# The Pension Challenge

## Risk Transfers and Retirement Income Security

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Chapter 13

# Securitized Risk Instruments as Alternative Pension Fund Investments

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Financial innovation has dramatically expanded the variety of assets available to investors over the past two decades. Assets that formerly were held on-balance-sheet by banks, insurers, other financial institutions, and industrial firms, are now actively traded in securities markets. Moreover, the types of cash flows that are traded in financial markets have expanded significantly beyond traditional categories and now encompass many new asset-backed securities and derivative instruments.[1] Other chapters in this volume have focused on the integration of capital market instruments into traditional pension and annuity contracts as a means of expanding *individual investor* investment opportunities (Maurer and Schlag, Chapter 9; Turner and Rajnes, Chapter 12; Vetzal, Forsyth, and Windcliff, Chapter 10; Walliser, Chapter 11) and the difficulty that many individual investors have in understanding these contracts (Bodie, Chapter 2). This chapter focuses on the potential opportunity that these new securities offer for more sophisticated *institutional investors* charged with optimally investing pension fund assets on behalf of individual investors.

The expansion in the number and types of assets traded in the marketplace provides unprecedented opportunities for institutional investors to improve the risk-return performance of their pension portfolios. Securities have been introduced to trade the risk in "exotic underlyings," including catastrophic property losses (CAT bonds and options), temperature risk (weather derivatives), and other unconventional risks. Yet, many of the new securities are unfamiliar and complex, and they may expose investors to risks that are not fully understood.[2] As a result, investment managers, concerned about fiduciary responsibilities and beating market index benchmarks, have a disincentive to take positions in these assets unless they can be convinced that they clearly help their portfolio performance. With little price transparency and few tools for analyzing the risks inherent in the new assets,

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investment managers often pass on these securities and forego the material diversification benefits offered by these structures.

The purpose of this chapter is to help resolve some of the uncertainty associated with the innovative securitized products available in today's financial markets by providing information on some of the most promising new assets that have emerged from the securitization process. We outline the characteristics of these new securities, analyze their advantages and disadvantages, and provide a simplified approach for valuing these deals in the context of the familiar linear capital asset pricing model (CAPM). We focus primarily on asset-backed securities (ABS), which are the securitized products most likely to be of interest to institutional investors. We also comment on some particularly promising non-asset-backed derivative securities recently introduced.

Our primary focus is to evaluate ABS from the perspective of enhancing portfolio diversification within the pension fund, as opposed to developing new hedging instruments for pension liability risks. From an asset-liability management perspective, our analysis can be generalized to incorporate the purchase of structured products that "hedge" the risk of pension liabilities or pension asset concentrations. The practical problem of analyzing pension fund hedging strategies with structured notes is that, short of a few emerging mortality-linked notes that may be used to hedge pension mortality risk, few structured products offer acceptable hedging benefits for individual defined benefit pension funds as currently structured. Thus, while our approach is sufficiently general to incorporate liability-motivated structured note purchases, we defer a formal discussion of pension fund hedging strategy to future research.

## Background on the Development of Securitization

Securitization involves the repackaging and trading of cash flows that traditionally would have been held on-balance-sheet by financial intermediaries or industrials. Securitizations generally involve the agreement between two parties to trade cash flow streams to manage and diversify risk and/or to take advantage of arbitrage opportunities. The cash flow streams to be traded often involve contingent payments as well as more predictable components that may be subject to credit and other types of counterparty risk. Securitization provides a mechanism whereby contingent and deterministically scheduled cash flow streams arising out of a transaction can be unbundled and traded as separate financial instruments that appeal to different classes of investors. In addition to facilitating risk management, securitization transactions also add to the liquidity of financial markets, replacing previously untraded on-balance-sheet assets with tradable financial instruments.

Securitization has been driven by both demand and supply factors. Demand-driven securitization occurs when new risks emerge or when existing risks become more significant, rendering traditional hedging techniques inadequate or obsolete. For example, the increasing levels and volatility of interest rates during the late 1970s led to a demand by banks to liquidate the mortgage loans on their balance sheets. Precedent for this type of securitization had arisen during the late 1970s and early 1980s when government institutions such as the Federal National Mortgage Association began to issue securities backed by pools of mortgage loans. These mortgage-backed assets were initially unattractive to many investors due to prepayment risk. A breakthrough in mortgage securitization was the development of collateralized mortgage obligations (CMOs) that unbundled the cash flows arising from mortgage portfolios and repackaged the cash flows into various tranches of bonds with different risk characteristics. This process provided securities with greatly reduced prepayment risk that appealed to relatively risk averse investors as well as riskier tranches that appealed to investors willing to take more risk to earn higher returns. As a result, the market for US agency mortgage backed securities grew from about $100 billion in 1980 to more than $2.8 trillion by 2001.[3]

The emergence of new risks and the increasing magnitude of existing risks on the demand side have led to a significant expansion in the markets for interest rate, foreign exchange, commodity price, and credit derivatives. The increasing property exposure in geographical areas prone to property catastrophes such as hurricanes and earthquakes has led to the development of securities designed to finance catastrophic risk, including CAT bonds and options, which are discussed below. The exposure of energy companies and other firms to risk from temperature fluctuations has led to the development of an active market in weather-linked securities. Other innovations, such as products that securitize cash flows from life insurance and annuities also have begun to emerge.

Supply side factors also have influenced the growth of the market for securitized financial instruments. The development of modern financial theory, including option pricing models and models of the term structure of interest rates, provided the basis for standardizing the pricing of many financial products, facilitating the development of liquid markets. Simultaneously, rapid advances in computing and communications technologies have enabled financial engineers to develop sophisticated new products at an unprecedented rate.

