



Protecting Value in the Face
of Mass Fatality Events



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0.55	-0.62	Magal	10.71	+0.09	NBRESec	14.69	+0.05	Perrin Cp	1.05	-0.13	Roydief	
0.23	-0.21	MagelHl	36.00	-0.55	NB Rity	18.57	-0.12	PerrinM	1.05	-0.13	Royce	
0.73	-1.28	MaglMids s	32.52	-1.13	NeurMtrx	29.45	+0.69	Prman	1.05	-0.13	RubyTu	
2.39	+0.15	MagelPt	2.98	+0.07	Neuroch g	10.96	+0.35	Perotsys	1.05	-0.13	Ruddlcl	
0.92	-0.12	Magma	8.89	+0.09	Neutcrine	46.08	+0.07	Perigo	13.50	-0.07	RudCell	
0.16	-0.17	MagmaEnt	6.12	-0.33	Neurgn	6.01	-0.53	PeruCop gn	1.05	-0.13	RudMtr	
0.27	-0.91	MagnaI g	75.81	-0.47	NeuStar n	27.93	+0.38	PetMed	10.56	-0.17	RudPn	
0.22	-0.07	MagnTk	2.84	-0.01	NeuVGas	10.37	-0.06	PetroKar g	45.16	-0.16	RudPn	
0.64	+0.08	MaguirePr	28.00	+0.22	News30 gn	15.79	+0.03	PetroC g	71.34	-0.36	RudPn	
0.74	-0.20	MaldenB n	17.74	...	NewAm	2.22	...	PetChina	68.95	-2.55	RudPn	
0.44	-0.07	MnStrBks	26.72	-0.79	NwCentFn	43.58	-0.06	PetroEng	13.95	-0.07	RudPn	
0.11	-0.43	Majest n	6.19	+0.49	NDragon	2.05	+0.26	PetrofdE g	17.90	-0.80	RudPn	
0.73	...	ManTech	2.70	-0.17	NewFmt	7.35	+0.40	Petrohawk	11.26	-0.14	RudPn	
		MgdHl	28.38	-0.61	NJ Racs	45.30	-1.42	PetbrsA	51.18	-1.36	RudPn	
		MgdMun	6.38	+0.01	NPlanExl	26.43	+0.09	Petrobrs	58.42	-1.90	RudPn	
		ManhAssc	5.25	+0.02	NrvPrnt	38.06	-1.94	PetDiv	37.26	-0.53	RudPn	
		ManHov	10.80	+0.04	NY&Co h	20.12	-0.19	PtqstE	8.13	-0.30	RudPn	
		ManHov	21.70	+0.02	NY CmtyB	17.79	-0.20	PetsMart	27.87	-0.81	RudPn	
		MannKd	45.82	-0.46	NY Times	32.19	-0.59	Pfizer	26.05	-0.15	RudPn	
		Manntch	11.56	+0.06	NewAllBc	14.77	-0.11	PFWeb	1.98	-0.18	RudPn	
		ManorCare	16.46	-0.22	Newcastle	29.02	-0.29	PhmHTR	71.90	-0.60	RudPn	
		Manpwl	39.00	+0.32	NewellRub	24.30	-0.73	PhmPdt	55.29	-0.19	RudPn	
		Manulst	45.00	-0.72	NewExp s	45.47	-0.73	PhmPct	8.02	+0.03	RudPn	
		ManulH g	1.39	-0.02	NewIntM	40.85	-0.21	PhmPcy	2.21	-0.04	RudPn	
		Marathon	50.66	-0.23	NwprRs	8.63	+0.44	Pharmion	24.01	+0.75	RudPn	
		MarchxB	60.92	-1.35	Newport	12.95	-0.15	PhaseFwd	7.34	-0.25	RudPn	
		Marcus	14.35	-0.16	NewsCpA n	16.88	-0.24	Phazar	16.51	-0.74	RudPn	
		MarPet	19.62	-0.18	NewsCpB n	17.81	-0.24	PhelD	110.88	-3.64	RudPn	
		MarineMx	27.87	+0.63	Newtek	2.57	-0.04	PhlCons	78.76	-0.69	RudPn	
		MktAcxs n	29.87	-1.18	Nexen gs	39.47	-1.13	PhllD	29.51	-0.37	RudPn	
		MarIntA	10.00	-0.36	NiSource	22.94	-0.30	PhlpsEl	32.75	-1.24	RudPn	
		MarIntB	67.68	-0.12	NichAcv	15.83	+0.07	PhnxTc	6.98	+0.04	RudPn	
		MarIntC	27.25	+0.02	NichAcv2	15.29	+0.10	PhotoMdx	2.48	...	RudPn	
		MarshM	44.70	-0.28	Nicor	39.38	-0.67	Photrn	24.98	-0.52	RudPn	
		Marshls	46.01	-0.06	Nicet	80.80	-1.37	Piednng s	23.73	-0.36	RudPn	
		Martek	26.06	-0.10	NiCtwns n	10.44	-0.30	Pier 1	14.03	-0.29	RudPn	
		MStewrt	59.50	-0.35	99 Cents lf	22.59	-0.27	PikeElec n	14.21	+0.21	RudPn	
		MartMM	18.80	+0.05	NlppnTT	21.04	-0.11	PilgrimsPr	32.45	-1.05	RudPn	
		MarvelE	43.88	-1.18	Nissan	19.90	-0.58	PimcoCpl	15.03	-0.12	RudPn	
		MarvllT	31.16	-0.34	NKroMed	68.39	-1.29	PimCoOp	17.23	+0.16	RudPn	
		Masco	46.89	-1.43	NobleCorp	85.00	-2.28	PimFISr n	18.07	-0.01	RudPn	
		MasseyEn	10.85	-0.19	NobleEngy	15.39	-0.34	PimcOHl	14.96	+0.02	RudPn	
		Mastec	35.00	+0.20	NortelNet	13.31	-0.44	PimcoMu2	15.25	-0.04	RudPn	
		MatlRtH s	47.70	-0.15	NordicAm	39.00	+0.09	PinnacIa	9.64	+0.17	RudPn	
		MatlRtH s	17.13	-0.18	Nordson	31.96	-0.96	PlnncIEnt	24.25	-0.18	RudPn	
		MatlRtO lf	17.86	-0.18	Nordstrm s	31.12	-1.48	PinWst	43.94	-0.69	RudPn	
		Matsush	8.00	-0.02	NorflkSo	36.40	-0.35	PlonrCos n	24.01	-0.49	RudPn	
		Mattel	42.33	-0.59	NortelNet	3.19	-0.07	PioneerCp	15.63	-0.19	RudPn	
		Mattson	59.50	-0.35	NovaChem	4.98	+0.02	PlaybPp	15.30	-0.39	RudPn	
		MavTube	32.47	-1.11	NoFrkBc s	27.48	-0.57	PlonFltr n	17.71	...	RudPn	
		Maxim	26.30	...	NoWestCp n	30.50	-0.23	PlonNtrI	44.69	-0.37	RudPn	
		Maximus	8.80	-0.45	NoestUt	19.84	-0.32	PiperJaf	32.29	-0.38	RudPn	
		Maxtor	40.17	-0.76	NoBodr	48.80	-0.56	PitnyBw	44.03	-0.49	RudPn	
		Maxam	18.77	+0.03	NDynMn gn	2.61	-0.08	Plxar s	43.30	-1.17	RudPn	
		Maxygen	66.97	-1.11	NORion g	3.75	-0.04	Pxlwrks	7.22	-0.31	RudPn	
		MayDS	33.46	-0.76	Nthfidlb	12.30	-0.52	PlacerD	15.48	+0.03	RudPn	
		Maytag	25.11	-0.35	NthpM g	1.29	+0.05	PlainsEA	44.83	-0.97	RudPn	
		McClatchy	33.17	-0.43	NorthropG	55.91	+0.16	PlainsEX	36.22	-1.33	RudPn	
		McComm	23.49	-0.07	NwstAln	4.65	+0.48	Plantron	8.12	-0.10	RudPn	
		McDnlds	47.33	-0.68	NwAir99	16.20	+1.87	PlantOn	33.94	-0.30	RudPn	
		McGrath s	18.56	-0.70	NwstNG	36.50	-0.57	PlatUnd	34.85	-0.05	RudPn	
		McGrwH s	30.22	+0.76	NwstNG	34.53	-0.45	PlatUnD	7.19	+0.06	RudPn	
		McKesson	46.53	-0.28	NovaDel	1.39	+0.08	PlaybPp	13.93	-0.07	RudPn	
		McMoRn	4.90	-0.09	NovaGld g	8.00	-0.03	Plexus	14.37	-0.33	RudPn	
		McAfee	10.09	-0.34	Novartis	49.44	-0.03	PlugPower	5.16	-0.05	RudPn	
		Mediacm	28.42	-0.56	NovaStar	35.13	-0.22	PlumCrk	35.81	+0.06	RudPn	
		MedData	22.13	-0.62	NvateI	24.19	+0.05	Plumtree	4.30	-0.01	RudPn	
		MedDataA	2.52	-0.08	NvstWrls	11.00	+0.11	PogoPd	54.90	-1.29	RudPn	
		MeadowVly	29.00	+0.38	NvstWrls	4.88	+0.01	Polaris	54.10	-0.74	RudPn	
		MeadWvco	25.00	-1.36	Novavax	21.73	-0.44	PortRec	41.73	-0.15	RudPn	
		MeasSpcl	27.56	-0.08	Novells n	6.04	-0.01	Polycom	16.51	-0.13	RudPn	
		MechTch	10.30	+0.26	Novus	26.44	-0.41	PolyMed	35.93	-0.46	RudPn	
		MechlTch	10.00	-0.26	Noven	17.08	-0.14	PolyOne	7.07	-0.27	RudPn	
		Mediastn	49.30	-0.04	NSTAR s	28.98	-0.33	PooreBr	5.35	+0.01	RudPn	
		MediBay	65.54	-2.11	NstOr	2.11	+0.01	PopuHar	26.46	-0.16	RudPn	
		Mediacm	4.8	+0.02	NuSkrt	21.31	-0.45	PortPlay n	24.32	+0.58	RudPn	
		MediAlk	5.9	-0.14	NuCo2	25.20	+0.19	PortTel	41.73	-0.15	RudPn	
			2.70	+0.20	NuVaslye	19.57	-0.27	PortTelTel	10.10	+0.08	RudPn	

