LUND UNIVERSITY
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An Event Study on the Stock Market Responses of Insurance and Reinsurance Companies in Asian and European Countries under Natural Disaster Shocks

By

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Abstract：

This paper aims to comprehensively examine the impact of global climate change, particularly how climate change and the natural disasters it triggers affect the insurance sector in Asia and Europe and the stock market performance of reinsurance companies in both Asia and Europe. Using an appropriate event study methodology, the study investigates the impact of two natural disasters in China and two natural disasters in Japan on the stock indices of related companies.

Keywords: stock market, natural disaster, Climate Change, Cumulative Abnormal Returns

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1、Introduction

In recent years, due to the influence of geological structure changes, ecosystem evolution and climate change, the frequency of global natural disasters has significantly increased(United Nations, 2025).With the enhancement of public risk awareness, natural disasters have increasingly drawn extensive attention from all sectors of society. Against this backdrop, insurance, as an important mechanism for risk transfer and loss compensation, has received high attention from both the public sector and private institutions. For insurance and reinsurance enterprises, the degree and evolution trend of their risk exposure to natural disasters have become core issues of common concern in industry regulation, investment decision-making and academic research. This article takes storms and floods as the research objects, mainly based on the following considerations. In terms of occurrence frequency, storms and floods are the most common types of meteorological disasters in the Asian region, especially in countries like China and Japan, and their occurrence has distinct seasonal and periodic characteristics. These two types of disasters not only occur frequently but also have a high degree of damage, often causing significant direct economic losses and accounting for a relatively high proportion in the insurance compensation structure. Besides in terms of the insurance and reinsurance markets, storms and floods often trigger

large-scale property losses and business disruption claims. Insurance companies are exposed to a relatively high cumulative risk, which in turn conveys the pressure to the reinsurance market, potentially having a substantial impact on their financial conditions and even stock price performance (Pagnotti et al. (2021)).

Compared with other natural disasters such as earthquakes and droughts, storms and floods have more systematic and continuous historical observation data and disaster records. Several international databases, including EM-DAT adopted in this study, provide relatively complete relevant materials, which is conducive to conducting empirical modeling and statistical inference based on the event study method. In recent years, the frequency and intensity of storms and floods have both been on the rise, and related risk issues have gradually become research hotspots in both academic and industrial circles(Seetharam, 2017).

This paper adopts the research framework of "method first - empirical follow-up", and systematically examines the impact of flood disasters on the stock prices of insurance and reinsurance enterprises by constructing event Windows and analyzing excess returns. The study finds that the impact of flood events in Asia on the stock markets of insurance and reinsurance companies varies overall, but is mostly relatively positive. This suggests that the market believes the losses can be managed through global risk diversification mechanisms, and also expects that rising

reinsurance rates will expand profit margins for these companies. And through rigorous single-sample t-tests, the cumulative average abnormal returns (CAAR) generated by the four analyzed natural disaster events in the market were statistically verified. The test results provide a solid quantitative foundation for the core findings of this study. The results clearly show that not all disaster events will statistically trigger significant abnormal market returns, and the market's response is selective and complex.

2、Overview of the empirical literature

Existing literature widely employs event study methods to analyze the impact of extreme events on financial markets. For example, there is a paper used the BMP test to reveal that terrorist attacks lead to significant abnormal returns(Tahir et al.2020), while another similar paper pointed out that industry portfolios exhibit heterogeneous reactions to disasters: pre-disaster market adjustments are slower, and some industries may even show positive responses(Malik et al.2019). Similarly, it usually combined non-parametric methods with the Generalized Autoregressive Conditional Heteroskedasticity Extreme Value Theory(GARCH-EVT) model, revealing that these three approaches demonstrate that terrorist attacks and natural disasters cause significant positive and negative return fluctuations in commodity and bond markets. In contrast, financial crises

have a positive impact on these markets. Terrorist attacks and financial crises lead to return reversals on the event day, most of which are extreme in nature, with the intensity of the impact diminishing over time after the event. As for natural disasters, negative effects are more commonly observed in the post-event period(Johnston et al.2019).

Paolo Pagnottoni emphasized that financial market responses to disasters vary depending on the type of event and geographic location. Climate and biological disasters (such as typhoons and pandemics) have the most significant impact on global markets, followed by geophysical disasters (such as earthquakes). Chinese scholars'research on typhoons found that the first typhoon event has a significant negative impact on the stock market, but the effect diminishes marginally with increased frequency(Shao et al.2023). Similar conclusions were drawn in COVID-19 research, which showed that the pandemic led to significantly negative abnormal returns (ARs) and cumulative abnormal returns (CARs) in global stock markets, with prominent cross-regional contagion effects(Liu et al.2020).

In extreme disaster scenarios, the risk management role of the insurance industry is crucial. Anselm Molka pointed out that insurance companies need to balance disaster response policies through precise risk identification and assessment systems. A cross-cultural study paper used event study methods and other estimation approaches similar to those in

my article and found that the insurance industries in the U.S., Japan, and China exhibit different trading behaviors around severe natural disasters(Fieberg et al.2019).

3、Methodology

3.1 Time series test

I adopt the event study method to investigate the impact of natural disasters on the stock market of insurance companies and reinsurance companies. First of all, I need to confirm several event windows. Storm and flood are two relatively common types of natural disasters, and their impacts involve different effects before and after the disaster. Extreme weather also makes people fear disasters and the secondary impact of post-disaster aftereffects on society also affects the development of companies and society. Therefore, I set several event windows to facilitate a more comprehensive and concise analysis(Xiao.2018).

3.2 Determination of the time window

1、Estimation Window: A period of 215 trading days prior to the event date (t = 0), defined as [-216, -6], is used to estimate each firm's normal returns.

2、Event Window: A short time frame surrounding the event, defined as [-5, +5] trading days, captures the immediate market reaction to the

disaster.

The reason is that by estimating the company's "normal rate of return" through historical data, a longer window (typically 1-2 years) can cover the market fluctuation cycle, reduce the interference of short-term noise, and improve the accuracy of model parameters.

3.3 CAPM model

The Capital Asset Pricing Model (CAPM) is a foundational economic theory that describes the relationship between systematic risk and expected return for assets. It is used to determine a theoretically appropriate required rate of return. The model's linear specification is given by the following equation:

$$E(R_i) - Rf = \beta_i (E(R_m) - Rf) \quad (1)$$

Where $E(R_i)$ is the expected return on security

Rf is the risk-free rate

R_m is the expected return of the market portfolio

β_i is the beta coefficient, measuring the sensitivity of the asset's return to the return of the market portfolio

The term $E((R_{mt}) - Rf)$ represents the market risk premium

The daily return for individual stocks and market indices is calculated as

follows:

$$R_i = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}} \quad (2)$$

$P_{i,t}$ is the closing price at time t

$P_{i,t-1}$ is the closing price at time t-1

Similarly, the market return is calculated as:

$$R_{mt} = \frac{index_t - index_{t-1}}{index_{t-1}} \quad (3)$$

$index_t$ represents the value of the market index at time t.

$index_{t-1}$ represents the value of the market index at time t−1.

The beta coefficient β_i is a key parameter of the CAPM, quantifying the asset's non-diversifiable risk. An asset with a beta greater than 1 is more volatile than the market, while an asset with a beta less than 1 is less volatile.

In this study, the following representative indices were used to calculate the market return for different regions:

European Market Index is STOXX Europe 600 Index

Asian Market Index is MSCI AC Asia Pacific Index

In applications, a broad-based stock index is used as a proxy for the market portfolio, with the S&P 500 Index, the CRSP Value Weighted

Index, and the CRSP Equal Weighted Index being popular choices. The model implies that the only reason an asset should earn a return greater than the risk-free rate is to compensate investors for taking on higher levels of non-diversifiable market risk(Matthew E. Kahn et al.,2019)..

3.4 Event Study Methodology

3.4.1 Abnormal Return Models and Their Calculation

The event study method is adopted to assess the impact of specific events (i.e, natural disasters in Asia) on the European stock market. The core of this method lies in Cumulative Abnormal Return (CAR), which quantifies the excess performance of a stock's actual return rate compared to its expected return rate within the event window period, and clarifies the "event" under study and its occurrence date. In this study, events are defined as four major natural disasters that occurred in the Asian region. For each event, I set an event window period at the beginning of the article. Abnormal Return (AR) is the difference between the actual return of the stock and the normal return predicted by the model. It represents the excess return or loss resulting from the occurrence of a specific event. The calculation formula for abnormal returns is:

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) \quad (4)$$

$AR_{i,t}$ is the abnormal return of stock i on day t

$R_{i,t}$ is the realized return of stock i at time t

To assess the overall impact of an event on a stock throughout the entire window period, we accumulate the abnormal returns of each day within the event window period to obtain CAR. The calculation formula for cumulative abnormal returns is:

For a single stock i, the Cumulative Abnormal Return (CAR) over the event window [T1,T2] is calculated as follows:

$$\mathrm{CAR_i} = \sum_{t=T_1}^{T_2} \mathrm{AR_{i,t}} \qquad (5)$$

$\mathrm{CAR_i}$ =The cumulative abnormal return (CAR) for stock i during the event window [-5, +5]

3.4.2 Statistical Testing

To determine whether the Average Abnormal Return (AAR) and Cumulative Average Abnormal Return (CAAR) are statistically significantly different from zero, statistical hypothesis testing is conducted. This study employs a standard t-test.

For the AAR on day , the t-statistic is constructed as follows:

$$t_{AAR_t} = \frac{AAR_t}{\sigma（AAR）}\sqrt{N} \qquad (6)$$

where σ(AAR) is the standard deviation of the AAR series estimated over the estimation period.

For the CAAR over the window [T1,T2], the t-statistic is constructed as follows:

$$t_{CAAR}=\frac{CAAR(T_1,T_2)}{\sigma(CAAR)\sqrt{L}} \quad (7)$$

Where L=T2−T1+1 is the length of the cumulative window. Under the null hypothesis (that the event has no effect), these test statistics follow a t-distribution. A significant t-value leads to the rejection of the null hypothesis, indicating that the event generated a significant stock price reaction.

1.Statistical Significance Test To assess whether our empirical results are statistically significant, we conducted a t-test on the average rate of return of the sample. The t-test can help us determine whether the observed average rate of return is significantly different from zero, thereby ruling out the possibility that the result is caused by random fluctuations. We set the significance level at 0.05. If the p-value is less than 0.05, we will consider the result statistically significant.