Although the market for securitized financial products has experienced remarkable advances, there are still obstacles to be overcome in order for the more innovative and complex securitizations to be fully successful. To a significant extent, the ability of markets to supply securitized financial products has outrun the existing demand. In part, this is due to a lack of

TABLE 13-1 Asset-Backed Securities: New Issuance Market Share by Asset Type, 2001 (Volume in $ US Billions)

| *Asset Type* | *$ Volume* | *Number of Deals* | *Market Share (%)* |
|---|---|---|---|
| Residential mortgage | 142.9 | 374.0 | 18.9 |
| Commercial mortgage | 97.0 | 171.0 | 12.8 |
| Credit cards | 80.4 | 127.0 | 10.6 |
| Corporate bonds | 76.0 | 223.0 | 10.0 |
| Sub-prime mortgages | 65.2 | 134.0 | 8.6 |
| Non-US home loans | 59.9 | 123.0 | 7.9 |
| Auto loans (prime) | 52.0 | 57.0 | 6.9 |
| Home-equity loans | 38.5 | 78.0 | 5.1 |
| Auto loans (sub-prime) | 21.7 | 34.0 | 2.9 |
| Equipment leases | 17.0 | 53.0 | 2.2 |
| Other | 105.8 | 260.0 | 14.0 |
| Total | 756.4 | 1634 | 100.0 |

*Source*: Authors' computations derived from asset-backed alert <www.abalert.com>.

understanding by investors of the parameters of the available contracts and the role that such contracts can plan in improving portfolio performance. However, there is also uncertainty about how to price the new products, and there is still perhaps insufficient standardization within some of the new classes of securities to permit the development of more liquid markets. These problems can be expected to recede as issuers and investors gain experience with the contracts and the market continues to mature.

During 2001, more than $756 billion in ABS was issued worldwide, a 34 percent increase over the $566 billion in ABS issued during 2000. An additional $55 billion in ABS was issued during January and February of 2002. While almost $600 billion of the ABS issued in 2001 was placed in the United States and benchmarked to US collateral, non-US ABS activity represents a growing share of overall issuance—accounting for approximately 21 percent of issuance volume in 2001.[4]

Not surprisingly, a majority of the new issuance volume, both in the United States and overseas, continues to be backed by traditional assets. This is shown in Table 13-1, which reports the 2001 worldwide ABS issuance by asset type. The securitization of receivables backed by real estate, credit cards, automobile loans, and corporate bonds, continues to represent over 80 percent of all new issuance in terms of dollar volume (83 percent) and number of deals (81 percent):

1. The securitization of real estate assets, including prime residential and commercial mortgages, sub-prime mortgages, non-US mortgages,

home-equity loans and home-equity lines of credit (i.e. HELOC's), represented over half (53 percent) of all securitization activity in 2001 ($403 billion).

2. The securitization of credit card assets was $80.4 billion or 10.6 percent of new issuance volume in 2001, maintaining a relatively constant market share despite the deteriorating credit conditions in the US economy and the problems faced by large issuers like Providian Financial.
3. The securitization of corporate bonds through collateralized debt obligation (CDOs) or collateralized loan obligations (CLOs) dropped in 2001 to $76 billion or 10.1 percent of the total issuance volume—down from $78.5 billion (13.9 percent) in 2000.
4. Automobile loan securitizations totaled $73.7 billion in 2001 for a market share of just under 10 percent. Issuance volume in 2000 was $67.3 billion, or just under 12 percent of the market.

Given the size of the market for traditional ABS, pension investment managers usually have access to mark-to-market or mark-to-model pricing, to value structures backed by traditional asset collateral. As such, pension fund managers have a level of comfort in dealing with traditional ABS. The focus of this chapter, however, is non-traditional ABS and innovative non-asset backed products that have been introduced and where fund manager familiarity is often less certain.

## The Non-traditional ABS Market

How should pension fund managers evaluate non-traditional ABS securities? With names like Act-of-God bonds, Bowie bonds, Tobacco bonds, and Kelvin Weather Derivatives, these structures have often gained considerable public attention and interest in the market. Moreover, non-traditional ABS represents a growing share of the overall ABS market. According to Standard & Poor's (S&P), non-traditional ABS (as defined herein), which represented 15 percent of the public ABS market in the United States in 1995, had grown to 25 percent of the public ABS market by 2001 (Hu, Coyne, and Elengical, 2002).

What are the risk-return dynamics of these securities? Are non-traditional ABS an appropriate investment for pension fund managers? To address these questions, we must first understand the structure of non-traditional ABS, and then develop the tools needed to measure the risk-return dynamics of these securities in the context of how pension fund managers measure risk.

While often equipped with catchy marketing names, non-traditional ABS are structured using the same format as traditional ABS. In any ABS structure, a company that is exposed to the risks associated with an uncertain set of cash flows is looking to sell some or all of these risks to third-party investors

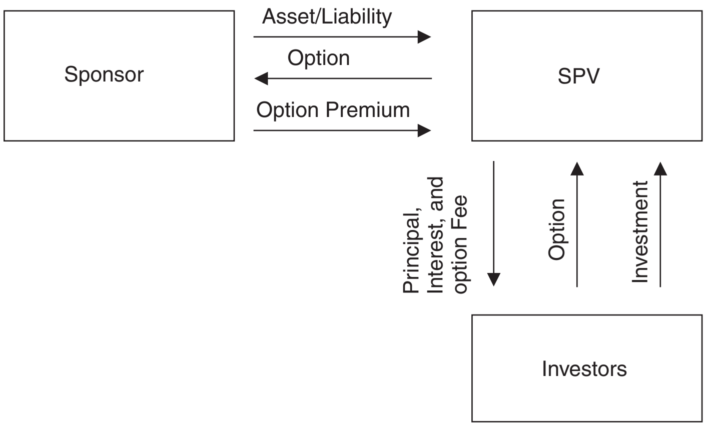


Figure 13-1. Basic ABS structure. (*Source*: Authors' derivation.)

in exchange for the risk-adjusted return available on these cash flows. The motivations of the seller can range from regulatory arbitrage, to the need to manage a concentration of risk on the balance sheet, to sourcing a lower cost of funds for origination activity.