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All data underlying this study are publicly available and were obtained from a variety of online sources including, but not limited to, various corporate websites and *Dow Jones Reuters Business Interactive*, the international newspaper and newswire archive. Whilst every effort has been made to ensure the accuracy and integrity of these data, Oxford Metrica accepts no liability for any inaccuracies contained herein.

Foreword

I am delighted to introduce Oxford Metrica's third briefing on the value impact of crises. Our first report in 1996 focussed on corporate catastrophes and their impact on shareholder value; the results highlighted the critical contribution to value recovery of the leadership demonstrated by senior management in times of crisis. The second report in 2001 updated the previous research, and introduced the notion of reputation and value; the results illustrated the interaction between reputation and value, and measured the increase or decrease in reputation equity from selected crises. The current briefing updates and further extends this body of work.

Since the publication of the last briefing, the world has endured a number of major crises involving mass fatalities, including the 9-11 attack on the World Trade Center in New York and, more recently, the Tsunami tragedy in South East Asia. As this briefing is going to print, the Gulf Coast of the United States is still recovering from the devastation of Hurricane Katrina. We consider it appropriate, therefore, to focus the current briefing on mass fatality events. The results demonstrate that the mass fatality feature of a crisis amplifies considerably the reputation effects, as reflected in the impact on value.

We hope that this briefing will provide corporations around the world with some insights on managing effectively such tragic events and better enable firms to protect value. It is demonstrably clear that doing the right thing is not only an essential part of a corporation's ethical responsibility, it is also the best way to protect shareholders' interests.

We are grateful especially to all of those who shared their views on such tragic events and, in particular, to Robert Jensen and his colleagues at Kenyon International who generously supported our work.

A handwritten signature in blue ink, reading "Rory F Knight". The signature is written in a cursive style with a small star-like flourish at the end.

Dr Rory F Knight
Chairman
Oxford Metrica

In Memoriam

To the 234,339 people who lost their lives in the tragic events reported herein.

Executive Summary

The aim of this briefing is to measure the shareholder value impact of mass fatality events and to identify the key determinants of value protection and recovery. Mass fatality events are defined generally as those which produce more fatalities than can be handled using local resources. In this study, we include also those events which had the potential to result in mass fatality but, thankfully, did not. Events emanating from four prominent perils over the last five years are evaluated:

- Aviation disasters
- Fires and explosions
- Terrorist attacks
- Natural catastrophes

The tragic nature of mass fatality events brings a number of managerial behaviours into painfully sharp focus and there is much to learn from the different ways in which firms respond. A firm's share price reflects the consensus view of investors as to how management has performed under such pressure. For the research presented herein, these share price reactions are analysed extensively to reveal some core policy implications for senior management. The key conclusions are listed below.

Key Conclusions

- 1 Mass fatality events have double the impact on shareholder value than corporate catastrophes in general; Figures 1 and 2.
- 2 The market makes a rapid judgement on whether it expects reputation to be damaged or enhanced by a crisis. However, shocking news takes time to be digested and, in the case of mass fatality events, the multiplier effect on value takes, on average, 100 trading days to emerge prominently.
- 3 As with non-fatal reputation crises for firms, the key determinant of value recovery relates to the ability of senior management to demonstrate strong leadership and to communicate at all times with honesty and transparency.
- 4 For mass fatality events particularly, the sensitivity and compassion with which the Chief Executive responds to victims' families, and the logistical care and efficiency with which response teams carry out their work, become paramount. There is a 40% value premium associated with the engagement of such specialist services; Figure 6.
- 5 Irrespective of whose responsibility is the cause of a mass fatality event, a sensitive managerial response is critical to the sustaining and creation of shareholder value.

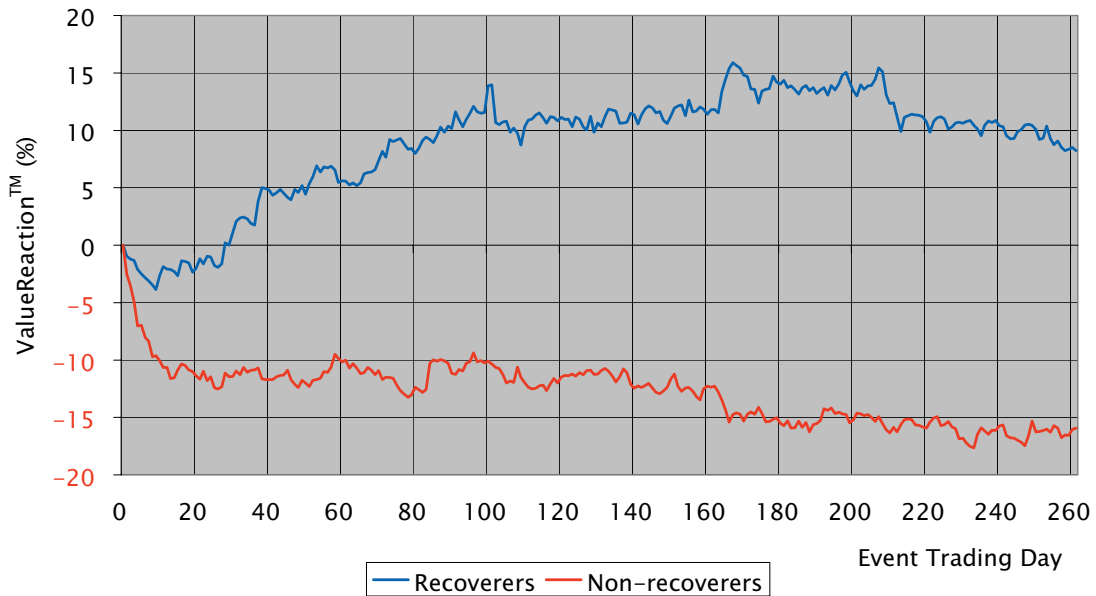
The empirical evidence on the value impact of mass fatality events is compelling. Beyond the obvious moral rationale for good behaviour by management, it is clear that the markets respond positively to firms which demonstrate essential human qualities; sensitivity, compassion, honesty and courage. The managerial awareness of what is required, and the courage to act accordingly, sends a strong signal of skill to investors.

1 Extreme Events

The research results presented in this briefing build upon over a decade's research into the effects of extreme, negative events on firms' share prices and the varying abilities of management to recover from such events. The first study¹ measures the impact of corporate catastrophes on shareholder value and identifies the drivers of value recovery. It was found that the way in which senior management, and the Chief Executive in particular, handles a disaster is a much stronger determinant of recovery than are the direct financial consequences of a loss.

The second study² centres on reputation crises, irrespective of any underlying physical loss, and their relationship with shareholder value performance. The results support those of the first study and, further, reveal the considerable power of signalling in markets as investors make major re-adjustments (up or down) to their views of management and to their expectations of future cash flow emanating from crisis-struck firms. It was found that firms tend to fall into one of two relatively distinct groups - Recoverers and Non-recoverers - depending largely on the ability of senior management to deal effectively with the aftermath of the crisis. These value patterns are illustrated in Figure 1.

