

Catastrophic Events, Parameter Uncertainty and Implicit Long-term Contracting: The Case of Terrorism Insurance

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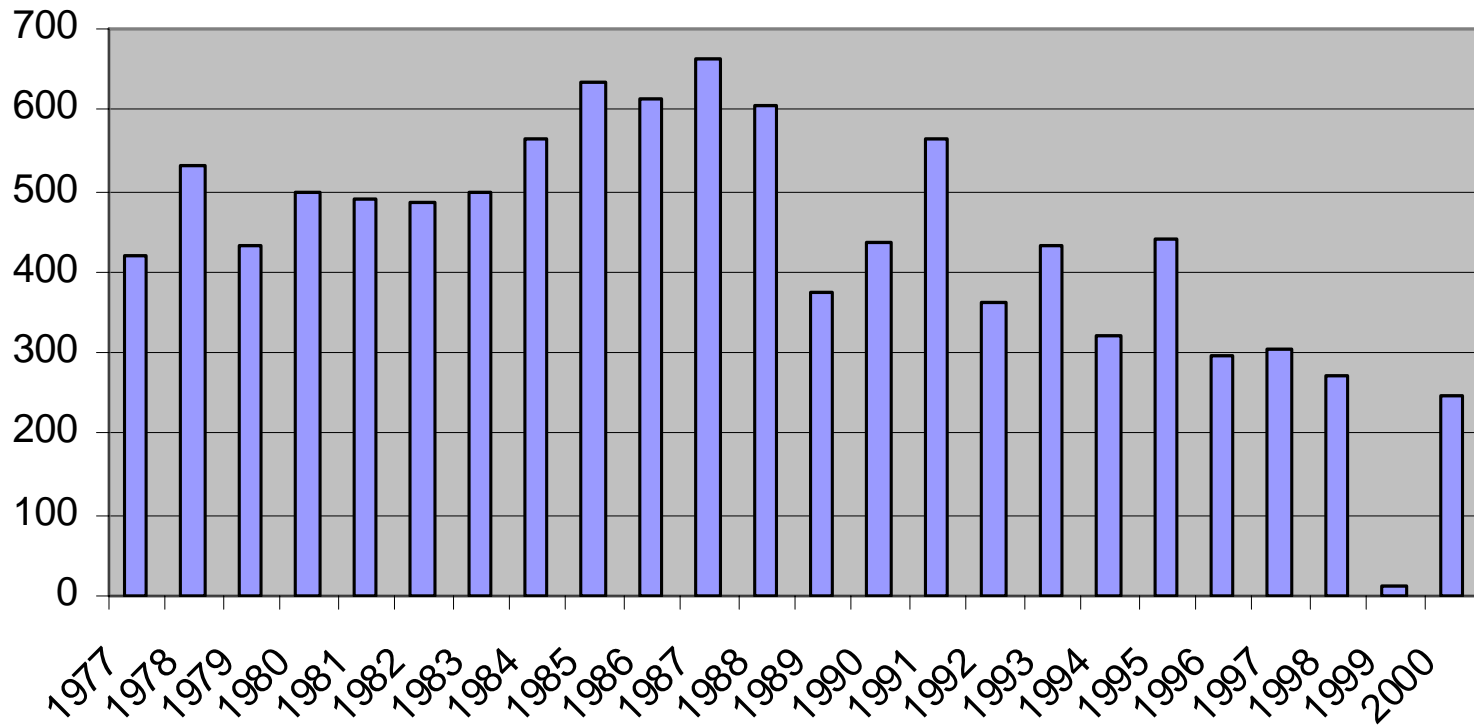
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History of Terrorism Attacks

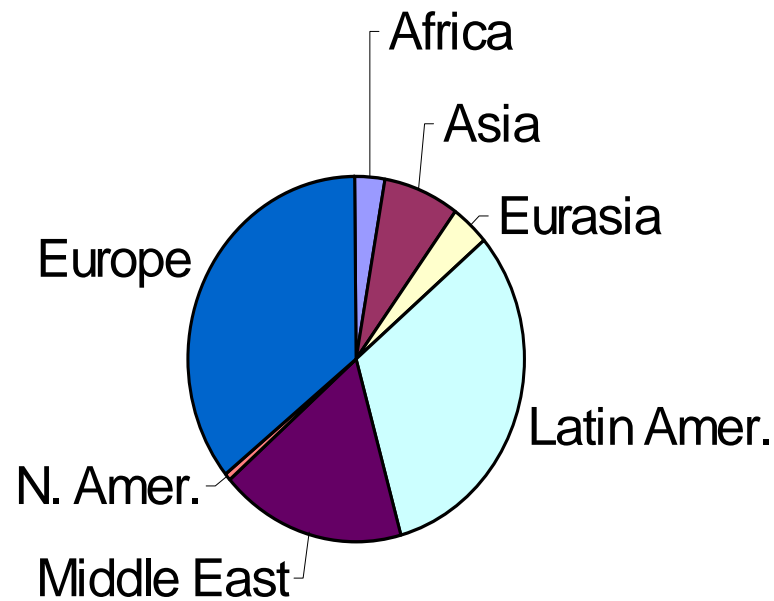
Figure 1: International Terrorist Attacks: 1977-2000



