to the literature is to investigate whether fines impact stock returns among different markets.

3. Research questions and Hypothesis

3.1 Research questions

In this paper, we examine the extent of the effects of legal penalty announcements against different firms by the legal and legislative authority on the companies' stock prices. Legal penalty announcements impart the market with the various latest information regarding the future or current earnings for the firms or businesses in question. In this relevant situation, the Efficient Market hypothesis with the semi-strong form holds, we can expect a rapid reaction to the stock market, and it might be adjusted correspondingly to the announcement details. Even though it has a direct impact of legal announcements in the financial news on the stock market, empirically, this news is not feasible enough to consider for the stock market to be hugely affected. Therefore, some questions arise concerning how the stock market responds to the legal penalty announcements.

Now the vital question arises, what are the major determinants that cause the stock market to be reacted to the legal announcements? It is sensible to assume that the size, duration, or amount of the penalty are important in the first place, but we need to find if any additional characteristics drive the stock market. Furthermore, do the different stock markets in different geographical areas make the appropriate adjustment to the legal penalty announcements? or if there are any leakages of information before the events.

To explore the above discussion, we have ended up with the following research question:

How does the stock market react to the legal penalties announced in various financial markets?

3.2 Hypothesis

The interest in studying penalties started with our curiosity of which external power drives the return of a company. Recently DNB got a penalty for breaching the anti-money laundering act in Norway, but did it affect the return of the company? We wanted to find this out and if penalties, in general, had any impact on the return. From earlier studies such as Karpoff and Lott (1993) and Alexander (1999), we could see that fraud and criminal offenses had a consequence of negative abnormal return if the offense affected related parties to the firm such as consumers or investors. In contrast to these findings Karpoff, Lott, and Wehrly's (2005) later study presents a negative abnormal return for environmental law breaches, which is a third-party violation. Then the question arises, do the announcements of a penalty give a reputational loss – in form of a negative market reaction? Consequently, our first hypothesis is if legal penalties, in general, is followed by negative abnormal return.

H1: The announcement of a legal penalty is followed by a negative abnormal return.

Due to Becker (1986) penalties are given such that the penalty size is relative to the severity of the crime. But fines can be high but still be small for a well-established company, at the same time as a small fine can be huge for a company with a smaller market capitalization. Therefore, we want to investigate whether the relative penalty size affects the stock return and if the relative penalty size reflects the severity of the crime. Hence, the second hypothesis is:

H2: The penalty size relative to the market capitalization is not relevant to the abnormal return.

Something that caught our attention was that in the studies of Djama (2013), with data from France, that it was the announcement of an investigation which was followed by the abnormal negative return, while the announcement of the penalty itself was not an announcement which affected returns. On the other hand, the study of Armour, Mayer, and Polo (2017), which was conducted by data from the UK, got negative abnormal returns after the announcement of the penalty. In contrast to the example from France, the UK financial regulatory system only have one public announcement, which is after the investigation process is completed. The question of whether different countries react differently to penalty announcements arose. After going through some previous studies, we found that abnormal returns differ when the countries are different. Hence, the third and last hypothesis is:

H3: The penalty impact will differ relative to which country the company is listed in.

4. Theory

The Efficient Market Hypothesis is strongly tied to the event study methodology. Event studies begin with the assumption that the market is rational in the sense that prices quickly reflect available information (MacKinlay, 1997). Simultaneously, Fama (1991) contends that event studies provide direct evidence of efficiency. As a result, the Efficient Market Hypothesis will be discussed in this section.

4.1 Efficient Market Hypothesis

Fama (1970) reported in his studies that the efficient market model has a strong null hypothesis. The null states that in an efficient market all available information will be fully reflected at any time in security prices. According to Fama (1970), this hypothesis has been categorized and broken down into three categories, weak, semi-strong and strong form, to identify at which level of information the null is breaking down. The weak form of efficiency asserts that historical prices or returns reflect the security prices. Further, the semi-strong form of efficiency claims that all public information is reflected in security prices and involves how fast the latest information is affecting the security price. Lastly, the strong form of efficiency states that all information, historical prices, public information, and non-public information, is reflected in security prices.

The conclusion of Fama's (1970) studies of where the null is breaking down is that both the weak form- and the semi-strong form of efficiency supports the efficient market hypothesis. On the other hand, the strong form is better used as a benchmark for instances when market efficiency does not hold. This implies when specialists and/or corporate insiders have monopolistic access to information. Further, Fama's (1991) more recent study acknowledges that the efficiency of the market exists from a proper event study, specifically daily return event studies. This is concluded from an event study literature by Fama (1991), which indicates that prices adjust to firm-specific events.

5. Methodology

In this thesis, an event study methodology together with cross-sectional regression analysis by MacKinlay (1997) is conducted to investigate the impact of legal penalty announcement on stock returns. This methodology has been supplemented by Strong (1992) and McWilliams and Siegel (1992). The event study methodology is employed to determine market reactions to the latest information of selected events. Analysts can make use of this method to check whether stock returns are abnormally high or low in response to occurrences. Furthermore, cross-sectional regression analysis is used to measure how much of the abnormal return is associated with different event characteristics.

The event study methodology will be explained in this section. Then, there will be a description of normal performance measures, which is followed by estimation and aggregation of abnormal returns. Then there will be clarification of a cross-sectional test. Lastly, cross-sectional regression analysis is explained.

5.1 Event study methodology

After identifying relevant events and event dates, then there is a designation of an event window and an estimation window. The event window will be used to examine the abnormal returns given the event, which is investigated, while the estimation window will be used to calculate the normal return before the event and is used as a proxy for future normal performance (MacKinlay, 1997). After estimating normal performance for the event window, the abnormal return will be calculated by subtracting the normal return from the real return. When the abnormal return has been determined, the data must be aggregated to find the abnormal return for the whole sample, and if necessary, clustering considered. Finally, a test will be performed to determine if the null hypothesis should be rejected or retained.

5.1.1 Event window

An event window must be constructed after locating relevant events and event dates. According to MacKinlay (1997), the event window is typically extended across many days. It is possible to study intervals close to the event itself by selecting a window greater than the exact time of interest. This can be useful if the market has been notified about the event before the actual announcement, or if the market is informed after the stock market closes so that the reaction to the event occurs the next day.

McWilliams & Siegel (1997) reports that the event window should be as small as possible. The rationale for this is to account for overlapping events. Hence, McWilliams & Siegel (1997) states that the event window should be such long that it captures the effects of the event significantly but should be such short that it can deduct confounding effects. Both MacKinlay (1997) and McWilliams & Siegel (1997) agreed upon the fact that the event window should include time before the announcement of the event in case of leakage of information, such that the leakage will be captured in the abnormal return.

5.1.2 Estimation window

An estimation window must be created to estimate normal performance. According to MacKinlay (1997), the estimation window is typically comprised of stock returns before the event. It is not desirable to have the event impact normal performance since the estimation is used as a baseline of expected return before the event (Strong, 1992). Hence, the event itself will not be included in the estimation window (MacKinlay, 1997).

Strong (1992) highlights the need of avoiding extending the estimation window too far back in time in case the foundation of expected return has changed over time. Simultaneously, the estimation window should be long enough to optimize statistical accuracy.

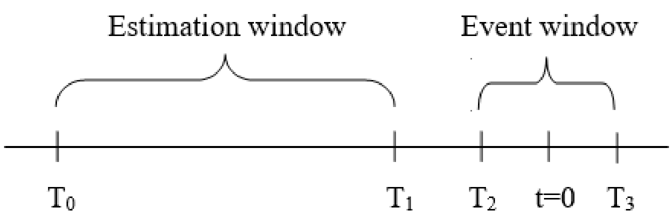


Figure 1: Estimation- and event window

Before introducing relevant equations, some notations need to be defined. The event date will be defined as $\tau=0$. The event window is then defined as $\tau=T_2+1$ to $\tau=T_3$, while the estimation window will be defined as $\tau=T_0+1$ to $\tau=T_1$. Then lengths of these windows will followingly be $L_1=T_1-T_0$ for the estimation window, and $L_2=T_3-T_2$ for the event window. The period between T_1 and T_2 can be defined as a hold-out window and is used such that the estimation window is not influenced by the event.

In this thesis, there will be an estimation window of 150 trading days to capture the normal performance before the event day. Further, there will be a hold-out window of five trading days, to make sure the estimation period is not affected by the event itself. Lastly, there will be four event windows in addition to the event day: [-1,1], [-1,2], [-2,5] and [-5,5]. These were selected to see if there is any significant abnormal return associated with smaller and/or larger gaps.

5.2 Normal performance measure

The normal performance from the estimation window is calculated as the following stage in an event study. This can be accomplished using a variety of ways that fall into either the statistical or economic methods (MacKinlay, 1997). A statistical model will be employed in this investigation, as they are in most event studies.

Statistical models are based on statistical assumptions rather than economic considerations. The assumptions are that the return on a security is independently and identically distributed across time and that the return is jointly multivariate normally distributed (MacKinlay, 1997). The statistical model presented and used in this thesis is the Market Model.

5.2.1 Market model

A market model can be useful to detect effects from occasions. The market model is a linear model of a company's normal return relative to a selected market portfolio. As presented by MacKinlay (1997) the market model is as follows:

$$R_{i\tau} = \alpha_i + \beta_i R_{m\tau} + \varepsilon_{i\tau} \qquad 1.1$$

$$E(\varepsilon_{i\tau} = 0) \qquad var(\varepsilon_{i\tau}) = \sigma^2_{\varepsilon_i}$$

Where $R_i\tau$ is the predicted normal return for firm i in period τ, $R_m\tau$ is the market return for period τ and $\varepsilon_{i\tau}$ is the zero mean disturbance term. The parameters of the market model, α_i and are estimated by the Ordinary Least Squares (OLS) procedure (MacKinlay, 1997).

In the calculation of the parameters, it is usual to use a market index containing a broad variety of stocks (MacKinlay, 1997). In this thesis, the selected market portfolios are determined by which country the company is listed in.

5.3 Estimating and aggregating abnormal returns

The third step of the event study is estimating and aggregating abnormal returns. MacKinlay's (1997) framework has used the market model as a starting point for the measurement and aggregation of abnormal returns.

By using the normal performance calculated in the market model above, the abnormal return can be estimated as shown in equation 1.2.

$$AR_{i\tau} = R_{i\tau} - \hat{\alpha}_i - \hat{\beta}_i R_{m\tau} \qquad 1.2$$

From the equation, it is shown that the abnormal return is computed by subtracting two of the components in the market model from the period-τ return. Hence, the abnormal return equals the disturbance term in the market model (MacKinlay, 1997).

The abnormal returns, on condition of the event window, will have jointly normally distributed returns with a zero conditional mean and conditional variance of:

$$\sigma^2(AR_{i\tau}) = \sigma^2_{\varepsilon_i} + \frac{1}{L_1}[1 + \frac{(R_{m\tau} - \hat{\mu}_m)^2}{\hat{\sigma}^2_m}] \qquad 1.3$$

The conditional variance is expressed by the equation above as (1) disturbance variance term as presented in section 5.2.1, the market model, and (2) additional variance. The increased variance is due to sampling error in $\hat{\alpha}_i$ and $\hat{\beta}_i$, which results in a serial correlation of abnormal returns, even though real disturbance should be time-independent (MacKinlay, 1997). Easy mathematics says that the larger L_1 is, the closer to zero the component will become. Hence, the larger the estimation window, L_1, and the additional variance move closer to zero, the sampling error will be terminated (MacKinlay, 1997). As the estimation window in this thesis is 150, the additional variance is assumed to be zero, hence the variance of abnormal returns will be equal to $\sigma^2_{\varepsilon_i}$ and the abnormal return will be independent through time.

To get the reasoning for the event of interest the abnormal return observations must be aggregated. This can be done both across time and security. Aggregation through time is used when there is an event window consisting of multiple days (MacKinlay, 1997). To define aggregation through time, cumulative abnormal returns (CAR) are calculated as follows:

$$CAR_i(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} AR_{i\tau} \qquad 1.4$$

Where τ_1 and τ_2 is the time between T_2 and T_3: $T_2 < \tau_1 < \tau_2 < T_3$. CAR is then the abnormal return in the event window (MacKinlay, 1997). For this aggregation, there is assumed that there is no clustering, which means that there is no overlap in the event windows of the included securities. If there is clustering, it must be considered because the aggregated results will not be applicable due to covariances of abnormal returns will no longer be zero. In this thesis, clustering should not be an issue since there is a small amount of clustering, and according to Bernard (1987), when using daily data, bias from clustering is not considered to have large effect on the data.

The variance of $CAR_i(\tau_1, \tau_2)$ for each security is defined as:

$$\sigma_i^2(\tau_1, \tau_2) = (\tau_2 - \tau_1 + 1)\sigma_{\varepsilon_i}^2 \tag{1.5}$$

From this equation, the variance for the aggregated abnormal returns is calculated by using the number of days in the event window and the variance for the disturbance term, which is the variance of the abnormal return as illustrated in equation 1.3.