Figure 1: Value Reaction to Reputation Crises in general



The x -axis in the graph represents one calendar year following the crises (261 trading days) where the date of each crisis has been aligned on event day 0. The y -axis calibrates a modelled share price reaction where market-wide influences have been stripped out and returns have been risk-adjusted. The ValueReaction™ modelling procedure thereby captures a very clean measurement of share price impact following a sudden and

¹ *The Impact of Catastrophes on Shareholder Value*, (1996), by Rory F Knight & Deborah J Pretty, Templeton College, University of Oxford, commissioned by Sedgwick.

² *Reputation and Value: the case of corporate catastrophes*, (2001), by Rory F Knight & Deborah J Pretty, Oxford Metrica.

unexpected event. It should be noted that the two groups depicted in Figure 1 exhibit the statistical characteristic of two separate distributions.

The new research presented in this briefing focuses on mass fatality events - incidents which produce more fatalities than can be handled using local resources - and incidents which had the potential to become such events. The results bring into sharp focus the managerial behaviours that are required for value recovery to be efficient and sustained following corporate tragedy.

Shown in Table 1 are the number of events with the associated number of firms affected and fatalities (confirmed dead and missing) included in the study.

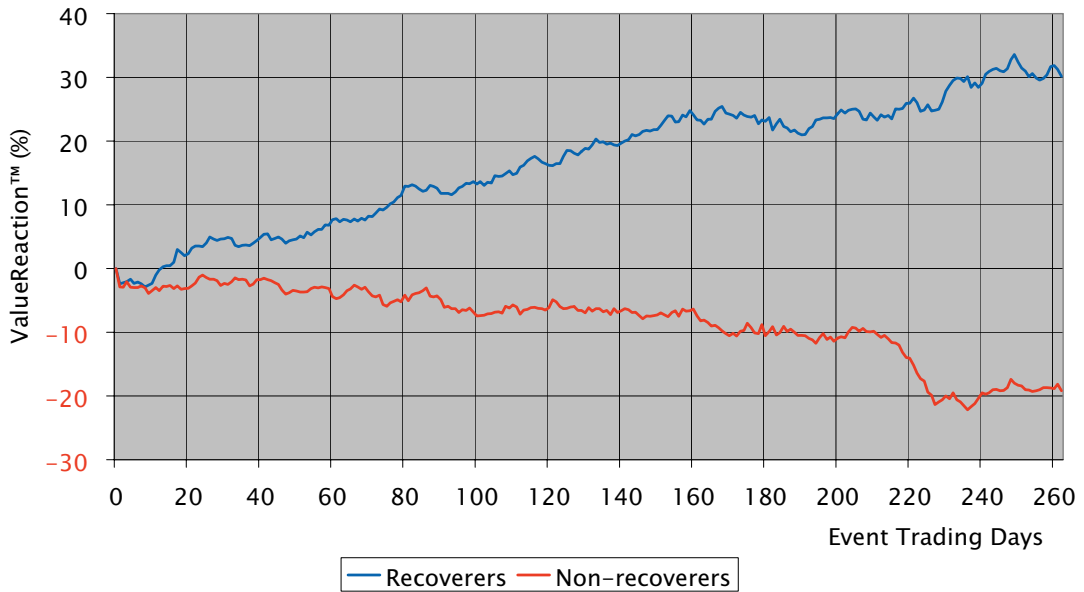
Table 1: Mass Fatality Events Analysed

Peril	Date	Events	Firms	Fatalities
Aviation disasters	1 Jan 2000 - 31 Dec 2004	22	22	1,886
Fires & explosions	1 Jan 2000 - 31 Dec 2004	27	28	509
Terrorist attack on the WTC and Pentagon	11 Sep 2001	1	12	3,025
Asian tsunami	26 Dec 2004	1	12	228,919 ³
Total		51	74	234,339

The list of events included is not exhaustive sadly but reflects practical issues of data identification and availability. Depicted in Figure 2 are the shareholder value reactions to mass fatality events, where the reactions are analogous to those of the general reputation crises shown in Figure 1.

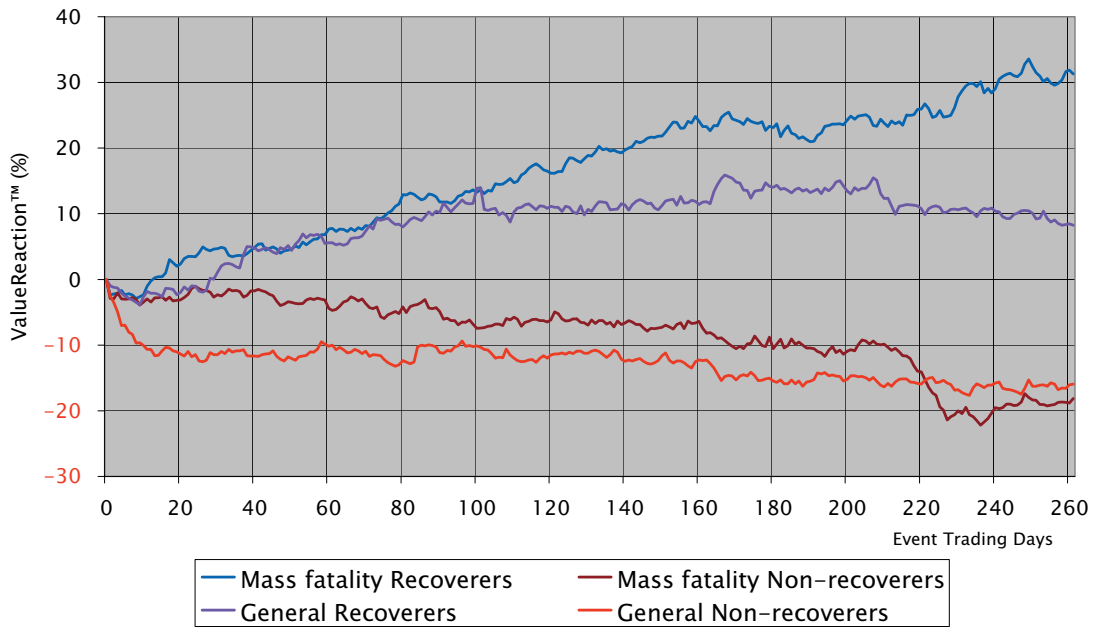
³ Latest estimate at 5 May 2005, Reuters News.

Figure 2: Value Reaction to Mass Fatality Events



When comparing Figures 1 and 2, it becomes clear that the value impact of mass fatality events is much greater than for reputation crises in general. In fact, whereas the value differential between Recoverers and Non-recoverers by the end of the post-event year is 25% for general reputation crises, the differential between the two groups is a striking 50% for mass fatality events; Figure 2a.

Figure 2a: Comparative Value Reactions



This result implies that the ability to manage well a mass fatality event is even more impressive to investors, and the *inability* to manage such events is even more disappointing, than in less tragic corporate crises. The presence of mass fatality, therefore, acts as a multiplier on the re-estimation process by investors of the future cash flow expected from a firm. It becomes even more critical to manage these events well.

It is also noticeable that the discrepancy in performance between the two groups - Recoverers and Non-recoverers - emerges more gradually in mass fatality events than in general reputation crises. Shocking information takes a while to sink in. The Recoverers (of mass fatality events and reputation crises in general) are on approximately the same trajectory to Day 100. Thereafter, the Recoverers of mass fatality events continue to increase in value. The Non-recoverers of mass fatality events do not appear to drop as sharply initially but, by the end of the post-event year, these firms have under-performed the Non-recoverers of general crises.

The amplified value impact may be due also to issues of responsibility, where it is not always clear immediately in mass fatality events whether the company is ultimately responsible for the cause of the event; acts of terrorism and natural catastrophes being two obvious examples where the company is not responsible for the peril itself. Verdicts on managerial responsibility and opinions on pre- and post-event responsible behaviour, therefore, may be made much later than for general reputation crises.

Trading volume activity reflects the speed and intensity with which information about a firm is disseminated, digested and acted upon by investors. The Trading Volume Multiplier is defined as the multiple of the previous year's average daily trading volume in ordinary shares. Thus a Trading Volume Multiplier of one indicates normal trading volumes and no significant impact on liquidity.

