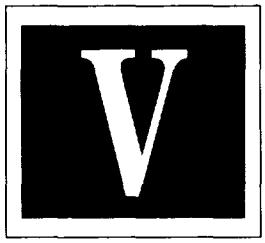

The Emerging Asset Class: Insurance Risk*

Ten years ago, the insurance industry never talked in terms of a $10 billion loss; today, the industry is concerned about a potential earthquake or hurricane loss of $50 to $100 billion. Catastrophic risks can be much larger as a result of greater concentrations of people and developed property, as well as higher exposed values than previously believed.

Reinsurance has always provided a level of surplus protection to insurance companies; however, as the stakes get higher, traditional reinsurance capacity is unable to handle these new enormous potential losses.

By establishing insurance risk as an asset class, participants (insurance and reinsurance companies, reinsurance intermediaries, capital market institutions, and investors) will provide the insurance industry with vast pools of capital to mitigate catastrophic risk through the use of new nontraditional reinsurance products. These products look like financial instruments to investors and reinsurance contracts to insurance companies. Investors can now invest directly and solely in insurance risk through these instruments without becoming a reinsurance company.

Catastrophe Exposure Coverage

The High Cost of Catastrophe Insurance

Financial innovation is changing the property-casualty insurance industry. The driving forces are the size of the industry and the economic inefficiencies surfacing in some areas of the insurance/reinsurance infrastructure. U.S. property and casualty (P&C) premiums totaled $264 billion in 1994. Of this, the most rapidly growing area is that of catastrophe (commonly referred to as CAT) exposure coverage, an area which currently accounts for anywhere between $10 and $20 billion of premiums annually. These flows are by no means small in comparison with other major financial cash flows. For example, dividends paid in 1994 by all firms listed on the NYSE were $130 billion. The sheer size of insurance markets means there are substantial rewards for value-added innovation.

High cost is one factor that attracts innovation. P&C costs are high for several reasons. First, there are limited pools of capital dedicated to P&C exposures, with the limitations being particularly severe in certain segments. A paucity of risk-takers implies poor diversification, resulting in high costs of insurance capital.

Second, innovators attempting to capture profit associated with new forms of risk distribution will have a window of opportunity to earn large returns, and, at the same time, substantially reduce system-wide costs.

Third, the information and analysis used to identify and price risk—particularly CAT—has lacked sophistication. Inadequate information generates unwillingness to

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supply insurance. It also dampens consumer demand for insurance products, as lack of hard exposure analysis makes it difficult to tell consumers a straight story justifying price and credit quality.

Fourth, widely accepted standardized packages of aggregated risks are just beginning to become accepted and used. The presence of this type of aggregated risk packaging is essential for promoting liquidity and low-cost transferability of CAT risks.

Today, these high cost barriers are eroding rapidly. With existing technology, it is possible to spread undiversifiable insurance risks better, make distribution activities more efficient, provide better identification and analysis of risks for product pricing, and create standardized packages of risks which can be priced in a broader, more liquid marketplace.

When measured by these technological capabilities, today's institutional mechanisms for financing insurance have fostered an environment for rapid evolution. Innovative approaches are springing up.

The Long and Short of CAT Exposures

Although the route that innovation will take is complex and unsure, its destination is clear: some insurance risks will be traded among investors and issuers like the securities of any other asset class. Here we focus in on the most immediately securitizable of these insurance risks: CAT exposures.

CAT exposures constitute the largest unacknowledged asset class today. However, this lack of recognition is about to change. While in the past people viewed CAT risks primarily from the perspective of an insurance customer, it will soon be commonplace that the investor perspective will be of equal importance. The job of the financial system is to redistribute CAT risks from insurance customers to investors.[1]

There is only one way to accomplish this redistribution: make insurance investors out of insurance customers. That is, people who buy insurance for themselves as customers must sell insurance to others as investors. It is as though each person is born excessively "long" for his own risks and excessively "short" for the risks of others. To undo this, financial intermediation is required. New forms of intermediation must provide the bundling, repackaging, and unbundling needed to transform reliable customer liabilities into liquid investor assets. In practice, this means that customers will obtain high-credit quality, low-cost insurance for their homes by having their pension portfolios underwrite a portion of those risks.