Source: U.S. Department of State, Patterns of Global Terrorism: 1993-2000

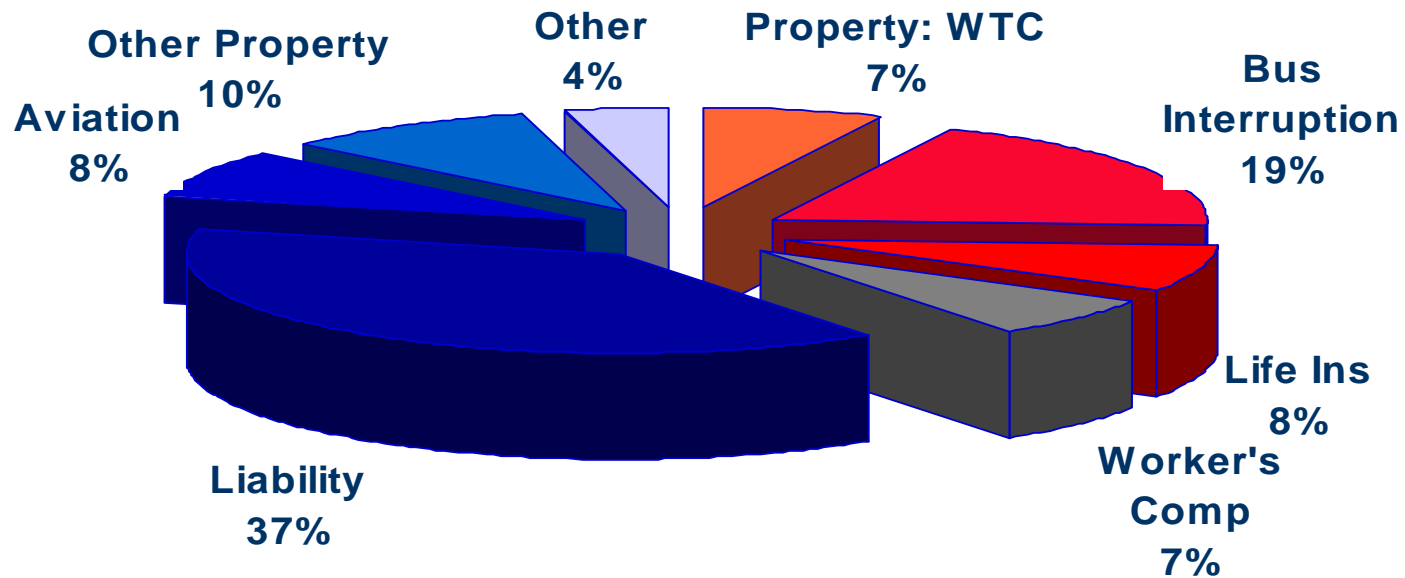
History of Terrorism Attacks

Figure 2: International Terrorism Attacks By Region:1991-1998



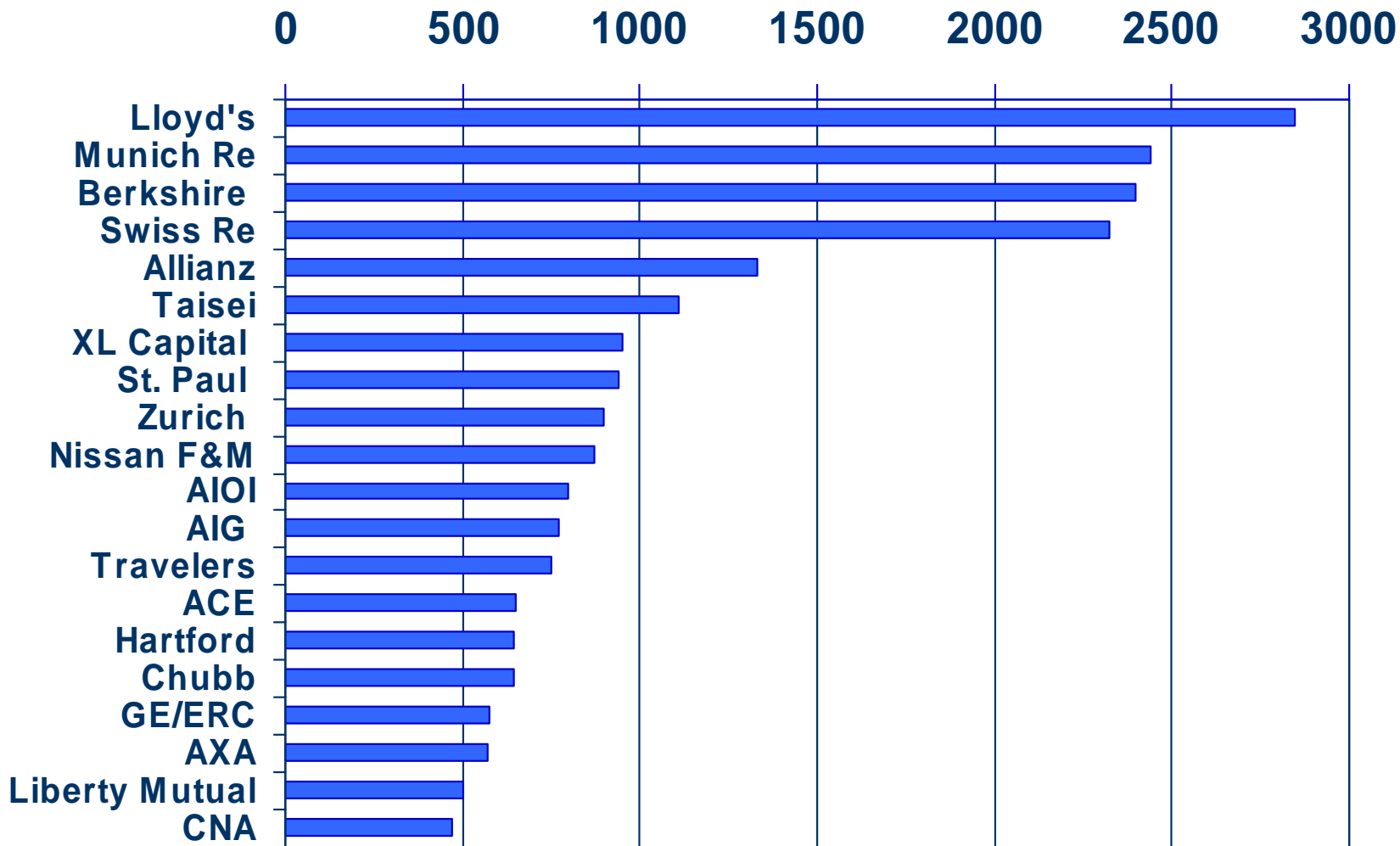
Estimated Insured Losses: WTC Attack

Total Projected Insured Losses = \$52 Billion

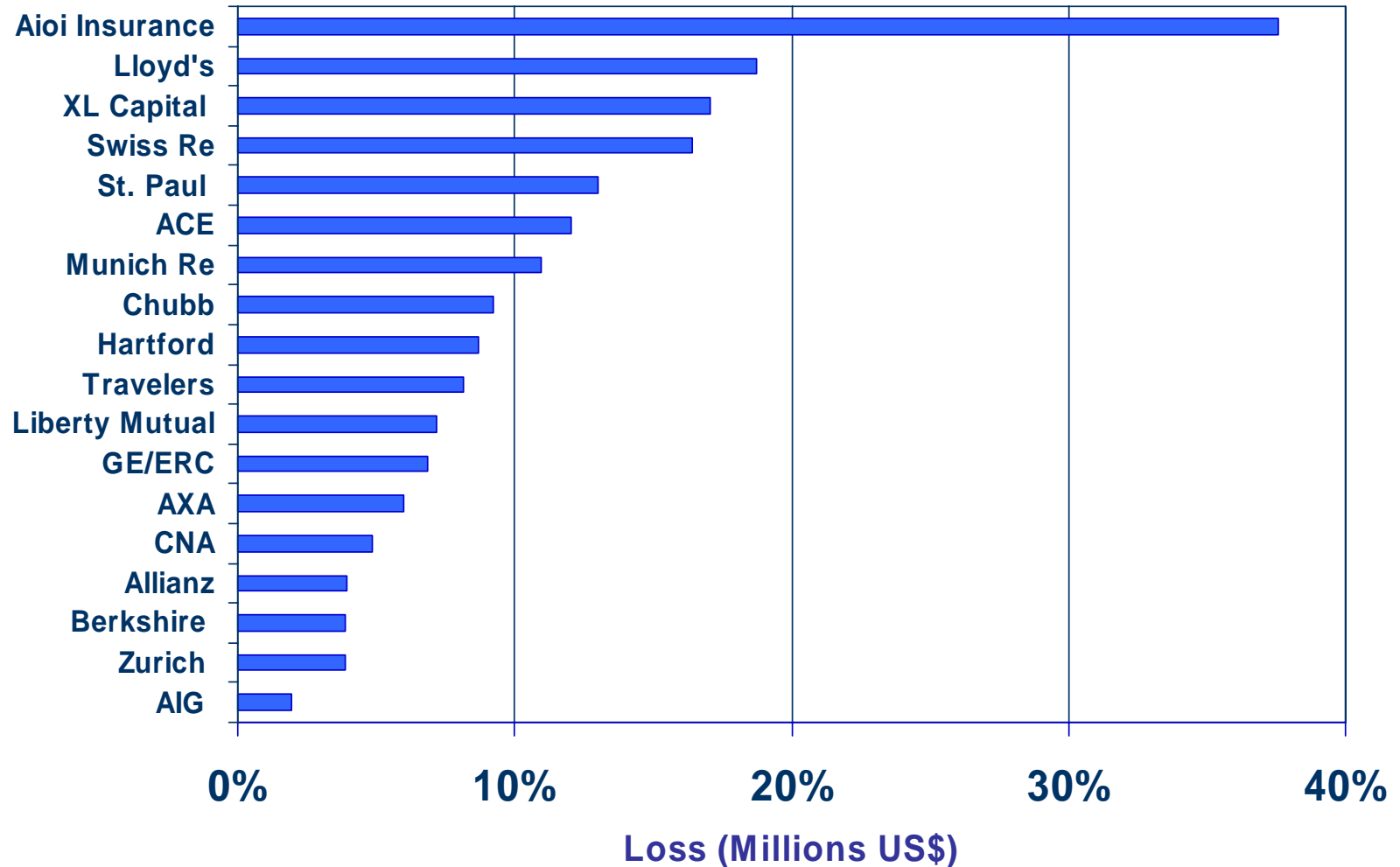


Source: A.T. Kearney and Morgan Stanley, *Business Insurance*, September 9, 2002.