After computing the $CAR_i(\tau_1, \tau_2)$ for each security, these can be further aggregated across each other. The cumulative abnormal returns and variance across securities, given N events, will then be calculated as follows (MacKinlay, 1997):

$$\overline{CAR}(\tau_1, \tau_2) = \frac{1}{N}\sum_{i=1}^{N} CAR_i(\tau_1, \tau_2) \tag{1.6}$$

$$Var\left(\overline{CAR}(\tau_1, \tau_2)\right) = \frac{1}{N^2}\sum_{i=1}^{N} \sigma_i^2(\tau_1, \tau_2) \tag{1.7}$$

The last two equations will be used for the cross-sectional test which follows in section 5.4.

5.4 Cross-sectional test

To test whether the null hypothesis shall be rejected or retained, a test needs to be conducted. From MacKinlay (1997) a modified Student's t-test is used to test if the abnormal return is significantly different from zero:

$$\theta_1 = \frac{\overline{CAR}(\tau_1, \tau_2)}{Var\left(\overline{CAR}(\tau_1, \tau_2)\right)^{\frac{1}{2}}} \sim N(0,1) \tag{1.8}$$

θ_1 follows the normal distribution of a mean of zero and a standard deviation of one. The null hypothesis will be rejected whenever $\theta_1$exceed ±1.96, Which indicates that there is a significant level of 95%.

5.5 Cross-sectional regression analysis

Cross-sectional regression analysis can be interpreted to investigate the relationship between the abnormal returns associated with the event and the characteristics of both the event and the firm. In a regression of N observations of abnormal returns and M firm- and/or event characteristics, the definition of the model will be as follows:

$$AR_j = \delta_0 + \delta_1 x_{lj} + \cdots + \delta_M x_{Mj} + \eta_j \quad 1.9$$

$$E(\eta_j) = 0$$

In this equation, firstly AR_j is the abnormal return for the j^{th} observation. Then it is the regression coefficients which are δ_M where M = 0, …, M. Further, the characteristics for the j^{th} observation is given by x_{Mj} where M = 0, …, M. Lastly, the zero mean disturbance term is expressed by η_j, which is uncorrelated with the x's (MacKinlay, 1997).

By using the cross-sectional regression approach there may arise some issues concerning the interpretation of the results. The abnormal return in the event window will in a lot of cases be related to firm characteristics, through both the valuation effects of the event and to the extent investors can predict the specific event. The valuation effect's linear relation with the firm characteristics may be hard to find in these certain cases (MacKinlay, 1997).

6. Data sampling

In this study, the sampling data consists of events from the following stock exchanges: Oslo Stock Exchange (Norway), NASDAQ (US), London Stock Exchange (UK), Tokyo Stock exchange (Japan), Osaka Stock exchange (Japan), Shanghai Stock exchange (China) and Shenzhen stock exchange (China). The main reason behind choosing these countries is that we wanted to examine some of the biggest markets in the world and the Oslo Stock Exchange so that we can compare the events and investigate whether these events play a vital role in any price changes.

We examine all the relevant press releases and statements which are found to be related to legal or disciplinary actions by the regulatory authority or the stock exchanges on their websites, news portal, or governmental information bureau from the year 2011 to 2021. For instance, where there are no publications from governmental regulatory or the stock exchange, the newspaper's webpages were used. We collected all the events that were completed with their final investigations and found the specific date of the events on which the announcements were published. Since we were interested in finding the share price reactions due to the event announcements, we have built a database of all the event news for the listed companies or subsidiaries of those listed companies in MS excel before we model in R programming. We excluded all the events for the delisted or non-listed firms. After careful consideration of the events, we decided to work with 163 cases for all the stock exchanges.

6.1 Sample selection

The data set has been created by gathering events from reliable sources from 2011 to 2021. After checking that the company of the penalty was listed, the event was listed in an excel sheet. Thereafter the selection criteria were set for later cleaning of data.

According to Brown & Warner (1985), one can get a few difficulties while using daily data to conduct an event study. They added that the market model gives well specified and powerful outputs when we use the daily returns. Thus, we use the daily stock price in our analysis.

6.1.1 Time horizon

In the study, there has only been a focus on events from the past ten years: 2011-2021. The time horizon had to be big enough to gather a substantial number of events, at the same time as avoiding the financial crisis of 2007-2008 due to disturbance in the market. Furthermore, to prevent influence by the heavy downfall in the world economy in March 2020, events which are having an overlapping event window or estimation window will be withdrawn from the sample.

6.1.2 Data collection process

As the purpose of the thesis is to investigate whether stock returns react to legal penalties or not, the events have been gathered by searching through press releases from the stock exchanges, the companies themselves, government pages, and news.

For some countries, it has been harder to find penalties than for others. Hence, the investigation process has been different for all countries. For Norway, all the legal penalties have been found by searching for “Foreleg,” “Gebyr,” “Finansdepartementet,” “Konkurransetilsynet” and “fine” on NewsWeb.OsloBors.no, as well as Google, has been used to find events. Whenever there has been a positive hit for a legal penalty on google for listed Norwegian companies, the event date has been searched for on NewsWeb and then the press release has been identified and noted.

For the US, the legal penalties have been gathered by using google to find events. In the search for fines for US companies, several articles about “the biggest fines in history” came up. From there, all companies from the articles were checked up against NASDAQ. Those of which were listed were noted. Further, the events were checked up against press releases from the companies. Because of several small explicit lists of fines during times, more events were found on the web page of the U.S. Securities and Exchange Commission and the U.S. Department of the Treasury. Here, the keywords of use were “Civil penalty” and “penalty.” Just as for the articles, all the companies which have been penalized were checked up against NASDAQ.

On the web pages for the U.S. Securities and Exchange Commission and U.S. Department of the Treasury, there were penalties for abroad firms as well. These were checked up upon as well, and if they were listed on one of the stock exchanges that we are going to investigate, we noted them in our Excel sheet. Companies for both Japan and UK were found.

In the search of events for the UK, it was not possible to find news on the London Stock Exchange from further back in time than 2019. Hence, all the companies had to be investigated one at a time. Online, there is a webpage tracking all violations by company name, called Good Jobs First. On this page, all companies from the LSE were investigated, and events were noted if the event were within the time horizon of choice and if the main source were either a governmental press release or a press release from attorneys. Both large penalties and small penalties were chosen.

In the search for Chinese stock data, even though it was not easy to get all the price and event information due to some regional restrictions in the web server or internet, we managed to collect all the relevant events from the Shanghai Stock Exchange website, China stock market & Accounting research (CSMAR) database, Security and Exchange commission website of US, financial times news, global times of China and other international news portals. All the companies that were chosen for our study are listed in the Shanghai- and Shenzhen stock exchanges.

All the data for the events that happened in Japan were mainly collected from the news portal of Tokyo stock exchanges and Japan exchange group. Some of the events were collected from international news portals as it was not available in any governmental or stock exchange news sources.

All the stock prices were collected from Yahoo Finance and for some companies, the information was gathered from Bloomberg. Information was only collected from Bloomberg if certain values were missing from Yahoo. The stock prices had a period of maximum 1st of October 2009 for companies which has been listed for a long time, for companies listed after 1st of October, we used prices as far as it goes. The latest date for company prices was the 4th of October 2021. All of the data was gathered 6th of October 2021 from Yahoo, while the data from Bloomberg was gathered 21st of October.

Information such as market cap was gathered from the web page for stock exchange for Norway, US., and UK. and from Yahoo Finance for the Chinese and Japanese firms, while average trading volume was only gathered from Yahoo Finance. The market caps were gathered 17th and 18th of October 2021, while the average trading volume was gathered 10th of November.

Since the Market Model is the one that is being used for the analysis in this thesis information about the different markets had to be gathered. All the market data was gathered from the Refinitiv Eikon database. The indexes were chosen based on which country the company is listed in. Hence, for Norwegian companies, the market index was OSEBX, while for the US, Companies the NASDAQ Composite Index was used. For the UK. Companies, FTSE 250 were gathered, and for Japan, the index which was used was Tokyo SE JPX - Nikkei Index 400. Lastly, for China two different indexes were used since the companies gathered are evenly listed on Shenzhen- and Shanghai stock exchange. Hence the indexes used for the companies listed on the Shanghai stock exchange is Shanghai Composite Index, and for companies listed on the Shenzhen stock exchange, the Shenzhen Composite Index was used. The market indexes were gathered 15th of November.

6.1.3 Selection criteria

In the investigation, if legal penalties have a significant impact on the stock price, it is important to select selection criteria such that there are no confounding events to impact the stock returns, at the same time as the average trading volume must be high enough such that the trades may have an impact on the stock price. Hence the selection criteria for the firms will be as follows:

The first selection criteria are that **there is no significant event at the same time as the estimation window or event window**. If there is a cofounding event at the same time as normal returns are estimated, then the normal return will be influenced by another event and the abnormal return might not be significant. This also applies to a cofounding event during the event window. If there are two events at the same time, it is impossible to know how much of the abnormal return belongs to both events.

The second criteria which are chosen are that the company **must have an average trading volume above 50 000 trades**. This is because we want stocks that have a high frequency of trading such that we know that the stock price reflects several trades and not just a few trades.

Since it is stock returns that will be analyzed, the third criteria are naturally that all the companies **must be listed** both today and at the time they got the penalty.

The fourth and last criteria which are set is that there is **no missing data around the event date**. For some days such as holidays, there is data that is not available (NA's), in these cases, NA's will be deleted and not be considered a trading day. When there is still missing data around the event day, the event will be deleted from the sample.

6.2 Data Cleaning

The initial sampling of data consisted of 192 observations. From the initial sampling, 5 events had to be extracted from the sample due to overlapping of estimation window or event window and the economic downfall in March 2020.

Furthermore, companies with an average trading volume of less than 50 000 are deducted from the sampling. Hence 14 events had to be taken out of the sample.

Lastly, as the companies had to be both listed and not have missing data around the event date, yet another 10 events were to be withdrawn from the sampling. Mostly due to a lack of data since the company was not listed at the time the penalty was given. One event was deducted because the market had missing values around the event date.

After the data cleaning, the sample consists of 163 events. These events are listed in Appendix A2.

Before calculating the return from stock- and market prices, the normal performance, and abnormal return, the NA values were deleted for only the stock prices. When deleting days for the companies which consisted of NA's, the same day was also deleted for the market. The assumption that was made here was that there were only NAs for days which was not a trading day. Hence normal return was calculated from the remaining days for both the stock and the market. How the normal return was calculated can be seen in Appendix A1.

6.3 Descriptive statistics

This subsection describes the data sample after the data cleaning. The sample consists of 163 companies divided across five countries. We extracted the companies for each group to create a table of the market capitalization and the penalty sizes. For easier comparison, all the market capitalization and penalty sizes have been converted to USD with the exchange rate given 19th of November.

Table 1 describes the average, median, minimum, and maximum market capitalization of each country represented in this thesis.

	Average	Median	Minimum	Maximum
Norway	6 868 633 418	343 198 685	4 324 803	84 579 117 899
USA	236 451 344 087	28 505 848 761	271 903 398	2 511 140 325 600
UK	49 402 220 668	35 840 618 464	3 289 288	183 701 155 950
Japan	21 994 806 675	5 580 311 716	32 389 288	247 010 825 183
China	12 207 675 942	2 433 564 000	242 886 600	85 508 478 951

Note: All the values are converted in US dollars. The average is for 163 companies, 5 countries.

Table 1: Company statistics

The first column depicts the average market cap for each country. From this, we can see that the average market cap for the U.S, a value of 236 billion, is almost five times bigger than the second highest market cap, which is for the UK and has a value of 49 billion. The third-highest average in Japan of approximately 22 bn dollars, followed by China of 12 bn and Norway of 7 billion. This can be compared to the biggest markets in the world, only mentioning the stock exchange used in this thesis. The largest due to market value is NASDAQ, then Japan exchange group, followed by Shanghai-, Euronext (OSEBX), Shenzhen- and London stock exchange, according to a study by Ali (2020).

The second column shows the median of the market caps, and if we compare these to the average, we can see that there is an indication of a skewed distribution and that most of the firms have a lower market cap than the average.

Furthermore, from the third and fourth columns, we can see the minimum and maximum market caps, and that there is an enormous difference in the selection of market caps. The maximum values are high, and all the countries have a maximum value of billions and far above the median, which increases the average.

Table 2 describes the number of penalties in each country, the average, median, minimum- and maximum values of the penalties. Additionally, we added the percentage of average penalties imposed in terms of the average market capitalization of each country.