Figure 3: Increased Trading following Mass Fatality Events

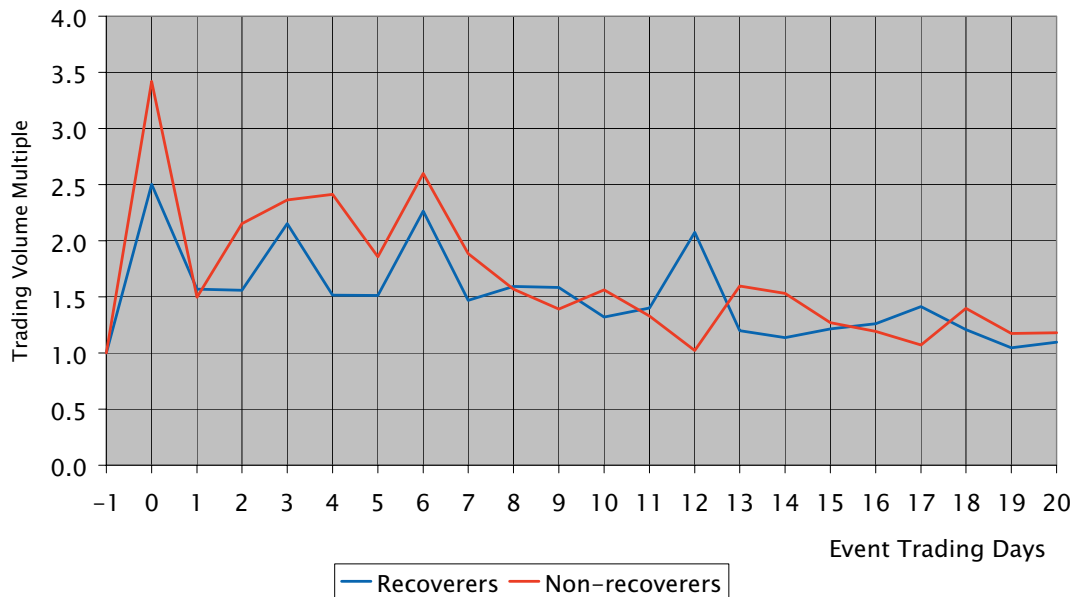


Figure 3 shows abnormally high trading volume (above 1) by firms throughout the month following a mass fatality event. This is particularly so for the Non-recoverers, and reflects uncertainty in the market and the difficulty of evaluating complex information.

2 Aviation Disasters

Analysed in this section are twenty-two aviation disasters from the last five years; listed in Table 2. A total of 1,886 people died in these air crashes.

Table 2: Aviation Disasters from 1 Jan 2000 - 31 Dec 2004

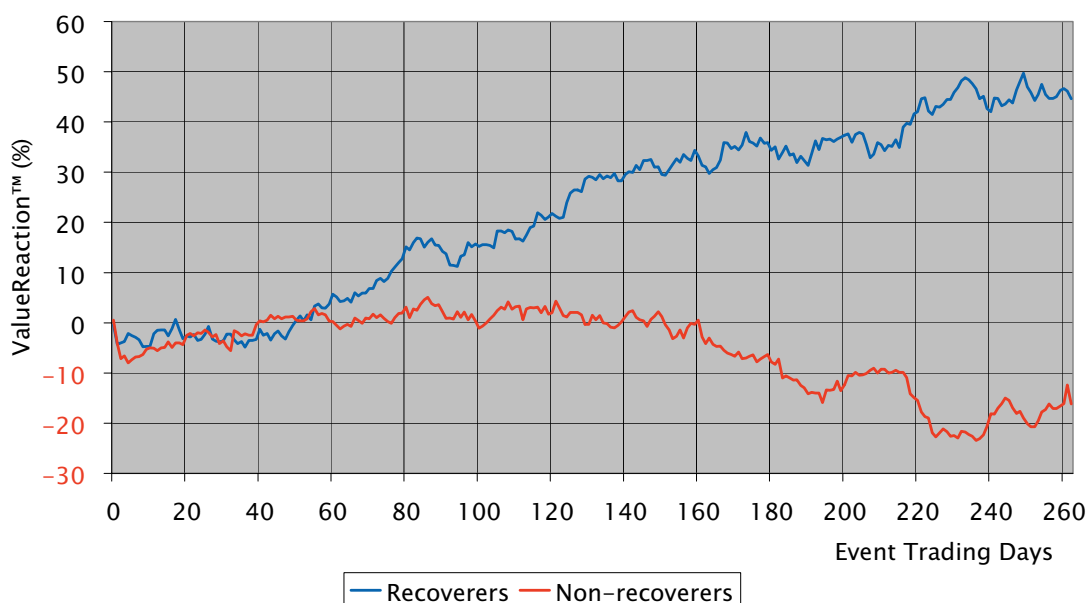
Date	Company	Ownership	Fatalities	Description
12 Nov 01	American Airlines (AMR Corp)	public	265	Flight 587, Airbus A-300, JFK; 260 aboard & 5 on ground died
25 May 02	China Airlines	public	225	Flight CI611, Boeing 747-200, Taiwan Strait
30 Jan 00	Kenya Airlines	national	169	Flight 431, Airbus 310, Ivory Coast; 10 survivors
31 Jan 00	Alaska Airlines (Alaska Air Group)	public	143	Flight 261, MD-83, California; all died
23 Aug 00	Gulf Air	national	143	Flight 0072, Airbus320, Bahrain; all died
19 Apr 00	Air Philippines	national	131	Flight 541, Boeing 737-200, Samal Island; all died
14 Apr 02	Air China	national	129	Flight CA129, Boeing 767-200, Pusan S Korea; 37 injured
8 Oct 01	Scandinavian Airlines System	public	118	Flight SK 686, MD-87, Milan, Italy
25 Jul 00	Air France	public	113	Flight AF4590, Concorde, Gonesse, near Paris
7 May 02	China Northern Airlines	private	112	Flight 6136, MD-82, Dalian
31 Oct 00	Singapore Airlines	public	82	Flight SQ006, Boeing 747-400, Taiwan; 97 injured
8 Jan 03	Turkish Airlines	national	75	BAe Avro RJ100, Diyarbakir; 5 injured
1 Jul 02	DHL (Deutsche Post)	public	71	Tupolev 154 jet (Russian Bashkirian Airlines) and DHL Boeing 757, Uberlingn, Germany
17 Jul 00	Alliance Air	private	55	Boeing 737, Patna, India; 51 aboard & 4 on ground died; 7 aboard survived
8 Jan 03	Air Midwest (Mesa Air Group)	public	21	Flight 5481, Air Midwest Beech 1900D, Charlotte, NC
16 Jul 02	Shell UK (Shell T&T)	public	11	Sikorsky S-76A helicopter, North Sea
10 Jan 00	SAir Group	bankrupt	10	Crossair Flight LX498, Saab 340B; Zurich; all 7 passengers & 3 crew died

23 Mar 04	Era Aviation (Rowan Companies)	public	10	Sikorsky S-76A helicopter, Gulf of Mexico
27 Feb 01	Logan Air	private	2	UK Flight LC670-A, Edinburgh
3 Mar 01	Thai Airways	national	1	Flight TG114, Boeing 737- 400, Bangkok; 149 aboard, 7 injured
26 Jul 02	Federal Express	public	0	Flight 1478, Boeing 727-200, Tallahassee; 3 injured
18 Dec 03	Federal Express	public	0	FedEx MD-10 Memphis
Total			1,886	

Three of the firms are privately-owned, six are national carriers and one is now bankrupt. The remaining twelve publicly-quoted firms are included in the value analyses.

Illustrated in Figure 4 are the value reactions for each group; the Recoverers and Non-recoverers. As in the previous section, the graph shows a modelled share price reaction, where market-wide factors have been stripped out and the daily returns have been risk-adjusted.

Figure 4: Value Reaction to Aviation Disasters



After an initial drop in prices, the market delivers its verdict within three months of the disaster, on average, and the now familiar split emerges between Recoverers and Non-recoverers.

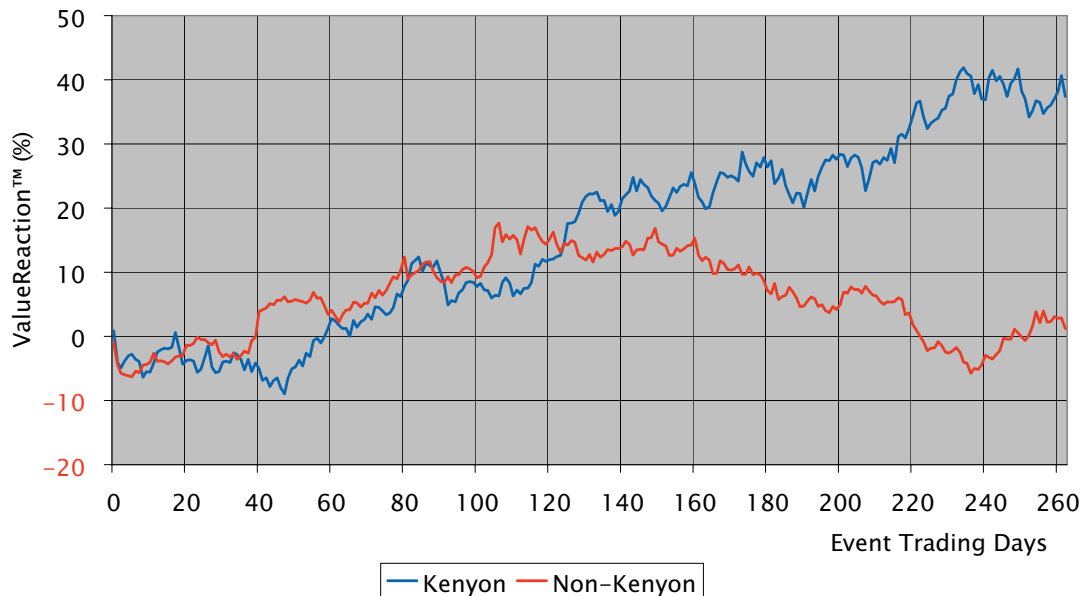
In some cases, it is difficult to discern objectively how compassionate or honest or courageous a management team has been in responding to extreme and tragic circumstances. In other cases, it is either humbling or painfully clear.