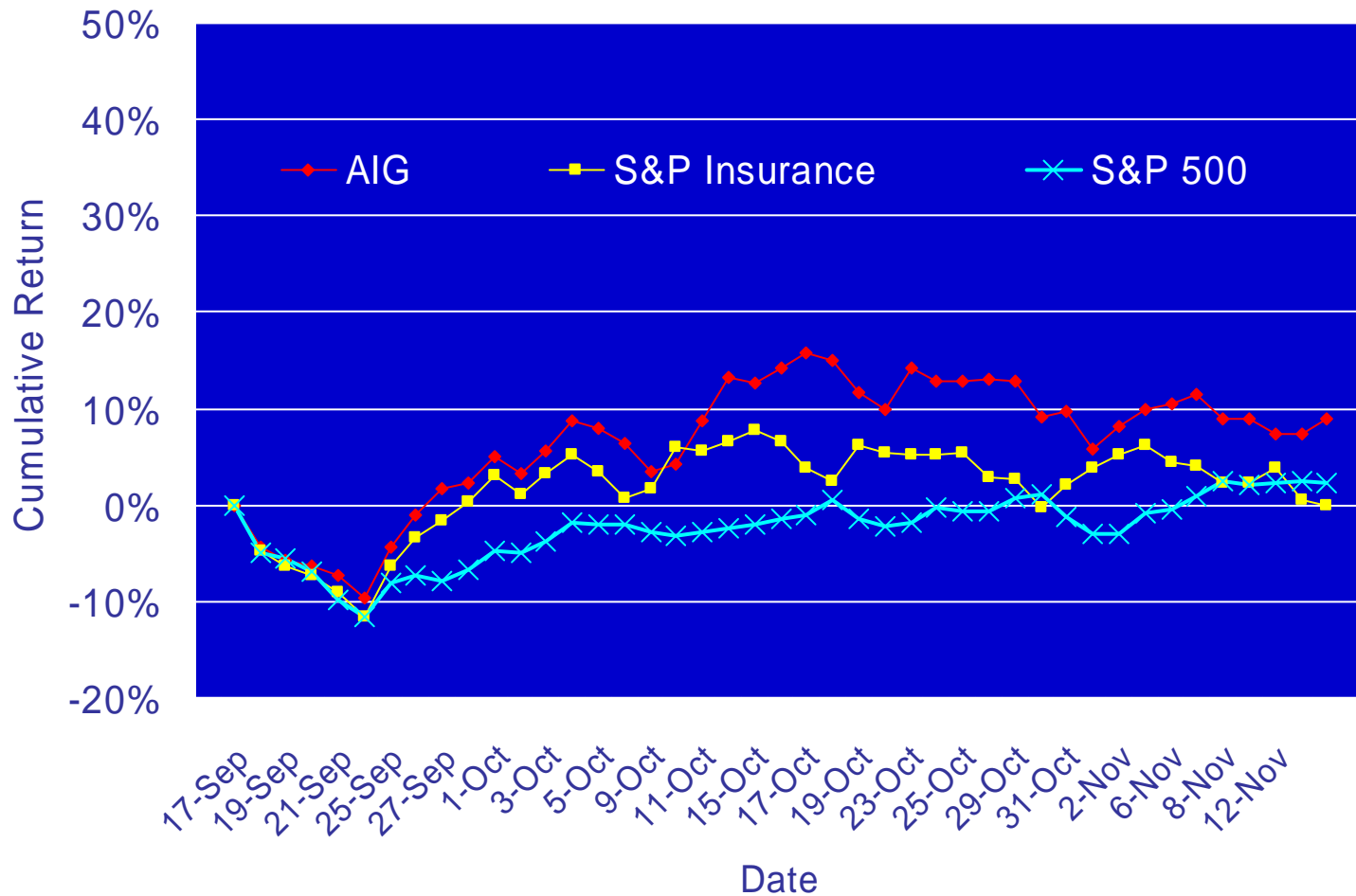
Top 20 Companies in WTC Insured Losses (US\$, millions)



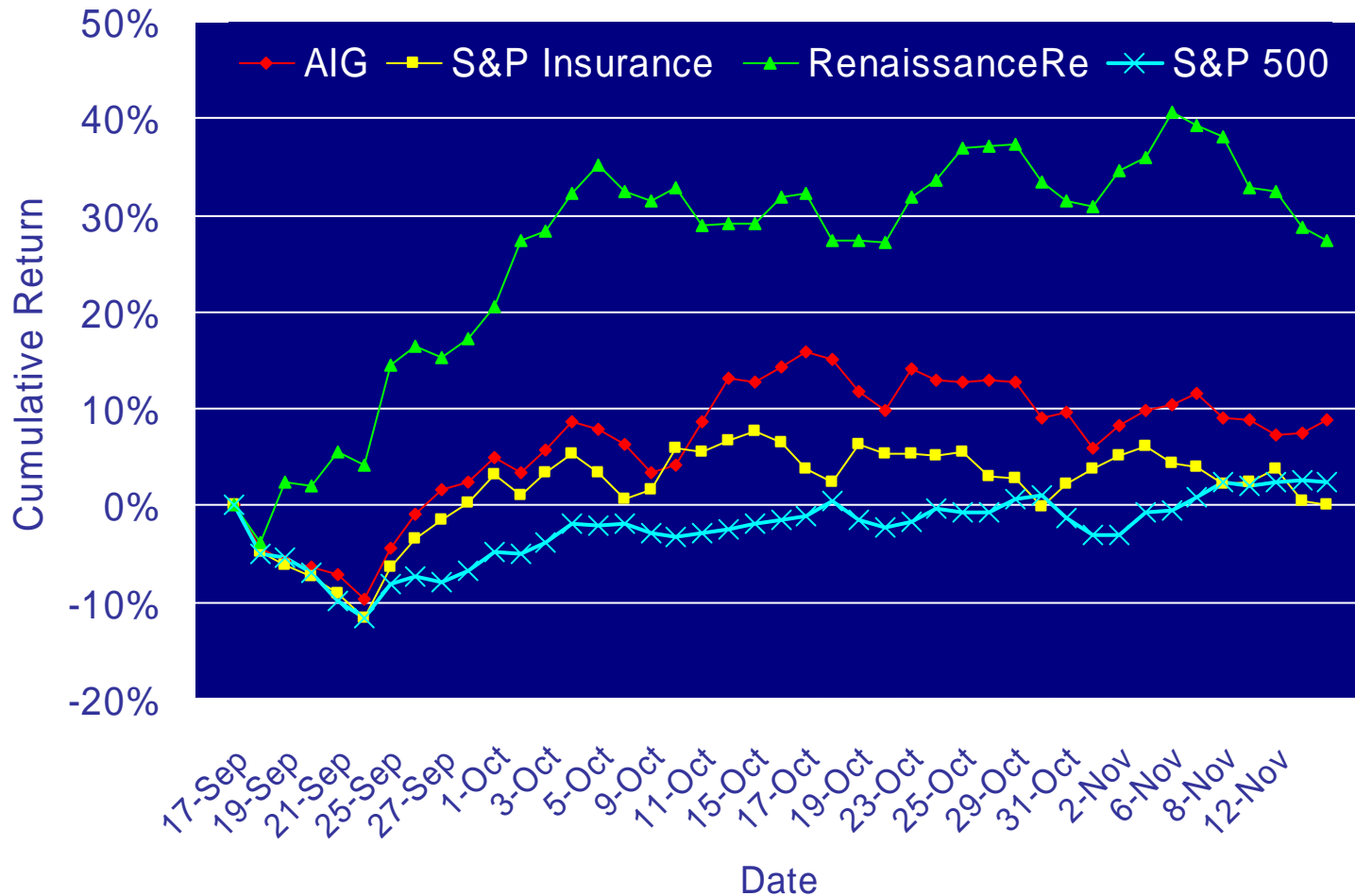
Top 20 Companies in WTC: Net Insured Losses/2000 Capital



Insurer Stock Performance: Sept 10 – Nov 13



Insurer Stock Performance: Sept. 10 – Nov. 13



Source: Yahoo! Finance

Objectives of Paper

- ◆ Measure the effects of the World Trade Center attacks on the stock returns of traded insurers
 - Average abnormal returns following the event date
 - Volatility of abnormal returns following event date

- ◆ Compare the stock price impact of the WTC attacks with previous major catastrophic events: WTC – \$52 billion
 - Significant prior events:
 - Hurricane Andrew (1992)– \$20 billion
 - Northridge Earthquake (1994) – 16.7 billion
 - Are terrorist attacks “different” from natural catastrophes?

