

**INSURANCE SECURITIZATION :
THE DEVELOPMENT OF A NEW ASSET CLASS**

Richard W. Gorvett, FCAS, MAAA, ARM, Ph.D.

Assistant Professor of Finance and Insurance
The College of Insurance
101 Murray Street
New York, NY 10007-2165

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Biography

Rick Gorvett is an Assistant Professor of Finance and Insurance at The College of Insurance in New York. He received a BS in Mathematics from the University of Illinois at Chicago, an MBA in Finance and Econometrics from the University of Chicago, and a Ph.D. in Finance and Insurance from the University of Illinois.

At The College of Insurance, Rick teaches undergraduate and graduate courses in insurance, financial management, and financial risk management. Prior to coming to The College of Insurance, he was on the faculty of the University of Illinois Department of Finance, where he taught insurance, risk management, investments, and corporate finance. Rick's background includes business experience as an actuary and a consultant, and he continues to consult in the actuarial area. Specific research and consulting interests include dynamic financial analysis, insurance securitization, and the use of financial models in determining insurance rates.

Rick is a Fellow of the Casualty Actuarial Society, a Member of the American Academy of Actuaries, and has the Associate in Risk Management designation.

Abstract

This paper provides an introduction to the insurance securitization process and its products. Insurance securitization is considered within a broad context, both as a subset of financial securitization, and as one of many sets of financial risk management tools available for use by insurers. A definition of insurance securitization is presented, and a description of the evolutionary process which securitization -- both insurance and non-insurance -- has undergone is provided. The factors that have led to the development and expansion of insurance securitization are discussed and examined, and various securitized products are described. Particular attention is paid to several recent successful catastrophe bond offerings, which have received significant publicity. The paper concludes with a discussion of the future of insurance securitization.

1. Introduction

The concept of “insurance securitization” originated with an article published some twenty-five years ago¹, in which insurance derivatives (specifically, reinsurance futures) were first speculated upon. Interestingly, this article appeared even before the word “securitization” was first coined by the financial markets, and it was only later in the 1970s that non-insurance securitized products -- in the form of asset-backed (specifically, mortgage-backed) securities -- began to be traded. Since that initial activity, it has taken nearly twenty years for *insurance* securitization to become a practical reality.

Throughout this paper, “insurance securitization” is treated, not as an isolated process in conflict with other techniques, but rather as one of many sets of financial risk management (FRM) tools. In order to better understand the evolution, current state, and future developments of insurance securitization products -- products which have the potential, like many financial instruments, to become rather complicated -- it is also important to consider securitization in terms of a broad financial and corporate framework. If actuaries and other insurance industry personnel are to make the best use of these instruments and concepts, it is critical that they understand the wider perspective, and become comfortable with the language of finance and financial risk management.

The format of the paper is as follows. Section 2 defines our subject, “insurance securitization,” in broad terms. Section 3 places securitization in its historical non-insurance and financial perspective, and briefly reviews the evolution and structure of non-insurance securitization products. Section 4 discusses the evolution of *insurance* securitization as a financial risk management tool, the factors which have accompanied its introduction, and the reasons typically given for its recent development. Section 5 describes some of the more important securitization products which have been introduced. Section 6 focuses on the recent catastrophe bond issues, and includes an appendix which identifies some characteristics of several of the more significant

¹ Goshay and Sandor (1973).

issues. Section 7 concludes with some thoughts regarding the future of insurance securitization. Finally, the paper includes a bibliography, and a glossary of financial risk management terms. (While not every item listed in the bibliography is specifically referenced in this paper, many of these sources served as background for the material covered here, and the reader may wish to refer to them for additional information and insights into insurance securitization and financial risk management.)

2. A Definition of Insurance Securitization

“Insurance securitization” can be defined as the transferring of underwriting risks to the capital markets through the creation and issuance of financial securities. In particular, the insurance securitization process involves the following two elements:

- The *transformation* of underwriting cash flows into tradable financial securities.
- The *transfer* of underwriting risks to the capital markets through the trading of those securities.

The first element might be identified as “financial engineering,” which is essentially the bundling and/or unbundling of cash flows into new and different financial securities. This is a common practice in the financial markets -- examples include Treasury strips or “zero-coupon bonds” (which essentially involve stripped-apart bond coupon and principal payments which are re-constructed into single-cash-flow securities), and collateralized mortgage obligations (involving the unbundling and re-bundling of cash flows on mortgages). The second element of insurance securitization involves the ultimate recipient of the traded risks. Instead of an insurance company transferring its underwriting risk to a reinsurer within the insurance industry, the risk is transferred to the broader capital markets. This is typically accomplished by the buying and selling of financial instruments whose cash flows (payoffs) are contingent upon underwriting experience. For example, with exchange-traded catastrophe options, the payoff on the option depends upon a sufficient amount of catastrophe losses being incurred by the insurance industry

(according to a particular industry index) during a specified time period. With catastrophe bonds, the payment of coupon interest and/or principal to the investors (bondholders) is contingent upon the occurrence or non-occurrence of an insurance “event” (which may be based upon an industry index, the level of catastrophe losses experienced by the company issuing the bonds, or some other “trigger”).

3. Securitization in Historical Perspective

Although securitization is a very recent phenomenon within the insurance industry, the process has existed in the general financial markets for some twenty years. This section describes the origins of “securitization” in its non-insurance context.²

In the late 1970s, a funding shortfall in the home mortgage market provided the genesis for the original securitization effort. In particular, excess demand by homeowners and potential homeowners for mortgages -- excess relative to what thrifts and savings and loans were able to supply -- led the financial markets to wonder whether there was a more efficient way to move funds from the suppliers in the capital markets to the mortgage demanders. The answer was the development of the mortgage securitization industry, in which the interest and principal payments on groups of individual mortgages formed the backing for the cash flows of newly created, tradable, and more liquid securities. The development of these securities and this market facilitated the transferring of funds from investors to borrowers.

The first mortgage securitization product was issued in 1977, by the Bank of America. Around that time, too, the word “securitization” was first coined -- although not without some initial objection from the press, which contended that the term could not be used because it wasn’t a proper word. Nevertheless, the term stuck, and is now deeply entrenched in the financial services industry. Over the last twenty years, the securitization market has blossomed significantly -- with some help from changes in the tax code and improvements in investment technology, the latter of

² A source of much information regarding the general securitization process is Kendall and Fishman (1996).

which has provided further support for the financial engineering of mortgage debt. (The proper pricing of mortgage-backed securities generally involves complex econometric models, since the cash flows of such securities are dependent upon future economic and financial developments. For example, the cash flows of mortgage-backed securities depend upon mortgage prepayment patterns, which in turn depend upon the pattern of interest rates.)