The notion that insurance exposures constitute an asset class might at first seem lofty and impossibly distant. Most market participants today would not consider CAT exposures as a potential asset class. However, it is hard to overemphasize how such widely-held notions are changeable. A useful example comes from that of foreign currencies.

Foreign exchange certainly meets the major requirements for an asset class. It is a large risk class (from a dollar-based investor's perspective, over half of the world portfolio is exposed to currency risk); a durable source of risk; and a distinctive exposure. It is also highly liquid, with a daily world trading volume of over $900 billion. Foreign exchange has today become widely accepted as an asset class. However, it has not always been thus.

Can Insurance Be an Asset Class?

In the early 1990s, a common theme at asset management conferences was: "Is currency an asset class?" Only four years ago, most practitioners were in agreement that foreign exchange was not an asset class on par with stocks, bonds, and real estate.

As for insurance risks, whatever the past preconceptions of investors might be, insurance exposures are clearly large enough, durable enough, and distinctive enough to be considered a separate asset class.

Some observers argue that there is no point distributing insurance risks across more investors. They maintain that certain of these risks—say a $100 billion hurricane—are too large and sudden to be managed effectively by the capital markets. This line of argument, however, is flawed. There is plenty of liquidity to finance these risks in an inexpensive and orderly way, if and when the risks are widely distributed.

While a CAT loss of $100 billion would surely be large by historical standards, it is small compared to what happens in the capital markets every day. To see this, note that a recent study puts U.S. wealth in stocks and bonds at approximately $13 trillion.[2] If one includes real estate (an illiquid but nevertheless risky asset class), U.S. financial wealth is probably at least $19 trillion. The daily standard deviation of this portfolio—which is one way to measure an average day's

fluctuation—is on the order of 70 basis points, or about $133 billion.[3]

In other words, a large and infrequently experienced CAT exposure is smaller than the average daily change in total financial wealth.

The Impact of CAT Risk on Financial Portfolios

As with any asset class, diversified investor holdings can only be achieved through the creation of low cost, standardized portfolio investments that can be purchased by pension funds, mutual funds, endowments, and high net-worth individuals. As with any asset class, the rationale for holding these instruments must lie in their portfolio properties. Too much exposure to CAT risk in a specific portfolio is clearly bad, as is too little.

As we will see, moderate amounts of exposure to CAT risk have little effect on portfolio returns while decreasing portfolio risk.

Portfolio Aspects of CAT Risks

To see the impact of CAT risks on portfolios, we need to examine their return characteristics. In the past, this would not have been possible because hard information on returns from underwriting such risks was not available.

However, in this paper, we use new pricing and claims data from actual reinsurance contracts—more than 2,000 of them—brokered by Guy Carpenter from 1970 to 1994. For much of this sample period, the data cover a substantial portion of the CAT risks reinsured by large U.S. insurance carriers. There is coverage of regional insurers in the sample as well. Most of the contracts carry CAT risks that last one year.

Our returns are those an investor would have earned by providing capital directly to fund reinsurance contracts. All of our contracts are "excess-of-loss," which means that there is a prespecified maximum amount, or limit, at risk. Each contract "layer" represents a limit in excess of a deductible. However, many of the contracts also include reinstatement commitments which require that a fresh contract of the same limit be struck should an event occur prior to the end of the contract year. Because of this reinstatement feature, it is theoretically possible that, if two large events occur during the contract period, an investor could lose twice the limit.