The Impact of Specialist Service Firms

Since by its definition, mass fatality events require external assistance, it is interesting to investigate whether there is any discernable difference in market response associated with the engagement of a specialist service firm. Our analysis showed that 50% of the disasters were handled with the assistance of Kenyon International Emergency Services, a company which specialises in mass fatality disaster management. Since there is a clear market leader, the sample of aviation disasters was partitioned into a Kenyon and a non-Kenyon group to allow for a valid statistical comparison. The results are presented in Figure 5.

Kenyon differs from its competition in that it is the longest established and it offers a full range of services including; contingency planning, disaster management response and recovery, identification of human remains and personal effects, training, family assistance, call centres, memorials and humanitarian services. Kenyon has been responding to aviation disasters since 1929.

Figure 5: The Value Premium for Specialist Care



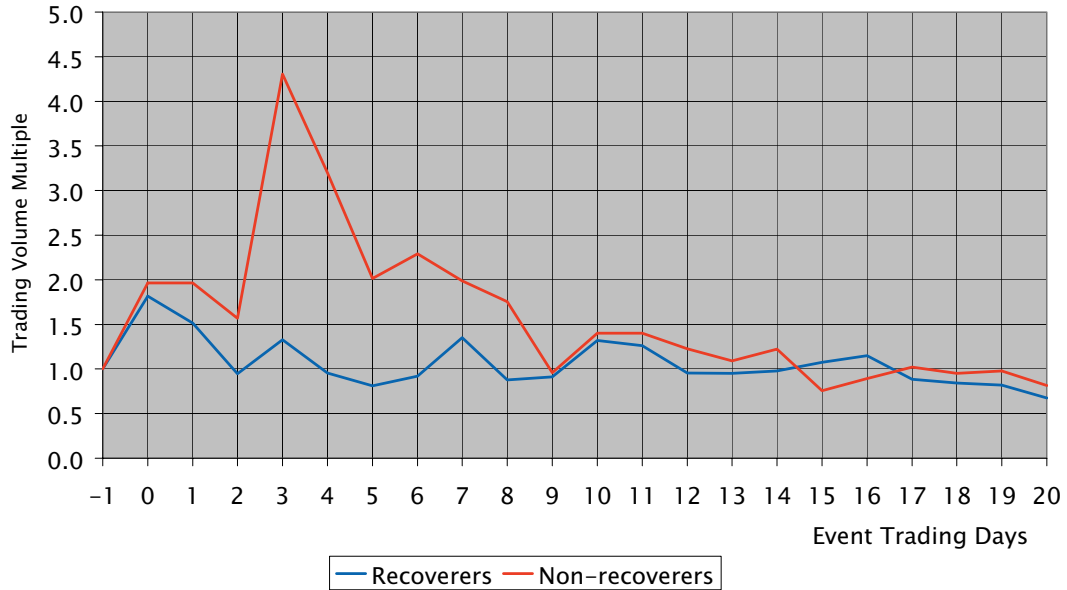
By the end of the post-event year, those firms with the specialist services from Kenyon were outperforming their peers by 40%. The enlisting of specialist care enables experts in disaster response and recovery, and humanitarian services to carry out their work efficiently and sensitively. This is consistent with the anecdotal evidence that suggests firms are more likely to experience efficient value recovery if they demonstrate strong leadership, honesty and compassion.

It is important to note that the engagement of specialist services does not suggest a delegation of responsibility. Mass fatality events are extreme and profoundly shocking. It is unrealistic to expect a corporate management team to be able to cope effectively with the consequences of such a disaster without help.

The patterns of trading volume in Figure 6 indicate that those firms which recover well from the disaster - the Recoverers - very soon settle down to normal levels of trading

activity. The Non-recoverers, in contrast, experience abnormally high trading activity for the majority of the month following the air crash.

Figure 6: Trading Reaction to Aviation Disasters



The analysis of aviation disasters suggests that markets respond well to management teams which demonstrate an understanding of what essential action is required, an appreciation that specialist help is almost certainly necessary, and the courage to act sensitively and efficiently in unexpected and devastating circumstances.

3 Fires and Explosions

Twenty-seven fires and explosions over the last five years have been researched in this study. In these events, 509 people died. An additional 14, 072 people were injured, of whom 13,387 were injured from three events: China National Petroleum Corporation's well blowout on 23 December 2003 (10,000 injured), TotalFina's fire on 21 September 2001 (2,442 injured) and SE Fireworks' explosion on 13 May 2000 (945 injured).

While this research was being conducted, the worst refinery explosion for over ten years occurred at BP's Texas facility on 23 March 2005. Fifteen people died and a further 170 were injured.

Table 3: Fires & Explosions from 1 Jan 2000 - 31 Dec 2004

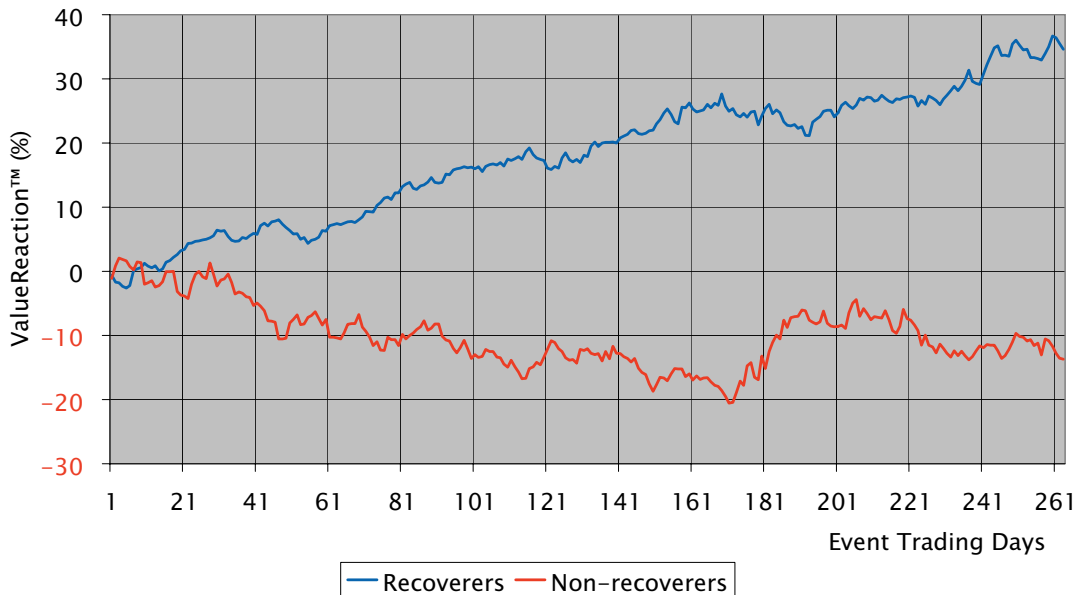
Date	Company	Ownership	Fatalities	Description
23 Dec 03	China National Petroleum Corp	national	243	Well blowout and gas leak, PetroChina Luojiazhai No. 16 well, Kai County, Chongqing
29 Oct 02	AIG	public	100	Saigon Int'l Business Centre, fire from welding accident, Ho Chi Minh City, Vietnam; 22 AIG employees died
21 Sep 01	TotalFina	public	29	AZF chemical fertiliser plant, Toulouse; 90% owned by TotalFina
30 Jul 04	Fluor; Shell/Suez	public	23	Gas pipeline explosion, Ath near Antwerp, Belgium
13 May 00	SE Fireworks	private	21	Enschede, Netherlands; Grolsch adjacent brewery; 17 died directly in blast, 1 died later in hospital, 3 missing
28 Feb 04	Odfjell	public	21	Chemical tanker Bow Mariner explodes and sinks, 50 miles east of Chincoteague off Virginia's Eastern Shore
1 Sep 04	Sasol	public	16	Ethylene plant in refinery, Secunda, S Africa; 7 died, 9 missing
8 May 01	Gold Fields	public	12	Beatrix gold mine, Virginia, Free State, South Africa
11 May 04	ICL Plastics	private	9	Explosion at plastics factory, Glasgow, Scotland
25 May 03	Norwegian Cruise Line	private	8	Boiler explosion and fire on board SS Norway, Miami
15 May 00	Gold Fields	public	7	Beatrix gold mine, Virginia, Free State, South Africa
29 Jan 03	West Pharmaceutical	public	6	Explosion at medical supply plant, Kinston, N Carolina