In general, the mortgage securitization process has involved the following participants:

- Borrower (homeowner)
- Loan originator (bank)
- Special Purpose Trust
- Underwriter (investment bank)
- Investors (capital markets)

These participants can be viewed as comprising two pairs -- the borrower and loan originator, and the underwriter and investors -- with an “intermediary” between the pairs. That intermediary is termed a “Special Purpose Trust,” which generally purchases the groups of individual loans from the first pair, and issues the mortgage-backed securities to the second pair. As we will see in Section 6, this same type of “intermediary” has, at least up until now, been an important part of the catastrophe bond issuance process.

The asset-backed securitization process has several benefits which have led to its popularization and expansion. One significant benefit involves enhanced *liquidity*: for example, non-rated and illiquid mortgage loans have been transformed into highly liquid, tradable assets. Another benefit, which flows from the securities’ tradability, is the ability to determine the *market values* of loans. In addition, securitization provides a more efficient and *lower cost* way of moving funds from investors to borrowers. Given these and other benefits, an additional advantage is the possibility of an *improved credit rating*.

The original mortgage-backed securities have now been joined by other types of asset-backed securities -- e.g., the packaging of auto loans, and credit card receivables. Other asset-backed securities that are more unusual and innovative have also been either proposed or issued: the future sales on David Bowie's record albums, and debt issued by the National Football League. (The latter was an intended 10-year, \$600 million debt offering that would have been largely supported by the recent \$18 billion television agreement signed by the NFL; however, this debt issue was subsequently withdrawn, at least partially because the term of the debt exceeded the term of the NFL's television agreement that was going to be used to support the issue.)

Insurance securitization, then, is a step in the evolution of the general securitization process. When considering insurance securitization's future, it is interesting and instructive to compare the specific characteristics of the insurance industry with those financial sectors that have already proven amenable to securitization. For example, the existence of a "funding shortfall" in the mortgage financing market was referred to above as the primary motivation for the initial development of securitization. In fact, it has been suggested that a funding shortfall is the critical element, or the prerequisite, for having a successful securitization market in any industry segment. In Section 4, we will examine whether this "prerequisite" is fulfilled with regard to insurance securitization, or whether there are other, more important motivations. Another interesting issue involves the types of things that are securitized. Historically, the assets that have been most successfully securitized have been those that have significant volume and that are in some sense relatively "stable" -- e.g., mortgage loans, auto loans, and credit card receivables. It is interesting, then, that the insurance industry has concentrated primarily upon an extremely volatile and unpredictable process -- natural catastrophes -- in its initial securitization efforts.

4. The Evolution of Insurance Securitization

A. Institutional and Finance-Theoretical Contexts

As mentioned in Section 1, it is instructive to put insurance securitization into a broad context, both historically and financially. For example, when insurance securitization was originally proposed -- and to some extent even now, after several years of development -- it was looked upon as a threat to “traditional” insurance. If looked at in strict isolation, that opinion is somewhat understandable. However, in a broader perspective, insurance securitization is really just one in an evolutionary sequence of “affronts” to traditional insurance which are changing the nature of the industry, rather than threatening its overall existence. A decade or two ago, self-insurance and captives were considered to be significant threats to the insurance industry. Three or four years ago, insurance securitization came on the scene, and still provides similar fears. Even more recently, “portfolio insurance” has attracted interest. (Portfolio insurance involves the packaging of both insurance and financial risks -- e.g., foreign exchange risks -- into a single multi-line policy; such packaging takes advantage of the potential benefits of portfolio theory and diversification of risks.) While there is no question that the insurance industry needs to address itself to each of these -- and other -- potential “threats” to its traditional business, these developments also provide opportunities of which the industry is well-positioned to take advantage.

Actuaries are accustomed to viewing insurance risks from what might be termed an “institutional” perspective. Recent efforts in dynamic financial analysis, for example, have largely involved the identification of the sources of risk faced by property-liability insurance companies. These sources include risks on both the underwriting and investment sides of an insurer’s operations. Some examples include:

- Underwriting

- Loss experience -- frequency and severity
- Underwriting cycle -- premiums and profitability
- Inflation
- Payout patterns
- Catastrophes
- Investment
 - Interest rate risk
 - Capital market performance

While the focus of insurance securitization has, so far, involved catastrophic risks, any of the risks above (or the others to which an insurer is subject) can prevent a company from meeting its objectives -- whether the objectives are defined in terms of profitability, solvency, liquidity, etc. Addressing risks to better enable a company to meet its objectives is the point of financial risk management and hedging. Thus, securitization, in its current incarnation and viewed as a tool of FRM, is intended to help meet an insurer's objectives by addressing catastrophic risk.

While it is useful and instructive to view securitization as an FRM tool, such a financial perspective brings up an interesting issue. An important question in financial economics is whether financial risk management techniques can actually create or increase firm value. The more general form of this question is whether the method of financing a company -- i.e., the form of the right-hand-side of the balance sheet, for example equity versus debt -- can affect the value of a company. In 1958, Modigliani and Miller,³ in what has become known as their "irrelevance" propositions, gave a qualified "no": under certain assumptions, the method of financing a company cannot affect its value, because value is determined on the left-hand-side of the balance sheet. In other words, it really doesn't matter how a company gets money in the door -- e.g., whether from issuing debt or issuing equity. Rather, what matters is how those funds are put to use -- e.g., what capital investments the company makes. If this is true, then since

³ Modigliani and Miller (1958).

financial risk management techniques involve financing, we are left with the question of whether FRM efforts are worthwhile.