Calculating Returns

To calculate return, we act as though the investor puts up an amount at the beginning of the contract year equal to two times the limit, thus accounting for a potential limit reinstatement. Insurers contribute the reinsurance premium and reinstatement premium (if any) into the same dollar pool. We assume that all these funds are invested in U.S. Treasury bills, until and unless there is a drawdown due to the occurrence of an event. At the end of the year, the investor takes home all funds remaining in the account minus 1% of the limit, which we assume goes toward transaction fees.[4] Unless otherwise mentioned, we calculate the resulting investor's return as the excess above what an equal-sized investment in one-year Treasury bills would have returned.

The above return calculation is conservative, in that it assumes investors have "fully collateralized" their risk exposure. That is, there is no way that they can lose more than they have put up, and indeed, are guaranteed to get at least something back at year's end. In practice, investors tend to "lever" such investments, often putting up only a fraction of the maximum potential loss. However, with leverage, there is at least a chance that they will have to pay out more later, much like Lloyd's names have recently done. In any event, leverage has the effect of increasing, by equal factors, the magnitude of excess returns and risk.

Return on Investment

Table 1 presents summary data from the fully collateralized returns in excess of the risk-free rate. By investing in a portfolio of CAT reinsurance contracts (weighted by limit), an investor would have earned 200 basis points above the Treasury bill rate. If insurance companies were to prepay the full premiums, investors would need to put up less of their own money initially. The investment, therefore, could be fully collateralized using less investor-provided funds. As a result, the return on the same portfolio of reinsurance contracts rises to 224 basis points[5] above the Treasury bill rate.

In the best and worst years from 1970 to 1994, the excess return would have been 7.5% and −22.1%,

TABLE 1
RETURNS IN EXCESS OF RISK-FREE RATE FROM INVESTMENTS IN CAT REINSURANCE[1,2]

	Mean	Maximum	Minimum	Standard Deviation	Observations
	Basis Points			(%)	
1970–1994: All Layers Limit Weighted	200	753	−2211	5.8	25
National	210	879	−2561	6.6	25
Regional	44	253	−245	1.1	25
1970–1994: Upper Layers Limit Weighted	137	599	−1843	4.3	25
National	142	726	−2258	5.2	25
Regional	43	173	−3	0.5	24
1970–1994: Lower Layers Limit Weighted	232	1198	−2970	10.8	25
National	249	1290	−3257	11.7	25
Regional	78	469	−733	3.2	25
1970–1994: All Layers Equally Weighted	237	595	−1182	3.9	23
National	248	823	−2764	7.3	25
Regional	83	364	−241	1.3	25

[1] National refers to a company that writes policies throughout the United States. Regional refers to a company that writes policies in a sub-part of the United States. A third classification, International, refers to a company whose underwriting extends beyond the United States. International contains only a few observations, so it is not shown separately, but it is included in the totals.
[2] CAT returns are net of expenses of 100 basis points of limit.

respectively. Higher average returns were earned by the lower layers, which are the excess-of-loss contracts that are most frequently impacted by loss. Also, the returns on national exposures were generally higher than returns on regional exposures. However, they were more volatile too, which is expected given national companies are, on average, more exposed to high risk areas (such as Florida and California).

Figure 1 shows that CAT investments under-performed domestic stocks, but over-performed domestic bonds.[6] It is evident from Figure 2 that the returns on CAT risks are less volatile than either stocks or bonds. Even the largest of these losses (due to Hurricane Andrew in 1992) is smaller than some of the losses in stocks.[7]

Taken together, Table 1 and Figures 1 and 2 suggest that CAT risk investments on average earned returns substantially in excess of Treasury bills during this period, much like investments in stocks and bonds. CAT investments appear somewhat less volatile than these other asset classes, but still have large downsides should a serious event occur.[8]

Zero Beta Asset

The second major characteristic of CAT exposures is that they are uncorrelated with the returns on other major asset classes, such as stocks and bonds. This point is made in Table 2. The table shows the correlations between returns on CAT exposures and other major asset classes: foreign stocks and bonds, in addition to the domestic stocks and bonds shown above. The results suggest that CAT risks are basically uncorrelated with these other asset classes. The estimated correlation coefficients between CAT exposures and other asset classes range from a low of −0.13 to a high of 0.21. None are statistically distinguishable from zero.