2.Calculation of Standard Deviation and Standard Error Before conducting the t-test, we first need to calculate the standard deviation of

the sample and the standard error of the average return rate. Sample standard deviation (σ) : The standard deviation is used to measure the volatility of daily (or specific period) returns, and its calculation formula is:

$$\sigma=\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(R_i-\bar{R})^2} \quad (8)$$

R_i is the rate of return of the i-th sample, $\bar{R}$ is the average rate of return of the sample, and n is the number of samples

The standard error (SE) of the average rate of return: The standard error is a key parameter in the t-test, measuring the difference between the sample mean and the population mean：

$$SE=\frac{\sigma}{\sqrt{n}} \quad (9)$$

t-statistic:

$$t=\frac{\bar{R}}{SE} \quad (10)$$

SE and $\bar{R}$ can be be calculated using the formula mentioned earlier

4、Empirical Analysis

4.1 Data sources

I sourced data on natural disasters from the Emergency Events Database (EM-DAT), prioritizing events occurring after 2015 due to limited data availability in earlier periods. The dataset comprises detailed information on the geographical scope, temporal duration (including precise start and end dates), and quantitative impact metrics of each disaster, encompassing both human casualties and economic losses.

For the selection of natural disasters, this study focuses on events within China and Japan. The final sample of four disasters was determined based on two principal criteria: (1) the temporal distribution of events to ensure relevance to the study period, and (2) the magnitude of impacts, as measured by reported human and financial losses. This selection strategy ensures the inclusion of events with significant societal and economic consequences, thereby enhancing the analytical validity of subsequent empirical investigations.

4.2 Selection of sample data

I selected storms and floods as the two types of disasters（show on table1）because typhoons are particularly well-suited for our research objectives, for the following reasons:

Predictability: Typhoons and heavy rainfall have specific tendencies, but we cannot predict the next event based on existing information about past typhoons and storms.

Exogeneity: For individuals, companies, and policymakers, these events are exogenous. Therefore, the observed responses cannot easily be attributed to unobserved heterogeneity or reverse causality.

Regional Impact: Typhoons and heavy rainfall are disasters with distinct regional trends, causing severe damage to affected areas worldwide(Abe et al.2013).

Additionally, I primarily studied disasters with significant losses to ensure ameaningful analysis.

Table1: Key Characteristics of the Four Selected Natural Disasters

Disaster Type	Country	Location	Magnitude	Magnitude Scale	Start Day
Flood	Japan	Kumamoto province	18480.56	Km2	2016-06-20
Flood	China	Jiangsu, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Chogqing, Sichuan, Guizhou, Yunnan	720844.3	Km2	2016-06-28
Storm	China	Southern, Guangdong, Guangxi Zhuang, and Fujian Provinces Guizhou and Yunnan	144	Kph	2017-08-24
Storm	Japan	Tokyo, Fukushima, Miyagi, Shizuoka, Kanawanga, Nagano, Saitama, Gunma, Ibaraki, Tochigi	160	Kph	2019-10-12

4.3 Stock data and financial data

4.3.1 Acquisition of sample data

To illustrate the impact of the natural disasters under study on the stock market of companies, I have collected relevant stock and financial data from the EIKON database and various financial websites. This includes all insurance and reinsurance companies in Europe, as well as those in China and Japan and other Asia companies. The sample is restricted to insurance and reinsurance companies only. The companies' name is on table 2.

Natural disasters are highly sudden, but some events (such as typhoons and earthquakes) may be accompanied by early warning signals. Choosing a window that ends six days (-6) before the event can prevent the market from reacting in advance due to potential warning signals (such as abnormal fluctuations in reinsurance company stock prices). In addition, the impact of natural disasters is usually quickly reflected in stock prices after the event occurs (such as expectations of catastrophic losses and claims settlement pressure). The Windows of [-5, +5] can cover the potential information leakage before the event (such as disaster warning) and the market digestion period after the event. The share prices of the insurance industry may also be affected by other factors, such as changes in interest rates and the release of financial reports. When i continue to analysis, i used more than 11 days, and less than 20 days, because it can

make the data more easy to analysis. An overly long window will introduce noise, while these days short-term window can focus on the direct impact of disasters. The Estimation Window and Event Window are on table 3.

4.3.2 The estimation of α and β

The estimation of the CAPM parameters—specifically, the beta (β) and alpha (α) coefficients for each security—is conducted through a regression analysis based on data from the estimation window. The daily return of each security is calculated using adjusted closing prices obtained from the Refinitiv EIKON database. To ensure consistency and eliminate biases arising from non-synchronous trading across different markets, a Python program is employed to perform data cleaning and filtering, retaining only valid trading days within the estimation period(Wang.2017).

To represents the risk-free rate of return. For the risk-free Interest rate (Rf) in the European market, this article is selected from the Key ECB Interest Rates announced by the European Central Bank (ECB). This interest rate, as an important benchmark for monetary policy in the Eurozone, is widely used to measure the cost of funds and risk compensation. Therefore, in empirical research, it can be regarded as a risk-free interest rate agent in the European market.

For Asia, due to the lack of a unified risk-free interest rate indicator in the Asian region, in academic research, the yield of government bonds, which have high liquidity and credit security, is usually selected as an alternative variable. This paper, following the practices of existing literature, adopts the yield of the 10-year US Treasury bond as a proxy indicator for the risk-free interest rate. U.S. Treasury bonds are widely regarded as the assets with the lowest risk and the strongest liquidity in the global financial market. Their long-term interest rates are often used as approximations of risk-free rates in international financial research.When calculating market returns, the STOXX Europe 600 Index is used as the benchmark for the European market, while historical data from the MSCI All Country Asia Pacific Index is employed for the Asian market.

Ordinary Least Squares (OLS) regression is applied to the time-series data of each stock over the estimation window to obtain estimates of α_i and β_i. These parameter estimates are subsequently used to compute abnormal returns during the event window.

From the outcomes, we can see from European market：

1. Systemic risk exposure (β coefficient) The β coefficient indicates that there are significant differences in the sensitivity of different insurance companies to disaster impacts. For instance, the beta value of a certain insurance company reached 1.38, indicating that the fluctuation range of

its stock price was 38% larger than the market benchmark. This is positively correlated with the concentration of its high-risk business in the Asian region. Some German enterprises show negative β values (such as -0.21), which may be attributed to the hedging characteristics of their reinsurance business or the regional risk diversification advantages. This differentiation reflects the differentiated risk exposure of insurance enterprises in disaster events.

2.The empirical results of excess return performance (α coefficient) show a significant non-zero α value, which deviates from the theoretical expectations of CAPM. Negative α values were concentrated in the group of catastrophe insurance underwriters (mean -0.15%, $p<0.05$), directly reflecting the excess capital loss caused by disasters. Some comprehensive insurance groups showed a positive alpha value (up to 0.23%), which might be attributed to the buffering effect of their non-life insurance business. This differentiation highlights the explanatory limitations of a single market factor in extreme events, and it is necessary to incorporate enterprise-specific factors (such as reinsurance ratio and risk reserve adequacy ratio) for supplementary analysis.

3. Model Explanatory Power (R^2 Value) The R^2 values of all regression models are below 0.1, indicating that market returns can only account for less than 10% of the changes in individual stock returns. This result is in line with the characteristics of disaster events

We can see from Asian market：

1. The β values are generally positive, indicating that there is a highly significant positive correlation between the stock returns of these companies and the market returns. The beta value measures a company's sensitivity to market fluctuations. The beta values of most companies range from 0.7 to 1.2. A β below 1 (for example, 0.81 in Vietnam and 0.85 in China) indicates that the volatility of these companies is lower than that of the entire Asian market. This is usually a characteristic of defensive industries such as insurance, whose stock prices increase less when the market rises and also decline less when the market falls. A β above 1 (for example, 1.13 in Japan) indicates that the company is more sensitive to market fluctuations. Overall, the significance of the β value validates the applicability of the CAPM model in your research, demonstrating that market risk is a key factor influencing the stock price returns of these companies.

2. The α values of all companies are very close to zero, and the P values are generally much greater than 0.05.This is in line with the market efficiency hypothesis in financial theory. Your results indicate that during the estimation window period, the share prices of these Asian insurance companies were effectively priced, with no systematic overvaluation or undervaluation. Investors were unable to achieve excess returns above the market average through a simple buy-and-hold strategy.

3. The R^2 value is generally between 0.1 and 0.3. It measures the market's excess return rate (independent variable), which can explain the lower value of the company's excess (10% to 30%), indicating that although market fluctuations do have an impact on the company's stock price, most of the changes (70% to 90%) are caused by non-systematic risks (i.e., company-specific risks). Non-systematic risks may include a company's management decisions, specific product strategies, financial leverage, or specific policies of the country where it operates, etc. This discovery highlights that when analyzing individual stocks, apart from macro market factors, the companies themselves

4.4 The estimation of CAAR

To determine whether the calculated abnormal return (AR), cumulative abnormal return (CAR), and cumulative average abnormal return (CAAR) have statistical significance, we conducted a standard t-test. This test is crucial for verifying that the observed results do not merely stem from random market fluctuations but truly reflect the response to the events under study. The core of our statistical analysis is to test the null hypothesis, which holds that the mean of abnormal returns is zero, meaning that events have no impact on stock prices. To assess the overall impact of the event within the entire window, we examined the statistical

significance of CAAR and calculated the t-statistic of CAAR within the window. Under the null hypothesis (i.e., events have no impact), these test statistics follow a t-distribution. If the T-value is significant, usually corresponding to a P-value that is less than our preset significance level of 0.05, we will reject the null hypothesis. This indicates that the event has produced a significant stock price response.

These four charts demonstrate the dynamic changes in the cumulative average abnormal return (CAAR) of the Asian market stock group within their respective event Windows. By analyzing the trend of the CAAR curve, we can assess the immediate impact of the event on the market and its subsequent continuous influence.

Figures 1 to 4 respectively show the CAAR curves of the four major natural disasters, specifically analyzing the stock market impact on insurance and reinsurance companies in Asia. Overall, these charts reveal the market's significant response to the events under study.

