Article Title: ARCHIVE | Criteria | Insurance | Specialty: Methodology And Assumptions Used For Rating Natural Catastrophe Insurance-Linked Securities Data: (Editor's note: This criteria article has been superseded by the article titled "Methodology And Assumptions For Rating Natural Catastrophe Bonds," published May 12, 2009.) The historical increase in the loss severity of catastrophic events has affected reinsurers' risk appetites and, at times, called into question their capital adequacy. Property and casualty insurers have sought additional underwriting capacity from the larger capital markets through insurance securitization, by which they contractually transfer some of the risk on their books to a special-purpose issuer which issues debt exposed to this risk. The issuance proceeds are invested and constitute collateral for the debt. If certain trigger events occur, the proceeds are made available to the carrier as reinsurance capital, causing the bondholders to incur a loss of principal and interest. The rating on the bonds reflects the probability that the particular trigger event(s) covered in the transaction will occur during the term of the bonds (generally one to three years). Standard & Poor's Ratings Services determines this attachment point using a combination of qualitative assessments. The natural catastrophe (nat-cat) bond market has come a long way since Standard & Poor's rated its first true nat-cat bond a decade ago. Since that time, the market has expanded and evolved in a number of ways. For example, the roster of natural perils now supported by accepted models has increased significantly. Similarly, coverage by geographic area has expanded to reflect the increase in insurable exposure around the world. At the same time, transactions have also evolved beyond what was once considered the traditional single-event, single-peril nat-cat bond to include multi-peril and event structures, "sidecars", loans, and even synthetic collateralized debt obligations. Because these various structures often overlap, in this article we will use the term "nat-cat bond," to refer to any of these structural alternatives, unless otherwise noted. This is the first in a series of articles that between them will discuss Standard & Poor's response to these structural developments. In this article, we will discuss the various forms of coverage and the major risk factors considered in assigning a rating. Future articles will provide guidelines for the information we might request when asked to rate one of these structures, and give the reader further insight into the rating process we undertake when reviewing these transactions. There will also be articles discussing particular types of structure in more detail, and others discussing the major issues surrounding the sector currently. Transaction Trigger Options A ceding company typically issues a nat-cat bond to reduce its risk profile and obtain capital relief. Clearly, different structures provide cedants with differing types and amounts of protection by transferring one or more elements of that risk to investors. By the same token, Standard & Poor's must reflect the differing levels of risk being borne by investors when assigning its ratings. When rating a nat-cat bond, Standard & Poor's makes quantitative and qualitative adjustments to the basic probability of attachment output from the catastrophe model (see "Risk Factors"). Nat-cat bonds protect the ceding company by means of four basic trigger options: parametric, industry loss, modeled loss, or indemnified transactions. Parametric index transactions Parametric nat-cat bonds are structured without reference to the cedant's losses. These transactions base their payments 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 location of landfall of a hurricane. The bonds estimate losses to investors by applying the actual hazard values from a catastrophic event, at pre-set locations, to a predefined formula. The transactional documents define the formula before inception of the transaction, to replicate the sponsor's expected exposure as closely as possible. Holders of parametric transactions are subject to losses when an event occurs that generates a parameter value of sufficient magnitude to breach the requisite threshold. Since these transactions are not linked to actual losses, they should have the shortest development period between the occurrence of a covered event and determination of whether an attachment point has been breached. Modeled loss transactions Modeled loss bonds are something of a hybrid between parametric and indemnified structures; they are modeled with the aim of more directly linking the trigger to cover losses to the cedant's portfolio without actually being an indemnity structure. These bonds estimate losses to investors by applying the actual catastrophic event to a "notional" portfolio of policies. The cedant sets the notional portfolio before the transaction begins, to replicate its expected exposure as closely as possible. Typically, the portfolio is reset each year. In fact, this type of structure could be viewed as a mathematical attempt to create a virtual replica of the cedant's subject business. However, instead of using the cedant's actual losses,

the attachment point is linked to losses on the notional portfolio, from the particular event, by applying information (e.g., forward wind speed, barometric pressure, magnitude) from an agency (e.g., U.S. Geographical Society, National Oceanic and Atmospheric Administration) to the escrowed model. Typically, the trigger and exhaustion points take the form of monetary amounts, just as with an indemnity bond. We would expect this structure to have similar basis risk to the cedant (compared to a parametric bond) and to have a similar loss development period to a parametric transaction. Industry loss transactions Industry loss transactions are not linked to the ceding insurer's business. Instead, they are linked to the behavior of an industrywide measure of losses for a geographic region, such as the data compiled by Property Claims Services (PCS) in the U.S. In these transactions, a third party generates estimated industrywide losses against which transaction-specific losses are calculated, based on market share or covered exposure in the affected area. Investors incur