For example, the market for mortgage-backed securities developed in the late 1970s and early 1980s as banks and thrifts—caught in the vice of high funding costs and low yielding long-term mortgage assets—explored options for reducing asset concentrations and lowering the funding costs associated with mortgage origination. In a similar fashion, foreign competition and record delinquencies on automobile loans enticed the automobile companies in the early to mid-1980s to use the automobile installment credit as collateral and issue securitized car loans to obtain a cheaper source of funding (Fink, 1998). Credit card issuers followed the same model, providing banks and financial companies with a lower cost alternative to retail funding.

In the non-traditional ABS market, the range of underlying asset types and risks can vary widely, and each deal merits individual attention. However, as depicted in Figure 13-1, the basic structure for most ABS and structured notes is the same. The sponsor of the program is looking to transfer a risk associated with an asset or a liability to private sector investors. The underlying asset could be the right to future income streams, the value of a loan portfolio, or an insurance portfolio. The corresponding risk that the sponsor is looking to transfer, which can be viewed as a financial option, could be the risk of economic downturns on cash flows, credit deterioration in a loan portfolio, or catastrophic property claims from an insurance portfolio. In each of these cases, the sponsor is looking to sell these risks or options to private sector investors that are willing to take the risk in exchange for an enhanced fixed-income return in the form of an option premium.

The economic rationale for these transactions is as follows: If investors value the option as a diversifying asset, the risk premium that they demand for underwriting the option risk will be lower than the internal funding costs of a sponsor that has a concentration of this risk. The use of a special purpose vehicle (SPV) in structuring the deal helps to ensure that investors are protected against the bankruptcy risk of the sponsor, to provide for transparent servicing of the assets/liabilities, to structure and collateralize various tranches of debt, and to provide tax and accounting benefits to the sponsor. All of these functions tend to be deal-specific. In addition, the SPV insulates the investors from the agency costs and risks of the issuing firm's other operations, creating a "pure play" in the subject cash flows.

For a pension fund manager to evaluate a non-traditional ABS, therefore, he must address three core questions:

1. Do I understand the dynamics of the risk being transferred in the deal?
2. What is the expected value of the loss being transferred and am I being compensated for this expected loss?
3. Is this a diversifying asset in my portfolio and what is a fair risk premium for underwriting this exposure?

To address these issues across a wide variety of asset classes would require an entire volume. To keep the discussion manageable and to provide maximum value-added for institutional investors, we instead review the process of evaluating non-traditional ABS in the context of the main growth areas in asset-backed securitization.

## Important Types of Non-Traditional ABS

An important challenge in the study of non-traditional ABS is that these new structures are primarily privately placed, either directly or as a US Rule 144a security.[5] As such, obtaining a full list of transactions and obtaining accurate information on any one transaction is difficult.[6] Therefore, we focus here on evaluating the five broad categories of non-traditional ABS that have garnered the most attention in the market: credit-linked notes, insurance-linked notes, aircraft securitizations, stranded cost securitizations, and future cash flow securitizations.

### Credit-Linked Notes

As the use of credit derivatives to buy and sell credit risk has expanded over the past 5–8 years, some institutions have started issuing instruments that combine traditional fixed income securities with an embedded credit derivative within the same structured note. While these credit-linked notes have come in many forms, the basic premise behind the structure is simple: a credit-linked note provides investors with an indirect opportunity to invest in the return associated with a particular entity's credit risk performance.

One of the principal drivers of the market for credit-linked notes is investor demand for bypassing regulatory restrictions on credit risk underwriting and risk-taking. For example, participation in the bank loan market is restricted to regulated financial institutions within the United States. Therefore, until the creation of the credit-linked note market, investors in other industries could not diversify their risk exposure to the bank credit market. With the advent of credit-linked notes, a wide variety of institutional investors now can invest in bank loan credit risk.

There are two basic forms of credit-linked notes (Das, 1998):

1. Traditional structured notes where the coupon or principal is indexed to the credit risk performance of an underlying reference credit. These traditional structures include a variety of product variations, including returns based on the total return of the reference credit, returns based on the spread between the reference credit and a market return (e.g. AA bond curve), and a return indexed to a credit default event.
2. Synthetic bonds that entail the use of embedded credit derivative structures to replicate the fixed income security characteristics and credit exposure of the underlying reference credit. Under this type of structure, the investor receives a fixed income return provided that the reference credit does not experience a "credit event" (e.g. bankruptcy). However, if the reference credit does have a default event, the investor's return would be adjusted to reflect the recovery value of the reference credit's debt.

To illustrate, an investor in a *total return credit-linked note* is essentially entering into two simultaneous transactions (see Figure 13-2). First, the investor invests in a floating rate note (FRN) indexed to a market return like the London-Interbank-Offer Rate (LIBOR). Then, at the same time, the investor matches the terms of the FRN with a total return swap whereby the investor pays the FRN LIBOR and earns a rate of interest tied to the underlying reference credit. As such, the return earned by the investor matches the total return associated with the reference credit. In simple terms, the investor swaps his/her floating rate return for the return of the reference credit.