- ◆ Hypothesis
 - **Market returns following the WTC attacks will be relatively high for insurers with strong financial ratings**
 - Sample: 43 publicly-traded national P&C insurers

Theoretical Background: Insurance Market Disequilibria I

- ◆ Large, unexpected loss shocks are known to cause disequilibria in insurance markets
 - Supply of coverage falls
 - Prices rise

Theoretical Background:

Insurance Market Disequilibria II

- ◆ Theories of disequilibria explain their existence in terms of 3 primary factors (Winter 1994, Cummins and Danzon 1997)
 - Parameter uncertainty – loss shocks create uncertainty about loss frequency and severity distributions, increases pricing uncertainty
 - Positive correlations among losses violate the law of large numbers and reduce the effectiveness of diversification
 - Capital market imperfections, chiefly informational asymmetries between insurers and capital markets, raise the cost of capital, making it difficult for insurers to recapitalize following a loss shock
- ◆ These theories imply that disruptions of markets due to the emergence of new risks and adverse information about existing risks lead to reductions in insurer market value

Theoretical Background:

External vs. Internal Capital

- ◆ Froot and O'Connell (1997) and Froot, Scharfstein and Stein (1999) model of financial intermediaries under the assumption that external capital is more costly than internal capital due to market imperfections
 - Intermediaries prefer to finance new projects using internal capital, providing an incentive to manage risk to reduce the probability of shocks to capital
 - Well-capitalized insurers are expected to have an advantage over weaker insurers because they have less need to raise costly external capital

Theoretical Background:

External vs. Internal Capital II

- ◆ Implications of the Froot, et al. model for insurers facing catastrophic losses
 - The supply of insurance by a given insurer is a positive function of its internal capital – thus, well-capitalized insurers are likely to gain relative to less-capitalized firms following an industry-wide shock to capital
 - Supply of insurance is inversely related to correlations among risks because such correlations increase the probability that an insurer's internal capital will be depleted by a shock – therefore, an event that raises insurer estimates of loss correlations will lead to supply restrictions
 - Supply of insurance is inversely related to the volatility of loss distributions – insurer will restrict supply and increase prices in highly volatile lines of insurance

Theoretical Background:

Implicit Multi-Period Contracts

- ◆ Reinsurance often involves implicit or explicit multi-period contracting
 - The reinsurer makes loss payments to the primary insurer when losses are relatively high and recovers part of these losses when losses are relatively low
 - May be an implicitly understood part of the agreement
 - In some cases, e.g. “spread-loss” reinsurance, the agreement is explicit

Theoretical Background:

Implicit Multi-Period Contracts II

◆ Reinsurance with multi-period contracting

- Implicit long-term contracts are useful in managing “distribution uncertainty” risk (Lewis and Murdock 1996)
 - Information about the risk is revealed during the term of the contract that reduces information asymmetries
 - Long-term contracts also expose both parties to counter-party credit risk
 - Information can also be revealed that leads one party to defect from the contract
- Credit risk and defection risk are inter-dependent
 - If both parties are financially strong following a loss, both can credibly be expected to perform on the long-term contract and defection risk is low
 - If one party is significantly weakened by a loss, its ability to continue to perform under the multi-period contract is reduced, giving the other party an incentive to default, possibly pushing the weaker party into bankruptcy

Multi-Period Contracting: Predictions

- ◆ Multi-period contracting arguments predict that stronger insurers will bounce back from a catastrophic loss shock, whereas weaker insurers will recover more slowly
 - Stronger insurers can benefit by picking up clients who have defected from relationships with weaker insurers
 - Financial weakness of one party gives the stronger party to the contract the incentive to delay or resist claim payments in order to devote financial resources to more attractive projects
 - Therefore, increased parameter uncertainty and financial weakness are likely to break down multi-period contracting arrangements such that firms with superior financial strength are better able to recover from loss shocks

Defection from Insurance Contracts: Examples

- ◆ The 2001 insolvency of Reliance Insurance Group was hastened by a slowdown in payments from its reinsurers in the aftermath of the WTC attacks.

Douglas McLeod, "Road Ends for Reliance," *Business Insurance*, October 8, 2001, pp. 3 ff.

- ◆ Mutual Risk Management, also encountered severe financial problems associated with the collectability of reinsurance receivables.

Michael Bradford, "MRM Plan Aims To Restore Investor Confidence, Profits," *Business Insurance*, May 13, 2002.

Theoretical Background: Stock Price Volatility

- ◆ Both theoretical and empirical evidence establishes a positive relationship between the variance of stock prices and the variance of the flow of new information into securities markets
 - Theoretical analysis – Ross (1989)
 - Empirical evidence – Beaver (1968), Christie (1982), Ohlson and Penman (1985), Dravid (1987), Pound and Zeckhauser (1990)
- ◆ To the extent that the WTC attacks and other catastrophes increase the variance of the flow of new information, such events will increase the volatility of insurance stocks

Hypotheses

Hypothesis 1: *The market reaction to the WTC attacks will be strongly negative for exposed insurers in the days immediately following the attacks.*

Hypothesis 2: *The WTC attacks created a significant event-induced increase in the variance of insurer returns in the week immediately following the attacks.*

Hypothesis 3: *The significant increase in variance induced by the WTC attacks would persist in the month following the event.*

Hypothesis 4: *The market returns to individual insurers following the first week of the WTC attacks will be relatively high for insurers with strong financial ratings.*

Data and Methodology

- ◆ Initial sample of 48 property-casualty insurers:
 - Publicly-traded on the NYSE, AMEX, or NASDAQ stock exchange around the time of September 11th;
 - Had a pre-September market capitalization greater than \$500 million
 - Classified as a property-casualty insurer under the Standard Industrial Classification (SIC) code system.

Data and Methodology II

- ◆ Restricting the sample to firms with a market capitalization greater than \$500 million focuses attention on national and large regional carriers that are less constrained by local economy factors
- ◆ Of the 48 companies in our initial sample, we discarded 5 firms due to insufficient historical price information
 - Four firms were subsidiaries of foreign insurers
 - The fifth firm, Travelers Property, did not start trading until after the event window

Data and Methodology III

◆ Standard market model event-study methodology:

- Computed returns for each of the 43 firms in our sample using data from the Center for Research in Security Prices (CRSP) tapes and rating information as of September 11th from the A.M. Best Company. The expected return is defined as follows:

$$R_{jt} = \alpha_j + \beta_j R_{mt} + \varepsilon_{jt}$$

- where R_{jt} is the dividend-adjusted return on security j on day t [$\log((\text{Price}_t + \text{Dividend}_t)/\text{Price}_{t-1})$], R_{mt} is the CRSP equally-weighted market return on day t , α_j is the idiosyncratic return on security j , β_j is the beta coefficient of security j , and ε_{jt} is the regression error term

Data and Methodology IV

- ◆ Estimated the market parameters for each insurer using 250 days of returns ending in the last week of August 2001 (returns for the week of September 3rd were excluded)
- ◆ Computed the daily abnormal return (AR) for each security during the event period – event date: 9/11/2001
 - (0,+30) event window.
- ◆ The abnormal return in day t in the event window for security j is the estimated disturbance term of the market model calculated out-of-sample:

$$AR_{jt} = R_{jt} - \hat{\alpha}_j - \hat{\beta}_j R_{mt}$$

Data and Methodology V

- ◆ The distribution of the abnormal return, conditional on the market return, is jointly normal with a zero conditional mean and a conditional variance equal to the following:

$$\sigma^2(AR_{jt}) = \hat{\sigma}_{\varepsilon_j}^2 + \frac{1}{L_1} \left[1 + \frac{(R_{mt} - \bar{R}_m)^2}{\hat{\sigma}_m^2} \right]$$

- ◆ where $\hat{\sigma}_{\varepsilon_j}^2$ represents the sum of the squared residuals (i.e., abnormal returns) from the market model estimation divided by $(L_1 - 2)$, and L_1 represents the number of non-missing daily periods over which the market model was estimated for firm j .

