

Article Title: ARCHIVE | Criteria | Insurance | Specialty: Rating Catastrophe Bonds Data: (EDITOR'S NOTE: —This article is no longer current. It has been superseded by "Framework For Rating Natural Peril Catastrophe Bonds," published July 5, 2007.) Insurers continue to turn to the capital markets for structured finance and derivative solutions to the volatility of both insurance capacity and pricing. Standard & Poor's Ratings Services criteria for these transactions address their legal and structural components, the models evaluating their underlying perils, and the potential for rating-agency capital relief for the ceding insurer. Standard & Poor's has expanded coverage of rated securitizations to indexed and parametric transactions. Standard & Poor's has also considered the possibility of rating some transactions investment grade.

Evolution in the Capital Markets The historical increase in the loss severity of catastrophic events has affected reinsurers' risk appetites and, at times, called into question their capital adequacy. In the early 1990s, reinsurers raised premiums sharply and tightened the availability of certain covers, which forced primary insurers to try to control catastrophe exposures through the use of increased deductibles and coverage limitations to their policyholders, including caps on replacement costs. Insurers have also established maximum aggregate insured limits per county or zip code. In some high-risk areas, government-sponsored funds stepped in to provide reinsurance. Entities such as the Florida Windstorm Underwriting Assoc., the Florida Hurricane Catastrophe Fund, the Texas Windstorm Insurance Association, and the California Earthquake Authority are supported by industry assessments. Clearly, it would benefit insurers to seek additional underwriting capacity from the larger capital markets. However, it is difficult for traditional noninsurance company investors to participate in the rewards of insurance underwriting, which include diversification into nontraditional risks. Only licensed insurers have regulatory authority to underwrite insurance risks, either by writing policies or by entering into reinsurance agreements. Insurance securitization provides an effective way for investors to target their investments and for insurers to access the markets' risk capital. The key to the transfer lies in the use of a special-purpose reinsurer: a special-purpose, bankruptcy-remote vehicle incorporated to enter into the reinsurance agreement with the cedent. Most securitizations have used a Bermuda or Cayman Islands special-purpose vehicle, although some issuers have employed a European or U.S.-based special-purpose vehicle.

Catastrophe Bonds: Benefits and Risks to Investors Investors are subject to loss of principal in the event of a catastrophic insured peril. From an investor's perspective, the appeal of property catastrophe and other natural hazard insurance lines is their low correlation with more typical capital market risks. Because of the low correlation between, for instance, earthquake risk and interest rate risk, an investment in natural hazard bonds raises a portfolio's Sharpe ratio. Equity investments in property/casualty reinsurance companies do not provide the capital markets investor much risk diversification away from the market portfolio, according to a 1996 study published in the *Journal of Derivatives*. That study showed that such direct investments were highly correlated with the equity markets, with a beta exceeding 0.80, while the correlations of insurance securitizations with the much larger markets were near zero. Each insurance note is collateralized by a highly rated investment portfolio. The portfolio principal may be protected by a highly rated counterparty, which also swaps returns on the portfolio into a floating-rate coupon (usually LIBOR-based), mitigating price volatility. Coupons exceed those of corporate bonds with similar default expectations, but Standard & Poor's recognizes that a portion of what appears to be excess spread in the note coupon stems from the nature of the default risk in these securities. Catastrophe notes are structured and rated with regard to the probability of triggering the underlying insurance cover. Although the probability of default is low, the notes are likely to default without a gradual decline in credit quality and with little warning to investors. (This phenomenon is sometimes referred to as the credit cliff.) For this reason and because uncertainty inherent in the modeling of complex, high-severity, low-frequency perils implies a certain level of false precision, Standard & Poor's has chosen not to rate catastrophe bonds above 'BBB+' except for catastrophe bonds with a triple-event payout trigger. Because triple-event catastrophe bonds require a succession of qualifying events, there is a greater degree of early warning that mitigates the concern of a credit cliff. Consequently, the maximum rating assigned to a catastrophe bond with a triple event payout trigger is 'A+'. In addition, it is prudent to expect defaulted catastrophe bonds to offer no significant post-default recovery, while corporate issues usually do. Investors should also consider the possibility of moral hazard. To the extent that a ceding insurer has retained significant exposure to the peril underlying the notes, investors are unlikely to see atypical risk in the notes. This retention may