The key to answering this question is in the assumptions that Modigliani and Miller made in formulating their irrelevance propositions. If financing in general -- and, for our purposes, FRM in particular -- are to impact company value, it must do so through “violations” of one or more of their assumptions. Specifically, they assumed no tax effects, no costs of financial distress, and a fixed investment policy. Thus, if FRM *is* to matter, it must be through one or more of the following three items:

- *Tax effects:* A convex tax function, where the marginal tax rate increases with increases in the company’s income, may cause financing policy in general, and FRM in particular, to matter. In this case, more volatile earnings will result in a higher average tax liability. Thus, FRM can add value to the firm by decreasing the volatility of the future earnings stream.
- *Financial distress / bankruptcy costs:* Highly leveraged or solvency-threatened firms may behave in sub-optimal ways, for example by favoring high-risk investments. Thus, FRM can add value by promoting better operational behavior through minimizing the costs of financial distress.
- *Effect on future investment decisions:* When a company experiences losses, it is possible that new, sound, profitable investments may be “crowded out.” The only way the company can then afford those investments is by raising external capital, which tends to be more costly than internal funds (e.g., from retained earnings). The alternative is to completely miss an important investment opportunity. Thus, FRM can add value if it can promote better capital investment behavior by reducing the potential impact of losses.

Securitization, then, as a financing and FRM tool, can theoretically add value to a firm through one or more of these irrelevance “loopholes.”

B. Why Insurance Securitization Now?

Although it has been more than two decades since insurance derivatives were first suggested, only in the last few years has a market developed for such products. Why has the evolution of insurance securitization taken so long? On the other hand, why is it happening now, rather than years in the future, if at all? The answer to these questions lies in the confluence of insurance and capital markets incidents and developments.

Three primary factors have influenced the current interest in insurance securitization:

- 1) *Recent catastrophe experience:* After significant catastrophe losses in the first half of the 1990s -- particularly Hurricane Andrew in 1992 and the Northridge earthquake in 1994 -- the industry reassessed the catastrophe risk to which it was exposed. Suddenly, it was realized that losses in the tens of billions of dollars -- or greater -- were more than theoretically possible. These catastrophes, and the accompanying attitudinal changes, had at least temporary effects on the demand for, and pricing of, reinsurance. Thus, concerns developed regarding the future availability and stability of reinsurance. (In addition, Lloyd's of London was having problems around this time.)
- 2) *Capital market developments:* Investors and the capital markets have become increasingly mature and aggressive. The capital markets are always on the lookout for new asset classes and asset-backed markets. An ideal area for investment is one that would provide high yield with diversification benefits.
- 3) *Structure of the insurance industry:* A significant trend has been occurring recently in the insurance industry: mergers, acquisitions, and consolidations. In addition, there have been discussions regarding possible demutualizations. All of this activity suggests that the industry is becoming ever more driven by Wall Street and the financial markets.

These factors -- especially the first two -- have led to two commonly accepted reasons for the existence of insurance securitization.

C. Reasons Typically Given for Securitizing Insurance Risk

Typically, two primary reasons are given for securitizing insurance risks:

- *Capacity*: There is a risk of huge catastrophic losses which could severely impair the capital of the property/casualty insurance industry (which is perhaps \$250 billion or so). On the other hand, the capital markets, it is argued, could easily handle a loss that would otherwise amount to a significant drain on the P/C industry's net worth. In fact, the entire net worth of the industry amounts to perhaps 1 to 2 percent of the value of the U.S. equity markets -- an amount that is not particularly uncommon any more in terms of the *daily volatility* of the stock markets. Thus, it is felt that a large catastrophic loss, while a threat to the P/C insurance industry's solvency, could be handled without difficulty by the capital markets.
- *Investment*: If it is accepted that catastrophe exposure is uncorrelated with movements in the capital markets, then this exposure, if a way can be found to invest in it, has diversification potential. In other words, investment in catastrophic exposures -- e.g., through catastrophe bonds -- should be desired by the capital markets because it will generally be uncorrelated with existing investment portfolios. Investment in catastrophe exposures will be even more desirable if it also provides a high yield relative to the underlying risk.

While both of these reasons seem to be well-entrenched in the blossoming insurance securitization industry, one can argue with one or both of them. The zero-beta investment reason is largely an empirical issue. However, let's look more closely at the capacity issue. In Section 3, the terminology "funding shortfall" was referred to as a possible "prerequisite" for the development of a successful securitization market. Does this apply to the insurance industry? According to the capacity argument, it does. However, *is* there a capacity shortfall in the P/C industry? Three points make the issue less than completely clear. First, one reason the industry has built up its net worth is to address future potential catastrophes. One of the purposes of surplus is to protect solvency in the event of adverse loss experience. Although it is certainly

difficult to identify how much surplus is “enough,” and the impact of a large catastrophe should always be of concern, the threat of such a loss may be within the scope of what the industry has prepared for. Second, although a large catastrophe could result in significant losses to property, the proportion of property values actually covered by insurance is low in certain places and with regard to certain coverages – e.g., earthquake and flood insurance is far from universal. Thus, the *insured* loss may be significantly less than the projected overall property damage. Third, as was demonstrated with regard to Bermuda catastrophe insurers after hurricane Andrew, new capital enters an industry when rates of return are high. Thus, significant losses to the industry may be only temporary, offset later by increases in rates and the entry of new insurers.

In summary, then, the capacity and zero-beta rationales for insurance securitization may be reasonable, but they beg for additional consideration and investigation. They may not be the last word.

D. Other Issues Regarding the Potential Success of Insurance Securitization

The “capacity” and “zero-beta investment” reasons for securitization are essentially factors involving the *existence* of securitization. Other issues, such as the following, can affect the potential future success or failure of securitization in the long-run:

- *Understanding*: To be successful, the securitization process needs to be understood by both the capital and insurance markets. Complete understanding of insurance securitization requires familiarity with the vocabulary of *both* markets. Without understanding, there will be skepticism.
- *Functional separation*: Historically, the insurance and finance functions in many insurance companies have been separated. The persistence of this separation will not enhance the evolutionary process of securitization.
- *Information and technology*: The capital markets will require quick and precise information in order to price and trade securities.

- *Difficulty in pricing:* While modeling techniques have advanced significantly, accurate pricing of catastrophe exposure is still extremely difficult. Further model developments, and greater comfort of investors with those models and their pricing implications, will be important.
- *Cost:* Securitized products may be perceived to be more or less expensive than traditional catastrophe insurance or reinsurance, depending upon the state of the market and the position of the underwriting cycle. (It is interesting that the current securitization products have been introduced in a relatively soft, inexpensive P/C market.)
- *Legal / tax / accounting issues:* Of course, these issues always exist. An example of a legal issue is the question of whether an investor who purchases an insurance securitization product is acting as an insurer -- and thus potentially subject to regulatory treatment as an insurer -- or as an investor.