Data and Methodology VI

- ◆ The average abnormal return and the variance in average abnormal returns across all N securities in a given time period are computed as follows:

$$\overline{AR}_t = \frac{1}{N} \sum_{j=1}^N AR_{jt} \qquad \hat{\sigma}^2(\overline{AR}_t) = \frac{1}{N^2} \sum_{j=1}^N \hat{\sigma}_{\varepsilon_j}^2$$

Data and Methodology VII

- ◆ We compute the cumulative average abnormal returns (CAR) for the N securities across two time periods (τ_1 and τ_2), as well as the variance in the CAR, as follows.

$$\overline{CAR}(\tau_1, \tau_2) = \frac{1}{N} \sum_{j=1}^N \overline{AR}(\tau_1, \tau_2)$$

$$\text{Var}[\overline{CAR}(\tau_1, \tau_2)] = \frac{1}{N^2} \sum_{j=1}^N \hat{\sigma}_j^2(\tau_1, \tau_2)$$

Additional Adjustments

- ◆ We standardized the abnormal return for each security by dividing by each security's estimated variance (Patell 1976)
 - Ensures that no single firm dominates the results
 - Improves the power of the test statistics.

- ◆ We adjust the estimated variance in returns by the contemporaneous cross-sectional variance of the sample, by applying the standardized cross-sectional procedure of Boehmer, Musumeci and Poulsen (1991)
 - Accounts for the increased rate of information flow in the overall market

Test Statistics

- ◆ We incorporate the Boehmer, et al. (1991) variance adjustment by developing a new Z-statistics as follows:

$$Z_t = \frac{TSAR_t}{\sigma_{sar,t} \sqrt{N}}$$

- ◆ where the adjusted standard deviation is given as follows:

$$\hat{\sigma}_{sar,t}^2 = \frac{1}{N-1} \sum_{j=1}^N [SAR_{jt} - \frac{1}{n} SAR_{jt}]^2$$

Test Statistics

- ◆ To measure the standardized cumulative abnormal returns across the portfolio, we define the Standardized Cumulative Abnormal Return (SCAR) for any security over the period (τ_1, τ_2) as its Cumulative Abnormal Return (CAR) divided by its corresponding asymptotic variance (for large L_1) as follows :

$$SCAR(\tau_1, \tau_2) = \frac{CAR_j}{\sigma_j^2(\tau_1, \tau_2)} = \frac{\sum_{t=\tau_1}^{\tau_2} AR_{jt}}{(\tau_2 - \tau_1 + 1)\sigma_{\varepsilon_j}^2}$$

- ◆ Finally, we average these standardized cumulative abnormal returns across all N securities and divide by an estimate of the standard deviation of the SCARs to obtain a test statistic for the portfolio SCAR

Test Statistics II

- ◆ This modified Z-statistics allows us to construct tests on the significance of the WTC attacks on the stock returns of the property-casualty insurance companies in our sample:

$$Z_t = \frac{\sum_{j=1}^N SCAR_j(\tau_1, \tau_2)}{\sigma_{scar} \sqrt{N}}$$

- ◆ Where

$$\hat{\sigma}_{scar}^2(\tau_1, \tau_2) = \frac{1}{N-1} \sum_{j=1}^N [SCAR(\tau_1, \tau_2) - \frac{1}{N} SCAR(\tau_1, \tau_2)]^2$$

Results

- ◆ World Trade Center
- ◆ Hurricane Andrew
- ◆ Northridge Earthquake

Standard Deviation of Standardized Cumulative Abnormal Returns

Event	StdDev	F-Test
WTC Attack:		
Window (-27, -7)	0.0648	N/A
Window (0, 7)	0.1180	3.32 ***
Window (0, 20)	0.1280	3.91 ***
Market Return		
Window (-27, -7)	0.0142	N/A
Window (0, 7)	0.0251	2.90 ***
Window (0, 20)	0.0127	0.581
Hurricane Andrew (8/24/1992):		
Window (-27, -7)	0.0777	N/A
Window (0, 7)	0.1316	2.868 ***
Window (0, 20)	0.1599	4.239 ***
Northridge Earthquake (1/17/1994):		
Window (-27, -7)	0.0934	N/A
Window (0, 7)	0.0519	0.31
Window (0, 20)	0.1016	1.184

Note: The symbol *** represents statistical significance at the 0.5 % level.

Standard Deviation of SCAR: Conclusions

- ◆ Effects on volatility of SCAR: WTC
 - WTC increased volatility for insurance stocks
 - WTC increased volatility for the market as a whole
 - Insurer volatility increase was sustained
- ◆ Effect on volatility of SCAR: Property CATs
 - Andrew increased return volatility – new information on the potential effects of CATs
 - Northridge did not increase volatility – information on CAT risk already “discounted” into insurance stocks
- ◆ Results consistent with hypothesis that return volatility reflects increased volatility of new information flow

Daily Average Abnormal Returns

Market Model, Equally-weighted Index

Day	N	Mean Abnormal Return	Patell Z-Score	Var-Adj Z-Score	EGLS Z-Score	Gen. Sign Z
-5	43	-0.14	-0.611	-0.83	-0.806	0.36
-4	43	0.09	0.2	0.254	0.255	1.275
-3	43	-0.61	-1.858 *	-2.265 *	-2.311 *	-1.166
-2	43	-0.78	-1.971 *	-2.4 **	-2.466 **	-1.776 *
-1	43	0.88	2.544 **	2.576 **	2.673 **	2.496 **
0	43	-4.74	-14.781 ***	-4.657 ***	-4.771 ***	-5.133 ***
1	43	0.1	0.044	0.035	0.033	-1.166
2	43	-0.96	-3.085 **	-2.157 *	-2.039 *	-0.861
3	43	-2.06	-6.215 ***	-4.513 ***	-4.456 ***	-2.997 **
4	43	-1.9	-6.455 ***	-3.678 ***	-4.069 ***	-2.692 **
5	43	2.65	7.905 ***	4.028 ***	3.995 ***	3.411 ***
6	43	1.51	4.585 ***	3.351 ***	3.406 ***	2.496 **
7	43	1.11	3.507 ***	2.092 *	2.222 *	2.801 **
8	43	2.9	8.658 ***	5.795 ***	5.915 ***	4.937 ***
9	43	2.92	8.831 ***	6.141 ***	6.043 ***	4.327 **
10	43	-0.73	-2.091 *	-2.42 **	-2.343 *	-1.776 *
11	43	0.78	2.315 *	1.551	1.58	2.496 **
12	43	2.41	7.412 ***	4.474 ***	4.656 ***	3.411 ***
13	43	-0.67	-1.657 *	-1.798 *	-1.728 *	-2.387 **
14	43	-1.13	-3.391 ***	-3.409 ***	-3.289 **	-2.387 **
15	43	-1.24	-3.519 ***	-4.757 ***	-4.588 ***	-2.692 **
16	43	0.64	2.074 *	1.642	1.618	2.191 *
17	43	0.62	1.671 *	1.1	1.038	-0.251
18	43	-0.76	-1.749 *	-1.26	-1.231	-1.471
19	43	-0.78	-2.208 *	-2.379 **	-2.294 *	-2.082 *
20	43	0.63	1.603	1.824 *	1.758 *	2.191 *
21	43	0.69	1.892 *	2.136 *	2.119 *	1.275
22	43	-1.96	-5.446 ***	-4.874 ***	-4.555 ***	-3.912 ***
23	43	-1.14	-3.482 ***	-3.745 ***	-3.539 ***	-2.997 **
24	43	-0.37	-1.759 *	-1.773 *	-1.699	-2.387 **
25	43	2.37	7.075 ***	6.32 ***	6.054 ***	3.411 ***
26	43	-1.68	-4.906 ***	-3.786 ***	-3.743 ***	-2.997 **
27	43	0.54	2.307 *	0.765	0.757	-0.251
28	43	-0.24	-1.091	-1.147	-1.106	-1.166
29	43	-0.19	-0.453	-0.518	-0.484	-0.861
30	43	-1.11	-3.142 ***	-3.65 ***	-3.522 ***	-2.997 ***