*Credit spread structured notes* mirror the total return structured notes with the exception that the investor enters into a credit derivative linked only to the basis risk between the reference credit and an underlying index. As such, the investor is only exposed to the relative credit performance of an underlying reference credit to the market index. In both the total return swap and credit-spread structures, the investor is able to leverage his return and to short the underlying index.

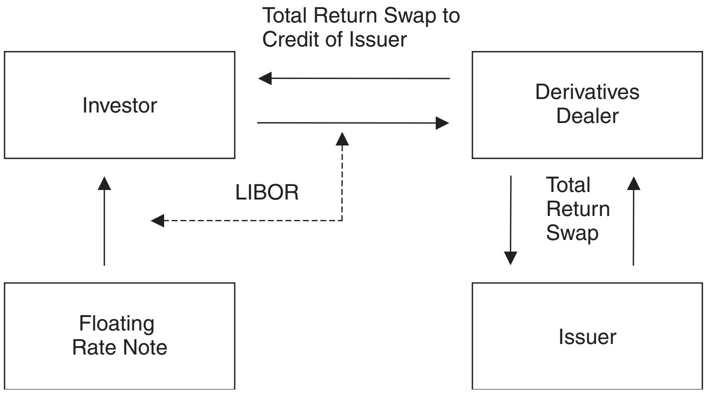


Figure 13-2. Credit-linked note. (*Source*: Authors' derivation.)

In a *credit-linked note with a credit default swap*, the investor purchases a portfolio of assets and then simultaneously enters into a credit default swap agreement with respect to a referenced credit asset. In this case, the return to the investor matches the portfolio of assets held in the trust of the structured note trust until such time that the reference credit experiences a credit default event. When this occurs, the trust has the right to substitute the "impaired" debt of the reference credit for the assets in the trust and the investor earns a return linked to the defaulted reference credit.

For example, in one credit default swap structure, investors ostensibly were investing in the bonds of the large California utility providers (i.e. trust assets). Actually, the structured note included a credit default swap whereby a default by a reference credit (i.e. Company ABC) would trigger the substitution of the defaulted company's debt into the trust in exchange for the utility company's debt—which presumably would be liquidated to help cover losses at the defaulted company. As such, the investors' return was based on the return of the utility company debt up, until the occurrence of a reference credit default, at which time the returns switched over to the return on the impaired reference credit assets. Of course, if the reference credit never defaulted the investors could earn a return equal to the utility companies' debt plus the option premium for underwriting Company ABC's credit risk.

*Synthetic bond structures* are designed to allow an investor to replicate an investment in a given company's debt instrument without having to purchase that company's debt. For example, JP Morgan structured a synthetic bond structured note that paid investors a return (Treasury + 65 basis points (bps)) that was designed to replicate the return on WalMart's debt. The advantage of purchasing a synthetic bond, as opposed to the direct purchase of WalMart's debt, is that WalMart never actually had to issue any debt to be purchased. In addition, the investor can obtain structuring advantages (e.g. enhanced credit rating of the structure) through the design of the structured note (Das, 1998).

Another good illustration of the value of synthetic bond structures and credit default swap structured notes, is the Sparc's Trust that was issued in the late 1990s. Under this structure, investors were able to purchase a pool of assets with a credit default swap linked to Uruguayan debt. For investors wanting to take a long position on Uruguayan debt but not having the international infrastructure to support cross-border investments, this structured security provided an ideal investment vehicle with a return of LIBOR + 250 bps.

To date, a large share of the credit-linked note market has focused on bank loans and public debt securities. However, there is growing interest in formulating a secondary market for emerging market trade receivables (EMTRs), which are letters of credit supporting international trade flows. To date, EMTR securitizations have been limited to more traditional bank-specific portfolios sales. However, growing interest on the part of exporters and export financiers should help push this market forward in the near future.

## Insurance-Linked Notes: Property-Liability Risks

Paralleling the securitization of bank loans, several types of insurance-linked securities have been developed over the years. Many of these have been designed to provide additional risk capital to finance property catastrophes from natural hazards such as hurricanes and earthquakes. The development of securitized instruments linked to property catastrophes was primarily motivated by demand side considerations. Hurricane Andrew in 1992 and the Northridge earthquake in 1994 resulted in $30 billion in insured property losses and led insurers to drastically increase their estimates of potential losses from property catastrophes. In fact, these dramatic events were the most prominent manifestation of a sharp increase in the frequency and severity of catastrophic loss events that began in the 1980s. During the period 1970–86, the number of catastrophes averaged about 35 per year. Beginning in 1987, however, the number of catastrophes increased sharply, and from 1990 to 2001, the number of catastrophes exceeded 100 in every year (Swiss Re, 2002).[7] From 1970 to 1986, insured losses from natural catastrophes exceeded $5 billion in only 1 year, and the average annual catastrophe loss for this period was $2.6 billion. From 1987 to 2001, however, insured catastrophe losses exceeded $8 billion in all but 2 years, and catastrophe losses averaged $14.3 billion per year (Cummins, Lalonde, and Phillips, 2002*a*).

As catastrophic losses continued to rise, it became increasingly apparent that international reinsurance markets were not adequate for financing this type of loss. Insurance and reinsurance markets operate most successfully in diversifying relatively small, frequent events, but are not well equipped to handle large, infrequent events. Moreover, events that are large relative to the capacity of the insurance and reinsurance industries are small relative to securities markets. For example, the $100 billion "Big One" in Florida or California would represent approximately 75 percent of the equity of the global reinsurance industry but would amount to less than half of 1 percent of the value of stocks and bonds traded on US securities markets. Moreover, because the occurrence of natural catastrophes is not linked to economic events, catastrophe-linked securities would be "zero-beta" assets and hence very valuable to investors for diversification (Cantor, Cole, and Sandor, 1996; Litzenberger, Beaglehole, and Reynolds, 1996). These factors led to the recognition that securitization is likely to offer the most logical and efficient solution to the catastrophic loss financing problem.