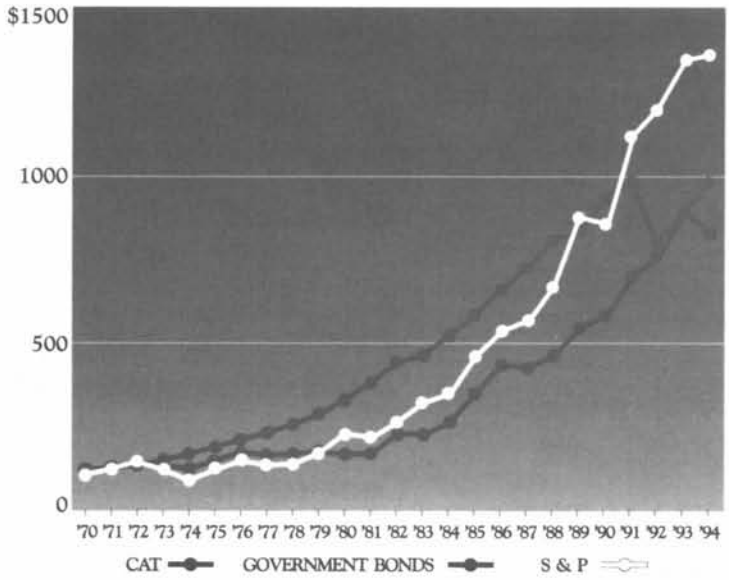
By comparison, the correlation between U.S. stocks and bonds is estimated to be much higher, at 0.40; between international stocks and international bonds at 0.45; and between international stocks and domestic stocks at 0.58. All of these latter correlations are statistically positive at standard levels of significance.

The fact that CAT risks are uncorrelated with returns on other asset classes suggests that the "fair" return on CAT risks are low. In particular, expected returns on CAT risk are likely to be lower than fair returns on stocks, which are commonly thought to be about 6% in excess of Treasury bills. The lack of correlation with all other asset classes and the small relative size of CAT exposures compared to U.S. liquid financial wealth, point toward a fair return for CAT risks that is approximately equal to the Treasury bill rate.

Portfolio Enhancements

Our findings that CAT risks have provided average returns above Treasury bills, with no correlation with

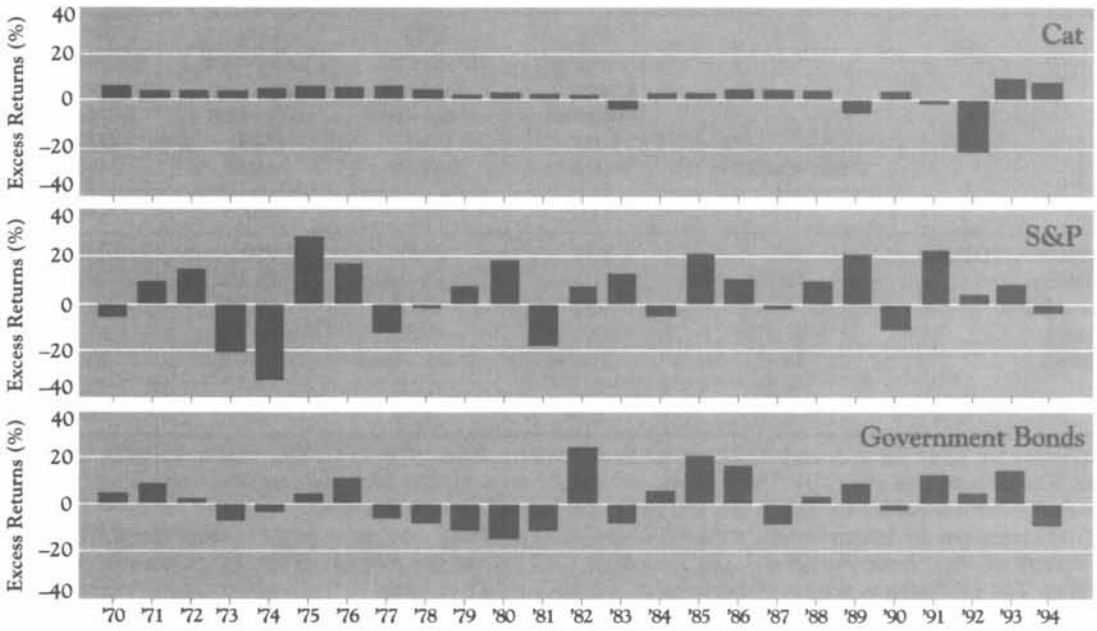
FIGURE 1
CUMULATIVE RETURNS ON ALTERNATIVE ASSET CLASSES