	Penalties	Average	Median	Minimum	Maximum	% of market cap
Norway	19	11 589 903	67 945	15 778	126 681 513	0.17
USA	46	1 369 399 459	1 604 663	19 125	18 700 000 000	0.58
UK	37	328 654 334	25 000 000	50 000	5 500 000 000	0.67
Japan	32	393 301 388	55 550 000	87 866	9 000 000 000	1.79
China	30	6 034 508	121 950	4 695	72 190 000	0.05

Note: All the values of the penalties are converted to US dollars. The last column: % of market capital is referred to as the fraction of penalty amount relative to the market capitalization.

Table 2: Penalty statistics.

The first column in Table 2 shows how many penalties belong to the companies in each country, or how many events are in each country.

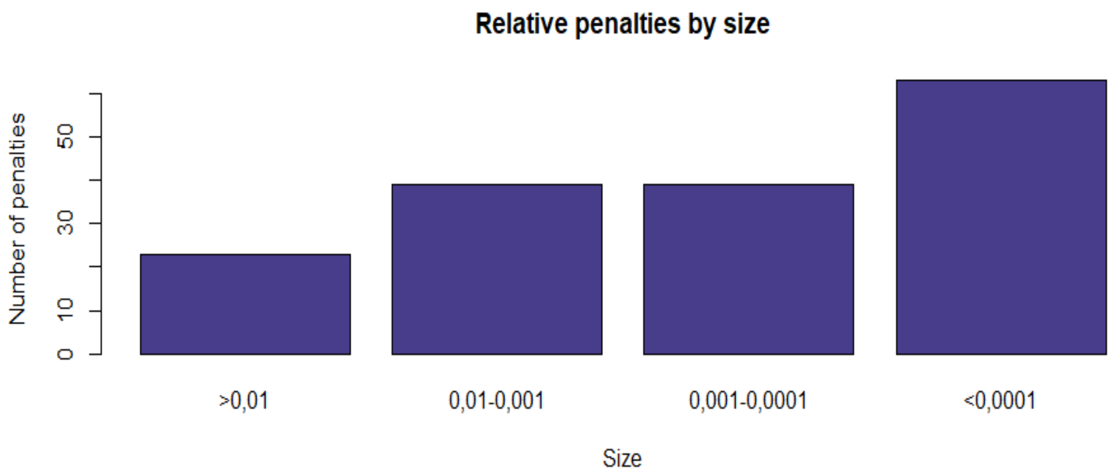
The second table shows again the average, but Table 2 shows the average penalty size. The biggest average is for the U.S firms with a value of 1 208 bn, followed by the UK companies of approximately 303 bn. This is around four times the size of the UK. The third biggest average penalty by country is Japan, followed by China and Norway. This is the same order as for the market cap.

The third column presents the median penalty size. Again, the table shows a skewness in the distribution of penalty sizes, which can be explained by the high maximum penalties in the fifth column.

In the fourth and fifth columns, the minimum and maximum penalty sizes are shown. From this, we can see a big spread in penalty sizes.

In the sixth and last column, the percentage of the average penalty size to the average market cap is shown. From there we can see that the average penalty is less than one percent of the average market cap. For these percentages, the order does not follow the same order as for the average market cap and average penalty size. The UK has the highest percentage of the market cap of 0,6%, the second-highest in U.S. penalties with 0,5%, followed by Japan with 0,4%, Norway with 0,1%, and China with 0,08%.

Figure 2 shows the distribution of the relative penalty size grouped in four categories. In contrast to the tables above, the events are grouped by relative size in local currencies.



Note: Vertical axis refers to Number of penalties, horizontal axis refers to the penalty size relative to the market capitalization of firms, which categorized in four different groups in terms of their relative penalty size.

Figure 2: Relative penalties.

The x-axis defines the groups into which the relative penalties are divided. The four groups which are given are relative penalties above 1%, then the relative penalties in between 1% and 0,01%, furthermore there is the group of relative penalties in between 0,01 % and 0,001 %. Lastly, the relative penalties are less than 0,001 %. We can see that the smallest sample is the penalties with a relative size of 1%, with a distribution of 23 events, then we have the second group of 39 events. The third group has a distribution of 38 events, and the fourth and largest group has a distribution of 64 events.

7. Analysis

The main purpose of our study is to find answers to a major question: *How does the stock market react to the legal penalties announced in various financial markets?* We followed the event study methodology by MacKinlay (1997).

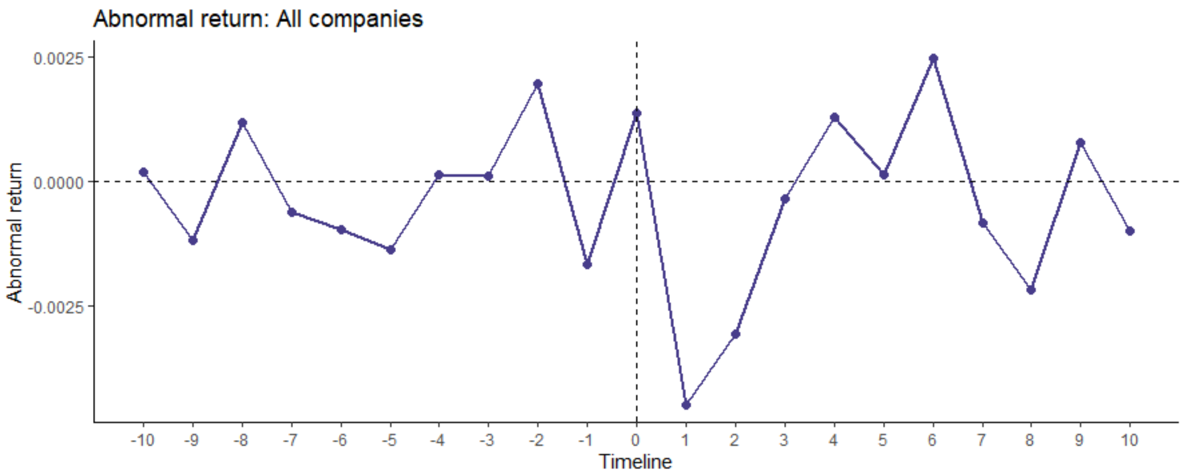
Before testing each hypothesis, the abnormal return (AR) and cumulative abnormal return (CAR) for each company were calculated with their belonging t-values. This was calculated by estimating the normal performance related to the market performance like equation 1.1 in section 5.2.1. To justify the calculation of the normal performance, the beta values for each company are listed in Appendix A2. Furthermore, the abnormal return was calculated with equation 1.2, by subtracting the normal performance from the real return. Lastly, we could find the AR for the event date and find the CAR by aggregating the AR from the event window τ_1 to τ_2. The AR is the abnormal return for the event day itself, which is referred to as [0]. The CAR is the cumulative abnormal return for the four-event windows used, which is [-1,1], [-1,2], [-2,5] and [-5,5]. After creating a table of all the values, the hypothesis could be investigated.

The analysis part consists of four parts: one part for each of the sub-analysis and the cross-sectional regression analysis. The first part will be a presentation of the impact of a penalty on company return. The second part will present the impact of a penalty on companies in four separate groups. The third part will explain the impact on the different countries represented in this thesis, while the fourth and last part will describe the cross-sectional regression analysis and its results.

7.1 Results of the event study

7.1.1 Hypothesis 1 - The impact on company return

The first hypothesis is: *The announcement of a legal penalty is followed by a negative abnormal return.* To visualize the movements of the AR for all the companies the average movements of all the stock returns are depicted in Figure 3.



Note: x-axis refers to the number of days before and after the event day, while y-axis depicts the average abnormal return.

Figure 3: AR for all companies.

From Figure 3, it can be observed that stock returns have a movement that is quite volatile. The day before the event date, the abnormal return has a negative value of 0.25 percent, this is followed by a positive abnormal return close to 0.1%. The AR has a sharper drop on the first day following the event date, with a negative AR close to 0.5 percent, and then progressively goes toward positive AR over the next two days.

By observing the movements close to the event date, there could potentially be a leakage of information one day before the announcement of a legal penalty. As mentioned, the abnormal return for the event date is positive. Hence, these movements could be random. After the event date, there is a downfall which is an obvious deviation from previous movements. This can indicate a reaction to the announcement such that H1 is true but cannot be determined before analyzing the t-stat, which is portrayed in Table 3 below.

Timeline	Market Model
[0]	0.001 (0.597)
[-1,1]	-0.005 (-1.4)
[-1,2]	-0.007** (-1.969)
[-2,5]	-0.005 (-0.828)
[-5,5]	-0.004 (-0.685)
Observations	*163*

Note: * p<0.01, ** p<0.05, *** p<0.01, values in the parentheses illustrate the t-values. The outcomes are captured from the market model.

Table 3: AR and CAR for hypothesis 1.

In Table 3 we can observe that the average event in the sample will have a positive AR on the event date, however, the average CAR would be negative for every window. Which is consistent with the Figure above. Positive abnormal return on the event date was not expected and could imply that there is some inefficiency in market reactions.

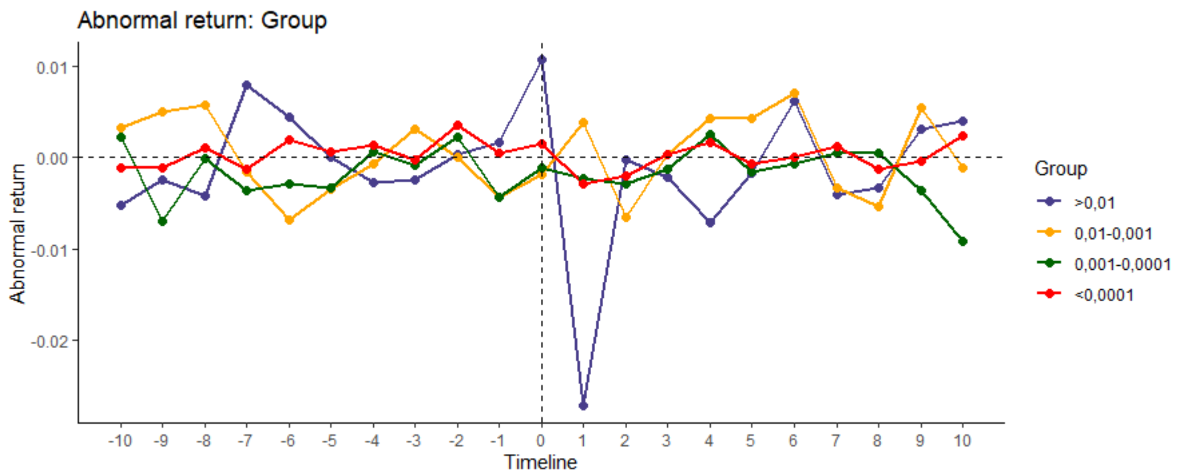
The most extreme reaction is within the window [-1,2]. Here, there is a statistically significant abnormal return of 0.7% percent. Furthermore, the window of one day before the event to one day post the event is close to significant, which argues in favor of a market reaction during the window [-1,1]. Due to the significance in the window one day before the event till two days after, there is associated negative abnormal return to the event.

7.1.2 Hypothesis 2 - Impact by the relative size of the penalty

The second hypothesis: *The penalty size relative to the market capitalization is not relevant to the abnormal return,* was investigated. Here it was analyzed if the penalty size relative to the company's market capitalization had any effect on the stock return. To differentiate the penalty sizes, the events were divided into four groups:

- “>0,01”: When the relative penalty was above 1%.
- “0,01-0,001”: When the penalty size was in between 1% and 0,1%.
- “0,001-0,0001”: When the penalty size is in between 0,1% and 0,01%.
- “<0,0001”: When the penalty size is less than 0,01%.

Figure 4 shows how the AR return has developed both before and after the event occurred for all groups.



Note: x-axis refers to the number of days before and after the event day, while y-axis depicts the average abnormal return. Different colors of lines in the graph refer to different relative penalty size groups.

Figure 4: AR for each group.

The observation from Figure 4 is that the group of the penalties above 1% has a positive AR return close to 1% on the day of the event. On the first day after the event, the AR is negative with a value of less than 2%. The movements for the event day and the day after both look like a clear reaction to the announcement. Though this cannot be determined by a graph, therefore, the significance will be presented in Table 4. In contrast, the three other groups, “0,01-0,001”, “0,001-0,0001” and “<0,0001” do not have movements that indicate any effect from penalty announcements. The three other groups are moving very much like random walk movements close to zero.