CAT-risk securities also are interesting because there is no traded underlying asset or commodity that can be used to trigger payment under the securities. In the absence of a traded underlying, CAT-risk securities have been structured to pay-off on three types of variables: issuer-specific catastrophe loss criteria, insurance-industry catastrophe loss indices, and *parametric* indices based on the physical characteristics of catastrophic events. The choice of a triggering variable involves a trade-off between moral hazard and basis risk (Doherty, 1997). Securities based on insurer-specific (or hedger-specific) losses have low basis risk but expose investors to moral hazard, whereas securities based on industry loss indices or parametric triggers greatly reduce or eliminate moral hazard but expose hedgers to basis risk.[8] Additionally, index-linked securities are more easily standardized than issue-specific instruments, thus providing the potential for the development of a more liquid market in index-linked contracts.

The first catastrophe insurance derivative contracts were introduced by the Chicago Board of Trade (CBOT), which began listing catastrophic loss futures contracts in 1992. The CBOT contracts eventually evolved into option spreads that settled on insurance-industry loss indices compiled by Property Claims Services (PCS), an insurance industry statistical agent.[9] Although the CBOT options are no longer traded due to low trading volume (mainly due to lack of interest in the options by insurers), they represent an important innovation and are likely to provide the model for exchange traded options that almost certainly will be developed in future years.[10]

Currently, catastrophe bonds account for the greatest amount of risk capital raised in the catastrophe securities market. Unlike the CBOT options, the CAT bonds issued to date are ABS analogous to the credit-linked products discussed above. The first successful CAT bond was an $85 million issue by Hannover Re in 1994 (Swiss Re, 2001). The first CAT bond issued by a non-financial firm, occurring in 1999, covers earthquake losses in

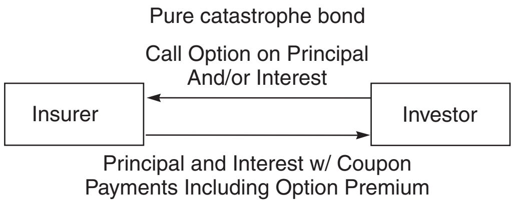


Figure 13-3. Pure catastrophe bond. (*Source*: Authors' derivation.)

the Tokyo region for Oriental Land Company Ltd., the owner of Tokyo Disneyland.

Under a very general catastrophe bond structure, shown in Figure 13-3, investors purchase debt securities from an insurer (or an insurance trust) in exchange for a nominal interest yield that compensates investors both for the use of their funds and for an embedded option that allows the insurer to reduce the yield (either through a reduction in principal and/or interest payments) if a predefined disaster event occurs during a preset exposure period. Stated differently, catastrophe bonds expose investors' principal and/or interest to loss in the event of a pre-specified natural disaster event. In return, investors receive a higher yield reflecting the embedded call option (on principal and/or interest payments) held by the insurer. In principle, this structure is no different from a credit default swap except that the underlying reference portfolio is basket of insurance risks instead of loans and the triggering event is a natural disaster loss instead of a credit default.

A good illustration of a CatBond structure is the catastrophe bond program established in 1997 by the US property-liability insurer USAA to transfer the risk of large-scale hurricane losses from the insurer to investors. USAA structured the CatBond so that investors earned an above market-yield on the notes, but were exposed to losing principle and/or interest if hurricane losses for USAA exceeded $1 billion (Lewis and Davis, 1998). If hurricane losses for USAA exceeded $1 billion, investors would have to cover 80 percent of USAA's hurricane losses in excess of $1 billion through foregone interest or principal payments on their notes.[11] The total payout by investors was capped, however, at $400 million. USAA retained the risk of hurricane losses below $1 billion, losses above $1.5 billion, and the 20 percent of losses not covered by investors in the $1.0–1.5 billion layer of protection provided by the CatBond.[12]

In implementing CatBond structures, however, insurers and investors often prefer to segregate the underlying liabilities in an insurance-linked note through the use of a special purpose reinsurer (SPR). Insurers prefer the use of a SPR to capture the tax and accounting benefits associated with traditional reinsurance. The SPR also keeps the transaction off the insurer's

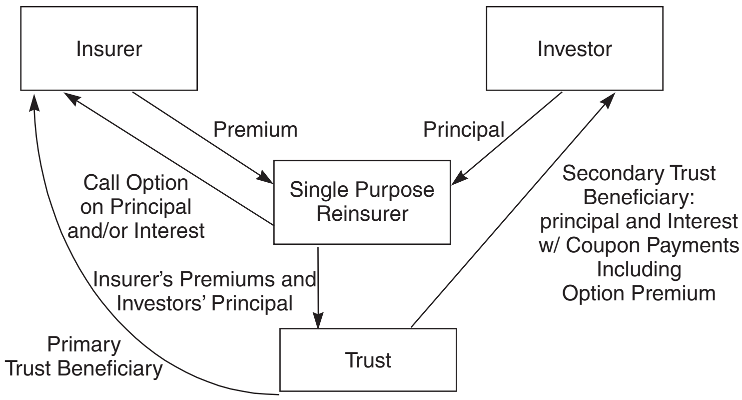


Figure 13-4. CatBond with SPR. (*Source*: Authors' derivation.)

balance sheet and hence does not change its capital structure. Investors prefer the use of a SPR to isolate the risk of their investment in the secured assets or liabilities from the general business and insolvency risks of the insurer. As a result, the issuer of the securitization can realize a higher return from the sale of assets or liabilities through segregation. The transaction also is more transparent than a debt issue by the insurer, because the funds are held in trust and are released according to carefully defined criteria.