Cumulative return is based on an initial investment of $100 at the beginning of the period.

Cat return is based on an expense loading of 100 basis points of limit.

FIGURE 2
EXCESS RETURNS OF THREE ASSET CLASSES



Cat excess return includes an expense loading of 100 basis points of limit.

TABLE 2
RETURN CORRELATION MATRIX OF EXCESS RETURNS FOR FIVE ASSET CLASSES

	CAT Bonds	S&P 500	Government Bonds	EAFE[1]	International Bonds
CAT Bonds					
S&P 500	−0.13				
Government Bonds	−0.07	0.40			
EAFE[1]	0.21	0.58	0.25		
International Bonds	0.21	−0.03	0.24	0.45	

[1] EAFE is an index constructed from a portfolio of European, Asian and Far East stock indices. *Source:* Goldman Sachs

other major asset classes, have an important implication for portfolios: adding CAT risk products improves overall portfolio performance.

Table 3 shows what happens when CAT risk investments are mixed in with a diversified portfolio of domestic and international stocks and bonds.[9] Note that, with additional increments of CAT risks, overall portfolio return falls somewhat while portfolio volatility falls substantially. This can be seen by comparing their ratio, commonly termed the "reward-to-risk" ratio (computed by calculating the realized return minus the risk-free return divided by the standard deviation of the portfolio). This ratio rises strongly as CAT risks are included in the portfolio. Indeed, it keeps rising after the CAT risk level in the mix rises all the way to 25%. Note, that if Treasury bills are sold when CAT notes are purchased, the net effect on overall portfolio returns is more positive, and the increase in the reward-to-risk ratio is retained.

All this occurs because CAT risks help to significantly diversify the portfolio. Greater portfolio diversification and lower volatility allow the investor to take on additional high-return, high-risk investments without a substantial net increase in portfolio risk.

Conclusion

The characteristics of CAT exposures make the linkage with capital markets very desirable. The benefits to investors are:

- the improvement of the overall behavior of their portfolios,

TABLE 3
PORTFOLIO ENHANCEMENT EFFECTS OF CAT BONDS[1]

	Basic Portfolio	5% Unlevered Expense Adjusted CAT Bonds[2]	10% Unlevered Expense Adjusted CAT Bonds[2]	15% Unlevered Expense Adjusted CAT Bonds[2]	20% Unlevered Expense Adjusted CAT Bonds[2]	25% Unlevered Expense Adjusted CAT Bonds[2]
	(1)	(2)	(3)	(4)	(5)	(6)
Average Excess Return (b.p.)	313	306	298	290	282	275
Portfolio Volatility	11.8%	11.3%	10.7%	10.1%	9.5%	9.0%
Reward to Risk Ratio	0.26	0.27	0.28	0.29	0.30	0.30
Minimum Return	−22.5%	−21.1%	−19.8%	−18.5%	−17.1%	−15.8%
Maximum Return	24.4%	23.3%	22.2%	21.1%	20.0%	19.0%
Skewness[3]	−0.34	−0.32	−0.30	−0.27	−0.25	−0.22
Kurtosis[4]	2.56	2.54	2.51	2.47	2.42	2.37

[1] Summary statistics are given for a dataset of 23 annual excess returns from 1970–1992. The "Basic Portfolio" is composed of 70% domestic and 30% international securities. The domestic securities consist of 70% S&P 500 and 30% long-term U.S. government bonds. The international securities consist of 70% EAFE and 30% international government debt.