5. Types of Insurance Securitization Products

There are several ways to categorize the many types of insurance-related instruments that exist or have been proposed. One approach is as follows:

- Those that transfer risk
 - Reinsurance: transfers risks to other companies within the insurance industry
 - Swap (including risk exchanges): transfers risks to other insurers (or to the capital markets)
 - Catastrophe bond: transfers risks to the capital markets
 - Exchange-traded derivative: transfers risks to the capital markets
- Those that provide contingent funding
 - Line of credit: right to borrow
 - Contingent surplus note: option to borrow contingent upon the occurrence of an event. Typically, funds are placed in a trust and invested, say, in T-bills. In the event of a catastrophe, the insurer can use those funds, replacing them with surplus notes.

- Catastrophe equity put: option to sell equity (usually preferred shares) at pre-determined terms, contingent upon an event.

Many of these instruments will be described in the following sub-sections. In addition, catastrophe bonds, which have received significant recent publicity, will be discussed in Section 6.

A. Chicago Board of Trade PCS Derivatives

The insurance derivatives traded on the Chicago Board of Trade (CBOT) have undergone a significant evolutionary process.⁴ The present description will concentrate on the instruments that are currently being traded: catastrophe option spreads.⁵ These instruments began trading on September 29, 1995, and have the following properties:

- They are European cash options – in other words, they are settled in cash, only at the expiration of the contract (either 6 or 12 months after the end of the loss period).
- Loss periods are generally calendar quarters, except for Western States and California options, which are annual (on the assumption that earthquake risks are not seasonal).
- Estimates of aggregate industry catastrophic losses are made daily by Property Claim Services (PCS); the estimates are expressed in the form of an index.
- Each index point is equivalent to \$100 million of aggregate industry catastrophe losses. The cash value of each index point, in terms of the settlement value of the option, is \$200.
- Strike values – the values which identify the parameters of the option and determine whether the option is in or out of the money – are in multiples of 5. The tick size (trading interval) is one-tenth of a point (thus, \$20).
- There are nine different instruments available from a geographic perspective, including three individual states and five regional state groupings:
 - *National*: All states + DC

⁴ See, for example, D’Arcy, Gorvett, and France (1999).

- *Eastern:* AL, CT, DE, DC, FL, GA, LA, ME, MD, MA, MS, NH, NJ, NY, NC, PA, RI, SC, VT, VA, WV
- *Northeastern:* CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, VT
- *Southeastern:* AL, FL, GA, LA, MS, NC, SC, VA, WV
- *Midwestern:* AR, IL, IN, IA, KS, KY, MI, MN, MO, NE, ND, OH, OK, SD, TN, WI
- *Western:* AK, AZ, CA, CO, HI, ID, MT, NV, NM, OR, UT, WA, WY
- *California*
- *Florida*
- *Texas*

Essentially, the CBOT options work much like excess reinsurance. An example demonstrates this analogy. Suppose a December 30/50 Texas call option spread has been purchased by an insurer which has property exposure in that state. The insurer's purpose might be to hedge that catastrophe exposure. Essentially, this option spread is analogous to a \$2 billion in excess of \$3 billion layer on fourth-quarter aggregate industry catastrophe losses in Texas, since

$$[50 - 30] \times \$100 \text{ million} = \$2 \text{ billion, and}$$

$$30 \times \$100 \text{ million} = \$3 \text{ billion.}$$

(Financially, the excess nature of the spread is accomplished by buying a call option with an exercise price of 30, and selling an option with an exercise price of 50. This buy-sell combination is built into the spread.) If fourth-quarter Texas catastrophe losses to the industry amount to \$4.5 billion, the company that purchased this option spread would receive \$3,000:

$$[(\$4.5 \text{ billion} / \$100 \text{ million}) - 30] \times \$200 = \$3,000.$$

For those CBOT contracts that involve spreads of twenty index points (a very common spread size), the most that any one spread can pay to its purchaser is \$4,000 (20 points multiplied by \$200 per point). Thus a large volume of spreads must be purchased in order to provide an effective hedge. How high has the volume been on these instruments since their introduction?

⁵ A good source of information is Chicago Board of Trade (1995).

Exhibit 1 shows the monthly volume of trading in PCS options, and the open interest at the end of each month, through October 1998. (Open interest is the number of contracts that are still open and outstanding – i.e., the expiration date has not yet been reached and the contracts have not yet been exercised.) The data underlying these figures is provided publicly by the CBOT on their web page.⁶ It should be noted that the CBOT counts a trade of a PCS option as two units of volume: one on each side of the transaction. Exhibit 1 reflects this CBOT approach to counting trading activity. This exhibit shows that trading of CBOT PCS options has not involved overwhelming volume.

B. Bermuda Commodities Exchange Catastrophe Options

Within the realm of exchange-traded insurance derivatives, there is an alternative to the contracts available on the Chicago Board of Trade: catastrophe options are also traded on the Bermuda Commodities Exchange (BCOE). Although the basic concept underlying these options is the same as that for CBOT PCS options, there are some interesting differences in the specific characteristics of the BCOE options:

- The trigger is based on the Guy Carpenter Catastrophe Index,⁷ which is in the form of a loss-to-value (or damage) ratio (paid homeowners losses divided by housing values). Values for the index are available as finely as by zip code, and are updated quarterly. The index reflects homeowners loss experience of companies (representing about 25% of homeowners premiums) reporting to ISO.
- The geographic contracts available include national, northeastern states, southeastern states, Gulf states, mid-western/western states, Florida, and Texas.
- Three different types of catastrophe options are available – single loss (largest catastrophic event during a period), secondary loss (the second largest event), and aggregate cat. (Note that

⁶ The web address is www.cbot.com

⁷ Described, for example, in Major (1997).

the CBOT has also been intending to introduce single-event options in the fourth quarter of 1998.)

- The risk periods underlying the options are semi-annual: either the first-half or the second-half of the calendar year.
- The BCOE options are “binary options.” Specifically, the options pay off either \$0 or \$5,000 at expiration -- there is no intermediate value possible (as there is with CBOT options).
- The value of the index is determined at quarterly intervals (1,4,7,10, and 13 months after the end of the risk period). At each of the above quarterly intervals (and only then), the option may or may not be settled, depending on how far below or above the strike price is the index value.