protect noteholders from aberrations in the cedent's claims-settlement process. Catastrophe Bonds: Benefits to Ceding Insurers Insurers and reinsurers that met difficulties in the early 1990s have been interested in developing a market with deeper capital and greater structural sophistication. Although the reinsurance market has not experienced significant strain in several years, and soft pricing prevails, many reinsurers and primary companies are eager to protect themselves from the capacity and premium gyrations that prevailed in the recent past. The primary issuer benefit is the introduction of the greater capital and risk capacity of the capital markets. For instance, in a widely hypothesized super catastrophe, hurricane damage to Miami might reach \$100 billion, more than five times the \$18 billion in damage caused by Hurricane Andrew. This \$100 billion would be less than 0.5% of the market capitalization of the S&P 500, a loss frequently and easily absorbed in the U.S. stock markets on a given day. Issuers may also find greater flexibility in the terms of coverage as well as a first-perfected security interest in the principal of the collateral account supporting the notes. The use of collateral removes counterparty credit concerns from the reinsurance treaty or retrocessional agreement providing relief to the issuer. Standard & Poor's believes the capital markets might one day support the hedging needs of potential issuers more cheaply than traditional reinsurance. By assuming natural-hazard risk into their portfolios, traditional capital-markets investors receive greater benefits of diversification than property/casualty reinsurers, whose aggregate businesses are already concentrated there. Thus, capital markets investors might require a lower risk premium than that asked by reinsurers. Investor demand following a large catastrophe would probably weaken, forcing coupons upward, but this surge in premium would likely be less than in the reinsurance market, which is smaller. The use of structured finance and derivative technologies may allow issuers to create a wide variety of structures linked to insurance risks. Three broad securitization categories have emerged so far. Types of Bond Cover Indemnified notes. When insurance securitizations were first considered, insurers were reluctant to disclose too much of their underwriting data. Cedents receive the most precise coverage from indemnified transactions, which respond directly to a specified group of policies, but many were reluctant to reveal their underwriting procedures or actual policy composition (beyond statutory filings). An indemnified transaction reflects the underwriting and claims-settlement process of the ceding company. To this extent, Standard & Poor's experience in analyzing the cedent's business provides investors with analytical support. Following the risk of a covered peril event, the primary difficulty facing investors in indemnified notes is the existence of lengthy development periods, which are bond extensions that allow for the discovery of damage and the settlement of claims, a feature typical of insurance cover. Although the risk period ends on the scheduled maturity, at the option of the cedent, investors might have to wait two years or more to determine the disposition of their investment. Indexed notes. Some insurance bonds are linked not to the ceding insurer's business but to the behavior of an industry-wide or geographic index, such as the data compiled by Property Claims Services (PCS) in the U.S. Ceding insurers that issue indexed notes can be exposed to significant basis risk to the extent that the index does not mimic cedent losses. Because it is generally easier to calculate an index than the final claims of the ceding insurer, indexed notes tend to have development periods under two years. Parametric notes. Finally, notes can be structured parametrically, without reference to the cedent's business. Parametric notes make their payments based on a mathematical formulation related primarily to the quantities associated with pertinent events, such as magnitude, intensity, and epicenter of an earthquake, or wind speed, forward velocity, and county of landfall of a hurricane. In fact, this formulation could be complicated and could be viewed as an attempt mathematically to create a virtual replica of the cedent's subject business. This synthetic indemnification could reduce basis risk to the cedent while nearly eliminating the development period for investors. Each indexed or parametric transaction must specify mathematically the relationship between the parametric formula or index and resultant claims against note principal by the ceding insurer. This can be a simple mathematical function (linear or step), or it can be a complex, multivariable relationship that attempts to reduce basis risk to the cedent. Impact on the Ceding Companies Indemnified transactions receive reinsurance credit. One of the primary concerns of the ceding company is whether it can expect capital relief upon the issuance of an insurance securitization. For financial strength rating purposes, Standard & Poor's gives full reinsurance credit to cedents using indemnified securitizations because they are exposed to no basis risk and little credit risk. Nonindemnified transactions reduce moral hazard. Standard & Poor's