[2] Columns (2)–(6) represent the excess returns a modified portfolio containing varying amounts of unlevered CAT bonds and the complimentary amount of the "Basic Portfolio." The 23 annual CAT returns are average values for policies in that year weighted by occurrence limit. The CAT returns are net of expenses of 100 basis points of limit.

[3] Skewness is an indicator of asymmetry in returns. A negative skewness coefficient indicates that the distribution of returns "tails off" to the left. The skewness of the portfolio moves closer to 0 as the proportion of CAT bonds in the portfolio increases, a consequence of the fact that CAT returns are negatively correlated with other elements in the portfolio.

[4] Kurtosis is a measure of the peakedness of a frequency distribution. The normal distribution has a kurtosis coefficient of 3. For a given standard deviation, a distribution with high kurtosis may have more outlying points farther from the expected value (the mean).

- the opportunity to add different investments without increasing portfolio risk, and
- the creation of a larger reservoir from which to support more efficient and more reliable customer insurance products.

The historical evidence suggests the addition of CAT exposures to investment portfolios is the equivalent to a free lunch for investors and insurance consumers alike.

END NOTES

1. For the distinction between customers and investors as claimants of financial firms, see Robert C. Merton, *Continuous Time Finance*, Basil Blackwell (Cambridge), 1990.
2. This study, by the U.S. General Accounting Office, puts the value of world liquid bonds and stocks at $18.6 and $13.7 trillion, respectively. The U.S. share of the $32.2 trillion total is about $13 trillion. This number leaves out not only real estate and cash, but also illiquid financial holdings such as letter stock private-company holdings.
3. The volatility of stock returns over the last two decades has been approximately 17% per annum, or 108 basis points per day. Average daily bond-return volatilities are about 70 basis points. Daily real estate volatilities cannot be measured directly. However, real estate returns (inclusive of mortgage borrowing) display volatility just below that of stocks. For the purpose of this report, we have used the more conservative 70-basis point figure in determining average daily fluctuation.
4. We make no attempt here to reconstruct actual costs. Given the arguments above, the costs of distributing insurance exposures can be expected to be quite different going forward than in the past. One percent of limit seemed to us a sensible level of expenses, but readers can make their own judgments—and adjustments—accordingly.
5. The tables and figures assume (conservatively) that the premium is *not* fully pre-paid, so that investors put up two times the limit of their own funds.
6. Domestic stock returns are measured here as the return on the S&P 500, while bond returns are measured by the Ibbotson long-term government bond index. Returns on these asset classes have not been reduced for expenses.
7. Our annual CAT return series pools together different contract inception dates, whereas stock and bond returns represent January 1 through December 31 results. Thus, Figures 1 and 2 and Table 2 do not contain exact figures and are intended only to be indicative of CAT return behavior and correlation.
8. Of course, the average returns reported here are very sensitive to the frequency with which large storms, such as Hurricane Andrew, or earthquakes happen to occur in the sample.
9. In this exercise, we use a base portfolio of 70% domestic (of which 70% is stocks and 30% is bonds) and 30% foreign (of which 70% is stocks and 30% is bonds). To the extent that the base portfolio is less heavily invested in U.S. stocks, CAT risk provides an even more attractive addition to the portfolio than reported in Table 3. Average holdings of U.S. stocks versus bonds are considerably less than the 70%/30% assumed above.