The structure of a CAT bond with a SPR and trust is shown in Figure 13-4. Once established, the SPR provides traditional reinsurance to the insurer for the pre-specified insurance risks being "securitized." The insurer also retains a residual interest in the SPR to ensure that the arrangement is fully recognized as reinsurance for regulatory and tax purposes. However, unlike traditional reinsurance firms, the SPR is financed through the placement of catastrophe bonds issued directly to investors. Proceeds from the sales of the securities to the investors and the insurer's premium payments for the catastrophe coverage are then placed in a trust, usually established in the United States. Funds from the trust can be released only to pay the issuing insurer's claims or to make payments on the bonds. This structure assures investors that they are not exposed to other risks inherent in the issuing insurer's book of business that would prevent it from repaying the bond were it issued direct by the insurer rather than the SPR.

The funds in the trust are invested in safe securities such as Treasury bonds. The investors receive the interest on the assets in the trust and a risk premium paid into the trust by the insurer. The risk premia on most CAT bonds issued to date have been in the range of 400–600 bps, and it is not unusual for the risk premium to be five or six times the expected value of the covered catastrophe loss (Cummins, Lalonde, and Phillips, 2002*b*). These high premia, which have made the bonds very attractive to investors, pose a pricing puzzle: That is, if CAT risk is truly "zero-beta," then the bonds should yield approximately the expected loss plus the risk-free rate of interest, not several times the expected loss. Possible explanations for the high premia include investor unfamiliarity with the contracts (a "novelty" premium), the low liquidity of the contracts issued to date (a liquidity premium), and investor uncertainty about the accuracy of the models used to estimate expected losses (a "modeling risk" premium). In addition, although the catastrophic events observed in the United States to date have been uncorrelated with returns in securities markets (Litzenberger, Beaglehole, and Reynolds, 1996), it is not clear that this lack of correlation also would exist for a $100 billion plus "Big One." It is possible that such a large event might have repercussions that could drive down securities prices, creating systematic risk for CAT securities. An extra premium for this type of risk might be characterized as a "hidden-beta" premium.

The CAT bonds that have been issued to date are summarized in Table 13-2. The table shows forty-two securitizations that account for over $5.5 billion in risk capital. Most of the transactions are limited to coverage of hurricanes and/or earthquakes, although fifteen are multiline, indicating that they could be triggered by events from other lines of insurance. The issues have ranged in value from $10 to $500 million, and nearly all have been privately placed.

Insurers also have hedged property-liability risk using other types of securitizations, including contingent capital/surplus note financings and option/swap contracts. A contingent capital transaction is structured similarly to a CAT bond, except that the financing event triggered by the contingency is an equity capital issue. For example, assume that an insurer issues contingent capital securities to investors. As in the case of a CAT bond, the funds from the capital issue are placed in a trust and invested in safe securities. If the triggering event occurs, the insurer is permitted to withdraw funds from the trust and to replace the funds with contingent capital certificates or surplus notes.[13] There is usually a provision for retiring the surplus notes according to a specified schedule. Thus, investors are exposed to the ultimate credit risk of the issuer (i.e. the risk that the notes will not be retired as promised) but otherwise will not lose their principal as the result of the occurrence of the covered event. The contingent capital transactions to date are summarized in Table 13-3. There have been sixteen transactions, raising a total of $4.5 billion in risk capital. All contingent capital transactions to date have been privately placed.

There also have been several option/swap securitizations covering property-liability risks. One model for this type of securitization is the catastrophic equity put option, where an insurer purchases a catastrophe put option from investors in return for an option premium. This derivative gives the insurer the right to issue a specified number of shares (usually

TABLE 13-2 Natural Disaster Catastrophe Bonds ($ US Millions)

| *Issue* | *Issuer* | *Year* | *$ Millions* | *Risk* |
|---|---|---|---|---|
| Georgetown Re | St. Paul Re | 1996 | 69.0 | Multi-line |
| AIG | AIG | 1996 | 25.0 | Multi-line |
| Winterthur | Winterthur Re | 1997 | 282.0 | Wind |
| SLF I | Reliance | 1997 | 20.0 | Multi-line |
| SLF II | Reliance | 1997 | 20.0 | Multi-line |
| Residential Re I | USAA | 1997 | 477.0 | Wind |
| SR Earthquake | Swiss Re | 1997 | 137.0 | EQ |
| Parametric Re | Tokio Marine & Fire | 1997 | 100.0 | EQ |
| Trinity Re I | Centre Re | 1998 | 84.0 | Wind |
| SLF III | Reliance | 1998 | 25.0 | Multi-line |
| Pacific Re | Yasuda Fire & Marine | 1998 | 80.0 | Wind |
| Residential Re II | USAA | 1998 | 450.0 | Wind |
| Mosaic Re I | F& G Re | 1998 | 54.0 | Multi-line |
| Trinity Re II | Centre Re | 1998 | 57.0 | Wind |
| Mosaic Re II | F& G RE | 1999 | 46.0 | Multi-line |
| SLF IV | Reliance | 1999 | 10.0 | Multi-line |
| Domestic Re | Kemper | 1999 | 100.0 | EQ |
| Halyard Re | Sorema SA | 1999 | 17.0 | Multi-line |
| Concentric Re | Oriental Land Co. | 1999 | 100.0 | EQ |
| Residential Re III | USAA | 1999 | 200.0 | Wind |
| Juno Re | Gerling | 1999 | 80.0 | Wind |
| Namazu Re | Gerling | 1999 | 100.0 | EQ |
| Golden Eagle Re | AmRe | 1999 | 182.0 | Multi-line |
| Seismic | Lehman Re | 2000 | 145.5 | EQ |
| Atlas Re | SCOR | 2000 | 200.0 | Multi-line |
| Halyard Re | Sorema SA | 2000 | 17.0 | Multi-line |
| Alpha Wind | Arrow Re/State Farm | 2000 | 90.0 | Wind |
| Residential Re IV | USAA | 2000 | 200.0 | Wind |
| NeHi | Vesta | 2000 | 50.0 | Wind |
| Mediterranean Re | AGF | 2000 | 129.0 | Wind/EQ |
| Prime Capital | Munich Re | 2000 | 300.0 | Wind/EQ |
| Western Capital | Swiss Re | 2001 | 100.0 | EQ |
| Golden Eagle Re II | American Re | 2001 | 120.0 | Wind/EQ |
| Halyard Re | Sorema SA | 2001 | 17.0 | Multi-line |
| SR Wind | Swiss Re | 2001 | 120.0 | Wind |
| Trinom Ltd | Zurich Re | 2001 | 161.9 | Multi-line |
| Mediterranean Re | AGF | 2001 | 129.0 | Wind/EQ |
| Redwood Capital | Lehman Re | 2001 | 160.5 | EQ |
| Atlas II | SCOR | 2001 | N/A | Wind/EQ |
| Munich Re | Open | 2002 | 500.0 | Multi-line |
| CEA | Open | 2002 | 100.0 | EQ |
| Swiss Re | Open | 2002 | 300.0 | — |
| | | Total | 5554.9 | |