Figure1: CAAR Curve(Event1)

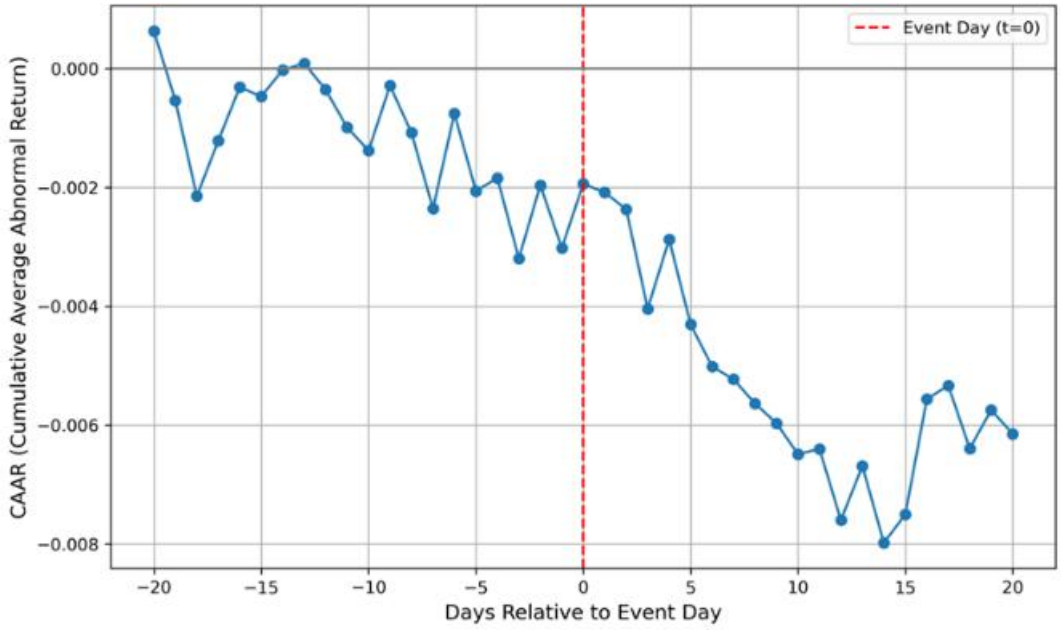


Figure2: CAAR Curve(Event2)

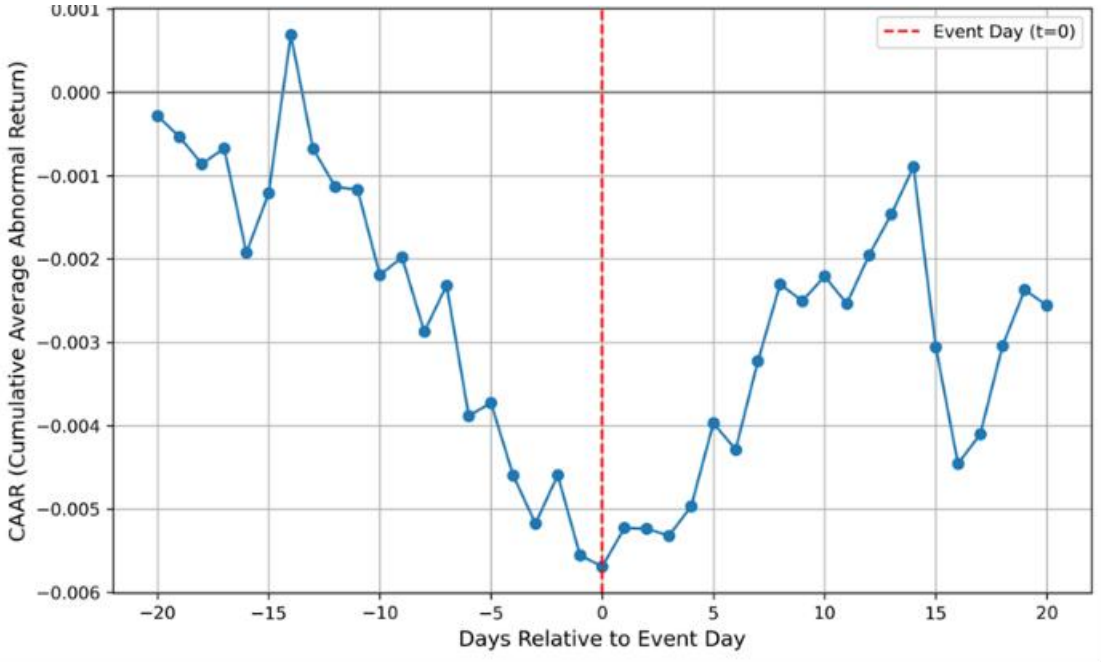


Figure3: CAAR Curve(Event 3)

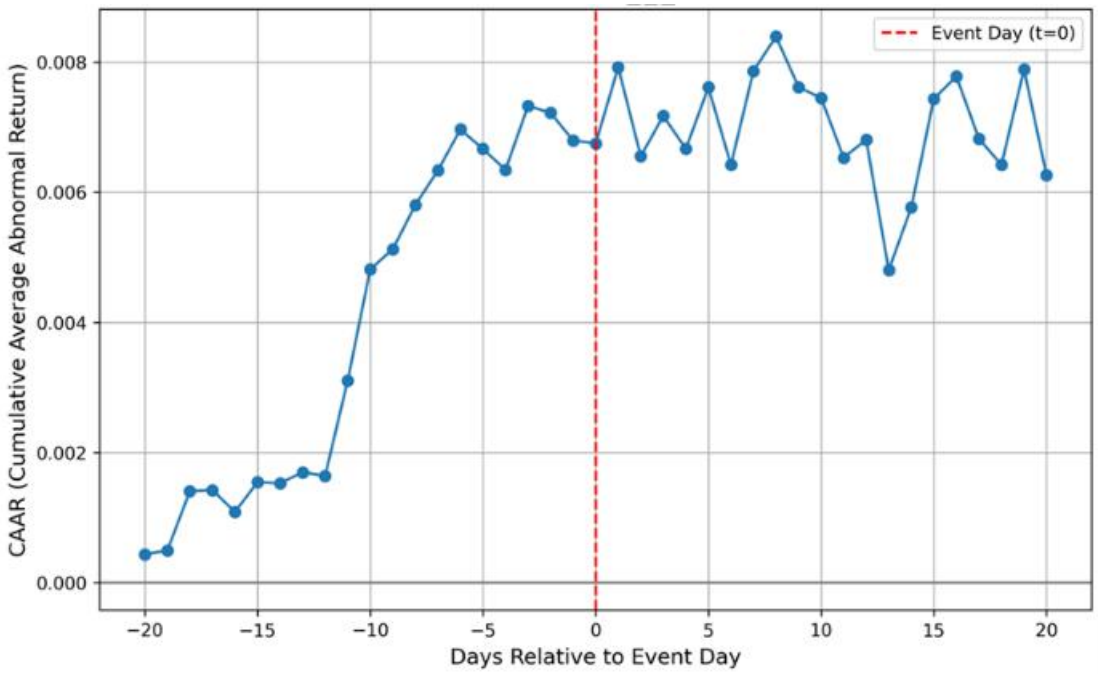
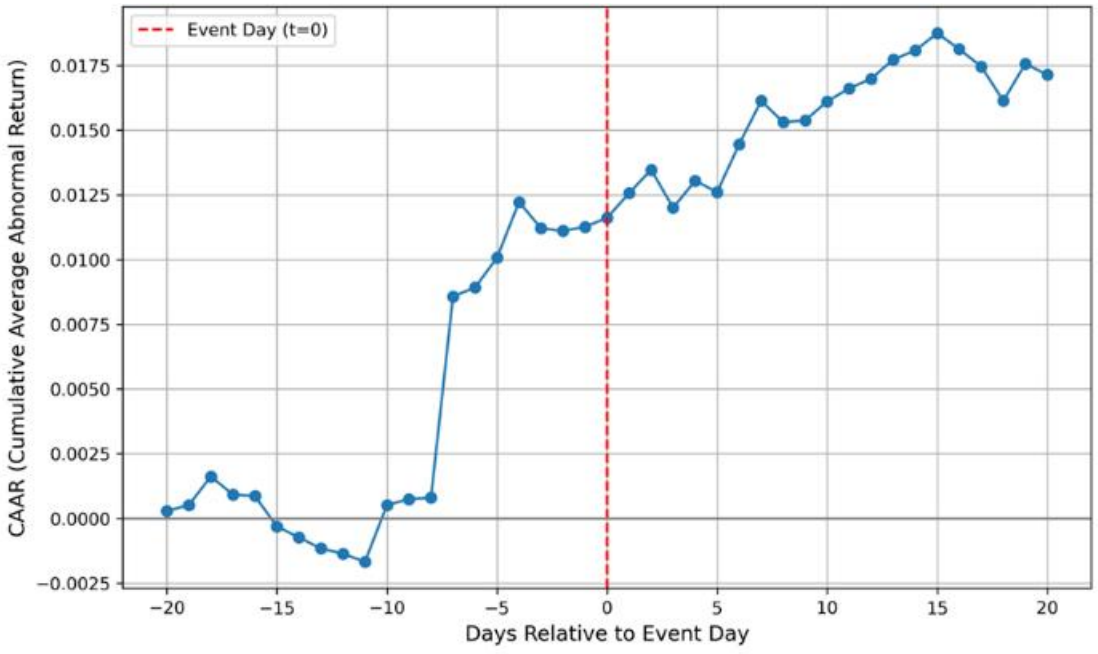


Figure 4: CAAR Curve(Event 4)



Background of the June 20, 2016 Flood Event in Japan: In June 2016, the Kyushu region of Japan experienced historically heavy rainfall, leading to large-scale flooding. CAAR curve analysis shows a slight upward trend in the days before the event, indicating divergent market expectations regarding potential losses from the flood. The upward trend may reflect that the market had already begun pricing in negative information prior to the disaster — investors had confidence in the risk management capabilities, capital adequacy, and effectiveness of reinsurance contracts in the Japanese insurance industry. Another interpretation is that the market may have perceived the scale of the disaster as manageable, not posing a substantial threat to the industry's fundamentals. After reaching a specific value on the event day, the CAAR curve continued to fluctuate at a relatively high level, showing a pattern of consecutive fluctuations and a gradual decline. This suggests that the market reacted further negatively as actual loss data were disclosed after the disaster, and the sustained volatility indicates that actual losses slightly exceeded market expectations.

Situation of the June 28, 2016 Flood Event in China: In the summer of 2016, the middle and lower reaches of the Yangtze River in China experienced the most severe flooding in recent years, with extensive affected areas and substantial losses. CAAR curve analysis reveals a fluctuating downward trend before the event. Given the large scale of the

flood, the market likely anticipated a significant increase in insurance payouts, but was still noticeably impacted. On the event day (day 0), the CAAR curve continued to rise and maintained an upward momentum, peaking several days after the event. This may indicate that the market believed the Chinese insurance and reinsurance industries had sufficient capacity to handle a disaster of this scale and might even benefit from it (e.g., through post-disaster reconstruction driving business growth and increased insurance awareness).