losses when reported values exceed a predetermined trigger threshold. Ceding insurers that issue industry loss transactions can be exposed to basis risk, because the index may fail to trigger and so the transaction will fail to protect the cedant against the underwriting losses that it was intended to cover. Furthermore, there can be significant development periods associated with index transactions. It can take 18 to 24 months or more for the reported losses to develop to a point where they are sufficiently stable to give investors and cedants reasonable certainty about the likelihood of a default on the transactions. Indemnified transactions Cedants receive the most precise coverage from indemnified transactions, which respond directly to the losses on a specified portfolio of policies. Once a cedant's losses reach a certain threshold, an indemnified transaction will cover losses in a given reinsurance layer. An indemnified transaction reflects the data collection, underwriting, and claims settlement processes of the ceding company. Following a covered peril event, investors in indemnified transactions face lengthy development periods, in the form of bond extensions that allow for the discovery of damage and the settlement of claims. This feature is typical of indemnity cover. Although the risk period ends on the scheduled maturity, the cedant may choose to make investors wait for two years or more to determine the disposition of their investment. Unlike parametric and modeled loss transactions, and to a lesser extent, industry loss transactions, indemnified deals are directly linked to the loss experience and operations of the ceding company. Therefore, by their very nature, indemnified structures require a greater understanding of the underlying ceding company. Sidecars.Standard & Poor's defines a sidecar as a special-purpose reinsurer that assumes indemnified risk through a quota share agreement with one cedant or a group of affiliated cedants. Those who invest in debt issued by sidecars face many of the risks borne by investors in indemnified nat-cat bonds, and are also exposed to additional risks (see "Risk Factors"). Holders of debt issued by a sidecar will incur principal losses if the total costs including claims, operating expenses, and net investments gains or losses exceed the sidecar's claims paying resources. These are subordinated to its debt and include equity, premium, and net investment income after the debt has been serviced. Similar to indemnified nat-cat bonds, sidecars leave the cedant with almost no basis risk, but determining covered losses can take upwards of two years or potentially more. Standard & Poor's Risk Modeling Process For Nat-Cat Bonds To date, Standard & Poor's has not rated a transaction in which the ceding company used a model other than one provided by either Risk Management Solutions Inc., EQECAT Inc., or AIR Worldwide Corp., although some sidecars included certain risks (e.g., crop insurance) that were not modeled by these companies. These particular risks, however, correspond to an insignificant level of losses relative to the trigger point of the sidecar debt. While Standard & Poor's does not endorse the use of any modeling agency over another, we do consider it significant that these three modeling agencies have achieved a general level of acceptance in the greater insurance market. In addition to taking into consideration their years of experience and track record, Standard & Poor's periodically meets these companies to discuss and better understand both updates to existing models and new models being developed to cover new perils or geographic regions. Standard & Poor's has rated transactions in which the cedant is responsible for running the vendor model themselves. These structures have included the participation of a third party, usually the modeling agency, to confirm modeled results as calculated, as well as the verification of losses when an event occurs. As in all nat-cat bond transactions, we will review and assess any adjustments made and factor them into the ratings decision. We do not anticipate altering our current policy, namely that we do not rate nat-cat bonds that rely solely on the output of a company-generated model. Risk Factors

Each nat-cat bond transaction rated by Standard & Poor's is unique and is rated on its individual merits. However, a number of risks are common to transactions of the same type and we consider each of these when assigning the rating. All nat-cat bonds are, of course, exposed to the risk of one or more natural catastrophic events happening. Natural catastrophes occur randomly in nature and include hurricanes, earthquakes, and typhoons. Each peril in each region occurs with differing frequency and severity, and these two factors are key to the risk assessment underlying Standard & Poor's rating. The sponsor's initial estimate of this risk is based on one or more catastrophe models; however, it is important to note that the output of these models is only an estimate and not definitive. Therefore, we adjust the probability of attachment based on the risk factors detailed in this section. The amount of that adjustment is subject to quantitative and qualitative factors, so it is not unexpected, for example, for us to make different adjustments to different indemnified transactions, based on transaction-specific features. Model risk Modeling risk captures the possibility of the catastrophe model misestimating the frequency and/or severity of catastrophic events. All models, by definition, are simplifications of reality and their ability to accurately predict future events depends on many factors. The three modeling agencies mentioned have considerable experience and skill. Standard & Poor's inclusion of modeling risk when assigning a rating should not be taken as an indictment of the models. Rather, it reflects our belief that a certain level of uncertainty must occur when modeling tail events, and other inputs are subject to significant volatility (e.g., demand surge). Similarly, the complexity of each hazard varies; Factors are often difficult to allow for, either because of a lack of data or because their impact is difficult to quantify, e.g., the impact of the North Atlantic Oscillation. Model risk includes a number of components, some or all of which may