takes a positive view of the use of parametric and indexed insurance bonds for investors because they reduce the uncertainty surrounding the cedent's claims-settlement process. In particular, these bonds may reduce moral hazard from the cedent. Here the settlement of claims cannot prejudice investors. The impact of derivatives on traditional analysis. Standard & Poor's applies its standard credit charges to investments in securitized risks and includes losses from these transactions in its view of operating performance. Standard & Poor's evaluates the risk transfer in nonindemnified securitizations and may allow capital relief for exposures that are substantially ceded. If a ceding company relies on an indexed or parametric note for protection, the cedent's ability to manage risk depends on its ability to model its exposures. In addition, statutory accounting treatment of these products affects their use as hedging tools. Property/casualty insurers are measured and benchmarked by various performance ratios, most notably the loss ratio and the combined ratio. These ratios are calculated from premiums, losses, and expenses, as defined by statutory accounting principles. Investment income is not directly considered in any underwriting calculations or ratios. The purchase of reinsurance directly affects these values, and the impact of the reinsurance transaction is reflected in the net underwriting results. Hedge accounting for nonindemnified transactions and derivatives. The purchase of an insurance-linked derivative is currently treated as an investment transaction. For example, under current statutory accounting, a purchased option is treated as an asset during its life. If the option expires without exercise, it is treated as an investment expense. If the option is exercised, the gain is placed on the income statement under Miscellaneous Investment Income. Underwriting profits and ratios are not affected by the purchase of the option. After a loss, an insurer that purchased an index-based derivative would post higher net underwriting losses and a higher combined ratio than an identical company covered by reinsurance with identical payouts. If no loss occurs, the impact on underwriting results is the opposite. If there were no difference in taxation, each company would end up with identical surplus, but when evaluated by statutory ratios, the insurer that transferred risk through the derivative might be viewed as a poorer underwriter. Following FAS 133, only an effective hedge is allowed hedge accounting treatment. The NAIC formed a Securitization Working Group to consider changes to statutory accounting treatment that would achieve underwriting rather than investment accounting for those nonindemnified derivatives shown to be effective in hedging the insured exposure. The profit or loss of such a derivative would offset underwriting income and affect underwriting ratios in GAAP. This group, assisted by the Casualty Actuary Society and the American Academy of Actuaries, is working on an objective test to evaluate the hedge effectiveness of nonindemnified insurance derivatives, including options, futures, and indexed and parametric insurance catastrophe bonds. In Standard & Poor's opinion, for financial strength rating purposes, a properly structured catastrophe bond serves the same function as a program of reinsurance. This is evident with an indemnified transaction. For other transactions, following the determination of the NAIC working group, this will follow from an examination of the effectiveness of the hedge. To the extent that a capital charge is assessed for property catastrophe exposure, Standard & Poor's will assess a capital credit for effectively hedged instruments that mitigate shocks to a company's capital base. Standard & Poor's expects clarification of this topic to lead to a greater use of securitization, even in those insurance lines where there are currently few capacity constraints. Rating Methodology Peril modeling. One of the primary factors in the analysis of a catastrophe securitization is the quantification of both frequency and severity of the risks underlying it. The risk analysis has normally been carried out by one of three peril-modeling firms whose models Standard & Poor's has evaluated for rating purposes. For each peril model, Standard & Poor's examines its source of data. For nearly two centuries, industry and various national governments have funded research in atmospheric science and seismogeology, particularly in the U.S., Japan, and throughout Europe. Some perils in some parts of the world might not be well documented, but these lie outside the realm of rated transactions. Primary global sources of peril data include: United Nation's International Atomic Energy Agency Japanese Meteorological Agency Nation Center for Atmospheric Research Japanese National Research Institute for Earth Science and Disaster Prevention U.S. Geological Survey European-Mediterranean Seismological Centre Laboratoire de Détection et de Géophysique, a network of seismic stations of an agency of the French government responsible for monitoring nuclear test explosions and earthquakes University NAVSTAR Consortium, an international organization of more than 80 universities and research institutions The agencies of the