August 24, 2017 Storm Event in China (144 km/h): In August 2017, Typhoon Hato made landfall in southern China with extremely high wind speeds, causing severe damage and economic losses. The curve shows unstable fluctuations before the event day (t=0), starting near 0.00, rising slightly, and then declining again, indicating complex and uncertain market sentiment before the typhoon's arrival. Although the CAAR values remained positive throughout, their decline from a post-event high (approximately 0.008) to a low (approximately 0.005) conveys a clear negative market signal. This suggests that initial market expectations may have been overly optimistic, and while actual losses were not large enough to push the CAAR below zero, they were still higher than expected, thereby eroding investor confidence in the profitability of these companies.

October 12, 2019 Storm Event in Japan (160 km/h): In October 2019,

Super Typhoon Hagibis made landfall in Japan with extremely high wind speeds, becoming one of the strongest typhoons to hit Japan in many years and causing large-scale destruction and casualties. CAAR curve analysis shows that the curve rose initially before the event and then declined, particularly exhibiting a slow downward trend as the event day approached. Similar to the Chinese storm event, this indicates strong negative market expectations regarding the potential for substantial losses from the typhoon. On the event day (day 0), the CAAR value was relatively low, reflecting market concerns that the storm would place significant claims pressure on insurance and reinsurance companies. After the event, the curve began to recover slowly, suggesting that market sentiment started to rebound after initially digesting the negative impact of the disaster. Investors may have realized that, despite the considerable losses, reinsurance mechanisms and adequate capital reserves would help insurance companies weather the challenge.

Characteristics of Expectation Management: All four events demonstrate the market's ability to react in advance. Significant changes (upward or downward) in the CAAR curves had already occurred before the disasters, indicating high market efficiency as information such as weather forecasts and disaster warnings was quickly incorporated into stock prices.

Disaster Type and Severity: Floods (Japan 2016, China 2016) and storms (China 2017, Japan 2019) had differing directional impacts on the CAAR curves. The two flood events appeared to cause fluctuating declines in the CAAR curves, while the storm events triggered increases. This may imply differentiated market expectations for the two types of disasters: the market may perceive the positive effects of storms (e.g., premium growth and business expansion) as outweighing the negative impacts (e.g., payout losses), reflecting an optimistic approach to expectation management.Although storm events in both China and Japan led to declines in CAAR, the curve patterns differed, reflecting variations in insurance market structures, reinsurance arrangements, and investor sentiment across countries.

Long-Term Impact: In all events, the CAAR curves exhibited varying degrees of fluctuation or reversal after the fact, indicating that the market adjusted its expectations based on new information — such as actual loss data, company announcements, and claims progress — after digesting initial negative or positive information.

Figures 5 to 8, respectively, show the CAAR curves for the four major natural disasters, with a specific analysis of the stock market impact on European insurance and non-insurance companies. Overall, these figures reveal a significant market reaction to the studied events.

Figure5: CAAR Curve(Event1)

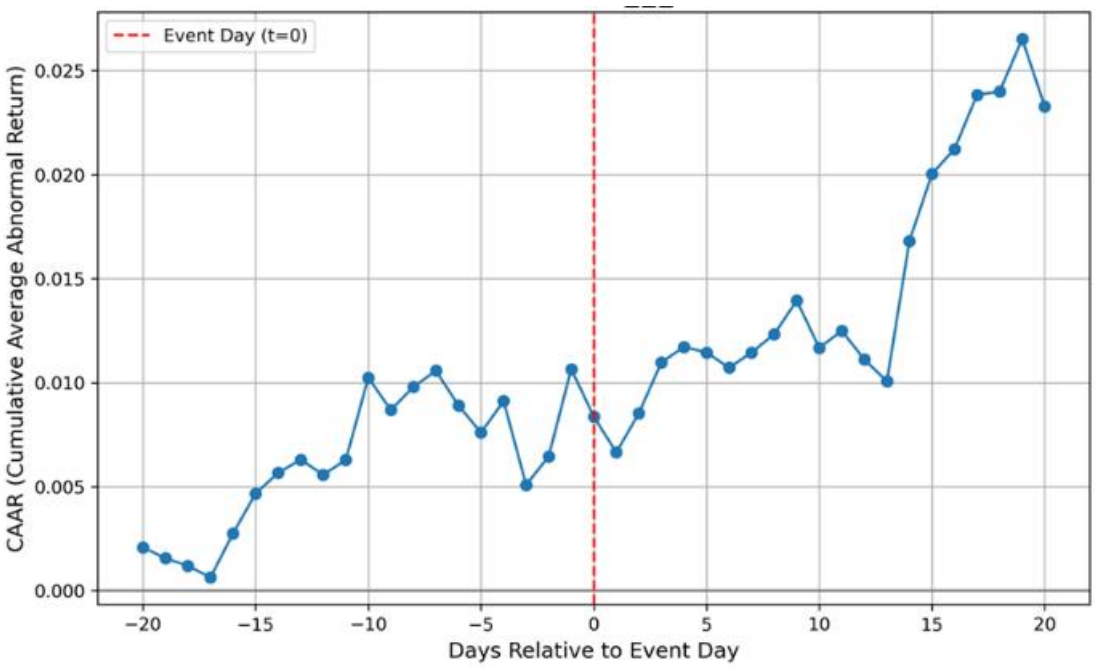


Figure 6： CAAR Curve(Event2)

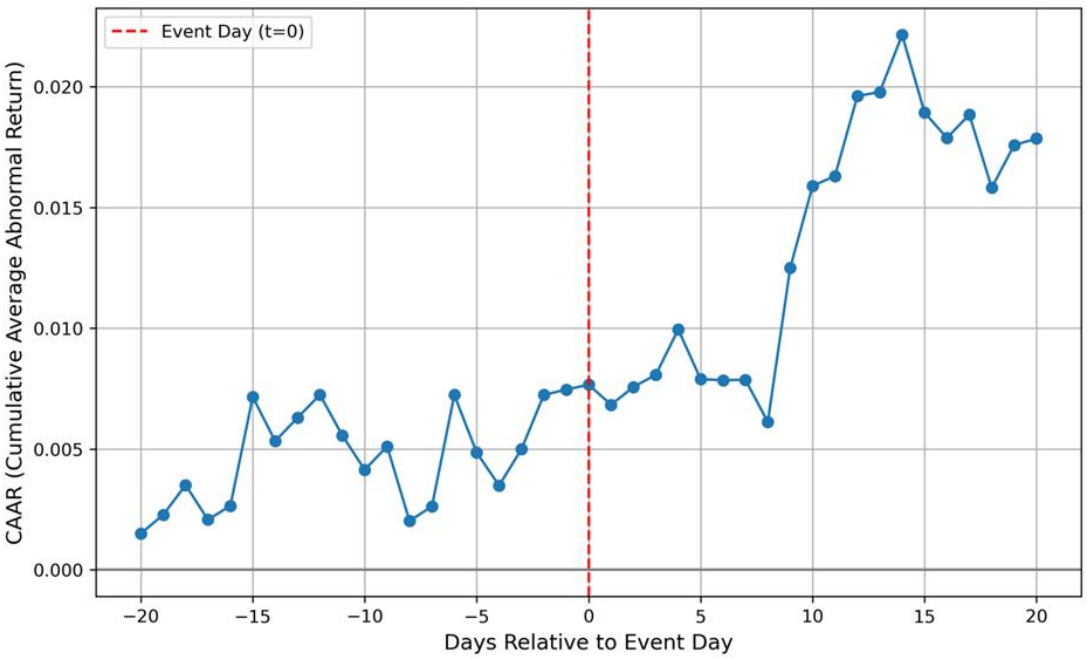


Figure 7: CAAR Curve(Event3)

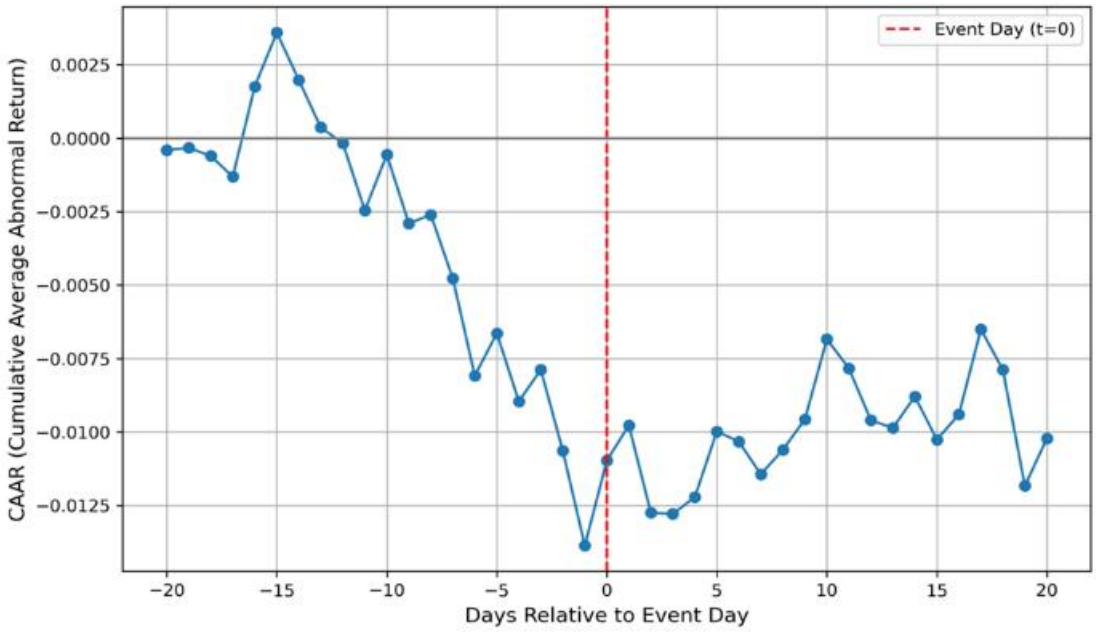
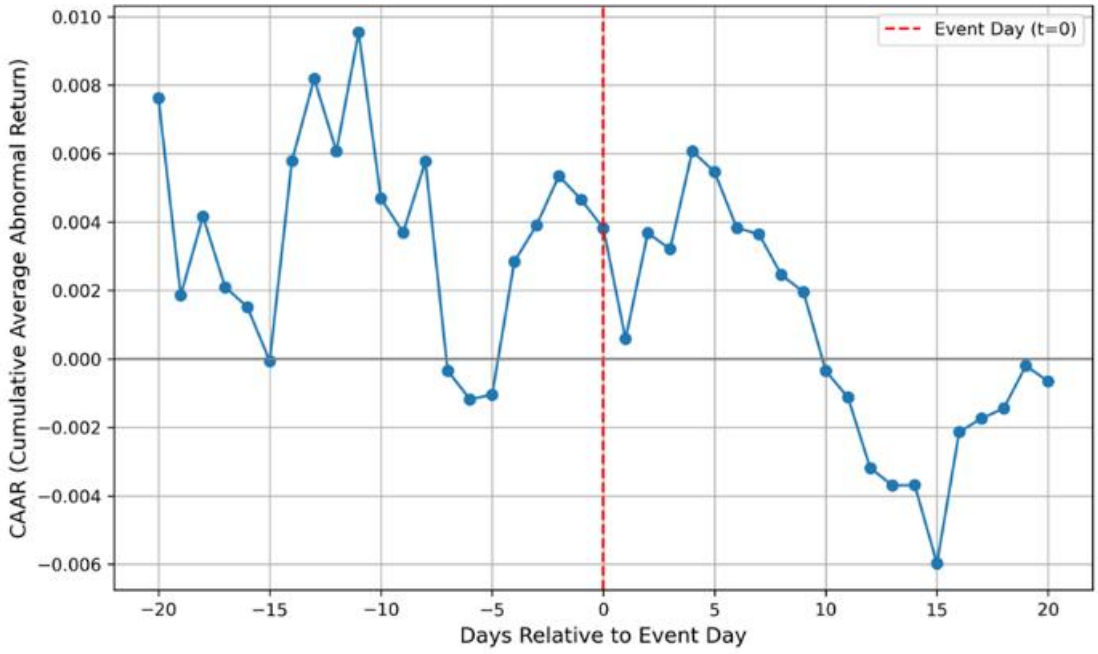