Abnormal Returns: Interpretation

- ◆ WTC attacks had a strong negative influence on insurer stock returns on the event day: -4.75%
- ◆ Unlike some other single event results, the impact was sustained with several additional significant negative responses in days to follow
 - Possibly due to new information about the extent of the loss
- ◆ Several significant positive return days mitigated the negative impact, also over a sustained period, suggesting market continued to react to new information

Cumulative Average Abnormal Returns (CAAR): Market Model, Equally-weighted Index

Window (Days)	N	Mean Cumulative Abnormal Return	Precision- Weighted CAAR	Patell Z-Score		Variance- adjusted Z-Score		Est. GLS Z-Score		Generalized Sign Z-Score	
(0,1)	43	-4.65	-4.88	-10.58	***	-4.12	***	-4.19	***	-3.91	***
(0,4)	43	-9.56	-10.01	-13.08	***	-5.12	***	-5.30	***	-3.91	**
(5,30)	43	7.80	8.11	4.59	***	3.11	***	3.09	*	1.89	*

- ◆ Conclusion: Stocks took initial hit and then recovered somewhat on average
 - Market expectations of price increases
 - Expected government intervention to shift burden to taxpayers
 - Signal of general hardening of market
 - Recognition that market worked well – spreading losses globally

Cumulative Average Abnormal Returns (CAAR) By Rating

A.M. Best Rating	N	Days (0,1)	Days (0,4)	Days (5,30)
A++	6	-2.95	-2.62	7.80
A+	17	-6.74	-8.38	9.30
A	12	-3.37	-7.05	-0.88
A-	3	-2.06	-5.51	-8.75
Not Rated	5	-3.97	-7.29	9.18

- ◆ **Conclusion:** Highly rated insurers recovered but lower rated firms did not
 - Stronger internal capital position
 - Implicit long-term contracting
 - Buyer flight to quality

Cross-Sectional Regression Results: Rating Impact on Insurer Returns

Standardized Cumulative Abnormal Returns (SCAR)

Panel A: SCAR in the week following September 11th (0-4 Event Window)

$$\text{SCAR}_{(0,4)} = -0.1116 + .03097 \text{ LowRating} + \varepsilon_t$$

(-4.21) (0.72)

$$\text{F-Test} = 0.52 \quad \text{P-value} = 0.4766 \quad \text{R}^2 = 0.0142$$

Panel B: SCAR during weeks following the week of September 11th (5-30 Event Window):

$$\text{SCAR}_{(5,30)} = 0.12902 - 0.1406 \text{ LowRating} + \varepsilon_t$$

(4.12) (-2.78)

$$\text{F-Test} = 7.70 \quad \text{P-value} = 0.0087 \quad \text{R}^2 = 0.1762$$

Note: t-statistics are in parentheses. LowRating takes the value of 0 for companies with an AmBest Rating of A+ or better, and 1 otherwise.

Daily ARs: Hurricane Andrew†

Market Model, Equally-Weighted Index

Day	N	Mean Abnormal Return	Patell Z-Score	Variance- adjusted Z-Score	Estimated GLS Z-Score	General Sign Z-Score
-5	28	1.33	0.613	0.559	0.329	0.697
-4	28	0.37	0.049	0.055	0.041	0.318
-3	28	-0.39	-0.903	-1.298	-1.116	-0.818
-2	28	-0.66	-1.101	-1.779 *	-1.234	-1.954 *
-1	28	-0.84	-1.453	-1.796 *	-1.234	-1.197
0	28	0.41	-0.338	-0.308	-0.216	-1.197
1	28	-2.52	-3.992 ***	-1.667 *	-1.173	-0.439
2	28	-1.49	-3.027 **	-2.097 *	-1.65	-1.954 *
3	28	0.62	-0.029	-0.022	-0.019	0.697
4	28	-0.95	-1.52	-1.054	-1	-0.061
5	28	0.05	-0.537	-0.367	-0.28	-0.439
6	28	-0.27	-1.013	-0.487	-0.506	-1.197
7	28	0.7	-0.429	-0.285	-0.277	0.318
8	28	-0.89	-1.18	-0.717	-0.761	-1.575
9	28	-0.22	0.128	-0.216	0.184	0.318
10	28	-0.39	-1.734 *	-1.782 *	-1.562	-0.818

† (8/24/1992)

Note: The symbols *, **, and *** represent statistical significance at the 5%, 1% and 0.1% level.

Daily ARs: Northridge Earthquake[‡]

Market Model, Equally-Weighted Index

Day	N	Mean Abnormal Return	Patell Z-Score	Variance- adjusted Z-Score	Estimated GLS Z-Score	General Sign Z-Score
-5	55	1.14	3.243 ***	3.319 ***	3.029 **	2.577 **
-4	55	0.01	0.091	0.094	0.092	0.684
-3	55	-0.55	-0.428	-0.48	-0.448	-1.75
-2	55	-0.47	-1.1	-1.727 *	-1.442	-2.561 **
-1	55	0.51	0.759	0.912	0.8	0.143
0	55	-0.65	-3.026 **	-3.667 ***	-3.412 ***	-2.561 **
1	55	-0.51	-1.194	-0.97	-0.962	-1.209
2	55	-0.25	-0.484	-0.514	-0.433	0.684
3	55	0.29	2.068 *	2.039 *	1.648	0.954
4	55	0.19	0.527	0.471	0.4	-0.275
5	55	-0.57	-1.798 *	-2.093 *	-2.011 *	-0.275
6	55	-0.11	0.147	0.2	0.18	-0.275
7	55	0.14	-0.044	-0.033	-0.033	-0.275
8	55	0.18	0.373	0.277	0.271	1.089
9	55	0.06	1.066	0.889	0.817	-0.003
10	55	0.11	0.96	0.872	0.873	0.816

[‡] (1/17/1994)

Note: The symbols *, **, and *** represent statistical significance at the 5%, 1% and 0.1% level.

Cumulative Average Abnormal Returns: WTC, Northridge, and Andrew

Window (Days)	N	World Trade Center	North- ridge	Andrew
(0,1)	43	-4.64	-1.16	-2.11
(0,4)	43	-9.56	-0.93	-3.93
(5,10)	43	10.36	-0.19	-1.02

Conclusions

- ◆ The empirical evidence is consistent with our hypotheses
 - Strong negative impact on insurer stock prices following 9/11
 - Volatility of abnormal returns increased significantly following the event, consistent with an increase in the volatility of new information flow due to the attack
 - “Flight to quality” effect – stock prices of strong insurers rebounded but those of weaker insurers did not

Conclusions II

- ◆ Was WTC a “unique” catastrophe?
 - WTC had a larger and more sustained impact on stock prices than Andrew or Northridge – however, was the impact due to magnitude alone or other factors?
 - “Bounce back” effect from WTC but not from Andrew and Northridge
 - Both WTC and Andrew increased the volatility of insurer abnormal returns but Northridge did not
 - WTC led to restrictions on insurance supply, but so did Andrew and the 1980s commercial liability crisis
 - Therefore, evidence for uniqueness is inconclusive

Public Policy Implications

- ◆ Market seems to have worked reasonably well in a “second-best” sense with risks being diversified and transferred into the capital markets through insurer stock ownership
 - Therefore, in the absence of government intervention, the market may have followed a trajectory to recovery similar to the recoveries from the liability crisis and earlier property catastrophes
 - On the other hand, if terrorism is inherently different, such a recovery would have been very slow to occur

Public Policy Implications II

- ◆ The government role in terrorism insurance markets
 - The government should devote resources to helping the industry understand the nature of terrorism risk, especially with regard to long-term frequency and severity of the risks
 - Flight-to-quality is a constructive manifestation of competitive market equilibrium –
 - The government should not interfere in this process by providing solvency protection for insurers
 - Any government assistance must be commercially viable in contract design and execution
 - Government terrorism insurance programs should be designed to encourage migration back to the private sector

Where Do We Go From Here? Federal Terrorism Reinsurance

The Terrorism Risk Insurance Act of 2002

An Empirical Analysis of the Economic Impact of Federal Terrorism Reinsurance

Jeffrey R. Brown, J. David Cummins,
Christopher M. Lewis, and Ran Wei

Terrorism Risk Insurance Act of 2002

- ◆ The Terrorism Risk Insurance Act will “strengthen America's economy, build confidence with America's investors, and create jobs for America's workers.”