National Oceanic and Atmospheric Administration, including the National Weather Service and the National Hurricane Center Standard & Poor's reviews the pertinent academic literature, engineering research, and other information delivered by the ceding company to evaluate whether the modeling assumptions and techniques are consistent with the literature. Standard & Poor's may review the variables, including temperature, wind speed, rotational storm velocity, presence of rain, composition of soils covering bedrock, fault activity (including slippage and subduction), and fire following quake. Standard & Poor's may then evaluate whether the model results correlate with local historical activity and refer to academic research to evaluate whether the model properly incorporates specific local features. Standard & Poor's may also consider whether the peril model is supported by the weight of market as well as scholarly and scientific opinion: whether the model in question is relied on by users who face substantial financial, personal, and political consequences in the event of failure. Such users could include builders or operators of hydroelectric dams, missile silos, alpine tunnels, elevated highways, and underground structures. For example, the three peril-modeling firms whose various models Standard & Poor's has reviewed for use in insurance securitization are consulted by primary property/casualty insurance companies and reinsurance companies representing 75% of global catastrophe insurance capacity. Other significant users include: Developers, large industrial corporations, schools, hospitals, low- to high-rise offices, R&D facilities, hotels, convention centers, museums, and parking and underground structures. Energy producers looking for oil and gas or those siting and building offshore drilling platforms, conventional power plant structures, energy storage tanks, and nuclear facilities. Nuclear-device-assembly facilities in the U.S. and Europe. The purpose of these reviews was not to determine each model's accuracy at predicting catastrophe but, rather, the model's reasonableness in the face of known engineering, scientific, and mathematical studies. At present, only Applied Insurance Research, EQE International's EQECAT, and Risk Management Solutions have had their models subjected to review. Each of the three has been reviewed for both earthquake and windstorm modeling. Legal issues. Standard & Poor's reviews the structure of the various corporate and partnership entities involved in an insurance securitization to determine that they meet Standard & Poor's structured finance criteria for bankruptcy-remoteness, grant of security interests to the cedent and the note holders, whether the issuing special-purpose vehicle is bankruptcy-remote, and whether the collateral that supports both the reinsurance and the notes is sufficient to pay the rated notes in accordance with their terms. Depending on the particular transaction structure, Standard & Poor's may request legal opinions addressing the following issues: If applicable, a nonconsolidation opinion to the effect that the issuing trust and the reinsuring entity would not be consolidated with any controlling entity. If applicable, an opinion that the issuing trust and the reinsuring entity have been properly constituted as a Delaware business trust. Opinions addressing, among other things, the due organization of the transaction parties, the enforceability of the transaction documents, and the compliance with all applicable laws and regulations, including those related to insurance matters. For offshore transactions, an opinion to the effect that the entity would not, for tax purposes, be deemed to be engaged in a trade or business in the U.S. An opinion to the effect that the rated obligations will not be subject to regulation of contracts of insurance or reinsurance under applicable state law and that the holders of such notes would not be subject to regulation as providers of insurance or reinsurance. If applicable, an opinion that the issuing trust and the reinsuring entity may not be terminated prior to the termination of the trust indenture without the consent of the indenture trustee, and that the trust may not be terminated by creditors and transferees of the municipality except as provided in the documentation. An opinion that the issuing trust and the reinsuring entity are not required to register under the 1940 Act. A debt-security-interest opinion to the effect that the issuing trust and the reinsuring entity, if applicable, have granted to the indenture trustee/custodian a first-priority perfected security interest in the transaction collateral and any proceeds thereof. The assignment of a rating. In assigning a rating to a catastrophe bond, Standard & Poor's bases its analysis on its corporate default study, which reflects 19 years of U.S. corporate note defaults. The resultant matrix is statistically stationary and is consistent with Standard & Poor's practices in rating collateralized debt obligations. Each note derives its rating by comparison with two rows of the matrix: the first corresponds to the maturity of the note (or, in the case of a re-setting note, the re-set term); the second stands as a surrogate for the instantaneous probability of attachment. Standard & Poor's

compares the note's lifetime and annual probabilities of attachment with the appropriate maturities and locates in each row the first rating category whose likelihood of default exceeds the corresponding probability of attachment. The lesser of these ratings will be the maximum possible rating on the note, subject also to a maximum rating of 'BBB+' ('A+' in the case of a third-event trigger). Whether a given note achieves the rating based on its attachment probability depends on Standard & Poor's analysis of the many parties to the transaction, particularly the swap counterparty and the ceding insurer. This analysis covers the strength of the agreements binding each party, the nature of any indemnification offered by these parties, and the safety of the assets in the collateral account. This analysis also covers the quality of the peril modeling and Standard & Poor's opinion of the cedent's financial strength and underwriting abilities. Standard & Poor's does not refer to expected losses directly in this calculation, but factors expected loss into the statistical analysis of the output of the peril modeling, where it is a measure of how well the loss distribution converges and how well the tail of the distribution behaves. A portion of the matrix follows: Standard & Poor's Cumulative Default Probabilities (%) STATISTICALLY STATIONARY TABLE FOR CATASTROPHE SECURITIZATIONS MATURITY (YEARS) A+ A A- BBB+ BBB BBB- BB+ BB BB- B+ B 1 0.140 0.140 0.150 0.230 0.230 0.540 1.670 2.770 2.790 3.670 8.590 2 0.311 0.324 0.368 0.541 0.648 1.353 3.322 5.262 5.664 7.541 14.508 3 0.512 0.553 0.647 0.924 1.198 2.314 4.924 7.496 8.377 11.086 18.586 4 0.743 0.823 0.978 1.368 1.834 3.343 6.448 9.488 10.822 14.131 21.437 5 1.002 1.130 1.353 1.861 2.523 4.389 7.876 11.255 12.970 16.665 23.479 Under Standard & Poor's criteria, catastrophe bonds are generally subject to a 'BBB+' cap. However, some third-event catastrophe bonds may be rated higher, subject to a 'A+' cap.