Figure 8：CAAR Curve(Event4)



The CAAR curves presented here track the market's response to four natural disasters occurring in Asia: two floods in 2016 (Japan and China) and two storms in 2017 (China) and 2019 (Japan). The analysis will focus on how a disaster in Asia impacts the stock performance of insurance and reinsurance companies in Europe. The key insight lies in the role of the global reinsurance market, where European firms play a dominant role.

Japan Flood (June 20, 2016), The CAAR curve shows a general upward trend, albeit with some volatility. It starts near a CAAR of 0.00 and climbs to approximately 0.01. This suggests that the market was reacting to the impending disaster with a positive, or at least not negative, outlook on European insurers. This could be due to a few factors. One is that the market perceived the potential losses from a regional flood to be manageable within the global reinsurance framework, with European firms well-positioned to handle any claims. Another possibility is that investors were anticipating a rise in premium rates following the event, which would be beneficial for reinsurers. Post-Event: The upward trend accelerates significantly after the event day. The CAAR rises from a little over 0.01 to a peak of nearly 0.025. This strong, sustained increase indicates a highly positive market reaction. This could be because the market realized that the actual losses were well-within the capacity of European reinsurers, or perhaps that the disaster served as a clear signal for a hardening of the reinsurance market, leading to higher prices and

improved profitability. The perception of European firms as resilient and profitable global risk managers was strengthened.

China Flood (June 28, 2016), Pre-Event: Similar to the Japan flood, the CAAR curve shows a moderate upward trend leading up to the event day. The curve starts at a low CAAR and fluctuates before climbing to approximately 0.007 at t=0. This implies a measured, but not overly concerned, market reaction to the impending large-scale flood in China. The market may have factored in the immense scale of the disaster but also the role of government-backed schemes and the global diversification of European firms. Post-Event: The most significant observation is the steep and sustained rise in the CAAR after the event. The curve jumps from about 0.007 to a peak above 0.02. This sharp increase strongly suggests that the market's initial concerns were unfounded, and that investors viewed the event positively for European reinsurers. This could be because the Chinese flood, despite its size, was covered by a combination of local insurance and international reinsurance, and the European firms' exposure was manageable. The event may have again highlighted the value of their risk diversification and pricing power.

China Storm (August 24, 2017): Pre-Event: The CAAR curve is highly volatile in the period leading up to the storm. It fluctuates significantly, rising to a peak and then falling back down to a CAAR near 0.00. This volatility suggests uncertainty in the market. Investors were likely trying

to gauge the potential for losses from the typhoon, balancing the high wind speed against the location and the level of insured assets in the area. The overall trend is downward towards the event day, indicating that some of the initial positive sentiment eroded as the storm approached. Post-Event: After a slight uptick immediately following the event, the CAAR curve begins a sustained and significant decline. Unlike the floods, this storm appears to have caused insured losses that were higher than the market's initial optimistic or neutral expectations. The decline suggests that European reinsurers may have had a more significant exposure to this type of wind damage than anticipated, or that the market was concerned about the potential for future similar events and a subsequent rise in claims.

Japan Storm (October 12, 2019): Pre-Event: The CAAR curve shows a clear and sustained downward trend leading up to the event. Starting from near 0.00, it falls to a low of approximately -0.0015. This strong negative pre-event reaction indicates that the market was highly concerned about the potential impact of this powerful typhoon. The high wind speed and the developed, insured nature of Japan likely led investors to anticipate significant insured losses that would directly impact the profitability of major global reinsurers, many of whom are based in Europe. Post-Event: The curve shows a slight bounce immediately after the event day but then continues to decline before starting to recover towards the end of the

window. The overall trend remains negative. The CAAR stays in the negative territory, reaching its lowest point around t=15 before a small recovery. This indicates that the market's initial fears were largely confirmed. The losses from this very strong typhoon were significant enough to cause a negative re-evaluation of the profitability and risk exposure of European firms. The subsequent recovery might be a result of the market realizing that the losses were still manageable, but the overall picture remained pessimistic.

Positive vs. Negative Reactions: The market reacted positively to the two major flood events, suggesting that it viewed these as manageable risks that might even lead to a strengthening of the reinsurance market. In contrast, the two storm events, particularly the more powerful one in China, triggered a clear and sustained negative reaction.

Perception of Risk: This difference highlights how the market perceives risk. Floods, while causing widespread damage, might be seen as having a more predictable and manageable loss profile for globally diversified reinsurers. Storms, especially high-wind ones, might be viewed as a more severe, concentrated risk that can cause unexpectedly high insured losses, directly impacting reinsurers' bottom lines.

Global Reinsurance's Role: The curves underscore the interconnectedness of the global reinsurance market. Events in Asia directly and significantly affect the stock performance of European companies, demonstrating their

critical role in absorbing and distributing catastrophic risk worldwide. The reaction is not uniform but depends on the specific nature and severity of the event.

4.5 T-test

We have observed different response patterns of the market to four natural disaster events from the CAAR curve. However, visual observation alone is not enough. Any conclusion regarding a "significant" response must be supported by statistical evidence. Therefore, the following section will present the results of the t-test, which will ultimately determine whether the CAAR we observe in different event Windows is statistically significant or fluctuates by chance. There are Chart1 and Chart 2 and show the outcomes in Asia and Europe.

Chart 1：

Event	CAAR	t	p
1	-0.0061	-1.4304	0.1538
2	-0.0026	-0.6739	0.5009
3	0.0063	1.8954	0.0391 **
4	0.0171	1.6613	0.0478 **

Notes: The table shows the Cumulative Average Abnormal Return (CAAR), t-statistic, and p-value for each event. Statistical significance levels are indicated by asterisks: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

This study employs a One-sample T-test to conduct a statistical significance test on the Cumulative Average Abnormal Returns (CAAR) for the four natural disaster events analyzed. The test results are shown in

Chart 1.

The results indicate that the CAAR for the first two events did not show statistical significance. The CAARs were -0.0061 and -0.0026, with p-values of 0.1538 and 0.5009, respectively. Specifically, the p-value for Event 1 was 0.153761 and for Event 2 was 0.500964, both of which are higher than the commonly used 5% significance level. This suggests that while there may have been some fluctuations in the CAAR curve, these fluctuations do not constitute a statistically meaningful abnormal market reaction and may be primarily due to random variations. However, the test results for the latter two events showed a significant positive impact. The CAAR for Event 3 was a positive value (0.00626) with a p-value of 0.039108, which is less than 0.05, indicating that this event generated a significant positive abnormal return for the market at the 5% significance level. Similarly, the CAAR for Event 4 was 0.017142 with a p-value of 0.047758, which is also statistically significant at the 5% significance level. These results clearly demonstrate that the market reacted positively to the natural disasters represented by Event 3 and Event 4, leading to an abnormal increase in stock prices. In conclusion, although not all events triggered a statistically significant market reaction, the analysis results clearly reveal that during certain specific disaster events, the market did experience significant abnormal returns. This finding provides a solid statistical basis for further in-depth exploration of how the market

perceives and processes information about different types of disasters.

Chart2:

Event	CAAR	t	p
1	0.023291	2.783894929	0.00673636***
2	0.017853	2.326873652	0.0225683 **
3	-0.01022	-1.799982146	0.075730001 *
4	-0.00066	-0.045749178	0.96362276

Notes: The table shows the Cumulative Average Abnormal Return (CAAR), t-statistic, and p-value for each event. Statistical significance levels are indicated by asterisks: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

This study further conducted statistical significance tests on the CAAR (Cumulative Average Abnormal Returns) for European insurance and reinsurance companies during four natural disaster events in Asia. The results (as shown in Chart 2) reveal the significant reactions of the European market to these distant events. In contrast to the analysis of the Asian market, the European market showed a significant positive reaction to the first two events. Specifically, the p-value for Event 1 was 0.006736, which is less than 0.01, indicating that this event generated a highly significant positive abnormal return for the European market. Similarly, the p-value for Event 2 was 0.022568, which is less than 0.05, confirming a significant positive market reaction. This finding is consistent with the upward trend revealed by the CAAR curve, suggesting that the market generally considered these events manageable for the European reinsurance industry, and that they might even benefit from post-disaster rate increases.

However, the test results for the latter two events were different. The CAAR for Event 3 was a negative value (-0.01022), with a p-value of 0.075730. While it is significant at the 10% level, it is not significant at the more stringent 5% level. This indicates a degree of negative market expectation for this event, but the statistical strength of this reaction is relatively weak. Furthermore, the CAAR for Event 4 was not statistically significant, with a p-value as high as 0.963622. This suggests that despite the negative CAAR value, it is more likely to be a random fluctuation, and thus does not prove any significant abnormal market reaction to this event.