Timeline	Relative Penalty Size			
	Group 1 >0,01	**Group 2 0,01-0,001**	**Group 3 0,001-0,0001**	**Group 4 <0,0001**
[0]	*0.011**** *(3.130)*	*-0.003* *(-0.534)*	*-0.002* *(-0.419)*	*0.002* *(0.648)*
[-1,1]	-0.015** (-2.330)	-0.001 (-0.067)	-0.009 (-1.218)	-0.001 (-0.230)
[-1,2]	-0.015** (-2.409)	-0.008 (-0.827)	-0.011 (-1.552)	-0.003 (-0.630)
[-2,5]	-0.023** (-2.256)	0.001 (0.084)	-0.012 (-0.986)	0.003 (0.491)
[-5,5]	-0.028** (-2.284)	0.004 (0.237)	0.015 (-1.033)	0.005 (0.626)
Observations	*23*	*39*	*38*	*63*

Note: * p<0.01, ** p<0.05, *** p<0.01, values in the parentheses illustrate the t-values.

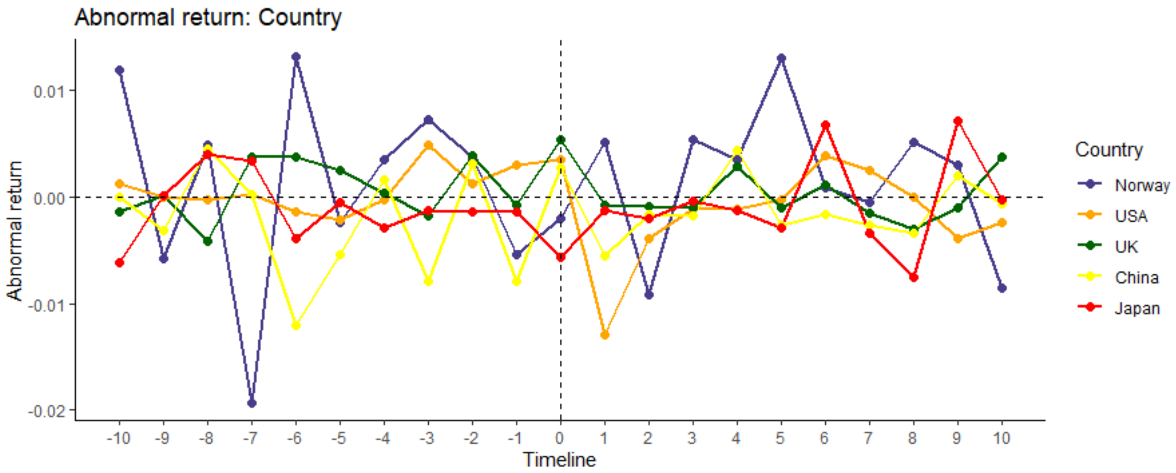
Table 4: AR and CAR for each group.

From Table 4, the first group has a statistically significant positive abnormal return on the day of the event. The positive AR has a value of 1.1%, with a t-value of 3.13. This is followed by negative cumulative abnormal returns for each of the windows used. The event window [-1,1] has a CAR of -1.5% with a t-value of -2.33. Then there is [-1,2], which has a negative CAR of 1.5 percent and a t-value of -2.41. Followingly, the event window of [-2,5] has a CAR of -2.3% with a t-value of -2.26, while the last window of [-5,5] has a CAR of -2.8% with a belonging t-value of -2.28. For all event windows, the first group is statistically significant. For the second, third, and fourth groups, we have no statistical significance for the results.

Due to the significance of group 1, there is associated abnormal return when the penalty size is above 1%. The three other groups do not have abnormal returns which are statistically different from zero, hence, there is no related abnormal return when the penalty is below 1% of market capitalization.

7.1.3 Hypothesis 3 - Impact by each country

The third and last hypothesis is: *The penalty impact will differ relative to which country the company is listed in.* To conduct this, all the events were grouped by which country it was listed in, then a subset was made extracting all events for each country. The average abnormal return for the companies in each country is presented in Figure 5.



Note: x-axis refers to the number of days before and after the event day, while y-axis depicts the average abnormal return. Different colors of lines in the graph refer to different countries of interest.

Figure 5: AR for each country.

It is possible to observe the average abnormal return for all countries in Figure 5. The Norwegian average is volatile and looks unaffected by penalty announcements. For the U.S., there is a market reaction on the first day after the event. UK and Japan look less volatile than Norway and have contradictory reactions on the event day. While the UK has a positive reaction on the event day, Japan has a negative reaction. Lastly, China has oscillated movements in abnormal return before the event day, and a positive AR on the event day. After the event day, the average abnormal return is more stable in the sense that they move close to zero without extreme movements. No conclusion can be drawn by the Figure; hence the AR for the event day and CAR will be presented in Table 5.

Timeline	Countries of Interest				
	Norway	**USA**	**UK**	**Japan**	**China**
[0]	-0.002 (-0.261)	0.004 (1.072)	0.005** (2.133)	-0.005 (-0.807)	0.002 (0.480)
[-1,1]	-0.003 (-0.197)	-0.006 (-0.959)	0.004 (0.912)	-0.009 (-0.849)	-0.010* (-1.682)
[-1,2]	-0.012 (-0.870)	-0.009 (-1.543)	0.003 (0.692)	-0.011 (-1.033)	-0.012** (-1.982)
[-2,5]	0.013 (0.612)	-0.011 (-1.072)	0.009 (1.306)	-0.018 (-1.041)	-0.009 (-0.921)
[-5,5]	0.022 (0.852)	-0.007 (-0.620)	0.010 (1.312)	-0.023 (-1.132)	-0.016 (-1.351)
Observations:	***19***	***46***	***37***	***31***	***30***

Note: * p<0.01, ** p<0.05, *** p<0.01, values in the parentheses illustrate the t-values.

Table 5: AR and CAR for each country

The AR and CAR in Table 5 show no significance different from zero, except the event date for the UK and the window one day before the event to two days after for China. This indicates that there is no difference between countries' reactions to penalty announcements. To test if there is a difference, a t-test was conducted to undermine that the market reaction is not different between countries. The results are presented in Appendix A3 and prove that the samples are indifferent to countries. This extension of our analysis helps us build a conclusion on the third hypothesis. Therefore, there is not any distinction between the selected markets' reaction.

7.2 Results of cross-sectional regression analysis

This section represents outcomes from the cross-sectional regression analysis on average abnormal return (AAR) and cumulative abnormal return (CAR) in the penalty size and market cap samples. A key assumption here is that all the events in our study are independent of each other and are not clustered through time. Therefore, we want to investigate whether there are other variables other than relative penalty size that can spell out the variation in CAR between the various events. Additionally, we have created some selected binary (dummy) variables that explain how the abnormal return reacts when we include event-specific variables.

We divided this section into two parts; First part defines the impact of only the relative penalty size on CAR, while the second part explains CAR´s behavior by adding additional event-specific variables in the model.

7.2.1 Cumulative abnormal return and the Relative penalty size

The following table explains the cross-sectional analysis where we depict the coefficients of the relative penalty size (RP) and the t-statistics in parentheses right underneath the coefficient's values. The relative penalty size is the ratio between the penalty size and the market capital of a firm. In this regression model, we study the consequences of relative penalty size on cumulative abnormal returns. Our results find that, even though the coefficients are insignificant on the day of the penalty announcement, there is an impact when we change the event windows. These changes indicate the significance of relative penalty size in the analysis. On the other hand, the reduction of the t-values in the model as time goes on indicates the gradual attenuation of the effect after a certain period and the abnormal returns start being the firm’s normal return.

Cross-sectional Regression of CAR on Relative Penalty Size

	Dependent variable: CAR				
	[0]	[-1,1]	[-1,2]	[-2,5]	[-5,5]
	(1)	(2)	(3)	(4)	(5)
RP	0.044	-0.355***	-0.335***	-0.557***	-0.639***
	(0.661)	(-3.690)	(-3.391)	(-4.404)	(-4.535)
Constant	0.001	-0.001	-0.004	0.002	0.003
	(0.215)	(-0.161)	(-0.852)	(0.292)	(0.424)
Observations	163	163	163	163	163
R^2	0.003	0.078	0.067	0.107	0.113
Adjusted R^2	-0.003	0.072	0.061	0.102	0.108
Note:	*p<0.1; **p<0.05; ***p<0.01				

Note*:* This table shows the results from the cross-sectional analysis conducted on the Relative Penalty size. Relative penalty size is the ratio between the Penalty size of each company and the total market capital of each company. Here, the dependent variables are the Cumulative average abnormal return, which is calculated following equation 1.7 in our methodology. The CAR calculation is measured over five different event windows respectively on Event Day, [-1,1], [-1,2], [-2,5], and [-5,5]. In the table, we reported the coefficient of explanatory variable and standard error which is adjusted for heteroscedasticity and multicollinearity.

Table 6: Cross-sectional regression results of CAR on relative penalty sizes.

This analysis also reveals that the investors do have a response to the penalty announcements even though their reactions come with a delay after the event dates. If we see the coefficients of RP in the table, we observe that event window [-5,5] gives us a more significant coefficient of –0.639 with a 99% Significance level. The results also exhibit that the coefficient of Relative Penalty size is significant for all the event windows except the event day. Intuitively, that makes sense since a larger penalty size relative to the size of the firm is a strong signal of affecting the return negatively. This analysis helps us produce a conclusion that a firm´s abnormal return does change if the penalty size and the market capital vary across the companies.

7.2.2 Cross-sectional Analysis of CAR on the event-characteristics

This section unravels whether there are any variables associated with the negative development in cumulative abnormal return in the event window [-1,1], [-1,2], [-2,5], and [-5,5] along with the event day. According to Laure Bartz (2020), some parameters have an enormous impact due to the sanctions, but they are not the most straightforward. Therefore, it is necessary to find the most relevant variables that mostly highlight the event characteristics. To conduct the regression, we created 9 binary variables for countries to examine if there is any significant impact on the abnormal returns or if the abnormal return changes depending on the geographical region. Additionally, we generated 4 more dummy variables that categorize the penalties by the size of the penalty amount, severity of the crime for the penalty, penalty from local or foreign authorities, sources of news, and the source of penalty- by the court or financial regulatory authorities.

<u>Insights behind selecting independent variables:</u>

Following MacKinlay (1997), it is very crucial to define the regulatory variable for the cross-sectional analysis, since these variables can indicate the magnitude of the abnormal returns of the firms and to what extent any announcements or events can change the company returns. There are two characteristics of variables, we could use in our study; firstly, the variables that define the firm´s characteristics, secondly, the variables that define the event characteristics. We are considering variables that as investors can rationally use the event characteristics to decide or forecast the probability of the event occurring, in our case the penalty announcements.

There are 5 event-specific variables that we have used for our research besides relative penalty size to see whether there is any greater impact or relativeness of those variables on the cumulative abnormal returns. First, it is assumed that depending on the different geographical regions, the abnormal return could vary since different ***countries*** have different investment approaches, governmental regulations, reactions of the investors to the events, etc. Additionally, the countries we have chosen for our study are different in terms of their size of the economy, GDP, stock exchanges, and currency values. So, it makes sense to keep the countries as a variable to see what happens to the company´s return and stock prices due to the events that occurred. Secondly, another variable we decided to use in our study is the ***severity of the crime*** of the companies for which they get penalties. The market will react differently by seeing the degree of the crime conducted. The more serious the reason for penalties, the more the market reacts negatively. The third variable is the ***foreign penalty*** which is chosen to see if there are any momentous changes in the abnormal return if the penalty is given by a local authority or a foreign authority. The next variable is defined as ***Court penalty*** which refers to the penalty announcements that are given by either any financial regulatory authority or by the court or other law institutions. We want to observe if there is any notable movement in the abnormal return when the penalty is given to parties. Lastly, we have chosen ***News*** as our event-specific variable since it is apparent that the reaction of the investors might alter depending on the source of the news. For this variable, we assume that, if the penalty announcement is published on local or international news platforms, it might have different effects compared to the very official press release or publications.

Therefore, ***three*** regressions had been conducted for each of the event windows to see the variation in the results.

Regression model 1: CAR on Relative penalty Size, Country Dummies

Regression model 2: CAR on Relative penalty Size, Severe crime, foreign penalty, Regulator (Financial institution or by the court).

Regression model 3: CAR on all variables including the source of News.

Assumptions of Dummy Variables:

- *Dummy for each country:* This variable is coded to 1 for each of the countries if the event has happened in that specific country, otherwise 0.
- *Dummy for Regulators:* This variable is coded to 1 if the penalty is given by financial regulators, otherwise by the court.
- *Dummy for foreign or local penalty:* This variable is coded to 1 if the penalty is given by a foreign authority, otherwise by the local authority.
- *Dummy for the severity of the crime:* This variable is coded to 1 if the penalty is severe, otherwise 0.
- *Dummy for news:* This variable is coded to 1 if the penalty is announced on a newspaper, another public medium, otherwise in the official notice or pages.

Description of the regression results:

This section describes all the results of cross-sectional regression with different event windows.