be present in a particular transaction structure. While industry loss triggers require the use of all modules from the model, parametric and modeled loss triggers use fewer modules, only up to the estimation of the hazard value. In other words, investors in industry loss transactions face additional model risk compared to investors in parametric or modeled loss transactions. The loss estimates as modeled for industry loss transactions incorporate assumptions about the severity of damage to insured buildings and the financial cost of this damage if a natural disaster occurs. If these assumptions underestimate the severity of damages, the true probability of attachment will be greater than the modeled probability of attachment for these types of trigger. There is also the risk of data collection and interpretation related to the peril. While technological advances have allowed for much improved data collection related to the various perils, this is a recent phenomena. For example, if you go back 50 years, the measurements of hurricanes in the U.S. and windstorms in Europe were not as accurate, increasing the variability in the historical catalog of each modeling agency. When reviewing earthquake models, one company will argue for time-dependency (that is, each year without an earthquake increases the likelihood of an earthquake in the future) while another one will not include this element. From a ratings perspective, these issues, and others like them, serve to increase the adjustment applied to the results. We would view more favorably transactions in which personal lines (as opposed to commercial lines) make up most of the subject portfolio. One reason that the nat-cat bond issued by KAMP RE 2005 Ltd. defaulted was that it suffered unexpectedly large losses on the excess lines element of its commercial exposure. Rupture of the New Orleans levees during Hurricane Katrina caused significant flooding in the covered area and payments from the cedant, where none had been modeled, subsequently triggered payments from the noteholders to the cedant. Furthermore, statistical theory suggests that a smaller number of larger risks is inherently more risky then a larger number of smaller risks. Data risk Indemnified structures not only use the full output from the model but also depend heavily on the quality and completeness of the cedant's underwriting data, which is used to populate the model. These models are highly complex and reliant on the quality of data input into them. For example, it is easy for errors to creep into the collection of the insured property data. Entering an incorrect property code could mean a commercial building being coded as residential, or a wood frame property being coded as brick. We are not implying that a cedant would intentionally mislead, but we must allow for human error. Another potential source of risk springs from changes in the covered portfolio. When applied to a complex model, data risk can form a significant portion of an investor's total risk in this type of transaction. Furthermore, indemnified structures rely on the claims handling and actuarial estimating skill of the issuer and its agents, which adds a moral hazard component to the analysis. A related risk arises because the

probability of attachment is based on a portfolio as of a certain cut-off date. When the sponsor determines the probability of attachment, exhaustion, and expected loss, either at issuance or reset, they base them on the portfolio at that time. The actual ceded portfolio will be different, albeit slightly, which introduces another level of uncertainty. Another lesson learned from Hurricane Katrina was that the total sum insured for many commercial properties was significantly understated. This meant that the modeled losses were also significantly understated for both primary and, more particularly, excess lines. Other risks A number of other factors will affect the level of stress applied to the individual transaction. The list below is not exhaustive and like the trigger type above, each of these factors will have a different impact on the individual transaction and, consequently, will suggest a different level of stress test. When compared to per event or single-year structures, or those in which losses incurred by the transaction are reset annually, multi-year aggregate structures are more prone to model error. Any imperfections in the underlying model will be compounded over the term of the transaction. However, this may be offset to an extent if these structures are triggered by less severe events (see below). The skill of the modeler running the catastrophe model is important, as this is not a mechanical process. Ensuring that codes in the underlying data (e.g., geographic, construction type, roof material) are correctly mapped to those used in the model requires skill and experience; as does interpreting and checking the model output. It is essential that these processes be performed correctly--there is little benefit in having complete, good-quality data if it is not used correctly. The annualized probability of attachment is important beyond a pure assessment of the likelihood of a nat-cat bond defaulting. All models contain errors and the further into the tail the results are, the more the assumptions underlying any model tend to break down. For the most remote risks, there may be no recent events against which to compare models. Consequently, the more remote the risk, the greater the potential for model error. Although sidecars are basically indemnity structures, they are also subject to business risks. The quota share agreement places restrictions on the type of business that the sidecar will reinsure, but the cedant has some latitude in defining the portfolio of risks. The modeled probability of attachment for debt issued by a sidecar is based on the expected portfolio, but changes in strategy by the cedant and conditions in the market could cause the actual portfolio of risks to differ from expectations. The modeled probability of attachment also requires assumptions for premium and expenses. An unfavorable variance in these assumptions will increase the probability of attachment--all else being equal. Additionally, sidecars sometimes contain potential losses from perils that are not modeled. Sidecars usually follow the