Perhaps the primary advantage of BCOE insurance derivatives is the potential ability to tailor an index to a company’s specific geographical exposure distribution. Rather than use an overall industry index (as do the PCS CBOT options), zip code data can be combined in appropriate ways, thus making the option payoff more consistent with the company’s own loss experience and exposure distribution. This might provide a reasonable compromise between the basis risk and moral hazard problems (see Section 6 below). The potential disadvantage is that the BCOE index is updated only quarterly, and covers only a fraction of the industry.

C. Risk Exchanges

While there are many forms that a financial “swap” can take (see Section 6.D for reference to two recent swap transactions, one within the reinsurance industry, and one to the capital markets), one example of the swap concept in the insurance industry is the recent emergence of risk exchanges. Catastrophe Risk Exchange (CATEX) New York is a computer-based trading exchange that allows subscribers to swap their catastrophe exposures. Thus, subscribers can adjust their risk distribution profiles -- by geographic location and/or by property type -- by trading written exposures. Risks available for trade can be “advertised” on the electronic system, where trades can be negotiated and completed. In addition, reinsurance can be purchased directly

from reinsurance subscribers.

Another such exchange is CATEX (Bermuda), which is a joint venture with the Bermuda Stock Exchange. This offshore exchange provides a mechanism for the exchanging or purchasing of risks, and is open to insurers, brokers, and capital market investors.

D. Catastrophe Equity Puts

Catastrophe equity puts are a form of contingent financing. An agreement is entered into whereby the insurer, in the event of a catastrophe, has the right to sell equity (usually preferred stock) to investors at a pre-specified price. This allows the insurer to shore up its balance sheet by replacing equity after a catastrophe.

6. Catastrophe Bonds

Of the various forms of insurance securitization summarized in this paper, the greatest amount of recent activity and publicity has probably involved catastrophe bonds. In this section, the typical catastrophe bond issuance structure is described, and a history and case studies of various offerings are provided. Both unsuccessful and successful catastrophe bond offerings are discussed, with particular attention given to the specific attributes of the largest and most recent offerings, including how catastrophe bond offerings have addressed basis risk and moral hazard through various types of bond triggers. Traits of both “failures” and successful offerings are examined, as are the various “costs” of issuing catastrophe bonds.

A. The “Trigger” Issue

An important issue in considering the potential effectiveness of an insurance securitization product is its ability to fulfill its role as a financial risk management hedging instrument. Property/casualty insurance (and reinsurance) itself, for example, can be considered a near-perfect hedge: the intention is to indemnify the insured for the actual loss suffered. Aside from

certain parameters of P/C policies which contractually limit payments -- e.g., policy limits, deductibles, coinsurance provisions -- and assuming that the insured has purchased the “correct” insurance, the only risk of inadequate coverage stems from credit risk: the risk that the insuring (or reinsuring) organization fails and is unable to meet its obligations. Thus, one way to measure the reasonableness of substituting securitized products for catastrophe insurance or reinsurance is to consider the relative effectiveness of the product as a hedging mechanism.

To a large extent, a securitized product’s ability to hedge catastrophe risk depends on the type of “trigger” used. Here, “trigger” is used to refer to the “event” that causes the payoff of the instrument to be adjusted. With respect to this issue, there are two risks:

- **Basis risk:** How closely the company’s losses follow the index used to determine the payoff on the securitized product. In situations where the index is based on aggregate losses to the overall P/C insurance industry, basis risk reflects the difference between the industry’s and the company’s catastrophe loss experience. The concern for a company is that, if its catastrophe experience is worse than the industry’s, the debt relief provided by the bond (which is a function of industry catastrophe experience) will be inadequate to hedge its own losses. Thus, basis risk occurs when a hedge is not exact.
- **Moral hazard:** Increased losses to the company may lead to debt relief -- a decrease in the level of the company’s debt obligations (principal and/or interest). Thus, there may be a perverse incentive for the company to pad its losses in order to take advantage of lower financing expenses.

Basically, there is a trade-off between these two sources of risk. Generally, a situation involving a large level of basis risk will have little or no moral hazard, and vice versa. The relative amount of each type of risk in a given insurance securitization arrangement depends on the specific nature of the trigger -- e.g., direct, industry, or event trigger. A brief description and examples (from Section 6.D and Appendix 1) of each type of trigger follows.

- *Direct*: the contingency upon which the payoff of the instrument depends is based on the company's losses. Examples include both of the large USAA bond offerings, in which principal and/or interest payments are adjusted in the event of a loss in excess of \$1 billion to the company from a category 3 or higher hurricane. With a direct trigger, there is no basis risk, since the payoff on the hedging instrument depends upon the company's own losses, rather than those of the industry as reflected by an index.
- *Industry*: payoffs depend upon overall industry loss experience, as reflected by an index. Examples include the Swiss Re California earthquake bond, and the CBOT PCS options. With an industry trigger, there is little or no moral hazard (in theory there could be some, since the company's loss experience may impact the value of the index), but basis risk can be significant. This is because the loss experience underlying the index may not match the loss experience of the company, and so the instrument would provide an imperfect hedge.
- *Event*: payoffs depend upon the occurrence of a defined event. An example is the Tokio Marine & Fire bond which has as its trigger an earthquake that registered 7.1 or more on the Japanese Meteorological Association scale. Potentially, an event trigger can involve significant basis risk, since the "payoff" of the bond is not based on the company's actual losses, nor even on the industry's losses, but on the occurrence of an event. (Admittedly, if the bond is constructed properly, the occurrence of the event should logically result in losses to the company.)

B. Types of Risk-Taking

In general, the interest and/or principal payment obligations of an insurer under a catastrophe bond are affected by the occurrence or non-occurrence of a certain level of catastrophic loss. From the investor's standpoint, depending upon the "tranche" invested in, there is the risk of losing some or all of the principal invested, and/or the risk of diminished or lost interest

payments. Very often, there is a tranche in which both principal and interest is at risk (and the coupon rate on that tranche reflects this large amount of risk and is, appropriately, relatively high). In addition, there is often a tranche in which at least part of the principal is “protected” or “defeased.” This means that, when the bonds are issued, some of the proceeds are placed in a protected account which funds the repayment of the principal. Often, there is a provision whereby, in the event of a catastrophe, the protected principal is repaid over an extended period of time.

C. Typical Catastrophe Bond Issuance Structure

The issuance structure underlying the catastrophe bonds that have been issued so far has been analogous to that described in Section 3. Typically, an insurance company sets up a Special Purpose Vehicle (SPV) to act as an “intermediary” between the company and the capital markets. Generally, the SPV is an offshore reinsurer; this structure is used to maintain favorable tax and accounting treatments. The SPV issues a reinsurance contract to the company; in turn, the company issues bonds to the capital markets through the SPV. The SPV pays the cash flows on the bonds (and funds the reinsurance protection) from the reinsurance premiums paid by the company, and from the invested bond proceeds.