Cross-sectional reggression: On Event day

	Dependent variable: CAR		
		[0]	
	(1)	(2)	(3)
RP	0.057	0.050	0.058
	(0.828)	(0.718)	(0.824)
Norway	0.005		0.005
	(0.464)		(0.372)
UK	0.012		0.015
	(1.236)		(1.393)
USA	0.011		0.009
	(1.161)		(0.972)
China	0.009		0.010
	(0.901)		(0.831)
Severe Crime		-0.008	-0.010
		(-1.104)	(-1.307)
Foreign Penalty		-0.0003	0.003
		(-0.044)	(0.323)
Court Penalty		0.003	0.003
		(0.372)	(0.362)
News			0.001
			(0.130)
Constant	-0.007	0.0001	-0.009
	(-1.026)	(0.006)	(-0.775)
Observations	163	163	163
R^2	0.015	0.012	0.027
Adjusted R^2	-0.016	-0.013	-0.031
Note:	*p<0.1; **p<0.05; ***p<0.01		

Note: Values in the parentheses refer to the t-value for each variable. The chronological numbers in the column headings are the regression model numbers. all the stars (*; **; ***) beside the numbers indicate the significance level of the test statistics at 10%, 5% 1% level, respectively.

Table 7: Cross-sectional regression of AR on event-specific variables on the event day.

Following *Table 7*, We see that even though the penalty is announced on a specific day, the abnormal return has no effect due to the announcement. This could be observed due to the late response of the market or investor for the event. The table also indicates that on the event day, all the variables selected are not statistically significant which pushes us to conduct the regression for the next event window [-1,1].

Cross-sectional reggression: Event Window [-1,1]

	Dependent variable: CAR		
	[-1,1]		
	(1)	(2)	(3)
RP	-0.368***	-0.376***	-0.379***
	(-3.721)	(-3.800)	(-3.759)
Norway	-0.004		0.004
	(-0.231)		(0.211)
UK	0.006		0.015
	(0.437)		(0.963)
USA	-0.004		-0.002
	(-0.269)		(-0.160)
China	-0.012		-0.005
	(-0.822)		(-0.305)
Severe Crime		-0.009	-0.014
		(-0.878)	(-1.251)
Foreign Penalty		0.007	0.010
		(0.655)	(0.830)
Court Penalty		-0.005	-0.002
		(-0.382)	(-0.120)
News			0.007
			(0.698)
Constant	0.002	0.003	-0.003
	(0.164)	(0.219)	(-0.200)
Observations	163	163	163
R^2	0.088	0.089	0.106
Adjusted R^2	0.059	0.066	0.053
Note:	*p<0.1; **p<0.05; ***p<0.01		

Note: Values in the parentheses refer to the t-value for each variable. The chronological numbers in the column headings are the regression model numbers. all the stars (*; **; ***) beside the numbers indicate the significance level of the test statistics at 10%, 5% 1% level, respectively.

Table 8: Cross-sectional regression of CAR on event-specific variables with window [-1,1].

Since we have not found any statistical significance from our first part of the event window which is on the event day, we conduct the next analysis which is depicted in *Table 8*. This table shows the prominent level of significance for relative penalty size on the cumulative abnormal return. Even though we have used all the event-specific variables in this event window, our study finds no notable impacts on the return by those additional variables. This insignificance indicates that even though the events are different in terms of countries, crime severity, source of news, or regulators, the market or investor only reacts when the size of the penalty differs along with the company´s market capitalization.

Cross-sectional rggression: Event Window [-1,2]

	Dependent variable: CAR		
	[-1,2]		
	(1)	(2)	(3)
RP	-0.352***	-0.364***	-0.365***
	(-3.464)	(-3.577)	(-3.529)
Norway	-0.011		0.002
	(-0.621)		(0.115)
UK	0.007		0.017
	(0.520)		(1.109)
USA	-0.005		-0.001
	(-0.362)		(-0.087)
China	-0.012		-0.001
	(-0.769)		(-0.073)
Severe Crime		-0.002	-0.008
		(-0.215)	(-0.695)
Foreign Penalty		0.012	0.015
		(1.003)	(1.190)
Court Penalty		-0.006	-0.003
		(-0.494)	(-0.222)
News			0.009
			(0.858)
Constant	-0.001	-0.002	-0.010
	(-0.063)	(-0.147)	(-0.585)
Observations	163	163	163
R^2	0.080	0.082	0.100
Adjusted R^2	0.051	0.058	0.047
Note:	*p<0.1; **p<0.05; ***p<0.01		

Note: Values in the parentheses refer to the t-value for each variable. The chronological numbers in the column headings are the regression model numbers. all the stars (*; **; ***) beside the numbers indicate the significance level of the test statistics at 10%, 5% 1% level, respectively.

Table 9: Cross-sectional regression of CAR on event-specific variables with window [-1,2].

From the results of the estimation by using the event window [-1,2] in Table 9, we find more interesting aspects of the analysis. The coefficient of the relative penalty is at its optimal in terms of our study. The values explicitly depict a prominent level of significance in this specific event window. Looking at the t-values in the parentheses, we also see that the main variable (RP) is very much significant as it does not lie between 2 and –2, which is a standard threshold to measure t-statistics.

Cross-sectional reggression: Event Window [-2,5]

	Dependent variable: CAR		
	[-2,5]		
	(1)	(2)	(3)
RP	-0.555***	-0.556***	-0.551***
	(-4.269)	(-4.264)	(-4.186)
Norway	0.016		0.025
	(0.744)		(1.052)
UK	0.017		0.029
	(0.917)		(1.444)
USA	-0.003		-0.003
	(-0.161)		(-0.149)
China	-0.007		0.0001
	(-0.377)		(0.004)
Severe Crime		-0.011	-0.019
		(-0.805)	(-1.291)
Foreign Penalty		0.014	0.023
		(0.915)	(1.404)
Court Penalty		0.010	0.013
		(0.587)	(0.794)
News			0.014
			(0.998)
Constant	-0.002	-0.007	-0.023
	(-0.134)	(-0.429)	(-1.054)
Observations	163	163	163
R^2	0.123	0.116	0.148
Adjusted R^2	0.095	0.094	0.098
Note:	*p<0.1; **p<0.05; ***p<0.01		

Note: Values in the parentheses refer to the t-value for each variable. The chronological numbers in the column headings are the regression model numbers. all the stars (*; **; ***) beside the numbers indicate the significance level of the test statistics at 10%, 5% 1% level, respectively.

Table 10: Cross-sectional regression of CAR on event-specific variables with window [-2,5].

Table 10 shows the cross-sectional regression analysis of cumulative abnormal returns on different penalty-specific variables. In this table, we observe that the level of significance for all other variables is identical (not statistically significant) except for the relative penalty. It is discernible that even though the event-specific variables have a truly minor impact on the abnormal return, the coefficients of relative penalty size differ from the analysis conducted with the event day window. The value of RP is decreasing in this model which indicates that there might be some correlation with the explanatory variables used in our models. Interestingly, the coefficient of RP is highly significant in all the event windows.

Cross-sectional reggression: Event Window [-5,5]

	Dependent variable: CAR		
	[-5,5]		
	(1)	(2)	(3)
RP	-0.634***	-0.633***	-0.629***
	(-4.398)	(-4.350)	(-4.292)
Norway	0.027		0.032
	(1.138)		(1.168)
UK	0.022		0.031
	(1.078)		(1.399)
USA	0.004		0.002
	(0.217)		(0.103)
China	-0.011		-0.008
	(-0.533)		(-0.332)
Severe Crime		-0.015	-0.022
		(-0.976)	(-1.336)
Foreign Penalty		0.008	0.016
		(0.456)	(0.885)
Court Penalty		0.009	0.013
		(0.499)	(0.703)
News			0.012
			(0.796)
Constant	-0.004	-0.003	-0.020
	(-0.292)	(-0.167)	(-0.817)
Observations	163	163	163
R^2	0.136	0.120	0.153
Adjusted R^2	0.109	0.098	0.104
Note:	*p<0.1; **p<0.05; ***p<0.01		

Note: Values in the parentheses refer to the t-value for each variable. The chronological numbers in the column headings are the regression model numbers. all the stars (*; **; ***) beside the numbers indicate the significance level of the test statistics at 10%, 5% 1% level, respectively.

Table 11: Cross-sectional regression of CAR on event-specific variables window [-5,5].

The results of *Table 11* give us a more interesting view of our study. We see that, with the enlargement of the event window, the coefficient of relative penalty size gets more extreme, which means apart from all other event-specific variables used in our model, the abnormal return is only very much sensitive with the size of the penalty and the firms´ market capital. Additionally, the impacts gradually increase as time goes on as we see the t-statistical level reduces.

Another aspect of this analysis exhibits that, even though the additional event-specific variables have less significance on abnormal return variation, they do have a change in their t-statistic values over different time frames. This is another indication that the abnormal return does have a slight reaction when those variables are taken into consideration.

7.3 Robustness tests

The robustness of the outcomes obtained in the preceding section will be analyzed. Specifically, the estimation of cumulative abnormal return found in section 7.1 will be investigated as they are the foundation of further analysis. Robustness tests have been conducted in this section to see the appearance of heteroskedasticity and multicollinearity in our analysis.

7.3.1 Heteroscedasticity test for cross-sectional regression

From a statistical perspective, we find heteroskedasticity in the regression models when the standard deviation of an estimated variable is not constant, which is observed over various values of an explanatory variable or as connected to prior periods. In our study, we conduct a **Breusch-Pagan** test to see if there is any heteroskedasticity in our linear model and if the error terms are normally distributed or not. BP test is also used to check whether the variance in the errors relies on the values of the explanatory variables. One way to measure the heteroskedasticity is to compare the p-value with 0.05. If the p-value is less than 0.05, then we do reject the null hypothesis, which means there will be no heteroskedasticity.

Models	[0]	[-1,1]	[-1,2]	[-2,5]	[-5,5]
Model 1	BP = 9.5691 **(0.058)**	BP = 12.048 **(0.034)**	BP = 14.331 **(0.014)**	BP = 13.276 **(0.021)**	BP = 9.4275 **(0.093)**
Model 2	BP = 1.9713 **(0.741)**	BP = 14.553 **(0.006)**	BP = 17.331 **(0.002)**	BP = 11.879 **(0.018)**	BP = 10.931 **(0.027)**
Model 3	BP = 17.517 **(0.041)**	BP = 19.955 **(0.018)**	BP = 21.599 **(0.010)**	BP = 20.284 **(0.016)**	BP = 17.557 **(0.041)**

Note: Values in parentheses refer to P-values.

Table 12: Results from studentized Breusch-Pagan test.

In the case of the event day window for models 1 and 3, we see that the p-values are less than 0.05 which indicates that there is no heteroskedasticity in these models while only model 2 gives us a higher p-value compared to the standard of 0.05. This implies that there might be a small inconsistency in the standard deviation for model 2. In the case of the event window [-1,1], all the p-values indicate the absence of heteroskedasticity since the values are less than 0.05 (95% confidence interval). In the case of event window [-1,2], [-2,5], and [-5,5], respectively, we do not find any inconsistencies in the standard deviation of the independent variables.

7.3.2 Multicollinearity test for cross-sectional regression

Per (Wooldridge, 2016), if the correlation between the independent variables is high, then there is a possibility to experience multicollinearity. Checking the imperfect multicollinearity in the models gives us a point of validation in the analysis. We measure the degree of multicollinearity by the value of VIF which means Variance Inflation Factor. Some other research gives the idea of measuring the multicollinearity between variables by considering the values of VIF is larger than 5 or 10, then it is assumed that the model has issues estimating the accurate coefficients. We will measure if there are any multicollinearity between the event-specific variables by considering the following scales:

If, VIF = 1, indicates no correlation between variables

If, 1<VIF<5, indicates a moderate correlation between variables

If, VIF>5, indicates a high correlation between variables

Variables	**All event window VIF**
Relative Penalty	1.076
Norway	1.839
UK	2.106
USA	1.990
China	2.141
Severe crime	1.118
Foreign penalty	1.723
Court Penalty	1.564
News	1.047

Table 13: Exhibition of all the Variance Inflation Factors.

According to the table above, we depicted the results from the VIF tests which are done in R to see if all the independent variables are correlated with each other or not. As we explained earlier in this section about the degrees of the VIF values and their scales, we observe that all the values from the test are indicating that there is no multicollinearity across the variables. There are some variables (the UK and China) that have values of more than 2, which means there is a moderate correlation between those variables compared to others. Since no values are found to be more than 5, we assume that there is no multicollinearity in the models.

8. Discussion

For the discussion, we will discuss the results of the analysis and compare them with what we could expect from previous literature. The three hypotheses will be discussed chronologically.

8.1 Market reaction to legal penalty announcements

The first hypothesis stated that a legal penalty announcement was followed by a negative abnormal return. The overall abnormal return from the analysis tends to have a negative abnormal return after an announcement, it is only for the window [-1,2] that there is a significant negative abnormal return. This result is also followed by a previous study conducted by Nourayi (1994) which found a negative market reaction to the sanction announcements or announcements of the investigations.