In conclusion, the statistical test results strongly support the thesis of this study: the European reinsurance market does not passively accept risk but rather reacts differently based on the type of disaster and the scale of potential losses. The significant positive CAAR for the first two flood events reflects investor confidence in the global reinsurance system's ability to cope with such disasters, while the negative (though varying in significance) CAAR for the storm events may indicate the market's concern over potential losses.

5、Conclusion

This study aims to deeply explore the impact of natural disasters caused by climate change on the insurance industry in Asia and the stock market performance of reinsurance companies in Asia and Europe through the event study method. The study selected four representative natural disaster events - two floods and two storms that occurred in China and Japan respectively - as the research objects and collected stock data of major insurance and reinsurance companies in Europe and Asia for empirical analysis.

This study utilizes a T-test to conduct an in-depth statistical analysis of the Cumulative Average Abnormal Returns (CAAR) for insurance and reinsurance companies in both Asia and Europe, in response to four natural disaster events in Asia. The results indicate that the market's reaction to disaster events is not monolithic or passive, but highly dependent on the nature of the event, the scale of potential losses, and the geographical location of market participants.

In the analysis of the local Asian market, I found that not all disaster events triggered a significant abnormal market reaction. In stark contrast, the European reinsurance market exhibited a distinctly different reaction pattern. In the face of distant Asian disasters, the European market generated a significant positive CAAR for some events. I believe this

demonstrates its ability to effectively manage and absorb such risks, and possibly even benefit from post-disaster rate adjustments. I contend that the global market faces complexity and variability in its reaction patterns to the same disaster events, with the local Asian market showing selective reactions, while the European reinsurance market demonstrates its proactive risk management and pricing capabilities based on the type of disaster and the scale of potential losses.

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Appendix:

Table 2: List of Companies

Company Name	European Country of Headquarters	Company Name	Asian Country of Headquarters
Assicurazioni Generali SpA	Italy	Allianz Ayudhya Capital PCL	Thailand
Muenchener Rueckversicherungs-Gesellschaft in Muenchen AG	Germany	Bangkok Union Insurance PCL	Thailand
Nuernberger Beteiligungs AG	Germany	Yunfeng Financial Group Ltd	Hong Kong
RheinLand Holding AG	Germany	Min Xin Holdings Ltd	Hong Kong
Wuestenrot & Wuerttembergische AG	Germany	KWI PCL	Thailand
Scor SE	France	Syarikat Takaful Malaysia Keluarga Bhd	Malaysia
AXA SA	France	Dhofar Insurance Company SAOG	Oman
Zurich Insurance Group AG	Switzerland	Oman United Insurance SAOG Co	Oman
Aon PLC	Ireland	Allianz Malaysia Bhd	Malaysia
Aviva PLC	United Kingdom	Max Financial Services Ltd	India
ZIGUP PLC	United Kingdom	Hubei Biocause Pharmaceutical Co Ltd	China
Legal & General Group PLC	United Kingdom	Manulife Holdings Bhd	Malaysia
Prudential PLC	United Kingdom	Oman International Development & Investment Company SAOG	Oman
ALM. Brand A/S	Denmark	Bahrain National Holding Company BSC	Bahrain
Aegon Ltd	Netherlands	Menora Mivtachim Holdings Ltd	Israel
Baloise Holding AG	Switzerland	Phoenix Financial Ltd	Israel
Unipol Assicurazioni SpA	Italy	Zur Shamir Holdings Ltd	Israel
Grupo Catalana Occidente SA	Spain	Sinar Mas Multiartha Tbk PT	Indonesia
Allianz SE	Germany	Asuransi Harta Aman Pratama Tbk PT	Indonesia
Anadolu Anonim Turk Sigorta Sti	Turkey	Asuransi Ramayana Tbk PT	Indonesia
Chubb Ltd	Switzerland	Equity Development Investment Tbk PT	Indonesia
Uniqa Insurance Group AG	Austria	IGI Life Insurance Ltd	Pakistan
FBD Holdings PLC	Ireland	Great Eastern Holdings Ltd	Singapore
Ecclesiastical Insurance Office	United Kingdom	Jubilee Life Insurance Company	Pakistan

PLC		Ltd	
Mapfre SA	Spain	Clal Insurance Enterprises Holdings Ltd	Israel
Minerva Insurance Company Public Ltd	Cyprus	Arab Insurance Group BSC	Bahrain
Helvetia Holding AG	Switzerland	Ayalon Insurance Company Ltd	Israel
Sampo Oyj	Finland	Charan Insurance PCL	Thailand
Turkiye Sigorta AS	Turkey	Jerusalem Insurance Company PSC	Jordan
AK Sigorta AS	Turkey	United Overseas Insurance Ltd	Singapore
MAPFRE Middlesea PLC	Malta	Migdal Insurance and Financial Holdings Ltd	Israel
Hannover Rueck SE	Germany	Dhipaya Group Holdings PCL	Thailand
Ray Sigorta AS	Turkey	Euro Arab Insurance Group PSC	Jordan
Croatia Osiguranje dd	Croatia	Thai Setakij Insurance PCL	Thailand
Anadolu Hayat Emeklilik AS	Turkey	Samsung Fire & Marine Insurance Co Ltd	Korea; Republic (S. Korea)
Cosmos Insurance PCL	Cyprus	Indara Insurance PCL	Thailand
Atlantic Insurance Company Public Ltd	Cyprus	Hanwha Corp	Korea; Republic (S. Korea)
Personal Group Holdings PLC	United Kingdom	Heungkuk Fire & Marine Insurance Co Ltd	Korea; Republic (S. Korea)
Willis Towers Watson PLC	United Kingdom	MAA Group Bhd	Malaysia
Ageas SA	Belgium	Mercuries & Associates Holding Ltd	Taiwan
Skagi hf	Iceland	Navakij Insurance PCL	Thailand
Swiss Life Holding AG	Switzerland	Asia Financial Holdings Ltd	Hong Kong
Beazley PLC	United Kingdom	Thai Reinsurance PCL	Thailand
Adris Grupa dd	Croatia	Lpi Capital Bhd	Malaysia
Chesnara PLC	United Kingdom	Askari General Insurance Company Ltd	Pakistan
Admiral Group PLC	United Kingdom	Asuransi Bina Dana Arta Tbk PT	Indonesia
NASK Oranta PAT	Ukraine	Asuransi Bintang Tbk PT	Indonesia
Vienna Insurance Group Wiener Versicherung Gruppe AG	Austria	Asuransi Dayin Mitra Tbk PT	Indonesia
Vaudoise Assurances Holding SA	Switzerland	Panin Financial Tbk PT	Indonesia
Tryg A/S	Denmark	Maskapai Reasuransi Indonesia Tbk PT	Indonesia
Protector Forsikring ASA	Norway	Paninvest Tbk PT	Indonesia
EuroHold Bulgaria AD	Bulgaria	Harel Insurance Investments and Financial Services Ltd	Israel
Adriatic Osiguranje dd	Croatia	Pacific & Orient Bhd	Malaysia

Ingosstrakh SPAO	Russia	Al Manara Islamic Insurance Company PLC Co	Jordan
SAK Energogarant PAO	Russia	Delta Insurance Company PSC	Jordan
Helios Underwriting PLC	United Kingdom	Arabia Insurance Company Jordan PSC	Jordan
Phoenix Group Holdings PLC	United Kingdom	Jordan French Insurance Company PSC	Jordan
Pozavarovalnica Sava dd	Slovenia	Jordan Insurance Company PSC	Jordan
Zavarovalnica Triglav dd	Slovenia	Middle East Insurance Company PSC	Jordan
Uniqa Osiguranje dd Sarajevo	Bosnia and Herzegovina	National Insurance Company PSC	Jordan
Triglav Osiguranje dd Sarajevo	Bosnia and Herzegovina	Philadelphia Insurance PSC	Jordan
Adriatic Osiguranje dd Sarajevo	Bosnia and Herzegovina	United Insurance Company PSC	Jordan
Bosna Re dd Sarajevo	Bosnia and Herzegovina	Al-Nisr Al-Arabi Insurance Company PSC	Jordan
Croatia Osiguranje dd Ljubuski	Bosnia and Herzegovina	Bahrain Kuwait Insurance Co BSC	Bahrain
Sarajevo Osiguranje dd Sarajevo	Bosnia and Herzegovina	EFU Life Assurance Ltd	Pakistan
Brcko Gas Osiguranje Brcko dd	Bosnia and Herzegovina	Business & Industrial Insurance Co Ltd	Pakistan
Drina Osiguranje ad Milici	Bosnia and Herzegovina	Union Insurance Co Ltd	Taiwan
Krajina Osiguranje ad Banja Luka	Bosnia and Herzegovina	Solidarity Bahrain BSC	Bahrain
Neskovic Osiguranje ad Bijeljina	Bosnia and Herzegovina	Kuwait Insurance Company SAKP	Kuwait
Triglav Osiguranje ad Banja Luka	Bosnia and Herzegovina	Warba Insurance and Reinsurance Company KSCP	Kuwait
Dunav Osiguranje ad Banja Luka	Bosnia and Herzegovina	DB Insurance Co Ltd	Korea; Republic (S. Korea)
Mikrofin Osiguranje ad Banja Luka	Bosnia and Herzegovina	Dubai National Insurance & Reinsurance Co PSC	United Arab Emirates
Wiener Osiguranje Vienna Insurance Group ad Banja Luka	Bosnia and Herzegovina	Minerva Insurance Company Public Ltd	Cyprus
Grawe Osiguranje ad Banja Luka	Bosnia and Herzegovina	Adamjee Insurance Company Ltd	Pakistan
Asa Central Osiguranje Sarajevo dd	Bosnia and Herzegovina	Lippo General Insurance Tbk PT	Indonesia
Euroherc Osiguranje dd Sarajevo	Bosnia and Herzegovina	Asia Insurance Company Ltd	Pakistan
Powszechny Zaklad Ubezpieczen SA	Poland	Hyundai Marine & Fire Insurance Co Ltd	Korea; Republic (S. Korea)
CPPGroup PLC	United Kingdom	Century Insurance Company Ltd	Pakistan
ASR Nederland NV	Netherlands	Crescent Star Insurance Ltd	Pakistan
Osiguranje Aura ad Banja Luka	Bosnia and Herzegovina	TPL Life Insurance Ltd	Pakistan
Fintech SA	Poland	East West Insurance Co Ltd	Pakistan