D. Catastrophe Bond Offerings

The history of catastrophe bond offerings can be segmented into two categories: the “unsuccessful” offerings, and the more recent successes. (One could refine the categorization by adding an intermediate group, which would include the very initial successes that led later to the “bigger” and more widely publicized successes.) The “unsuccessful” offerings include several items in or around 1996, including the first USAA attempt (an offering similar to the one that succeeded just one year later), an offering by ACE (covering U.S. hurricane and earthquake exposures, and having a \$25 billion industry trigger), and even the California Earthquake Authority (CEA) (which was going to involve a catastrophe bond, until Warren Buffett’s insurance company provided the coverage at a favorable price using traditional reinsurance).

Each of these offerings “failed” in the sense that they did not result in catastrophe bonds actually being sold to the capital markets. Possible reasons for the failures of these and other products might include:

- *Newness and unfamiliarity*: A lack of understanding, on the part of the capital markets and/or the insurance industry, regarding the workings of the other side. In addition, sufficient interest in and exposure to the securitization of catastrophe risk had not yet been achieved in the capital markets.
- *Uncertainty regarding pricing*: There was insufficient time to educate people about the appropriate prices for these instruments. In addition, there was uncertainty regarding the nature and adequacy of modeling and technology with respect to predicting and measuring future catastrophic loss potential.
- *Portfolio issues*: The potential returns and diversification benefits of investing in such instruments were not yet clear or fully understood.
- *Traditional reinsurance*: Especially in the case of the CEA, the nature of the underwriting cycle in the mid-1990s made traditional reinsurance pricing seem relatively favorable. (Interestingly, the CEA situation may well have ultimately *led* to the active securitization market we now see developing. Capital market investors may have reconsidered their cautious attitudes about insurance and catastrophe risks in light of the decision by Warren Buffet -- a respected and influential investor -- to take on such risks.)

In spite of these reasons, and the initial cautious reaction of the capital markets, the first insurance securitization successes appeared shortly thereafter. Among others, some of the early securitization successes included:

- **Hanover Re**: a reinsurance swap, involving Japanese earthquake and international storm risks.

- Reliance: a placement involving several classes of business, including aviation and property.
- Winterthur: a placement involving the company's exposure to automobile damage from hailstorms.

These successes set the stage for further offerings, many involving significant size and capital market involvement. Appendix 1 documents the parameters of many of these recent successful securitization offerings -- primarily catastrophe bonds, but a few other items are also included. This listing is approximately chronological. Comments on some of the offerings listed in Appendix 1 follow.

In many ways, the June 1997 USAA bond represented a watershed event in the development of catastrophe bonds. This issue was originally intended to be a \$150 million offering, but was significantly over-subscribed. USAA ended up issuing, through a Cayman Islands SPV called Residential Re, \$477 million of catastrophe bonds. These one-year bonds were sold to 62 investors; several investment banks were involved in the advising and issuing process. Of the \$477 million in proceeds, \$400 million represented a reinsurance cover provided by Residential Re; the other \$77 million was placed in a defeasance account to fund the principal repayment on tranche A-1. The reinsurance, in effect, represents a layer equal to 80% of \$500 million in excess of \$1 billion on USAA's hurricane losses. Thus, the bond involved a "direct" trigger: principal and/or interest payments would be affected in the event of a hurricane loss to the company in excess of \$1 billion.

The USAA bond issue involved two tranches: tranche A-1, in which only interest (but not principal) was at risk from the standpoint of the investor; and tranche A-2, in which both principal and interest were at risk. Tranche A-1, which received an investment rating of AAA (the highest), had its principal protected via the aforementioned defeasement account. In the event of a catastrophic loss, principal repayment was guaranteed for tranche A-1 investors, but an extension of as much as ten years to repay the principal would be permitted. Tranche A-2, which

was rated BB (below investment grade), was exposed to the risk of both lost interest and lost principal, and thus was riskier than tranche A-1. This relative riskiness between the two tranches was reflected in their respective coupon rates: the risk premium (coupon rate in excess of LIBOR) for tranche A-2 was more than twice that for tranche A-1.

As discussed later in this section, one of the “costs” of a securitization market in the early stages of its development is the possibility of relatively high yield levels on the securitized products. It is interesting, then, to compare the 1997 USAA bond with the 1998 USAA bond (which was very similar in structure to the 1997 version) in terms of the coupon rates applicable to each tranche. The premiums for each tranche have narrowed significantly, each by well over 100 basis points. Apparently, what has been called the “novelty (or newness) premium” imposed by the capital markets on these bonds has largely worn off. (This decrease in coupon rates may continue as the insurance securitization industry continues to mature -- at least until a catastrophe actually causes a loss for bond investors!)

The July 1997 Swiss Re offering involves an industry trigger: total losses to the insurance industry stemming from a California earthquake. Losses underlying these two-year bonds are measured by a PCS index. Bond losses for Classes A and B are triggered in the event of an earthquake resulting in losses of more than \$18.5 billion to the industry (\$12 billion for Class C). The proportion of the investors’ capital at risk that is lost in the event of such an earthquake increases as the size of the industry’s loss increases. The offering was in three classes, with partial protection of principal in the first class.

The Tokio Marine & Fire December 1997 offering involves an “event” trigger: bond cash flows are at risk in the event of a Tokyo earthquake registering 7.1 or more on the Japanese Meteorological Association scale. (Actually, slightly different triggers apply depending upon whether the earthquake occurs in an “inner” grid or an “outer” grid.) These are ten-year bonds, issued through a Cayman Islands SPV named Parametric Re.

The Yasuda Fire & Marine offering of June 1998 is interesting from a hazard-level perspective. Investors might well be concerned about the possibility, after bonds are issued, of the company changing its distribution of risk exposures, potentially causing the bonds to increase in risk. This could especially occur under a long-term bond (the Yasuda bonds have a term of at least five years). The Yasuda offering addresses the issue of a change in writings after bond issuance by recalculating the attachment point every year. Significantly, investors agreed to allow the use of a model to reset the attachment point so that there is a constant 0.94% chance of loss to the investors throughout the course of the bond. This indicates that the capital markets are becoming comfortable with the idea of using catastrophe models to estimate event probabilities and prices.