To some extent, previous studies are contradictory. Davidson and Worrell (1988), Davidson, Worrell, and Lee (1994), Karpoff and Lott (1993), and Alexander (1999) all have findings that support either negative abnormal return associated with a severe crime or crimes involving a related party. On the contrary, Alexander (1999) found that a crime involving a third party had an average positive abnormal return, which was coinciding with Davidson, Worrell, and Lee's (1994) finding for their whole sample; non-significance. In contrast, Karpoff, Lott, and Wehrly (2005) found a significant negative abnormal return. In addition, Becker (1968) stated that an optimal penalty is an optimal allocation of resources. Hence, it should be sensible that investors would also reallocate their resources to companies that serve the public the most. Therefore, we expected a negative market reaction to most penalties, despite previous research concluding otherwise.

Our findings compared to previous literature are partly expected. We did find associated negative abnormal return, though only one window was significant. We also added a dummy for the severe penalties in the cross-sectional regression and found that there is an associated negative abnormal return with a severe crime, even though it was not significant. The non-significance could be due to the size of the data set which will be discussed in section 9.1.

Our data set had a diverse number of penalties which included severe crimes, third-party crimes, infringement fines, and so on. Hence, we expected to find results coinciding with Karpoff, Lott, and Wehrly (2005) and reallocation of resources by investors. Though our findings coincide with the existing literature of Davidson, Worrell, and Lee (1994) and Alexander (1999), where there was no significance for the data sample for Davidson Et al. and no significance for third-party crime in Alexander’s study.

8.2 Penalty size matters

In the investigation of the second hypothesis, it was investigated whether the size of the penalty relative to the market capital matters. We expected there to reflect the severity of the crime in the relative penalty size. Davidson, Worrell, and Lee (1994) argued that severe crimes are penalized harder by the market than crimes in general. Becker (1968) also added that the more severe a crime is, the higher a penalty is given.

We have a significant negative CAR for each window, but a positive for the event day, in the first group; >0.01. The regression analysis shows that the relative penalty sizes do drive the negative cumulative abnormal return significantly. If Davidson, Worrell, and Lee (1994) are correct that severe crimes have a significant negative market reaction, then our results can indicate that severe crimes are penalized with higher relative penalties, not necessarily high penalties in general as mentioned by Becker (1968).

On the contrary, the ***severe crime*** variable for the cross-sectional regression analysis does not have any signs of driving the abnormal return, though it is close to significant. The fact that it is close to significant can argue in favor to be a driver of abnormal return. If the dataset had been bigger, the results could be more significant, unless there are outliers that drive the abnormal return for the severity dummy. From the previous literature, there is very less evidence that the outliers driving the severity dummy are close to significant.

In summary, the results give us a reason to believe that it is the relative penalty size that matters in the market reaction, not the penalty size. Also, comparing the results to previous literature, we believe that severity is closely related to relative penalty size.

8.3 Market irrelevancy

Our results show that there is no difference between countries’ market reactions to penalty announcements which are unexpected considering previous literature. From Djama (2013) we got to know that the French market had a negative reaction to announcements of investigations, but no reaction to penalty announcements. In contrast, Armour, Mayer, and Polo (2017) found that reputational loss (a negative market reaction) is associated with announcements of regulatory sanctions.

The difference between France and UK is that the Financial Market Regulator in France announces investigations before there is a conviction, while the UK's financial regulatory system only announces a penalty after the investigation is complete. Hence, it indicates that the penalty was already priced in the market in the French case. Our insignificant results for the third hypothesis can imply that the penalties were expected and already priced in the market. On the other hand, in the investigation of the first and the second hypothesis, certain windows and groups were significant, which indicates that not all events are already reflected in the stock price.

If the above-mentioned indications are correct, and the market already expects a penalty for most firms, this can be damaging for the companies' stockholders if the company is wrongly accused of a crime. Our results do indicate no AR significantly different from zero in hypothesis three, at the same time as it is proven to be significant in hypotheses one and two, hence some events might be priced in the market. Therefore, it could be relevant to investigate cases where the market already knows about an investigation of a crime in advance and cases where the market did not know before the prosecution, but a broader investigation than Djama (2013) and Armour, Mayer, and Polo (2017). If it shows that an opening of investigations is harmful to stockholders in cases of firms' innocence, then it could be discussed if announcements of investigations are necessary.

9. Limitations

9.1 Small sample size

A limitation of our study is the sample size. We study 163 events in total, and when dividing them into subsamples for hypotheses two and three, the smallest group had 19 events. A small sample size increases the likelihood of a type II error (Keller, 2017), where an incorrect null hypothesis has failed to be rejected. Hence, in our dataset, there is a risk of a type II error. By potentially increasing the sample size the sample would be more likely to represent the population and the probability of making mistakes would decrease.

The reason behind the size of the data set is due to the time limit, also due to the limit of the authors' knowledge, there is no direct database of penalties given by the government or other legal authorities. It would be possible to gather more events of larger penalties and penalties given by more diverse prosecutors if the period is larger. In addition, penalties for countries such as China and Japan were harder to find due to limited access to foreign pages, especially for China.

9.2 The penalty was anticipated

A second critical assessment to add is if the penalty was anticipated. From Djama (2013) we could see an example of where the penalty was anticipated due to the announcement of an investigation. On the other hand, from the study by Armour, Mayer, and Polo (2017) there was an instance of non-anticipated penalties since the regulatory system does not announce legal action until the investigation is over. If the penalty was anticipated the efficient market hypothesis says that this information should already be priced in the market.

10. Conclusion

This part will summarize our study and represent the significant findings while we describe some recommendations for further research in relevant fields.

10.1 Findings from the study

This study is dedicated to finding the influence of penalty announcements on stock markets in five different countries by quantifying the news of the penalties from diverse sources on the internet. In this study, some unexpected but interesting findings are summarized as below:

For hypothesis 1, the penalty announcement tends to have a negative impact on the stock market return for listed companies in specific stock exchanges. Although the effect comes with a delay, the investors do react in the event of a penalty. Therefore, we can conclude that we find negative abnormal returns due to the penalty announcements. Hence, the first hypothesis is supported.

For hypothesis 2, we wanted to study the effect of the penalty size relative to the market capitalization on the company´s abnormal return. Our study discovers that indeed the relative penalty size influences the abnormal return. When the news of the penalty publishes regardless of their sources of news, the investors looking at the penalty amount and market size of the company commit trades on the stocks of the related companies. Therefore, we draw a conclusion that the bigger the penalties relative to the firm´s size is, the more the negative cumulative abnormal return. Therefore, hypothesis 2 is not supported.

For the last hypothesis, we tend to detect whether the abnormal return varies depending on the different geographical regions. For this reason, we selected five countries that have larger economies. The study finds a noticeable result which points out that even though the country is different, and the company is listed in the different stock exchange, the nature of the investors is indifferent because there is little or no changes in the abnormal return when the country is different. Thus, we can wrap up that hypothesis 3 is not supported.

It is also found from the literature review in the previous section of our study that the announcements or news regarding any legal or financial actions against companies hurt their return. The variation in the returns depends on the severity of the crime committed. Therefore, we can also conclude the relevancy of the outcomes of our analysis with the study on previous research.

10.2 Recommendations and further study

After observing all the findings in our study, it can be concluded with the extension of further study in many interesting ways. First, we took only the penalty announcement into consideration, where we have not included other sanctions and regulatory actions. It will be interesting to see how the market reacts when we include the announcement of sanctions.

Second, we have collected 163 events for our study which could be a limitation of getting more accurate results from our analysis. It would be worth having more events of penalty announcements to get a broad view of the mechanism.

Third, from the discussion, we discussed that it can be relevant to investigate cases where there is a publishment of an investigation and cases where the market did not know of the crime before the prosecution. Hence, further research can compare if there is any differences and maybe look at the regulatory system and improve the system to be more gentle to shareholders.

Fourth, since it is more valid to test the assumptions taken for conducting the analysis, it is necessary to conduct tests to validate the model. We have conducted only the Heteroskedasticity test and Multicollinearity test. Therefore, it is suggested to commit different robustness tests in further research.

Lastly, we only find penalties in general by not looking at the size of the penalty. It is suggested to look at the penalties which are larger in size and try to find those from reliable sources because not all the large penalties are published on the local or international news platforms. On the other hand, it will also be gripping to consider if there is any information leakage before the events which have not been done in this study.

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Appendix

A1 Simple return

In the data processing, the simple return was calculated from the stock price and market price. This was done by using the following equation:

$$R_\tau = \frac{p_\tau}{p_{\tau-1}} - 1$$

Here, p_τ is the price of time τ and $p_{\tau-1}$ is the price of time $\tau - 1$.

A2 Penalties – Full data sample

The table below shows the full data sample after the data cleaning. Here, all the sample firms are listed with company names, the date of the event, fine in local currency, then the fine in USD, followed by the groupings which is the country and the group of relative penalty sizes. Lastly, we added the beta values for all the firms which were calculated by the market model.