Agesa Hayat ve Emeklilik AS	Turkey	EFU General Insurance Ltd	Pakistan
Gjensidige Forsikring ASA	Norway	Al Ahleia Insurance Co SAKP	Kuwait
Firstcaution SA	Switzerland	Habib Insurance Company Ltd	Pakistan
Talanx AG	Germany	Al Anwar Investments SAOG	Oman
Europejskie Centrum Odszkodowan SA	Poland	IGI Holdings Ltd	Pakistan
Votum SA	Poland	Shaheen Insurance Company Ltd	Pakistan
Swiss Re AG	Switzerland	Gulf Insurance Group KSCP	Kuwait
Strakhova Kompaniia Kraina AT	Ukraine	Lotte Non-Life Insurance Co Ltd	Korea; Republic (S. Korea)
Makedonija Viena Insurens Grup AD Skopje	Macedonia	MNRB Holdings Bhd	Malaysia
Triglav Osiguruvanje AD Skopje	Macedonia	Atlas Insurance Ltd	Pakistan
Eurolink AD Skopje	Macedonia	Jubilee General Insurance Company Ltd	Pakistan
Euroins Insurance AD Skopje	Macedonia	United Insurance Company of Pakistan Ltd	Pakistan
Direct Line Insurance Group PLC	United Kingdom	Universal Insurance Co Ltd	Pakistan
Interlife General Insurance Company SA	Greece	Pakistan Reinsurance Company Ltd	Pakistan
Just Group PLC	United Kingdom	First Insurance Co Ltd	Taiwan
SK Rosgosstrakh PAO	Russia	Premier Insurance Ltd	Pakistan
Insr ASA	Norway	Progressive Insurance Company Ltd	Pakistan
Sjova-Almennar tryggingar hf	Iceland	Reliance Insurance Co Ltd	Pakistan
Saga PLC	United Kingdom	Silver Star Insurance Co Ltd	Pakistan
NN Group NV	Netherlands	Askari Life Assurance Company Ltd	Pakistan
Coface SA	France	Korean Reinsurance Co	Korea; Republic (S. Korea)
Foyer SA	Luxembourg	Islamic Insurance Company PSC	Jordan
Optimco NV	Belgium	Qatar Insurance Company QSPC	Qatar
Kompaniya po Strakhovaniyu Zhizni Standard Life AO	Kazakhstan	Qatar General Insurance & Reinsurance Company QPSC	Qatar
Transilvania Broker de Asigurare SA	Romania	Ceylinco Holdings PLC	Sri Lanka
Sabre Insurance Group PLC	United Kingdom	Union Assurance PLC	Sri Lanka
KSZh Freedom Finance Life AO	Kazakhstan	Hanwha General Insurance Co Ltd	Korea; Republic (S. Korea)
DFV Deutsche Familienversicherung AG	Germany	Pakistan General Insurance Company Ltd	Pakistan
M&G PLC	United Kingdom	Muscat Insurance Company SAOG	Oman
Linea Directa Aseguradora SA	Spain	Al Khaleej Takaful Insurance	Qatar

Compania de Seguros y Reaseguros		Company QPSC	
LifeStar Holding plc	Malta	Takaful International Co BSC	Bahrain
Ondo InsurTech PLC	United Kingdom	Taiwan Fire & Marine Insurance Co Ltd	Taiwan
Gruppa Renessans Strakhovaniye PAO	Russia	Jordan International Insurance Company PSC	Jordan
Solid FAB	Sweden	Central Reinsurance Corp	Taiwan
Contract SA	Greece	Arab Jordanian Insurance Group PSC	Jordan
Yolo Group SpA	Italy	Shinkong Insurance Co Ltd	Taiwan
Revo Insurance SpA	Italy	China Taiping Insurance Holdings Co Ltd	Hong Kong
Millenium Insurance Broker MIB Broker De Asigurare Reasigurare SA	Romania	Qatar Islamic Insurance Company QPSC	Qatar
Mandatum Oyj	Finland	Arab Assurers Insurance Co PSC	Jordan
		Cosmos Insurance PCL	Cyprus
		Atlantic Insurance Company Public Ltd	Cyprus
		Softlogic Life Insurance PLC	Sri Lanka
		Gulf Insurance Group Jordan	Jordan
		Ahliea Insurance Group	Palestine
		National Insurance Co Ltd	Palestine
		Dubai Insurance Co PSC	United Arab Emirates
		Al Wathba National Insurance Company PJSC	United Arab Emirates
		Al Dhafra Insurance Company PSC	United Arab Emirates
		Al Khazna Insurance Company PSC	United Arab Emirates
		Emirates Insurance Company PSC	United Arab Emirates
		Al Ain Ahlia Insurance Company PSC	United Arab Emirates
		Doha Insurance Group QPSC	Qatar
		Fubon Financial Holding Co Ltd	Taiwan
		KGI Financial Holding Co Ltd	Taiwan
		Cathay Financial Holding Co Ltd	Taiwan
		Shin Kong Financial Holding Co Ltd	Taiwan
		Tokio Marine Holdings Inc	Japan
		Advance Create Co Ltd	Japan

		National General Insurance Co PJSC	United Arab Emirates
		United Fidelity Insurance Company PSC	United Arab Emirates
		Abu Dhabi National Insurance Company PSC	United Arab Emirates
		PICC Property and Casualty Co Ltd	China
		HNB Assurance PLC	Sri Lanka
		Asuransi Jasa Tania Tbk PT	Indonesia
		T&D Holdings Inc	Japan
		Union Insurance Co PSC	United Arab Emirates
		Kuwait Reinsurance Company KSCP	Kuwait
		Dubai Islamic Insurance & Reinsurance Company Aman PJSC	United Arab Emirates
		Sukoon Insurance PJSC	United Arab Emirates
		First Takaful Insurance Company KPSC	Kuwait
		Wethaq Takaful Insurance Co KCSP	Kuwait
		Company for Cooperative Insurance SJSC	Saudi Arabia
		Al Buhaira National Insurance Company PSC	United Arab Emirates
		Abu Dhabi National Takaful Company PSC	United Arab Emirates
		Ras Al Khaimah National Insurance Company PSC	United Arab Emirates
		Alliance Insurance PSC	United Arab Emirates
		Sukoon Takaful PJSC	United Arab Emirates
		Islamic Arab Insurance Co PJSC	United Arab Emirates
		Sharjah Insurance Co PSC	United Arab Emirates
		Asuransi Multi Artha Guna Tbk PT	Indonesia
		Al Sagr National Insurance Co PSC	United Arab Emirates
		Vietnam National Reinsurance Corp	Vietnam
		Al Mashriq Insurance PSC	Palestine
		Orient Insurance PJSC	United Arab Emirates
		Baominh Insurance Corp	Vietnam

		Amana Takaful PLC	Sri Lanka
		PVI Holdings	Vietnam
		China Life Insurance Co Ltd	China
		Ping An Insurance Group Co of China Ltd	China
		Arabia Insurance Cooperative Company SJSC	Saudi Arabia
		Malath Cooperative Insurance Company Sjsc	Saudi Arabia
		Mediterranean and Gulf Cooperative Insurance and Reinsurance Company SJSC	Saudi Arabia
		PICIC Insurance Ltd	Pakistan
		National Reinsurance Corporation of the Philippines	Philippines
		Arabian Shield Cooperative Insurance Company SJSC	Saudi Arabia
		Allied Cooperative Insurance Group SJSC	Saudi Arabia
		Gulf Union Alahlia Cooperative Insurance Company SJSC	Saudi Arabia
		Mediterranean and Gulf Insurance Company Jordan PSC	Jordan
		Al Fujairah National Insurance Company PJSC	United Arab Emirates
		Salama Cooperative Insurance Company SJSC	Saudi Arabia
		Central Insurance Company Ltd	Bangladesh
		Religare Enterprises Ltd	India
		Walaa Cooperative Insurance Company SJSC	Saudi Arabia
		Mutakamela Insurance Co	Saudi Arabia
		BaoViet Holdings	Vietnam
		First Insurance Company PSC	Jordan
		Saudi Arabian Cooperative Insurance Company SJSC	Saudi Arabia
		Bupa Arabia for Cooperative Insurance Company SJSC	Saudi Arabia
		AIFU Inc	China
		Al Sagr Cooperative Insurance Company Sjsc	Saudi Arabia
		Al Etihad Cooperative Insurance Company SJSC	Saudi Arabia

		China Pacific Insurance Group Co Ltd	China
		Asia Pacific General Insurance Company Ltd	Bangladesh
		Bangladesh General Insurance Company Plc	Bangladesh
		City Insurance PLC	Bangladesh
		Fareast Islami Life Insurance Company Ltd	Bangladesh
		Paramount Insurance PLC	Bangladesh
		Green Delta Insurance Plc	Bangladesh
		United Insurance Company Ltd	Bangladesh
		Peoples Insurance Co Ltd	Bangladesh
		Eastern Insurance Co Ltd	Bangladesh
		Janata Insurance Plc	Bangladesh
		Phoenix Insurance Co Ltd	Bangladesh
		Eastland Insurance PLC	Bangladesh
		Karnaphuli Insurance PLC	Bangladesh
		Rupali Insurance Company Ltd	Bangladesh
		National Life Insurance Plc	Bangladesh
		Federal Insurance Company Ltd	Bangladesh
		Reliance Insurance Ltd	Bangladesh
		Purabi General Insurance Co Ltd	Bangladesh
		Delta Life Insurance Company Ltd	Bangladesh
		Pragati Life Insurance PLC	Bangladesh
		Sandhani Life Insurance Co Ltd	Bangladesh
		Prime Insurance Company Ltd	Bangladesh
		Pioneer Insurance Company Ltd	Bangladesh
		Agrani Insurance Co Ltd	Bangladesh
		Mercantile Islami Insurance PLC	Bangladesh
		Global Insurance Ltd	Bangladesh
		Pragati Insurance Ltd	Bangladesh
		Meghna Life Insurance PLC	Bangladesh
		Nitol Insurance Company Ltd	Bangladesh
		Sonar Bangla Insurance Ltd	Bangladesh
		Prime Islami Life Insurance Ltd	Bangladesh
		Progressive Life Insurance Company Ltd	Bangladesh
		Continental Insurance PLC	Bangladesh
		United Cooperative Assurance Company SJSC	Saudi Arabia
		Saudi Reinsurance Company	Saudi Arabia