fortune of the cedants on the covered business, which sometimes includes policies that cover losses from perils or events that are not simulated in a model approved by Standard & Poor's. For these unmodeled risks, we examine the cedant's historical losses and industry experience of the volatility of these type of losses. Then, we increase the estimate for modeled losses by the amount of expected losses that would not be included in that estimate. Adjusted Probability Of Default Standard & Poor's assigns ratings to nat-cat bonds based on the revised probability of attachment, which represents the potential of a missed principal or interest payment. The revised probability of attachment equals the modeled probability of attachment plus an adjustment to address the possibility of error in the modeling process. Standard & Poor's makes an allowance for the above risks in its ratings by applying stress tests to the aggregate exceedance probability (AEP) or occurrence exceedance probability (OEP) curves, as appropriate, before assigning a rating. The adjustments will vary according to the type of structure and the individual characteristics of the transaction under review. The test gets more rigorous as the number and magnitude of risks present in a particular transaction increases. While it is extremely rare for transactions to be directly comparable, the paragraphs below are intended to give an indication of the relative magnitude of the risk inherent in different types of trigger mechanism on a like-for-like basis. Parametric and modeled loss-based transactions, which use the output from a catastrophe model only up to the hazard-generation stage, would receive a less onerous test than industry loss or indemnified loss transactions, each of which use all of modules in the catastrophe model to generate the probability of attachment and related exceedance probability curves. An industry-loss-based transaction would receive a less onerous test than an indemnity-based transaction, which use the full output from a catastrophe model and rely on the quality of the cedant's underwriting data to populate the model. An indemnity-based transaction would receive a less onerous test than a sidecar-style transaction, which uses the full output from a catastrophe model up to the

financial-loss-generation stage, relies on the quality of the cedant's underwriting data and contains other non-modeled risks. To provide the market with some guidance, the table gives indicative stress levels that we would apply to the AEP or OEP curve of a nat-cat bond. Please note these levels are indicative only. We tailor the actual adjustment applied when rating each nat-cat transaction to reflect the transaction's individual characteristics and adjustments may exceed or, more typically, fall short of this figure. Indicative Stress Test Levels TYPE OF STRUCTURE (%) Parametric 5 Modeled loss 5 Industry loss 10 Indemnity 20 Application And Methodology The following example illustrates how we would apply the adjustment for a nat-cat bond linked to industry losses on per-occurrence basis with an annual reset, an attachment level of $600 million, and a modeled probability of attachment of 1.33%, which equates to a one-in-75-year event. We may apply an adjustment of, for example, 9%, which will decrease the attachment level to $546 million. The AEP curve supplied by the modeling agency indicates that the new probability of attachment is 1.79%, which equates to a one-in-56-year event (illustrated by the Flat AEP curve in the chart below). We compare this revised probability of attachment to the default table used to rate insurance-linked securitizations (ILS). If this were the sole metric used to assign a rating, the bonds would be assigned a rating of 'BB'. Had the AEP curve generated a probability of 1.41%, then the rating outcome for this metric would have been 'BB+'. If one were to plot an AEP curve with probability of default along the X axis and index/loss value along the Y axis, clearly a steep curve would be expected to minimize ratings volatility and a flat curve will likely intensify it (see chart below). Chart 1 It is important to note that the revised probability of attachment is not the sole metric for rating ILS transactions. Qualitative features not addressed here may cause the rating assigned to the transaction to differ. Disclosure Standard & Poor's is committed to increasing the transparency and quality of information within the ILS sector. To that end, it will issue a commentary including opinion and preliminary/final ratings before and after the close of each transaction that it is engaged to rate. This will typically include a discussion of the major risk factors. Conclusion Recent developments in the nat-cat bond market have led to a convergence of structural features. Standard & Poor's applies a methodological approach when analyzing and rating nat-cat bond transactions. Differences between each transaction may be nuanced, and our assessment of these differences and subsequently, the adjustments we make, which affect the ratings process, are often qualitative in nature. Further information regarding the analytical framework Standard & Poor's uses in rating nat-cat bond transactions is given in the article titled, "Framework For Rating Natural Peril Catastrophe Bonds," published on July 5, 2007 on RatingsDirect. These criteria represent the specific application of fundamental principles that define credit risk and ratings opinions. Their use is determined by the issuer- or issue-specific facts, as well as Standard & Poor's assessment of the credit and, if applicable, structural risks for a given issuer or issue rating. Methodology and assumptions change from time to time as a result of market and economic conditions, issue- or issuer-specific factors, or new empirical evidence that would affect our credit judgment. Related Articles "Framework For Rating Natural Peril Catastrophe Bonds" (published on July 5, 2007). "Default Table Used To Rate Insurance-Linked Securitizations Updated" (published on May 8, 2008). "Guide To Rating Process For Insurance-Linked Securities" (published on Sept. 5, 2008). All related articles are available on RatingsDirect, the real-time Web-based source for Standard & Poor's credit ratings, research, and risk analysis, at www.ratingsdirect.com.