	Services			
5 Mar 03	Rand Inn International	private	6	Fire at hotel, central Johannesburg, South Africa
8 Nov 01	Corus	public	3	Explosion in blast furnace at Steelworks, Port Talbot
23 Oct 00	Krones Europe (Krones AG)	public	2	Ghent chlorine gas explosion
21 Feb 03	ExxonMobil	public	2	Explosion on barge while unloading at Port Mobil fuel distribution terminal, near Staten Island, New York
17 Jul 01	ChevronTexaco	public	1	Tank 393 at Delaware oil refinery collapsed causing fireball, near Wilmington
18 Mar 00	Philips	public	0	Fire at semiconductor plant, Albuquerque, New Mexico
16 Apr 01	Conoco	public	0	Oil refinery blast, Killingholme, England
2 Jun 02	Associated British Foods	public	0	Fire at Tip Top Bakeries, Fairfield NSW, Australia
16 Aug 02	BP	public	0	A-22 well explosion, Prudhoe Bay, Alaska
17 Oct 02	Rolls Royce/ Wood Group	public	0	Fire from electrical fault at warehouse, Dyce, Aberdeen
6 Jan 03	Shell Canada	public	0	Explosion at Muskeg River mine, Athabasca
3 Sep 03	Nippon Steel	public	0	Gas tank explosion, Nagoya steelworks
8 Sep 03	Bridgestone	public	0	Kuroiso plant, Tochigi; 5,000 people evacuated
5 Mar 04	Federal Mogul	public	0	Distribution facility, Smithville, Tennessee
30 May 04	Biolab (Great Lakes Chemical)	public	0	Chemical warehouse, Conyers, Georgia, USA
Total			509	

Figure 7 illustrates the stock market reaction to firms following a major fire or explosion. The value reactions, both for Recoverers and Non-recoverers are substantial but less severe than for the aviation disasters examined in the previous section. This makes sense for three reasons. First, there are usually fewer fatalities. Second, and related, there is usually less (and more localised) media exposure for fires than for air crashes. Finally, exposure to the public is usually less direct for the types of firm that are exposed to the risk of fires and explosions than for airlines seeking fare-paying passengers.

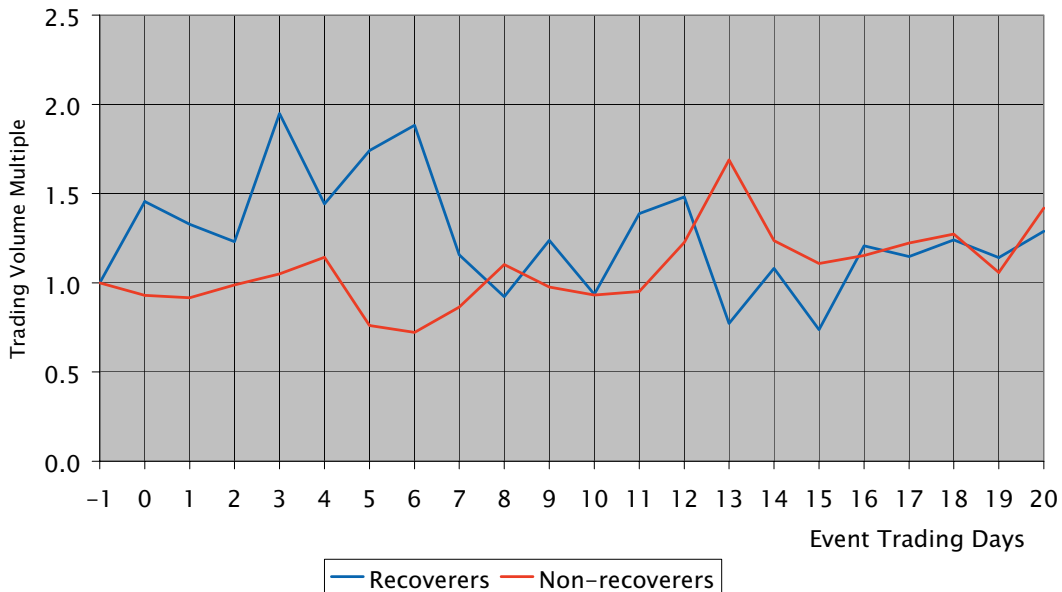
It can be seen also that the market makes its judgement of future cash flow potential sooner following fires and explosions than following air crashes. This also makes sense; the window for information digestion by the markets is usually shorter in the case of fires for the reasons outlined above.

Figure 7: Value Reaction to Fires & Explosions



Shown in Figure 8 are the trading activity patterns following fires and explosions. The results are consistent with the value reactions. The post-event levels of trading experienced generally are higher than normal but not extreme.

Figure 8: Trading Reaction to Fires & Explosions



Fires and explosions can have devastating effects. The industries involved historically have not been accustomed to enlisting specialist services for mass fatality events, unlike for example, the major airlines. However, as family demands increase for the best care and attention available, this situation may change.

4 Terrorist Attacks

The acts of terrorism on 11 September 2001 against the World Trade Center in New York and the Pentagon in Washington were unprecedented. 3,025 people were killed. This represents a change in the order of magnitude of terrorist impact; Table 4⁴.

Table 4: The Ten Most Deadly Terrorist Attacks

Date	Description	Fatalities
11 Sep 2001	Attack against WTC, Pentagon and other buildings; New York & Washington, USA	3,025
1 Sep 2004	Hostage-taking in school at beginning of new term; North Ossetia, Russia	338
23 Oct 1983	Bombing of US Marine barracks & French paratrooper base; Beirut, Lebanon	300
12 Mar 1993	Series of 13 bomb attacks; Mumbai, India	300
21 Dec 1988	PanAm Boeing 747 bomb explosion & crash; Lockerbie, Scotland	270
7 Aug 1998	Two simultaneous bomb attacks on US Embassy complex; Nairobi, Kenya	253
11 Mar 2004	Bomb attack on trains; Madrid, Spain	191
12 Oct 2002	Car bomb detonated outside nightclub; Bali, Indonesia	190
23 Oct 2002	Hostage-taking at theatre; Moscow, Russia	169
19 Apr 1995	Bomb attack on government building; Oklahoma City, USA	166
Total		5,202

This section of the report will focus specifically on the co-ordinated terrorist attack of 11 September 2001. Here is a mass fatality event that affected whole industries. One industry particularly affected - directly and indirectly - was the insurance industry.

- Hundreds of people from the insurance industry died in the event.
- Significant insurance claims were made against the industry across all major classes of loss.
- Insurers themselves were making reinsurance claims, and reinsurers were making retrocession claims, against reinsurers.
- Insurers and reinsurers hold substantial equity investments, affected by the downturn in markets and, in a few cases, affecting the insurer's ability to pay claims.
- A wave of downward rating action crossed the industry from the rating agencies.

However, some (re)insurers would benefit from the increase in premium rates as the commercial insurance markets hardened in the wake of the disaster. Presented in Table

⁴ Compiled from Swiss Re *sigma* publications: Nos. 1/2002, 2/2003, 1/2004 and 1/2005.

5 are the largest ten estimated total claims associated with the event incurred by quoted (re)insurers, as reported in their 2001 annual financial statements. The claims estimates presented are all net of reinsurance or retrocession and after tax, and amount to over US\$10 billion. The Lloyd's of London insurance market incurred a combined net loss of US\$3.1 billion, pre-tax. Since any tax charged is paid by individual members, it is not possible to assign a tax rate to this loss figure. However, applying an average rate of 30% would suggest a combined loss for Lloyd's of US\$2.2 billion which would lead Table 5.

Table 5: Top 10 Estimated Claims Against (Re)insurers

(Re)insurer	Claims estimate (US\$m)
1. Munich Re	1,959
2. Swiss Re	1,777
3. Berkshire Hathaway	1,500
4. Allianz	1,335
5. XL Capital	796
6. Zurich Financial	706
7. The St. Paul Companies	612
8. ACE	559
9. AIG	533
10. AXA	500
Total	10,277

Also affected significantly in value terms and profoundly in human terms were the two major insurance brokers in the US; Marsh & McLennan Companies and Aon Corporation. 295 Marsh employees and 175 Aon employees lost their lives in the tragedy.

Illustrated in Figure 9 are the recovery patterns of the insurers and reinsurers from Table 5, and of the two major brokers. Dominating the Recoverers are the (re)insurers assigned top ratings for long-term financial strength by the main rating agencies and the Bermudian companies. Dominating the Non-recoverers are the European carriers.