		SJSC	
		MS&AD Insurance Group Holdings Inc	Japan
		Bangkok Life Assurance PCL	Thailand
		Popular Life Insurance Company Ltd	Bangladesh
		Methaq Takaful Insurance PSC	United Arab Emirates
		Trust International Insurance Public Shareholding Ltd	Palestine
		Watania International Holding PJSC	United Arab Emirates
		Takaful Emarat Insurance PJSC	United Arab Emirates
		Janashakthi Insurance PLC	Sri Lanka
		Muang Thai Insurance PCL	Thailand
		Tongyang Life Insurance Co Ltd	Korea; Republic (S. Korea)
		Takaful Islami Insurance PLC	Bangladesh
		Standard Insurance Ltd	Bangladesh
		Northern Islami Insurance PLC	Bangladesh
		Republic Insurance Company Ltd	Bangladesh
		Gulf Insurance Group SJSC	Saudi Arabia
		CHUBB Arabia Cooperative Insurance Company SJSC	Saudi Arabia
		Asia Insurance PLC	Bangladesh
		HAYAH Insurance Company PJSC	United Arab Emirates
		Rupali Life Insurance Co Ltd	Bangladesh
		Buruj Cooperative Insurance Co SJSC	Saudi Arabia
		Liva Insurance Company SJSC	Saudi Arabia
		Gulf General Cooperative Insurance Company SJSC	Saudi Arabia
		Al Rajhi Company for Cooperative Insurance SJSC	Saudi Arabia
		Agriculture Bank Insurance Joint Stock Corp	Vietnam
		Islami Insurance Bangladesh Ltd	Bangladesh
		Dhaka Insurance Ltd	Bangladesh
		Anicom Holdings Inc	Japan
		Hanwha Life Insurance Co Ltd	Korea; Republic (S. Korea)
		Provati Insurance Company Ltd	Bangladesh
		Dai-ichi Life Holdings Inc	Japan
		Wataniya Insurance Company SJSC	Saudi Arabia

		Sompo Holdings Inc	Japan
		Samsung Life Insurance Co Ltd	Korea; Republic (S. Korea)
		Palestine Insurance Co	Palestine
		COFCO Capital Holdings Co Ltd	China
		Amana Cooperative Insurance Company SJSC	Saudi Arabia
		Sunshine Insurance Group Co Ltd	China
		BIDV Insurance Corp	Vietnam
		Al Madina Insurance Company SAOG	Oman
		Mirae Asset Life Insurance Co Ltd	Korea; Republic (S. Korea)
		New China Life Insurance Company Ltd	China
		Thai Life Insurance PCL	Thailand
		AIA Group Ltd	Hong Kong
		Insurance House P S C	United Arab Emirates
		Al-Aqeelah Takaful Insurance Company SA	Syria
		Syrian National Insurance Co SA	Syria
		Syria International Insurance Company SA	Syria
		United Insurance Company SA	Syria
		Post & Telecommunication Joint Stock Insurance Corp	Vietnam
		Global United Insurance Co	Palestine
		Al-Takaful Palestinian Insurance PLC	Palestine
		China United Insurance Service Inc	Taiwan
		TPL Insurance Ltd	Pakistan
		Petrolimex Insurance Corp	Vietnam
		Solidarity Alliance Insurance Company SA	Syria
		Asuransi Maximus Graha Persada Tbk PT	Indonesia
		Softlogic Capital PLC	Sri Lanka
		Syrian Kuwaiti Insurance Company SA	Syria
		Saudi Enaya Cooperative Insurance Company SJSC	Saudi Arabia
		Oman Reinsurance Company	Oman

		SAOC	
		IIRM Holdings India Ltd	India
		Mercuries Life Insurance Co Ltd	Taiwan
		Lifenet Insurance Co	Japan
		Aljazira Takaful Taawuni Company SJSC	Saudi Arabia
		Farglory Life Insurance Co Ltd	Taiwan
		Padma Islami Life Insurance Ltd	Bangladesh
		General Insurance Corporation of India	India
		Jiangxi Tianli Technology Inc	China
		TPL Corp Ltd	Pakistan
		Ahlia Insurance Co SA	Iraq
		Al Ameen Insurance Company SA	Iraq
		Dar Al Salam for Insurance Co	Iraq
		Gulf Insurance Co	Iraq
		Al Hamraa Insurance Co	Iraq
		Tune Protect Group Bhd	Malaysia
		Japan Post Holdings Co Ltd	Japan
		People's Insurance Company Group of China Ltd	China
		Sunlife Insurance Co Ltd	Bangladesh
		Thaire Life Assurance PCL	Thailand
		Takaful Oman Insurance SAOG	Oman
		IDI Insurance Company Ltd	Israel
		Taiming Assurance Broker Co Ltd	Taiwan
		Damaan Islamic Insurance Co Beema	Qatar
		Chuou International Group Co Ltd	Japan
		Arpico Insurance PLC	Sri Lanka
		China Reinsurance (Group) Corp	China
		SBI Life Insurance Company Ltd	India
		Bangladesh National Insurance Co Ltd	Bangladesh
		Arabia Falcon Insurance Company SAOC	Oman
		Japan Post Insurance Co Ltd	Japan
		Victoria Insurance Tbk PT	Indonesia
		HDFC Life Insurance Company Ltd	India

		Incar Finance Service Co Ltd	Korea; Republic (S. Korea)
		People's Insurance PLC	Sri Lanka
		Bao Long Insurance Corp	Vietnam
		ZhongAn Online P & C Insurance Co Ltd	China
		ASN Broker PCL	Thailand
		ICICI Prudential Life Insurance Company Ltd	India
		Amana Takaful Life PLC	Sri Lanka
		Capital Financial Indonesia Tbk PT	Indonesia
		Mortgage Service Japan Ltd	Japan
		New India Assurance Company Ltd	India
		Military Insurance Corp	Vietnam
		Kompaniya po Strakhovaniyu Zhizni Standard Life AO	Kazakhstan
		ICICI Lombard General Insurance Company Ltd	India
		Orient Takaful PJSC	United Arab Emirates
		Aditya Birla Capital Ltd	India
		Malacca Trust Wuwungan Insurance Tbk PT	Indonesia
		Oman Qatar Insurance Company SAOG	Oman
		Liva Group SAOG	Oman
		Asuransi Jiwa Syariah Jasa Mitra Abadi Tbk PT	Indonesia
		Asuransi Tugu Pratama Indonesia Tbk PT	Indonesia
		V2Y Corporation Ltd	Singapore
		IRRC Corp	Japan
		SBI Insurance Group Co Ltd	Japan
		KSZh Freedom Finance Life AO	Kazakhstan
		TQM Alpha PCL	Thailand
		Mandal General Insurance LLC	Mongolia
		Ard Daatgal JSC	Mongolia
		Golden Insurance Brokers Co Ltd	Taiwan
		MSIG Life Insurance Indonesia PT	Indonesia
		Thai Group Holdings PCL	Thailand
		Huize Holding Ltd	China

		Life Insurance Corporation Of India	India
		Express Insurance LTD	Bangladesh
		Union Insurance Company Ltd	Bangladesh
		Crystal Insurance Company Ltd	Bangladesh
		Sonali Life Insurance Company Ltd	Bangladesh
		Bhakti Multi Artha Tbk PT	Indonesia
		Tian Ruixiang Holdings Ltd	China
		International General Insurance Holdings Ltd	Jordan
		Bodi Insurance JSC	Mongolia
		TQR PCL	Thailand
		Cheche Group Inc	China
		Desh General Insurance Company Ltd	Bangladesh
		A Plus Asset Advisor Co Ltd	Korea; Republic (S. Korea)
		QLM Life & Medical Insurance Company QPSC	Qatar
		Hanoi Reinsurance Joint Stock Corp	Vietnam
		Vietnam National Aviation Insurance Corp	Vietnam
		Star Health and Allied Insurance Company Ltd	India
		Wesure Global Tech Ltd	Israel
		Adamjee Life Assurance Co Ltd	Pakistan
		Waterdrop Inc	China
		Tamkeen Palestinian Insurance	Palestine
		Libra Insurance Company Ltd	Israel
		Chartered Life Insurance Company Ltd	Bangladesh
		Sena Insurance Plc	Bangladesh
		LOLC General Insurance PLC	Sri Lanka
		Co-Operative Insurance Company PLC	Sri Lanka
		Meghna Insurance Company Ltd	Bangladesh
		Sikder Insurance Company Ltd	Bangladesh
		Trust Islami Life Insurance Ltd	Bangladesh
		FP Partner Inc	Japan
		Go Digit General Insurance Ltd	India
		Islami Commercial Insurance PLC	Bangladesh

		BlueVenture Group PCL	Thailand
		Agent Insurance Group Inc	Japan
		Thaivivat Holdings PCL	Thailand
		Zhongmiao Holdings Qingdao Co Ltd	China
		Nippon Souken Co Ltd	Japan
		Sai Gon Hanoi Insurance Corp	Vietnam
		Nippon Insure Co Ltd	Japan
		Seoul Guarantee Insurance Co	Korea; Republic (S. Korea)
		Zhibao Technology Inc	China
		BKI Holdings PCL	Thailand
		Niva Bupa Health Insurance Company Ltd	India
		Alskom Sug'urta Kompaniyasi AO	Uzbekistan
		SO Inson AO	Uzbekistan
		Kapital Sug'urta AO	Uzbekistan
		Uzagrosugurta AO	Uzbekistan
		Uzbekinvest EIIC JSC	Uzbekistan
		Temiryol-Sugurta AO	Uzbekistan
		Aria Sugurta Tashkiloti AO	Uzbekistan
		Autoris Group Holdings Bhd	Malaysia
		Tenger Daatgal JSC	Mongolia
		Asuransi Digital Bersama Tbk PT	Indonesia
		Allianz SE (Labuan Branch)	Malaysia
		Yuanbao Inc	China

Table3：

Event	Event Date (t=0)	Estimation Window	Event Window	Notes
2016 Japan Flood	June 20, 2016	Aug 11, 2015 – June 8, 2016	June 13, 2016 – June 27, 2016	Event window skips weekends.
2016 China Flood	June 28, 2016	Aug 18, 2015 – June 16, 2016	June 21, 2016 – July 5, 2016	Dates are in line with a standard event study.
2017 China Storm	August 24, 2017	Oct 11, 2016 – Aug 11, 2017	Aug 17, 2017 – Aug 31, 2017	Event window skips weekends..
2019 Japan Storm	Oct 14, 2019	Nov 29, 2018 – Sep 30, 2019	Oct 7, 2019 – Oct 21, 2019	Event window skips weekends.