The two swaps at the end of Appendix 1 are also worth mentioning. The X.L. Mid Ocean Re swap is significant for the process involved: a competitive bidding process between traditional reinsurance, capital market instruments (such as catastrophe bonds), and a swap. Perhaps largely due to time constraints imposed by a merger, the offering was done as a swap with the capital markets. Claim recovery is triggered by the level of catastrophe losses incurred by X.L. Mid Ocean Re.

The 1998 Swiss Re arrangement involves as much as \$10 million being swapped with a reinsurer. The structure is interesting and unusual: there are *two* triggers, one applying to industry losses, and the other applying to the reinsurer. Depending upon whether zero, one, or both triggers are exceeded, the swap could result in net payments going from Swiss Re to the reinsurer, from the reinsurer to Swiss Re, in both directions, or in neither direction. While this swap was done with a reinsurer as the “counterparty,” a similar structure might also work with the involvement of the capital markets.

A review of these successful offerings reveals certain traits that are common to many or most of them. These offerings generally involve the following characteristics:

- Highly volatile catastrophic risk
- Relatively high levels of protection
- Relatively short maturities (except, for example, the Japanese issues)
- Some protection of principal is included
- High coupon rates (although the 1998 USAA bond discussed above suggests that the coupon rates have already begun to diminish)

E. Costs of Catastrophe Bonds

There are several costs currently involved in catastrophe bond issuance. The continued development and future success of catastrophe bonds depends largely on the market's ability to reduce some of these costs. First, offered yields have tended to be rather high. Since the insurance securitization industry is still in its relative infancy, it could well be that default premiums will remain high for a time. As the process further develops and matures, the yields should decline somewhat. The evidence for this is already being seen in the market -- e.g., in the 1997 and 1998 USAA bond coupon rates.

The second set of costs involves setting up the Special Purpose Vehicle. Third are investment banking costs. Typically, investment banks are compensated through advising fees and/or through the spreads between the prices at which they purchase issues, and the prices at which they sell them to the capital markets. Finally, there are legal fees involved in setting up and issuing catastrophe bonds.

7. The Future of Insurance Securitization

The insurance securitization industry has developed quickly. There are a number of issues and questions underlying its potential future development and success.

- Will insurance securitization in general, and property/casualty securitization in particular, survive and grow? Over the last two years, there has been nearly three times as much P/C securitization activity than life insurance activity. Nevertheless, P/C securitization is currently contending with traditional insurance and reinsurance markets that are relatively cheap. The future conditions of the market will have an impact on the development of securitization. In addition, advances in technology will be an important consideration in determining securitization's future success.
- Will securitization products replace or supplement traditional transactions? So far, the answer has primarily been the latter, despite threats of the former. Nevertheless, the industry does need to adjust to the shift toward the greater importance and influence of capital markets.
- How will securitization affect reinsurance? While it might seem that securitization should represent a threat to the reinsurance industry, it is interesting that many reinsurers have become active securitizers in recent years, setting up securitization departments or subsidiaries. The nature of insurance regulation may also dictate the continued significance of the traditional reinsurance industry.
- Will "capacity" continue to be appealed to as a significant reason for securitization, or will other issues and concerns come to dominate? If the capital markets can promote greater efficiency in the insurance intermediation process, this could be the real value in securitization.
- Will volatile catastrophe risks continue to be the focus of securitization products, or will future instruments contemplate more traditional insurance lines? In many ways, it seems that the latter might provide even greater potential for securitization than the former. Recall that, in general, non-insurance securitization has focused on the high-volume areas such as mortgages and auto loans.
- Are securitization instruments "insurance"? Each jurisdiction will need to come to terms with the question of whether investors in insurance securitization products are engaging in

the business of insurance. In Bermuda, for example, the 1998 Bermuda Insurance Amendment Act said “no”: insurance derivatives are “investment contracts,” not insurance.

- What are the different tax and accounting implications of the various instruments? It should be kept in mind that certain products -- e.g., reinsurance, exchange-traded derivatives -- protect a company’s income statement, while others -- e.g., catastrophe equity puts -- protect the balance sheet. Such differences may affect the relative demands for various products.
- Finally, what form will insurer financial risk management take in the future? There is a wide range of techniques available to insurers – e.g., asset hedges, liability hedges, asset-liability management, contingent financing, and post-loss financing and recapitalization. Insurance securitization encompasses one group of techniques in a broader rainbow of financial risk management tools available for the insurer’s consideration.

Appendix 1

Summary of Recent Successful Securitizations

- USAA / Residential Re (June 1997)
 - Size: \$477 million, in two tranches
 - Trigger: hurricane losses to company
 - Coverage: 80% of \$500 million in excess of \$1 billion of losses to the company
 - Tranche A-1: rated AAA
 - \$163.8 million, of which \$77 million placed in a defeasance account to fund principal repayment
 - Only interest at risk
 - Coupon: LIBOR + 282 bps (basis points)
 - Tranche A-2: rated BB
 - \$313.2 million
 - Both principal and interest at risk
 - Coupon: LIBOR + 575 bps

- Swiss Re (July 1997)
 - Size: \$137 million, in three classes
 - Trigger: losses to industry from California earthquake; PCS index; industry insured loss, from a single event, greater than \$18.5 billion triggers losses on first two classes (greater than \$12 billion on Class C)
 - 40% of Class A proceeds to defeasance account
 - Coupon rates by class:
 - A-1: LIBOR + 255 bps
 - B: 10.493%
 - C: 12%

- Tokio / Parametric Re (December 1997)
 - Size: \$100 million, in two tranches
 - Trigger: Tokyo earthquake magnitude; a Japanese Meteorological Association magnitude rating of 7.1 or more involves loss of part or all of principal
 - Half of \$20 million proceeds from Tranche A and all of \$80 million proceeds from Tranche B are risk capital
 - Ten-year term
 - Coupon rates by tranche:
 - A: LIBOR + 206 bps
 - B: LIBOR + 430 bps

Appendix 1 (cont.)