*Sources*: Swiss Re (2001), Lane (2000, 2001).

*Note*: EQ = Earthquake, Wind = Hurricane/Windstorm.

TABLE 13-3 Contingent Capital/Surplus Notes (Volume in $ US Millions)

| *Issuer* | *Year* | *$ Millions* | *Risk* |
|---|---|---|---|
| Nationwide | 1995 | 400.0 | N/A |
| Hannover Re—Kover | 1995 | 85.0 | Multi-line |
| Arkwright | 1995 | 100.0 | N/A |
| FWUA | 1995 | 1,500.0 | Wind |
| Hawaii Hurricane | 1995 | 500.0 | Wind |
| RLI | 1996 | 50.0 | Multi-line |
| Horace Mann | 1996 | 100.0 | Multi-line |
| LaSalle Re | 1997 | 100.0 | Multi-line |
| CEA | 1997 | 700.0 | EQ |
| Lloyds | 1998 | 40.0 | Multi-line |
| Oriental Land Co. | 1999 | 100.0 | EQ |
| Pacific Electric | 2000 | 120.0 | Credit |
| Michelin | 2000 | 170.0 | GDP |
| US Consulting | 2000 | 250.0 | N/A |
| Royal Bank of Canada | 2000 | 200.0 | Credit |
| Countrywide | 2000 | 100.0 | Credit |
| | Total | 4,515.0 | |

*Sources*: Authors' computations from Swiss Re (2001), Lane (2000, 2001).

*Note*: EQ = Earthquake, Wind = Hurricane/Windstorm.

preferred stock) at an agreed upon price contingent on the occurrence of a specified catastrophe event. If the insurer's stock price drops below the option strike price as the result of a catastrophe, the insurer can replenish its equity capital by issuing shares at the strike price. Options have an advantage over CAT bonds in that they do not tie up pools of capital in trust. However, options expose the insurer to counterparty credit risk, and the issue of shares following an event dilutes the insurer's equity capital. For investors, these options should be attractive as long as the option premium is sufficient to compensate for the risk. However, because they are off-balance sheet transactions, investing in options/swaps may create regulatory problems for some types of institutional investors.

The option/swap contracts issued to date are shown in Table 13-4. There have been twenty transactions, raising $4.8 billion in risk capital. Aggregating the CAT bonds, contingent capital, and options/swap transactions in Tables 13-2, 13-3, and 13-4 gives a total of seventy-eight transactions that have raised nearly $15 billion in risk capital. Clearly, these securities have been viewed as attractive by both issuers and investors, and there is significant potential for the future development of this market.

TABLE 13-4 Property-Liability Linked Options/Swaps (Volume in $ US Millions)

| *Issuer* | *Year* | *$ Millions* | *Risk* |
|---|---|---|---|
| Hannover Re (K2) | 1996 | 100.0 | Multi-line |
| CAT LTD | 1997 | 35.0 | Wind |
| Mitsui Marine | 1998 | 35.0 | EQ |
| AXA | 1998 | 40.0 | EQ |
| XL Mid-Ocean | 1998 | 200.0 | Multi-line |
| Constitution Re | 1998 | 10.0 | Wind |
| CNA | 1998 | 115.0 | Wind |
| FIFA World Cup | 1998 | 3,000.0 | EQ |
| Societe Generale | 1998 | 45.0 | EQ |
| Societe Generale | 1998 | 100.0 | EQ |
| Reliance National | 1998 | 40.0 | Multi-line |
| AXA | 1998 | 21.0 | EQ |
| Allianz | 1998 | 150.0 | Wind |
| Hannover Re (K2+) | 1998 | 50.0 | Multi-line |
| CNA | 1999 | 50.0 | EQ |
| Lehman Re | 1999 | 111.0 | EQ |
| Tokio Marine/Arrow Re | 2000 | 200.0 | EQ |
| WestLB | 2000 | 45.0 | N/A |
| Tokio Marine/Swiss Re | 2001 | 450.0 | EQ/Wind |
| FIFA/ Munich Re | 2001 | 50.0 | EQ |
| | Total | 4,847.0 | |

*Sources*: Authors' computations from Swiss Re (2001), Lane (2000, 2001).