In part, the result reflects European firms' traditionally higher exposure to the equity markets; regulatory requirements deter US (re)insurers from holding large equity positions. More significant as a driver, however, is the 'flight to quality' as insureds sought out security amidst the market uncertainty.

Figure 9: Value Reaction to Terrorist Attack of 11 September 2001

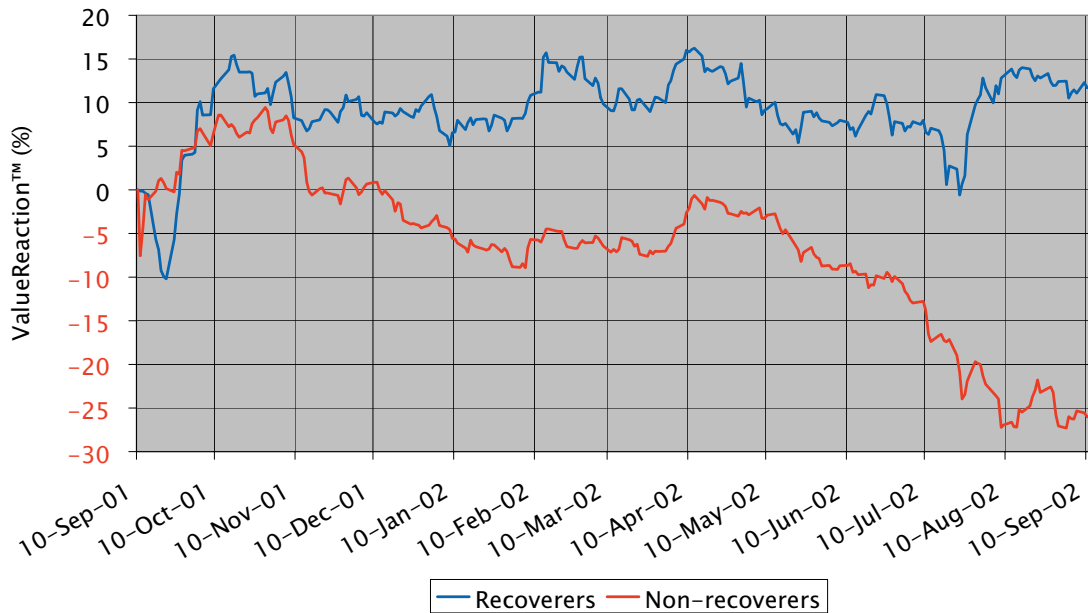
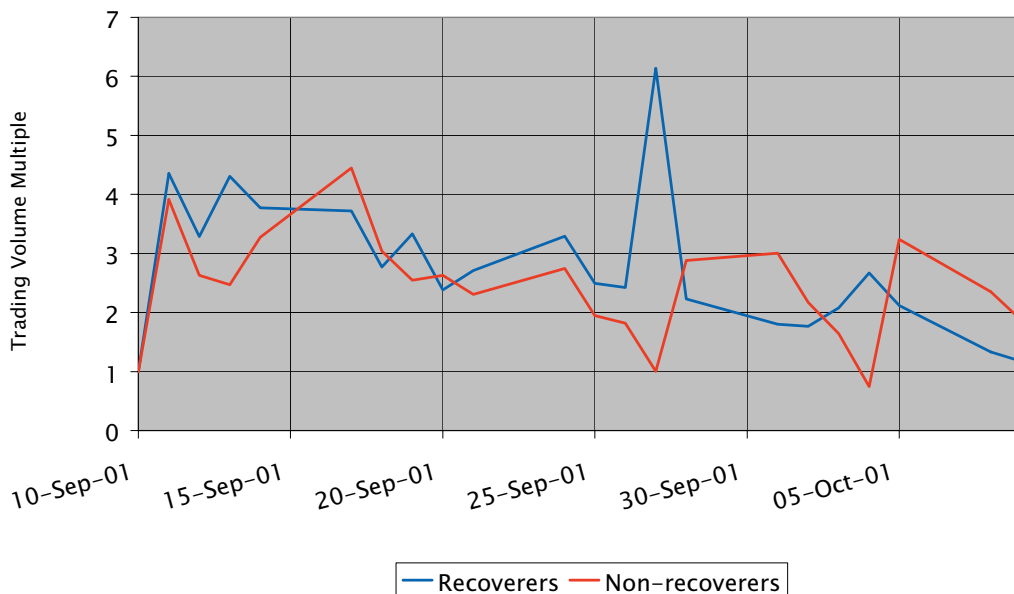


Figure 10 shows the heightened trading activity following the attack; up to four times normal trading levels for both Recoverers and Non-recoverers. The spike in liquidity on 27 September is due to the rating agencies affirming the ‘superior’ financial strength ratings for key Recoverers; ACE, XL Capital and Berkshire Hathaway.

Figure 10: Trading Reaction to Terrorist Attack of 11 September 2001



It was clear throughout this particular mass fatality event that policyholders and markets sought reassurance from the industry. Reassurance in the firms’ ability to pay claims and reassurance in their management teams’ ability to respond appropriately. Management which demonstrated strength and leadership under such trying circumstances won the confidence of investors and generated value for shareholders.

5 Natural Catastrophes

Natural catastrophes are defined as those caused by natural forces such as storms, floods, hurricanes, earthquakes, volcanoes and droughts. On 26 December 2004, an earthquake (or 'seaquake') off the coast of Sumatra triggered a tsunami of staggering proportions. The seabed rose by 10-20 metres, ruptured by the collision of two tectonic plates, and the fault line extended 1,200 kilometres. Densely populated coastal cities and villages were destroyed. The exact number of fatalities may never be known. The latest official figures⁵ report that 228,919 people have died. This represents the third most devastating natural catastrophe since 1970; Table 6⁶. Against the earthquakes and seaquakes is given their magnitude on the Richter scale.

Table 6: The Ten Most Deadly Natural Catastrophes

Date	Description	Fatalities
14 Nov 1970	Storm and flood; Bangladesh	300,000
28 July 1976	Earthquake (M 7.5); Tangshan, China	255,000
26 Dec 2004	Seaquake (M _w 9.1) tsunami; Indian Ocean	228,919
29 Apr 1991	Tropical cyclone Gorky; Bangladesh	138,000
31 May 1970	Earthquake (M7.7), rock slides; Peru	66,000
21 Jun 1990	Earthquake (M7.7), landslides; Gilan, Iran	50,000
26 Dec 2003	Earthquake (M6.5); Bam, Iran	26,271
16 Sep 1978	Earthquake (M7.7); Tabas, Iran	25,000
7 Dec 1988	Earthquake (M6.9); Armenia	25,000
13 Nov 1985	Volcanic eruption on Nevado del Ruiz; Colombia	23,000
Total		1,137,190

This section of the report will focus on the impact of the Asian tsunami of 26 December 2004. Listed in Table 7 are the countries directly affected, with the latest fatality estimates.

Table 7: Fatalities from Asian Tsunami - 26 December 2004

Countries	Dead	Missing	Total
Indonesia	126,915	37,063	163,978
Sri Lanka	30,957	5,637	36,594
India	10,749	5,640	16,389
Thailand	5,395	2,932	8,327
Andaman & Nicobar islands	436	2,641	3,077
Somalia	298	0	298
Maldives	82	26	108
Malaysia	68	6	74
Myanmar	61	0	61
Tanzania	10	0	10
Bangladesh	2	0	2

⁵ 5 May 2005

⁶ Source: Swiss Re *sigma* publication: No. 1/2005.

Kenya	1	0	1
Total	174,974	53,945	228,919
Foreign visitors included in figures above			
Sweden	544	200	744
Germany	301	276	577
UK	95	74	169
France	95	0	95
Austria	49	54	103
Switzerland	39	87	126
Denmark	36	10	46
The Netherlands	25	15	40
Hong Kong	21	19	40
Australia	21	6	27
Canada	15	7	22
Total	1,241	748	1,989

Against the human death toll, the economic losses are insignificant. One part of the economy particularly badly hit, however, is tourism. Table 8 identifies three prominent tourism-related sectors and key companies impacted by the disaster. The six tour operators named had 6,250 clients in the areas affected; 80% of the total number of package customers in the region⁷.

Table 8: Companies Affected by Asian Tsunami

Airlines	Hotels	Tour Operators
Qantas	Accor	MyTravel
Singapore Airlines	Laguna Resorts & Hotel	Cosmos
Thai Airways	MBK	First Choice
Air Asia	Royal Garden Resorts	Kuoni
Jet Asia	ShangriLa	TUI
Phuket Air	Sol Melia	Thomas Cook
ValuAir	The Oriental	Virgin Holidays ⁸

Illustrated in Figure 11 are the average value recovery patterns across all the quoted companies in Table 8, for three months following the tsunami. Figure 12 then shows the stock market reaction by sector. The tour operators recover earliest due partly to their more geographically diversified revenue-bases. Showing more recent signs of recovery are the major hotel chains operating in the region, while faring worst are the airlines. Even the airlines, however, are not extreme Non-recoverers, dropping approximately 6% on average following the disaster.