	Company	Date	Fine	Fine USD	Country	Group	Beta
1	DNB Bank ASA	2021-05-03	400000000	45080000	Norway	0,01-0,001	1.1638
2	Telenor ASA	2018-06-21	1058608656	126681513	Norway	0,01-0,001	0.7004
3	NEL ASA	2021-02-16	15000000	1690500	Norway	0,001-0,0001	2.0638
4	DNO ASA	2012-09-28	27000000	3042900	Norway	0,01-0,001	1.4041
5	TGS ASA	2017-03-03	85000000	9579500	Norway	0,01-0,001	1.5973
6	Yara International ASA	2014-01-15	295000000	33246500	Norway	0,01-0,001	1.0781
7	Aker BP ASA	2012-09-07	1000000	112700	Norway	<0,0001	1.4337
8	Equinor ASA	2012-08-06	3000000	338100	Norway	<0,0001	0.8967
9	Aker BioMarine AS	2021-08-19	500000	56350	Norway	0,001-0,0001	0.4123
10	Interoil exploration and production ASA	2021-07-01	208000	23442	Norway	0,01-0,001	1.0317
11	Arribatec Solutions ASA	2021-07-01	208000	23442	Norway	0,001-0,0001	0.6896
12	Havyard Group ASA	2020-09-01	203000	22878	Norway	0,001-0,0001	0.7490
13	DNB Bank ASA	2019-06-25	300000	33810	Norway	<0,0001	0.8567
14	DLT AS	2019-05-09	586200	66065	Norway	0,01-0,001	1.0984
15	INSR Insurance Group ASA	2016-08-29	164600	18550	Norway	0,01-0,001	0.4851
16	Hofseth BioCare ASA	2015-07-14	160000	18032	Norway	<0,0001	0.0052
17	Mowi	2012-07-02	602885	67945	Norway	<0,0001	1.1324
18	North Energy ASA	2012-06-15	140000	15778	Norway	0,001-0,0001	0.7371
19	Mowi	2021-09-02	800000	90160	Norway	<0,0001	0.6275
20	JP Morgan Chase & Co	2013-11-19	13000000000	13000000000	USA	>0,1	0.9422
21	Jp Morgan Chase & Co	2013-10-25	5100000000	5100000000	USA	>0,1	0.9542
22	JP Morgan Chase & Co	2015-05-20	892000000	892000000	USA	0,01-0,001	0.9517
23	Bank of America Corporation	2014-08-21	16650000000	16650000000	USA	>0,1	0.9369
24	BP p.l.c	2015-07-02	18700000000	18700000000	USA	>0,1	0.7710
25	General Electric Company	2020-12-09	200000000	200000000	USA	0,01-0,001	0.1837
26	Truist Financial Corporation	2019-03-05	5500000	5500000	USA	<0,0001	0.3179
27	Morgan Stanley	2017-01-13	13000000	13000000	USA	<0,0001	1.2064
28	Credit Suisse Group AG	2016-10-05	90000000	90000000	USA	0,01-0,001	1.7185
29	Bluelinx Holdings Inc.	2016-08-10	265000	265000	USA	0,001-0,0001	0.8576
30	Las Vegas Sands Corp.	2016-04-07	9000000	9000000	USA	0,001-0,0001	1.0358
31	Payoneer Global Inc	2021-07-23	1400301	1400301	USA	0,001-0,0001	0.8971
32	NewTek Business Services Corp	2021-09-09	189483	189483	USA	0,001-0,0001	0.2064
33	Moneygram International Inc	2021-04-29	34329	34329	USA	<0,0001	0.5661
34	Berkshire Hathaway Inc	2020-10-20	4144651	4144651	USA	<0,0001	0.7392
35	Keysight technologies Inc	2020-09-24	473157	473157	USA	<0,0001	0.9379
36	Comtech Telecommunications Corp.	2020-09-17	894111	894111	USA	0,01-0,001	0.8330
37	Deutsche Bank Aktiengesellschaft	2020-09-09	583100	583100	USA	<0,0001	1.0038
38	Apple Inc	2019-11-25	466912	466912	USA	<0,0001	1.2154
39	General Electric Company	2019-10-01	2718581	2718581	USA	<0,0001	0.9861
40	PACCAR INC	2019-08-06	1709325	1709325	USA	<0,0001	0.6925
41	Expedia Group Inc.	2019-06-13	325406	325406	USA	<0,0001	0.6273
42	The Western Union Company	2019-06-07	401697	401697	USA	<0,0001	0.4352
43	Stanley Black & Decker Inc.	2019-03-27	1869144	1869144	USA	<0,0001	0.9057
44	e.l.f Beauty Inc	2019-01-31	996080	996080	USA	0,001-0,0001	0.8380
45	JP Morgan Chase & Co	2018-10-05	1500000	1500000	USA	<0,0001	0.6562
46	Dentsply Sirona Inc	2017-12-06	1220400	1220400	USA	<0,0001	0.3721
47	Exxon Mobil Corporation	2017-07-20	2000000	2000000	USA	<0,0001	0.0560
48	American International Group Inc	2017-06-26	148698	148698	USA	<0,0001	0.2749
49	National OilWell Varco	2016-11-14	5976028	5976028	USA	0,01-0,001	0.9040
50	Halliburton Company	2016-02-25	304706	304706	USA	<0,0001	1.0189
51	John Beans Technologies Corporation	2015-06-19	391950	391950	USA	<0,0001	0.8005
52	Citygroup Inc.	2014-09-03	217841	217841	USA	<0,0001	0.8530
53	Truist Financial Corporation	2014-08-27	19125	19125	USA	<0,0001	0.6977
54	Bank of America Corporation	2014-07-24	16562700	16562700	USA	<0,0001	0.8969
55	American International Group Inc.	2014-05-08	279038	279038	USA	<0,0001	0.9499
56	Ubiquiti Inc.	2014-03-06	504225	504225	USA	<0,0001	1.4417
57	World Fuel Services Corporation	2013-09-09	39501	39501	USA	<0,0001	0.4966
58	Alphabet Inc.	2019-01-21	56850000	56579000	USA	<0,0001	1.0495
59	Wells Fargo & Company	2013-06-27	23937	23937	USA	<0,0001	0.7365
60	Deutsche Bank Aktiengesellschaft	2016-08-08	12500000	12500000	USA	0,001-0,0001	1.5660
61	Teledyne Technologies Incorporated	2012-02-07	30385	30385	USA	<0,0001	1.2434
62	Moneygram International Inc	2018-11-08	125000000	125000000	USA	>0,1	0.8502
63	Citigroup Inc.	2014-07-14	7000000000	7000000000	USA	>0,1	0.8265
64	Amazon.com Inc.	2021-07-30	885125718	844158680	USA	0,001-0,0001	0.9339
65	Alphabet Inc.	2021-06-07	268373336	248947600	USA	0,001-0,0001	0.9195
66	Real Good Food PLC	2019-05-30	300000	404100	UK	>0,1	0.0532
67	Barclay PLC	2015-05-20	418258100	650000000	UK	>0,1	1.5708
68	Standard Chartered Bank PLC	2019-04-09	489860015	639023750	UK	>0,1	1.2423
69	Barclay PLC	2016-02-08	1724297	2485890	UK	<0,0001	1.5927
70	HSBC Holdings PLC	2012-12-11	232889125	375000000	UK	0,01-0,001	1.0245
71	NatWest Group PLC	2013-12-11	20138467	33000000	UK	0,001-0,0001	1.3016
72	AstraZeneca PLC	2018-08-07	84880917	110000000	UK	0,001-0,0001	0.8117
73	AstraZeneca PLC	2011-03-10	42649024	68500000	UK	0,001-0,0001	0.4631
74	AstraZeneca PLC	2015-07-06	29807692	46500000	UK	0,001-0,0001	0.9841
75	Compass Group PLC	2012-09-19	11096982	18000000	UK	0,001-0,0001	0.6949
76	Compass Group PLC	2021-06-10	468598	663725	UK	<0,0001	1.9032
77	Burberry Group PLC	2017-07-17	1914635	2500000	UK	0,001-0,0001	1.0572
78	Lloyds Banking Group PLC	2014-07-28	50617020	86000000	UK	0,01-0,001	0.9648
79	Rolls-Royce Holdings PLC	2018-07-19	252239	327500	UK	<0,0001	0.7769
80	Rolls-Royce Holdings PLC	2017-01-17	137269900	170000000	UK	>0,1	0.3076
81	Unilever PLC	2016-06-29	147729	199500	UK	<0,0001	0.4038
82	Unilever PLC	2014-04-03	2713883	4500000	UK	<0,0001	0.6614

83	Unilever PLC	2014-04-08	45991	77000	UK	<0,0001	0.5814
84	Diageo PLC	2011-07-27	9781065	16000000	UK	0,001-0,0001	0.7451
85	Diageo PLC	2020-02-19	3865868	5000000	UK	<0,0001	0.0535
86	BAE Systems PLC	2011-05-16	48658470	79000000	UK	0,01-0,001	0.8676
87	British American Tobacco PLC	2020-09-29	28438678	35281533	UK	0,001-0,0001	0.5865
88	British American Tobacco PLC	2014-11-13	650000	875550	UK	<0,0001	0.4018
89	BHP Group	2015-05-20	16086750	25000000	UK	0,001-0,0001	1.0035
90	Flutter Entertainment PLC	2012-07-31	466025293	731000000	UK	>0,1	0.6154
91	Pearson PLC	2021-08-16	722000	1000000	UK	0,001-0,0001	0.6199
92	Reckitt Benckiser Group PLC	2012-12-17	154250	250000	UK	<0,0001	0.4385
93	Reckitt Benckiser Group PLC	2019-07-11	39844000	50000000	UK	0,01-0,001	0.3799
94	Johnson Matthey PLC	2015-10-15	32300	50000	UK	<0,0001	1.4920
95	Smith & Nephew PLC	2012-02-06	13897400	22000000	UK	0,01-0,001	0.7788
96	GlaxoSmithKline PLC	2012-07-02	1910828025	3000000000	UK	>0,1	0.3063
97	GlaxoSmithKline PLC	2016-09-30	15360000	20000000	UK	0,001-0,0001	0.1453
98	GlaxoSmithKline PLC	2014-06-04	62685000	105000000	UK	0,001-0,0001	0.5281
99	NatWest Group PLC	2017-07-12	4267340000	5500000000	UK	>0,1	0.9256
100	HSBC Holdings PLC	2014-11-12	173800000	275000000	UK	0,01-0,001	0.5260
101	NatWest Group PLC	2017-02-03	67915000	85000000	UK	0,01-0,001	1.7660
102	Elementis PLC	2013-11-14	1599660	2571800	UK	0,01-0,001	1.4371
103	Nanjing Kangni Mechanical and Electrical Co., Ltd.	2021-07-28	300000	46950	China	<0,0001	0.3999
104	Shanghai Pudong Development Bank Co. Ltd	2018-01-20	461906271	72190000	China	0,01-0,001	0.5086
105	Hybio Pharmaceutical Co. Ltd	2019-01-16	5037770	788411	China	0,01-0,001	1.2065
106	Jiangsu Dewei Advanced Materials Co. Ltd	2019-01-23	300000	46950	China	0,001-0,0001	1.3679
107	Chongqing Sanxia Paints Co Ltd	2019-01-23	150000	23475	China	<0,0001	0.9753
108	Kingfa Sci&Tech Co Ltd	2019-01-23	589131	92199	China	<0,0001	0.7744
109	Zhende Medical Co., Ltd.	2019-01-24	30000	4695	China	<0,0001	1.4605
110	Yunding Technology Co. Ltd	2019-01-25	1040000	162760	China	0,001-0,0001	0.1870
111	LB Group Co. Ltd	2019-01-25	150000	23475	China	<0,0001	0.9018
112	Guangdong VTR Bio-Tech Co Ltd	2019-03-02	300000	46950	China	<0,0001	0.8018
113	Gui Zhou Tyre Co. Ltd	2019-02-21	15100000	2363150	China	0,01-0,001	0.7667
114	Sichuan Dowell Science and Technology Inc	2019-01-30	33000	5164	China	<0,0001	1.0491
115	Tecon Biology Co. Ltd	2019-02-02	30000	4695	China	<0,0001	0.7045
116	Adama Ltd.	2019-02-13	1000000	156500	China	<0,0001	1.0416
117	Beijing TongRenTang Co., Ltd	2019-12-02	14088266	2204814	China	0,001-0,0001	0.7335
118	Shanghai Shenda Co Ltd	2019-02-15	350000	54775	China	<0,0001	0.9578
119	Guosen Securities Co. Ltd	2019-02-18	13106747	1950160	China	0,001-0,0001	1.0664
120	Yunnan Xiyi Industrial Co. Ltd	2019-02-21	80000	12520	China	<0,0001	1.1296
121	Shenzhen Kingkey Smart Agriculture Times Co. Ltd	2019-01-24	1510000	236315	China	0,001-0,0001	0.3038
122	Wenfeng Great World Chain Development Corp	2017-06-01	400000	62600	China	<0,0001	1.1992
123	Zhuhai Zhongfu Enterprise Co. Ltd	2019-03-12	600000	93900	China	0,001-0,0001	0.4395
124	Everbright Securities Co. Ltd.	2014-02-12	4300000	672950	China	<0,0001	1.5772
125	CITIC Securities Co. Ltd	2017-05-25	308000000	48202000	China	0,001-0,0001	1.1318
126	Haitong Securities Co. Ltd	2017-05-25	2500000	391250	China	<0,0001	0.4848
127	Guosen Securities Co. Ltd	2017-05-25	105000000	16432500	China	0,001-0,0001	0.8129
128	China United Network Communications Ltd	2018-10-05	145872	20528	China	<0,0001	1.2461
129	China Southern Airlines Co. Ltd	2014-05-19	72360	11600	China	<0,0001	0.9851
130	China Petroleum & Chemical Corp	2014-11-07	918236	150000	China	<0,0001	0.8666
131	Dongfeng Automobile Co. Ltd	2015-09-11	122415360	19200000	China	0,01-0,001	1.3651
132	Hua Xia Bank Co. Ltd	2021-05-21	98300000	15383950	China	0,01-0,001	0.4219
133	DLE Inc.	2018-12-28	33600000	295230	Japan	0,01-0,001	1.5906
134	UMC Electronics Co. Ltd	2019-12-19	48000000	421757	Japan	0,01-0,001	1.1887
135	Daiichi Commodities Co. Ltd	2020-07-11	20000000	175732	Japan	0,01-0,001	0.5621
136	Hyas&Co.Inc.	2020-11-27	33600000	295230	Japan	0,01-0,001	2.3179
137	Asia Development Capital Co.Ltd.	2021-08-07	28800000	253054	Japan	0,01-0,001	0.7994
138	Nomura Holdings Inc.	2019-08-28	10000000	87866	Japan	<0,0001	1.4820
139	J-Lease Co.Ltd	2018-12-27	33600000	295230	Japan	<0,0001	1.2916
140	Mitsubishi UFJ Financial Group,Inc.	2012-12-12	712302785	8571634	Japan	<0,0001	1.2751
141	Mitsubishi UFJ Financial Group,Inc.	2018-09-20	40000000	351464	Japan	<0,0001	1.0306
142	Toyota Motor Corp	2021-01-14	18659700000	180000000	Japan	0,001-0,0001	1.1216
143	Toyota Motor Corp	2014-03-19	121870800000	1200000000	Japan	0,01-0,001	1.0131
144	Mitsubishi Electric Corp	2013-09-26	18802400000	190000000	Japan	0,01-0,001	1.2842
145	Mitsubishi Heavy Industries Ltd	2013-09-26	1434920000	14500000	Japan	0,01-0,001	1.0476
146	Olympus Corp	2016-05-02	32589000000	306000000	Japan	>0,1	0.9647
147	Bridgestone Corp	2014-02-13	43422250000	425000000	Japan	>0,1	1.0754
148	Bridgestone Corp	2011-09-15	2148440000	28000000	Japan	0,001-0,0001	0.9224
149	Panasonic Corporation	2013-07-18	5683900000	56500000	Japan	0,01-0,001	1.0578
150	Hitachi Ltd.	2011-12-27	3033597344	38977224	Japan	0,001-0,0001	1.2700
151	Hitachi Metals Ltd.	2014-10-31	140225000	1250000	Japan	0,001-0,0001	1.1179
152	NHK Spring Co. Ltd.	2019-07-29	3101940000	28500000	Japan	>0,1	1.1982
153	Fujikura Ltd.	2012-04-23	1622800000	20000000	Japan	0,01-0,001	1.6573
154	Takeda Pharmaceutical Co. Ltd	2014-04-08	918900000000	9000000000	Japan	>0,1	0.6241
155	Furukawa Electric Co. Ltd.	2011-09-29	15335600000	200000000	Japan	>0,1	1.3421
156	Mitsuba Corp	2013-09-26	13359600000	135000000	Japan	>0,1	1.5030
157	Mizuho Financial Group Inc	2012-07-18	10045725000	127500000	Japan	0,01-0,001	1.4560
158	Toyo Tire & Rubber Co. Ltd.	2013-11-26	12166680000	120000000	Japan	>0,1	1.3659
159	Jtekt Corp	2013-09-26	10219599200	103270000	Japan	>0,1	1.5479
160	DENSO Corp	2012-01-30	5952726000	78000000	Japan	0,001-0,0001	1.0026
161	NSK Ltd.	2013-09-26	6749072000	68200000	Japan	>0,1	0.7016
162	Koito Manufacturing Co. Ltd	2014-01-16	5904512000	56600000	Japan	0,01-0,001	0.6674
163	Marubeni Corp	2012-01-17	4193280000	54600000	Japan	0,01-0,001	1.4109

