

Do natural disasters affect the stock market?

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Executive summary

Proponents often claim that catastrophe (cat) bonds are uncorrelated with stock and bond markets because their returns are determined by geological or meteorological phenomena rather than by economic activity. Observers have noted that natural disasters generally don't cause negative market reactions. We examined these anecdotal observations, tested them statistically, and found little correlation between natural disasters and financial markets. In fact, markets tended to rally after a catastrophic event – though not to a statistically significant degree.

Natural disasters: economic drag or stimulus?

Many investors consider cat bonds and general event-linked exposure to be a diversifier. After all, natural disasters are random events driven by physical processes that have virtually nothing to do with capital markets. As a result, cat bonds' independence makes them an effective tool for diversifying an investment portfolio. But while a stock-market crash certainly won't cause an earthquake or hurricane, it is reasonable to ask whether a large natural disaster couldn't depress the stock market. Indeed, disasters do destroy large amounts of insurance capital, interrupt business operations, and cost people their homes. Insured losses are frequently measured in the billions of dollars, with total economic losses – insured plus uninsured – often twice the size.

Not everyone agrees, however, that financial markets suffer after a natural disaster. Some reasons include:

- The federal government usually provides assistance to disaster regions, including cash payments, low-interest rebuilding loans, and unemployment benefits.
- The Federal Reserve can lower interest rates. Plus, market-priced forward rates may reflect anticipated easing of Fed policy rates.
- Insurance companies inject billions of dollars in assistance and claims payments.
- GDP calculus generally doesn't subtract the cost of disaster losses. (This is the classic question of how a baseball breaking a glass window impacts GDP: it increases the GDP, since the window gets fixed).
- In the aftermath, insurance markets frequently harden, allowing the industry to collect higher premiums.

Disasters have no effect on stock-market returns: the evidence

The jury is still out whether financial markets go up, down, or remain the same following a natural disaster. To look at the question quantitatively, let's consider the level of the S&P 500 before and after 10 major natural disasters in the United States, listed here with their insured losses. *Note: We grouped together highlighted entries because these events weren't separated by sufficient time to sort out their effects.* We normalized the index to 100 on the day of an event – or the start-day for a hurricane – and examined the index level 30 trading days before and after each event.

Then we compiled the pre-event index values for all events and performed a t-test¹ to determine whether this group's mean differed from that of the group of post-event index values. The results shown here indicate that index values were, in fact, slightly higher after a natural disaster for the set of disasters we considered. The t-statistic is too small, however, to claim this effect is more than noise. Thus, the average index value is roughly the same before and after a natural disaster, which implies that events have no discernible effect on stock-market returns.

Event	Start Date	Insured loss in billions of 2006 USD
Hurricane Hugo	9/15/1989	7.4
Loma Prieta earthquake	10/17/1989	1.7
Hurricane Andrew	8/16/1992	23.0
Hurricane Iniki	9/11/1992	2.3
Northridge earthquake	1/17/1994	19.0
Hurricane Georges	9/20/1998	4.4
Tropical storm Allison	6/5/2001	4.1
Thunderstorms, tornadoes, hail	5/2/2003	3.5
Hurricane Charley	8/11/2004	8.6
Hurricane Frances	8/26/2004	5.5
Hurricane Ivan	9/2/2004	13.7
Hurricane Jeanne	9/13/2004	4.0
Hurricane Katrina	8/24/2005	66.3
Hurricane Rita	9/18/2005	10.4
Hurricane Wilma	10/15/2005	13.0

Source: Swiss Re sigma 2/2007 and A.M. Best

Let's broaden our view to include man-made disasters – though this violates our assumption that economics don't cause physical catastrophes. Economics can cause man-made reactions. Witness the Boston Tea Party! If we expand the event list to include the attacks of September 11, 2001, which caused \$21.4bn of insured losses, and repeat our t-test, we find this: at the 99-percent confidence level, using the 2.7 t-statistic, the means are not equal. To clarify the large effect of including the September 11 disaster, we repeated the analysis for that event only. Shown here are the t-test results for the 30 days before and after.

At a very high confidence level, index values are lower after the event than before, which emphasizes the difference between September 11 and the other natural disasters. Considering this event gives us confidence in our method. Natural disasters – even massive ones like Katrina – are in a different class than the September 11 attacks. Natural events on average have little positive or negative effect on the stock market.

Note: In a future study, we plan to include global markets and events; however, we expect those results to be qualitatively similar.

Two-sample t-test (not assuming equal variances) for all 10 natural disasters

	<i>Before</i>	<i>After</i>
Mean	99.77	99.96
t-statistic	-0.82	

Two-sample t-test (not assuming equal variances) for all 10 natural disasters and September 11th

	<i>Before</i>	<i>After</i>
Mean	100.67	99.88
t-statistic	2.93	

Two-sample t-test (not assuming equal variances) for September 11th only

	<i>Before</i>	<i>After</i>
Mean	109.70	99.11
t-statistic	11.97	

Sample for illustrative purposes only.

Appendix

Two-sample t-test (not assuming equal variances) for all 10 natural disasters			Two-sample t-test (not assuming equal variances) for all 10 natural disasters and September 11th			Two-sample t-test (not assuming equal variances) for September 11th only		
	Variable 1	Variable 2		Variable 1	Variable 2		Variable 1	Variable 2
Mean	99.77	99.96	Mean	100.67	99.88	Mean	109.70	99.11
Standard deviation	2.72	2.81	Standard deviation	3.99	2.88	Standard deviation	3.37	3.48
Observations	300	300	Observations	330	330	Observations	30	30
Hypothesized mean difference	0		Hypothesized mean difference	0		Hypothesized mean difference	0	
Degrees of freedom	597		Degrees of freedom	599		Degrees of freedom	58	
t statistic	-0.82		t statistic	2.93		t statistic	11.97	
P(T<=t) one-tail	0.21		P(T<=t) one-tail	1.73E-03		P(T<=t) one-tail	1.32E-17	
t Critical one-tail	1.65		t Critical one-tail	1.65		t Critical one-tail	1.67	
P(T<=t) two-tail	0.41		P(T<=t) two-tail	3.47E-03		P(T<=t) two-tail	2.65E-17	
t Critical two-tail	1.96		t Critical two-tail	1.96		t Critical two-tail	2.00	

¹ A t-test is a statistical hypothesis test in which the test statistic has a Student's t distribution if the null hypothesis is true. For this analysis, we are assuming that sample means of before/after index values are normally distributed. The central limit theorem ensures that this is approximately true for large samples.

Past performance is no guarantee of future results.

Hypothetical example for illustrative purposes only.

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