⁷ Source: *Travel Weekly*, 7 January 2005

⁸ 49% owned by Singapore Airlines

Figure 11: Value Reaction to Asian Tsunami of 26 December 2004

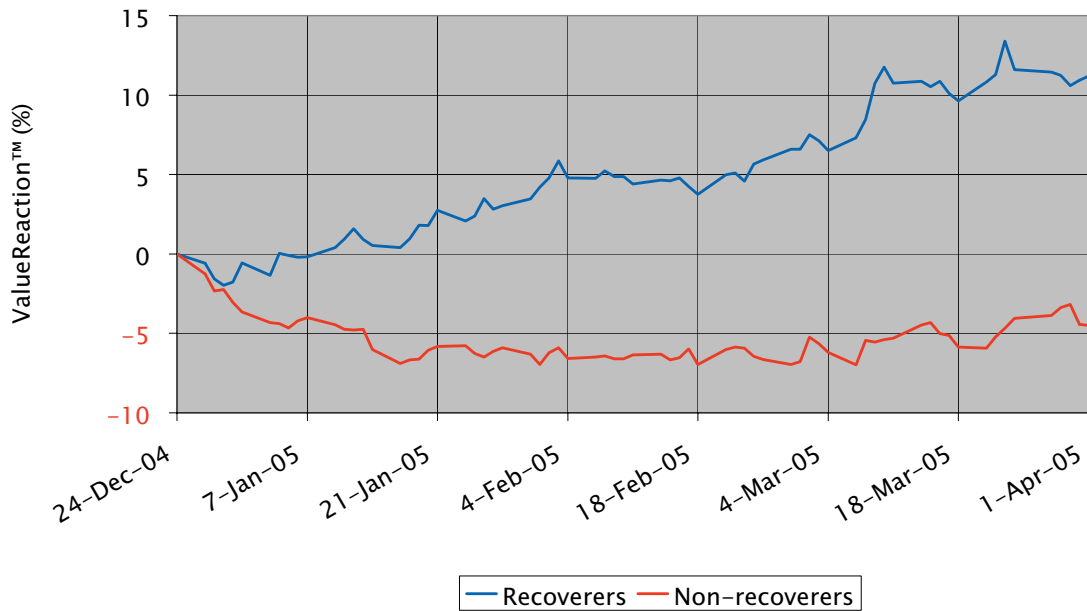
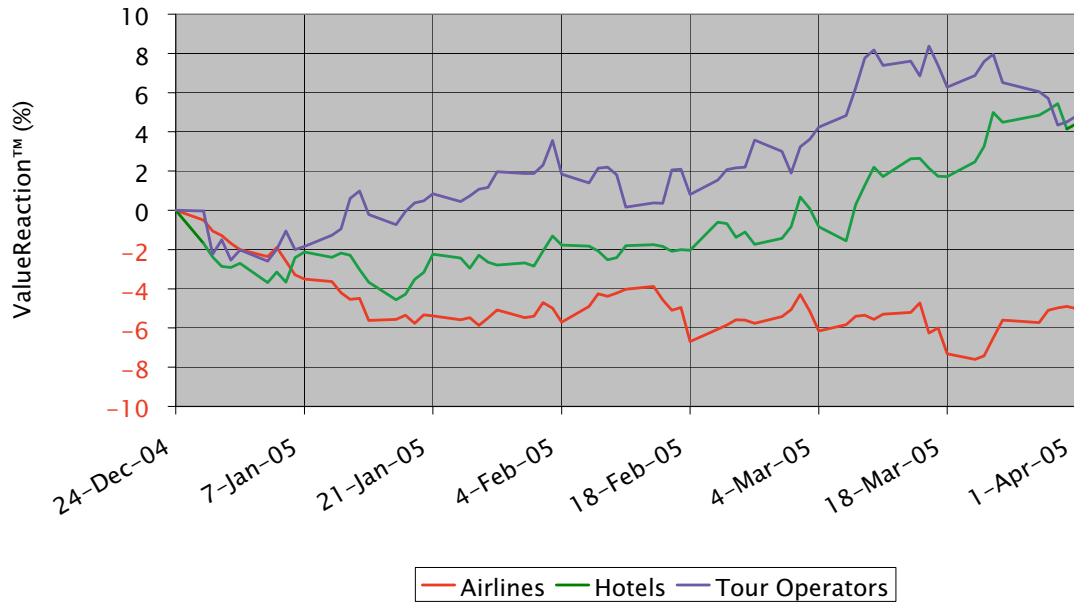
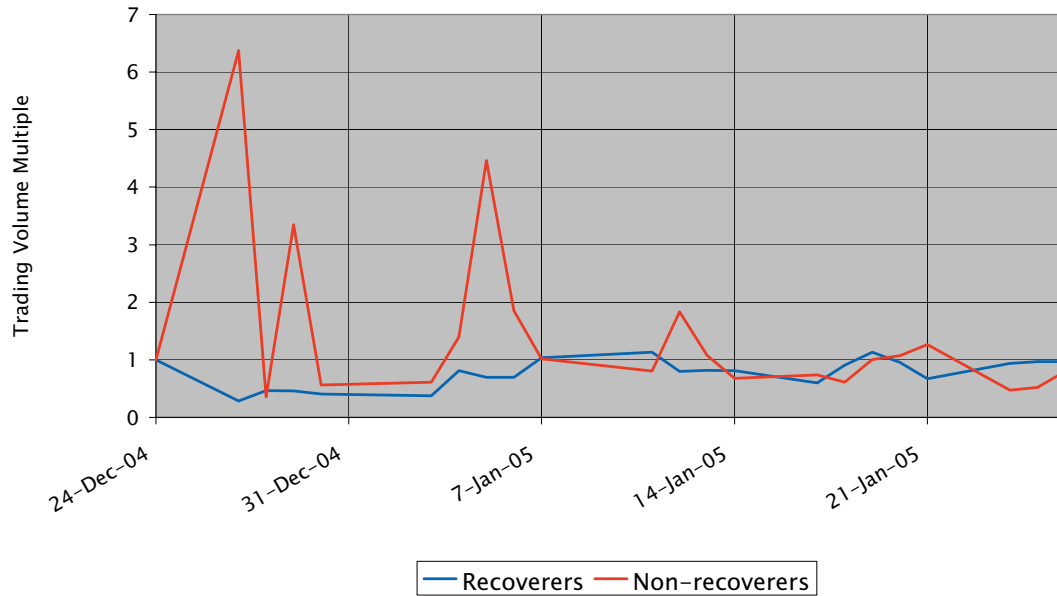


Figure 12: Value Reaction to Asian Tsunami by Industry



Shown in Figure 13 is the impact of the tsunami on firms' trading levels. The Non-recoverers drive the increase in liquidity, experiencing over six times normal trading activity as markets attempt to digest the complex information.

Figure 13: Trading Reaction to Asian Tsunami of 26 December 2004



In some respects, natural catastrophe risk resembles that of terrorist attack. Both involve sudden, exogenous shocks to the corporate system, and management is responsible not for the cause itself but for the firm's response to it. In addition, these particular mass fatality events can affect whole economies including many industries.

However, even in these cases, managerial responsibility is key to restoring confidence in the markets. The way in which Chief Executives respond to these extreme events is critical; critical primarily to the victims and families concerned, but critical also for the sustained recovery of shareholder value.

Conclusions

Extreme events provide an opportunity for investors to review their opinions about a firm and, more pertinently, about its management. Additional corporate information is forthcoming around such events that would not be available in more normal circumstances. This new information is received and digested by markets which form new estimates of future cash flow performance expected from these firms. The share price rises or falls, suddenly and significantly, in the light of the new information and the new expectations. These sudden shifts in share price tend to be sustained; until the next extreme event.

Mass fatality events are as extreme as they get. The circumstances are, by their nature, a gruelling ordeal for the management of any firm. It is precisely under such circumstances, however, that senior management can demonstrate the stuff of which they are made. These situations are not only logistically challenging but also profoundly emotionally traumatic. Mass fatality events demand strong leadership, honest communication and compassion. The awareness of what managerial decisions and behaviour are required, and the courage to act accordingly, reveals qualities in managers appreciated by the markets.

The research results presented herein support our earlier findings and demonstrate that the care, honesty and sensitivity with which management responds to mass fatality events inspire confidence in investors and add substantial value. Furthermore, the results suggest that the presence of mass fatality in an extreme corporate event has a multiplicative effect on the value impact. The market judgement of managerial ability is decisive, considerable and sustained.

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