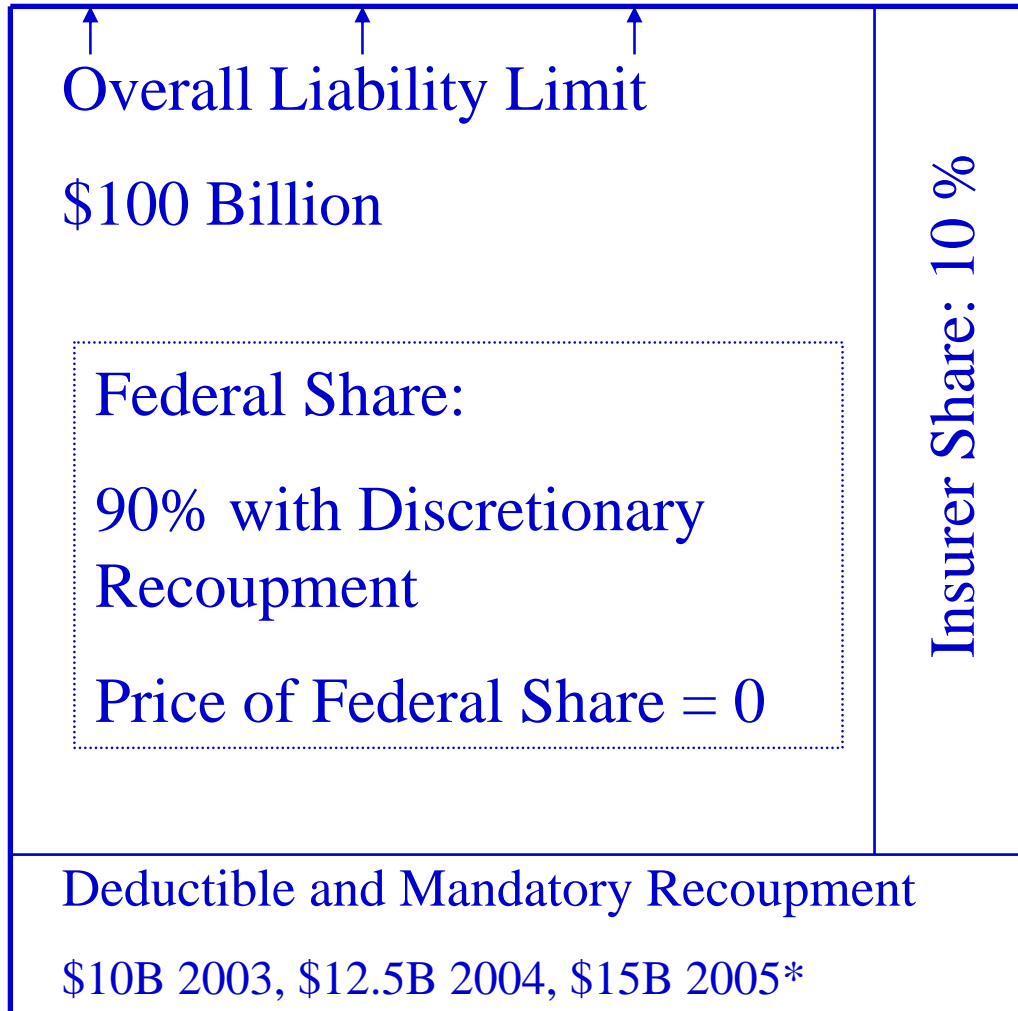
George W. Bush, December 2, 2002.



Terrorism Reinsurance Act of 2002 (TRIA)

- ◆ Established within Treasury the Terrorism Insurance Program, expires 12/31/2004 but Treasury can extend to 12/31/2005
- ◆ Nullified terrorism exclusions in commercial P&C policies and requires insurers to offer coverage
 - “that does not differ materially from the terms . . . applicable to losses arising from events other than terrorism”
 - Implicitly allows exclusion of nuclear, biological, and chemical events if states generally allow these exclusions
- ◆ Federal participation requires Treasury certification that a specific act constitutes foreign terrorism
- ◆ To be covered, event must cause losses > \$5 million

Reinsurance Coverage Under TRIA



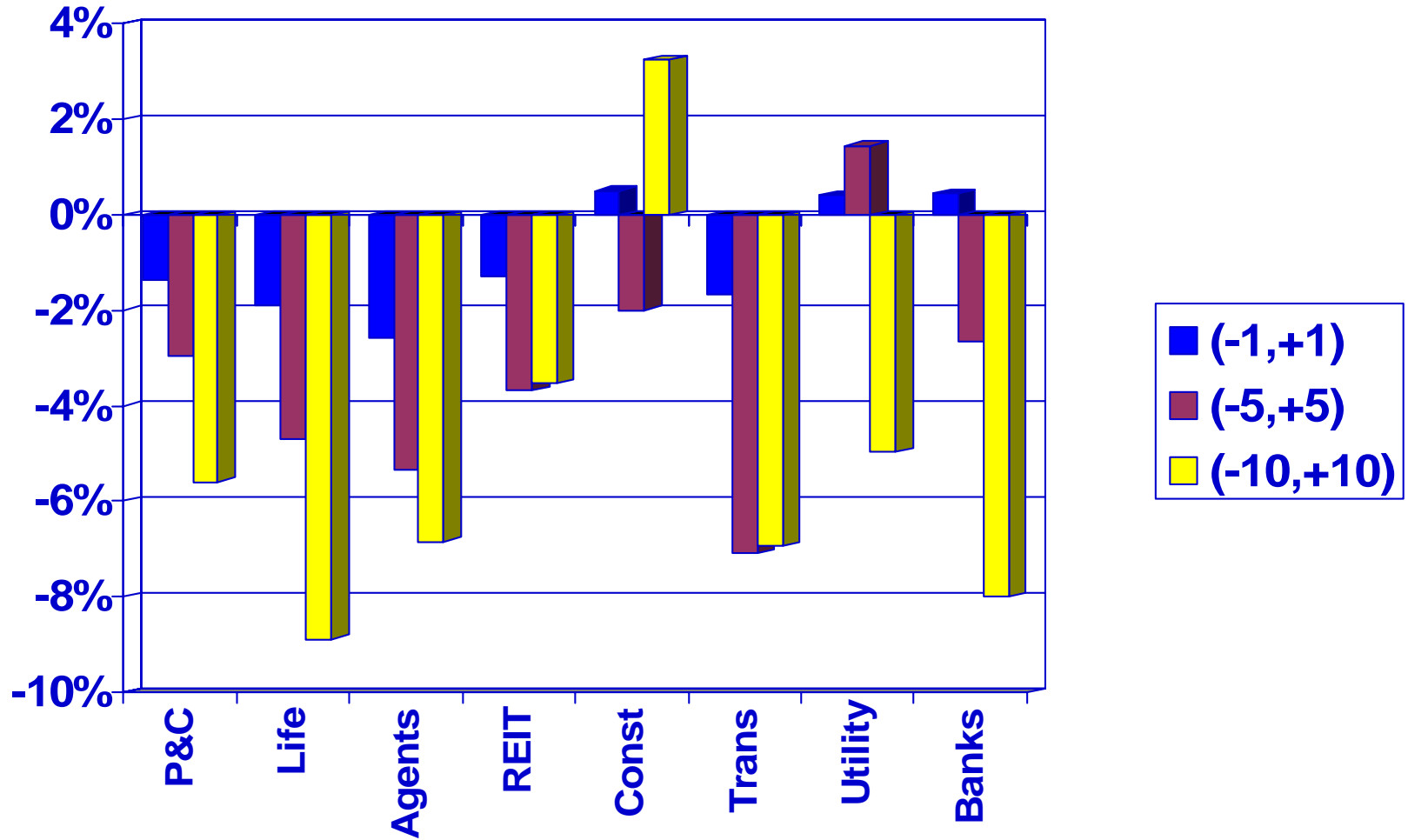
*Aggregate deductibles, individual insurer deductibles are 7% of premiums in 2003, 10% in 2004, and 15% in 2005.