- Centre / Trinity Re (March 1998)
 - Size: \$84 million, in two classes
 - Trigger: FL hurricane losses to company
 - Class A-1 notes (\$22 million in proceeds) provide for full principal repayment in event of a loss
 - Includes a trigger reset mechanism in event of a loss
 - Coupon rates by class:
 - A-1: LIBOR + 182 bps
 - A-2: LIBOR + 436 bps

- USAA / Residential Re (June 1998)
 - Size: \$450 million, in two tranches
 - Trigger: company losses greater than \$1 billion from hurricane
 - Coupon rates by tranche:
 - A-1: LIBOR + 140 bps (compare with 282 bps in 1997)
 - A-2: LIBOR + 400 bps (compare with 575 bps in 1997)

- Yasuda Fire and Marine
 - Size: \$80 million offering
 - Trigger: typhoon losses
 - Term: 5-7 years
 - Attachment point recalculated every year with exposure model, so that a constant 0.94% chance of loss to investors is maintained
 - Guaranteed limits and pricing for a second event (reinstatement)

- F&G Re / Mosaic Re
 - Size: \$54 million offering
 - Aggregate excess cover for a portfolio of catastrophe reinsurance contracts

- X.L. Mid Ocean Re
 - Size: \$200 million offering
 - Coverage: retrocessional hurricane and earthquake
 - Competitive bidding process
 - Swap

Appendix 1 (cont.)

- Swiss Re
 - Basis swap with reinsurer (“ABC”)
 - Up to \$10 million transferred
 - Two triggers:
 - SE windstorm losses of ABC
 - SE windstorm losses of industry (from PCS)
 - Exceed trigger?

<u>ABC</u>	<u>Industry</u>	<u>Result</u>
Y	N	Swiss Re pays
N	Y	ABC pays
N	N	Nothing
Y	Y	Pay each other

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SECURITIZATION AND FINANCIAL RISK MANAGEMENT GLOSSARY

Act of God bond: a debt security whose principal and interest payments are contingent upon the occurrence of an event (e.g., a catastrophe, a certain level of catastrophe claims incurred, etc.).

American option: an option that can be exercised at any time, up to and including the expiration date.

Basis: for a commodity, the difference between the cash (spot) price and the futures price.

Basis point: one hundredth of a percentage point. For example, if the yield on a bond falls from 10.0% to 8.5%, it is said that the yield has fallen by 150 basis points.

Basis risk: the risk that the derivative security does not move precisely with the underlying “hedged” security; the risk arising from the uncertainty regarding the future basis. For an insurer using catastrophe options as a hedge, it is the risk that the cat option position does not change precisely with the catastrophe experience of the insurer.

Bermuda option: an option that can be exercised only on certain dates on or prior to the expiration date.

Binary option: an option whose payoff is either zero (if the option is out-of-the-money), or a fixed amount (if the option is in-the-money). Thus, the payoff is discontinuous.

Bond: a discounted or interest-bearing security. This security represents long-term debt issued by either a government or a corporation.

Bond rating: an evaluation which reflects the probability of default of the issuer of a bond. Ratings are promulgated by organizations such as Moody’s, Fitch IBCA, and Standard & Poor’s. In general, bonds rated BBB or above are considered “investment grade,” while those with lower ratings are referred to as “junk” or “high-yield” bonds.

Call option: a derivative security which gives the holder the right to purchase the underlying asset at a pre-specified price (the “exercise” price). A call option is “in the money” and has a positive intrinsic value if the price of the underlying asset is above the exercise price.

Call option spread (specifically, a “bullish vertical spread”): a strategy in which a call option with one exercise price is bought, and a call option with a higher exercise price is sold (or “written”). Both options have the same expiration date and the same underlying asset. An example is CBOT catastrophe option spreads, which provide a “reinsurance layer” between the two exercise prices.

Catastrophe bond: a bond whose interest and/or principal may be diminished (partially or

completely) in the event of a specified catastrophic event.

Catastrophe option: an option based on a catastrophe index.

Catastrophe Risk Exchange (CATEX): a computer-based trading system through which insurers and reinsurers can swap their catastrophe exposures.

Clearinghouse: an organization that provides a guarantee that the parties to a transaction will meet their obligations.

Commercial paper: unsecured short-term debt obligations, with maturities up to 270 days.

Debenture: an unsecured bond.

Defeasance: discharging or “funding” of debt through the purchase of new securities. Often, T-bills are purchased and placed in a trust; these bills are then used to meet the obligations from previously issued debt.

Derivative: a financial instrument which derives its value from another (“underlying”) security.

European option: an option that can be exercised only on its expiration date.

Financial Engineering: the use and creation of financial instruments for the purpose of managing financial risks.

Floating rate note: a debt instrument with a variable interest rate. The interest rate usually is based on a money market index such as U.S. Treasury bills or LIBOR.

Forward contract: agreement to buy or sell a commodity or financial instrument, to be delivered at a future pre-specified date, at a pre-specified price.

Futures contract: agreement to buy or sell a commodity or financial instrument, to be delivered at a future pre-specified date, at a pre-specified price. Differs from a forward contract in that it is a standardized contract traded on an exchange, and is marked to market.

Indenture: formal bond agreement, or trust deed, between the issuer (borrower) and investors (lenders).

LIBOR: the London Interbank Offer Rate. The rate that most international money center banks charge each other for short-term loans. Often used as a benchmark for the rates on certain types of financial instruments.

Put option: a derivative security which gives the holder the right to sell the underlying asset at

a pre-specified price (the “exercise” price). A put option is “in the money” and has a positive intrinsic value if the price of the underlying asset is below the exercise price.

Rule 144a: An SEC rule dealing with private placements of securities. The rule allows large institutional buyers to buy and sell restricted securities among themselves.

Secured bond: a bond backed by specific assets or collateral.

Securitization: the process of bundling debt instruments or cash flows into securities which can be traded in the capital markets. This process enhances the credit rating of the instruments and provides additional liquidity.

Security: a financial instrument which represents either an ownership interest in, or a creditor relationship with, an asset.

Surplus note: fixed-income securities, issued by insurers, which are subordinated to (have lower priority than) policyholder claims. *Contingent* surplus notes are arrangements whereby an insurer has an option to borrow, contingent upon some event (e.g., a catastrophe) or other trigger.

Swap: an exchange of one security or set of cash flows for another. Most common with respect to interest rates and foreign currencies.

Tranches: classes into which the scheduled cash flows of a security are split. Often, one tranche of an issue has greater exposure to prepayment or default risk than another tranche, and this is reflected in the different rates investors earn on the various tranches.

Unsecured bond: a bond not backed by specific assets or collateral, but rather by the integrity of the issuing corporation.

Exhibit 1 -- CBOT PCS Options: Trading Activity