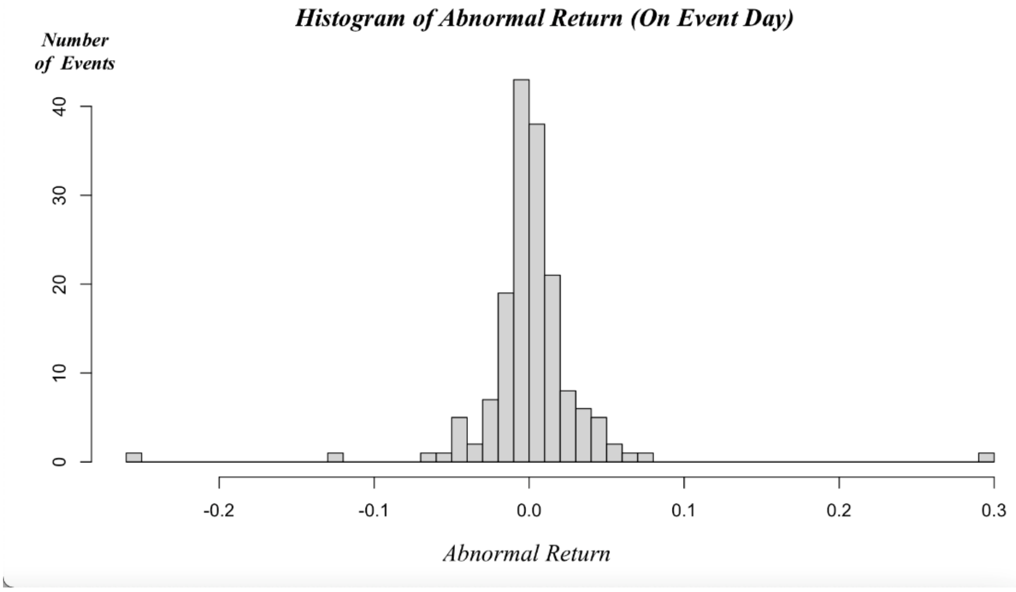
A3 t-test of countries

To test whether there is a difference in how investors in the five different countries react to penalty announcements, a t-test was used to compare the two populations. From the table below, there is no significance for any observation. Hence, we cannot conclude that the two samples are different from each other.

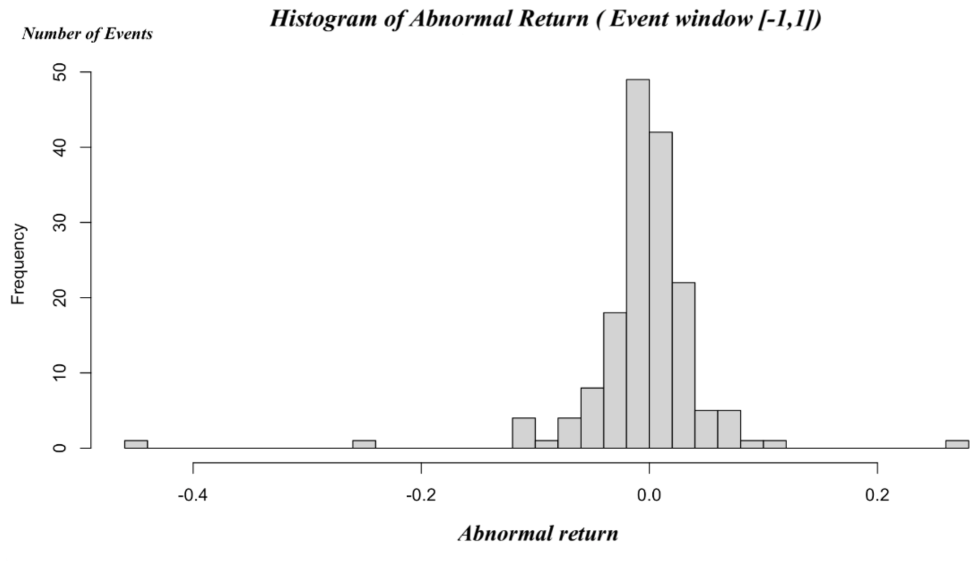
	Norway	USA	UK	Japan
USA				
[0]	-0.006			
	(-0.828)			
[1,1]	0.003			
	(0.217)			
[-1,2]	-0.002			
	(-0.142)			
[-2,5]	0.024			
	(0.826)			
[-5,5]	0.03			
	(1.00)			
UK				
[0]	-0.007	-0.001		
	(-1.03)	(-0.280)		
[1,1]	-0.006	-0.010		
	(-0.609)	(-0.819)		
[-1,2]	-0.120	-0.012		
	(-1.163)	(-0.997)		
[-2,5]	0.005	-0.019		
	(0.175)	(-1.551)		
[-5,5]	0.012	-0.017		
	(0.423)	(-1.281)		
Japan				
[0]	0.004	0.010	0.011	
	(0.252)	(0.682)	(0.774)	
[1,1]	0.006	0.003	0.013	
	(0.367)	(0.170)	(0.873)	
[-1,2]	-0.001	0.001	0.014	
	-0.055	(0.083)	(1.043)	
[-2,5]	0.031	0.007	0.026	
	(0.991)	(0.365)	(1.538)	
[-5,5]	0.045	0.015	0.033	
	(1.374)	(0.721)	(1.667)	
China				
[0]	-0.004	0.002	0.003	-0.008
	(-0.484)	(0.355)	(0.594)	(-0.522)
[1,1]	0.007	0.005	0.014	0.002
	(0.631)	(0.345)	(1.652)	(0.103)
[-1,2]	0.001	0.003	0.015	0.023
	(0.046)	(0.205)	(1.487)	(0.106)
[-2,5]	0.023	-0.001	0.018	-0.008
	(0.755)	(-0.074)	(1.225)	(-0.399)
[-5,5]	0.038	0.009	0.026	-0.007
	(1.182)	(0.423)	(1.361)	(-0.256)

A4 Histograms

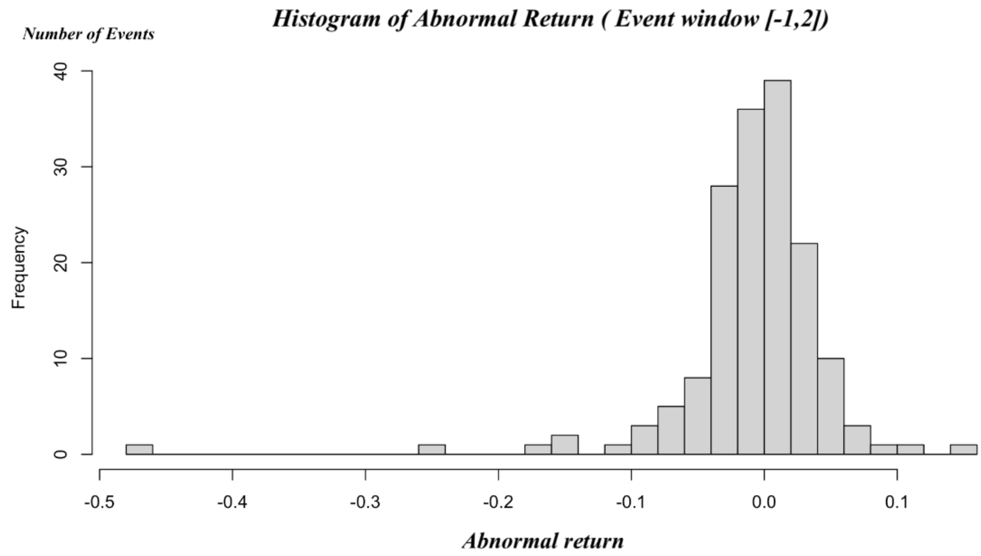
The following histograms show the abnormal returns for each of the events and indicate the frequency of events in the vertical axis.



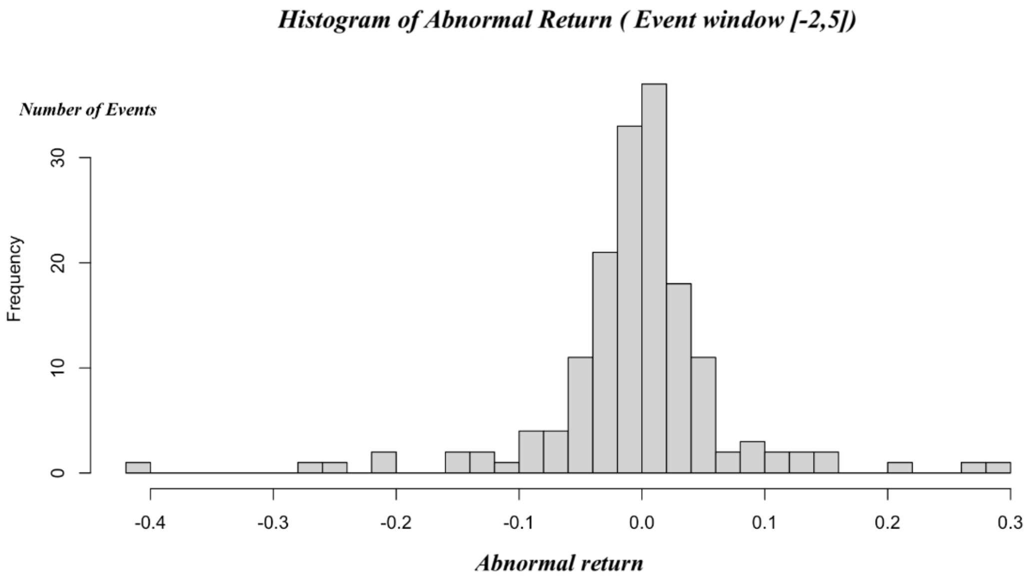
Graph A4.1



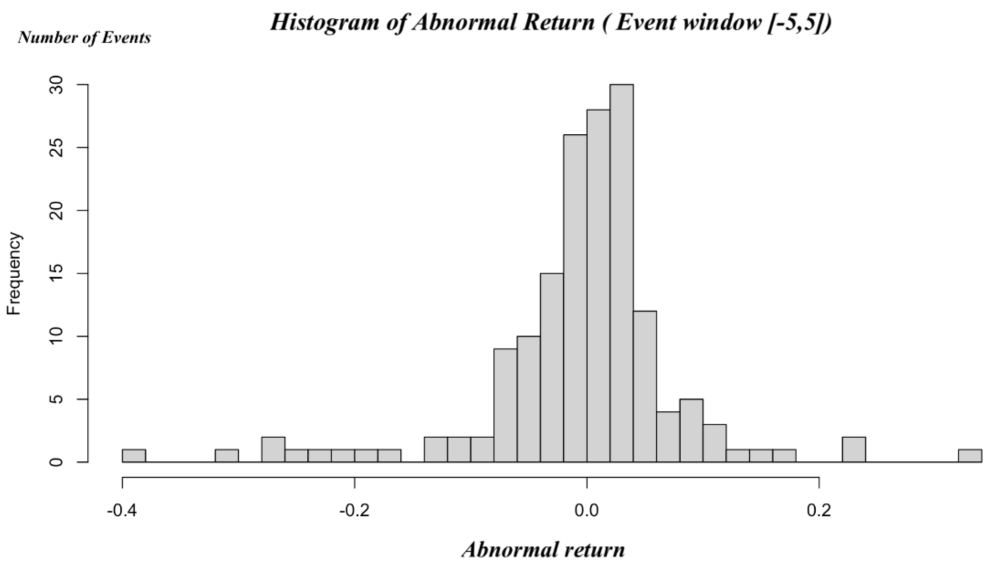
Graph A4.2



Graph A4.3



Graph A4.4


Histogram of Abnormal Return (Event window [-5,5])
Number of Events
Frequency
0
5
10
15
20
25
30
-0.4
-0.2
0.0
0.2
Abnormal return

Graph A4.5