Study Approach

- ◆ Multivariate regression model (MVRM) used to estimate the stock price impact on approximately 750 traded stock firms
 - Insurance
 - Banking
 - Construction
 - REITs
 - Transportation
 - Utilities

Results: The Passage of TRIA (11/20/2002)

Significant negative effect for at least one window for all industries except construction.



Conclusions: Why the Negative Effect?

- ◆ For P&C insurers, TRIA is at best a zero net present value project
 - Market is competitive so prices reflect expected costs and cost of capital
 - Insurers can't price "free" federal reinsurance into the contracts
 - TRIA eliminated the option "not to offer"
 - TRIA may have forestalled the reemergence of private reinsurance
 - Many insurers view TRIA deductibles as excessive

Conclusions: Why the Negative Effect?

- ◆ Nuclear, chemical, and biological losses are not covered
 - Market reaction may reflect a “discount” for expected future losses of these types
- ◆ The Samaritan’s dilemma
 - TRIA may have reduced market expectations about future federal assistance to industries suffering losses from terrorist events
 - Even though implicit government guarantees also have the potential to create inefficiencies, the direct effect of TRIA appears to have been adverse
- ◆ Inefficiencies created by intrusive federal intervention in a competitive market

Conclusions: Why the Negative Effect?

- ◆ Inefficiencies created by intrusive federal intervention in a competitive market
 - TRIA may have prevented or delayed reemergence of private market for terrorism coverage
 - Natural CAT experience shows that insurance markets tend to rebound following a disaster with new capital, lower prices, increased supply
 - Departure from a purely market-enhancing model may be the root of the problem
- ◆ Future federal intervention should attempt to facilitate private market solutions rather than substitute federal for private mechanisms

The Path To TRIA II

- ◆ October 15, 2001, Bush Administration terrorism reinsurance proposal
 - Federal reinsurance for 80% of 1st 20B, 90% of losses between \$20B and \$100B
 - \$100B cap on federal/insurance industry coverage
 - Federal reinsurance priced at zero
 - Tort liability reform for civil actions resulting from terrorist events
 - Program to sunset at end of 2004 unless extended

Federal Terrorism Reinsurance II

- ◆ Lack of insurance is said to have caused problems in the economy
 - Billions of \$ in commercial real estate construction have been cancelled or put on hold
 - Commercial mortgage-backed securities have suffered ratings downgrades
 - 300,000 construction jobs have been lost due to lack of insurance on real estate projects
- ◆ Solution: Federal reinsurance program

Federal Terrorism Reinsurance III

◆ Federal Reinsurance Program: Design parameters

- Three year program, expiring at the end of 2005
- Insurers have deductibles under the program
 - Year 1 = 7% of direct earned premiums in covered lines
 - Year 2 = 10% of direct earned premiums
 - Year 3 = 15% of direct earned premiums
 - Insurers favored the per company deductible rather than an industry deductible to reduce basis risk
- The deductibles are designed so that Federal reinsurance would be activated after the industry pays its first \$10 billion of insured losses in year 1, \$12.5 billion in year 2, and \$15 billion in year 3
- Above the deductibles, Federal program covers 90% of terrorism losses with insurers bearing 10% subject to an overall cap on Federal liability of \$100 billion

Federal Terrorism Reinsurance III

- ◆ What is a terrorist attack for the purpose of the reinsurance?
The Treasury Secretary must certify that the attack is terrorism based on three criteria:
 - Must be a violent act or an act dangerous to human life, property, or infrastructure.
 - Has to result in damage within the United States (with some exceptions such as damage to U.S. aircraft)
 - Must be politically motivated and initiated by foreign terrorist organizations (also cannot occur as the result of a declared war)
- ◆ In addition, the act must cause at least \$5 million in insured losses to trigger the reinsurance

Federal Terrorism Reinsurance IV

- ◆ More Design Features
 - Legislation nullifies terrorism exclusions approved by states
 - Treasury Secretary has authority to levy a 3% surcharge against policyholders to recoup some of the Federal aid
- ◆ Property/casualty insurers are required to participate in the program and must offer terrorism coverage
- ◆ Examples of lines not included in the reinsurance program are: personal lines (auto and homeowners), health, life, crop, private mortgage, medical malpractice

Federal Terrorism Reinsurance V

◆ Example of deductible

➤ AIG's commercial property and workers' compensation premiums

▪ Fire & allied lines	\$650M
▪ Commercial multiple peril	258M
▪ Inland marine	373M
▪ Workers' compensation	1,597M
▪ Commercial auto	545M
▪ Aircraft	190M
▪ Total	3,613M
▪ 7% of Total	252M

◆ More about deductibles

➤ Industry wide commercial lines premiums = \$146 Billion

- 7% = \$10 billion
- 10% = \$14.6 billion
- 15% = \$21.9 billion

Federal Reinsurance Program: Critique

◆ Good points about the program

- Imposes substantial deductibles
- Provides for 90%-10% split to control moral hazard
- Imposes an overall maximum on the Federal liability (Congress would want to revisit the issue for an extremely large event)
- It has a termination date which would have to be extended for the program to continue
- It seems to be addressing an important economic problem, although little rigorous empirical work was conducted to back up the contentions that lack of coverage has disrupted the real estate market and caused other economic harm

Federal Reinsurance Program: Critique

◆ Bad points about the program

- Insurers pay no premium for the reinsurance
 - Theory: Won't be able to charge for the Federal backstop in primary insurance policies if markets are competitive
 - The problem: Discourages the reemergence of a private market for terrorism coverage – reinsurers can't compete with “free reinsurance”
- Does it adversely affect the allocation of resources?
 - If property owners do not have to bear the costs of expected terrorism losses, there will be over-investment in commercial real estate that presents attractive targets for terrorists
 - On the other hand, do we want the design of our buildings and cities determined by terrorists?

Terrorism Insurance Project*

- ◆ Theoretical analysis of insurability: Is there something unusual about terrorism losses that calls for more governmental involvement than for other large catastrophes such as hurricanes and earthquakes?
- ◆ Event study analysis of the sequence of events from initial Congressional hearings in October 2001 to the passage of the TRIA in November of 2002 on insurance and other affected industries
- ◆ Analysis of economic time series to quantify the impact of the disappearance of terrorism insurance on
 - Commercial mortgage lending
 - New non-residential construction
 - Financial ratings of mortgage backed securities

*Jeffrey R. Brown, J. David Cummins, and Christopher Lewis

Final Sample for WTC Event (9/11/2001)

21st Century Insurance Group
ACE Ltd
Allianz Aktiengesellschaft
Allmerica Financial Group
AMBAC Financial Group
American International Group
Arch Capital Group
Argonaut Group Inc.
Berkshire Hathaway Inc.
Chubb Corp.
Cincinnati Financial Corp.
CNA Financial Corp.
Commerce Group Inc
Erie Indemnity
Everest Re Group
Fidelity National Financial
Harleysville Group Inc.
Hartford Financial Services
Horace Mann Educators
Markel Corp.
Mercury General Corp.
Odyssey Re Holdings

Ohio Casualty
Old Republic International
Philadelphia Consolidated
PMA Capital Corp.
Proassurance Corp.
PXRE Group Ltd
Radian Group
Renaissance Re Holdings
RLI Corp.
Royal and Sun Alliance
Safeco Corp.
SCOR Re
Selective Insurance Group
The Allstate Corp.
The First American Corp.
The Progressive Corp.
The St. Paul Companies
Unitrin Inc
White Mountains Ins Group
Berkley W.R. Corp.
Zenith National Insurance Corp.

Two Case Studies

Company	Net Pretax Estimated Loss	Shareholder's Equity Dec. 31 2000	Net Loss as % of Equity	Net Income 2000
St. Paul Co's WTC Loss Sept. 11	941	7,178	13.1%	993
Enron's Earnings Restatement Oct. 16	1,181	11,470	10.3%	979

Cumulative Return from Aug. 1, 2001 - Dec. 31, 2001