*Note*: EQ = Earthquake, Wind = Hurricane/Windstorm.

### Insurance-Linked Notes: Life Insurance/Annuity Risks

Unlike the property-liability insurance industry, securitization in the life insurance industry has been relatively rare. To date, we are aware of only five successful securitization transactions involving life insurance assets (see Table 13-5), and four of these were "closed block" securitizations completed by one reinsurance company, Hannover Re.[14] Under a "closed block" securitization, an insurance company segregates the life insurance policies and the associated assets of a given volume of business. The assets and liabilities are then sold to investors through an ABS structure. Through this mechanism, an insurance company can effectively originate a block of business and then "sell" that business block directly to investors through a securitization structure.

Life insurance securitizations are motivated by insurer needs to recapture funds expended in writing new life insurance. The need arises because the expense of writing new life insurance policies is generally incurred by the

TABLE 13-5 Life Insurance and Annuity Securitizations (Volume in $ US Millions)

| Issue | Issuer | Year | $ Millions | Risk |
|---|---|---|---|---|
| ASLAC Funding Trust I | American Skandia | 1996 | 42.0 | Annuity fees |
| Prudential | Prudential | 1996 | 175.0 | Mutual fund fees |
| ASLAC Funding Trust II | American Skandia | 1997 | 158.0 | Annuity fees |
| Interpolis Re | Hannover Re | 1998 | 57.0 | Closed life block |
| Mutual Securitization | National Provident Life | 1998 | 438.0 | Open life block |
| ASLAC Funding Trust | American Skandia | 1998 | 111.0 | Annuity fees |
| Interpolis Re | Hannover Re | 1999 | 250.0 | Closed life block |
| Whiterock | Hannover Re | 1999 | 49.0 | Closed life block |
| L4 Securitization | Hannover Re | 2000 | 182.0 | Closed life block |
| | | Total | 1,462.0 | |

*Sources*: Authors' computations from Swiss Re (2001), Lane (2000, 2001).

insurer in the first policy year and then amortized over the term of the policy. Thus, writing new business can create liquidity problems for life insurers. In addition, regulatory accounting requirements usually result in an increase in insurer leverage associated with new business. Consequently, one motivation for life insurance securitizations is to reduce leverage and obtain immediate access to the "profits" expected to emerge from a block of life insurance policies. The advantage for the insurance company is access to cheaper financing and the ability to bypass regulatory capital requirements associated with keeping the business on the company's balance sheet. In a series of transactions (known as L1–L4) dating back to 1998, Hannover Re has used "closed block" securitizations to sell four large blocks of life, health, and personal accident reinsurance in the market. The latest sale involved $182 million of life, health, and personal accident in December of 2000.

A more innovative life insurance securitization approach is the direct sale of interests in "open blocks" of life insurance policies underwritten by an insurance company. In an open block securitization of life insurance policies, a SPV is established to make a loan to the operating unit of an insurance company in return for the right to the surpluses expected to "emerge" on a specified block of life insurance policies. Emerging surpluses constitute the residual value within a block of life insurance policies at the end of each policy year, after subtracting dividends to policyholders. The present value of these emergent surpluses across future policy years represents the present value of future profits from the life insurance block. The SPV, therefore, is funded through the issuance of floating and fixed rate structured notes placed directly in the capital markets with investors interested in taking a position in the present value of future profits on these life insurance policies (Standard & Poor's, 2001).

In May of 1998, National Provident Insurer (NPI), a UK life insurance company, became the first company to successfully securitize an open block of life insurance policies. In this structure NPI, sold $438 million of life insurance policies through an SPV called Mutual Securitization PLC. The limited recourse bonds used to fund the SPV were rated A-by S&P and divided into Class A1 and A2 securities that carried terms of 14 and 24 years, respectively. Similar to the securitization of mutual fund asset fees, the main profit driver of emerging surplus in this transaction was the management fee levied by NPI on the portfolio fund backing these policies.[15]

While NPI remains the only open block life insurance securitization that has been successfully placed in the market, interest in life insurance securitization is once again drawing the attention of leading investment banks. In fact, it has been reported that Prudential Financial is exploring the opportunity to securitize up to $1.5 billion in portfolio life insurance policies.[16] Unlike closed block transactions, the direct securitization of life insurance emerging surplus enables insurance companies to "sell"—and investors to buy—the pure risk of adverse mortality and morbidity developments in its underwriting. Of course, mortality rates tend to remain extremely stable over time. Thus, the interest in life insurance securitization centers around the desire of life insurance companies to find capital-saving approaches to manage the risk of "catastrophic" changes in mortality rates, presumably from plagues, famine, large scale conflagrations, or terrorist attacks. In this context, the motivational factors behind the insurer demand for open block securitizations of life insurance are analogous to factors underlying the CatBond market for property–casualty insurance.

## Credit-Insurance

Parallel to the development of credit-linked notes, insurance companies have been exploring strategies for securitizing the risks associated with portfolio credit insurance. In the market for alternative risk transfer, reinsurance companies have spent the last few years developing a wide variety of innovative products to insure the portfolio credit risk exposures of both corporates and financial services firms. Examples of these innovative new policies include the $200 million in contingent capital protection against portfolio credit risk to the Royal Bank of Canada in January of 2001; the

$260 million of surety bond protection provided to ResidenSea Ltd; and the $159 million excess-of-loss policy provided to the Paris Bourse in the event of that member defaults and losses exceed $180 million. Coupled with traditional credit risk insurance products, this growth of insurance company credit exposure also has increased the demand for insurance companies to develop new approaches for securitizing the resulting concentrations of credit risk in their portfolios.

To find a precedent for the securitization of portfolio credit risk from an insurance company, however, we must once more look to Europe. In April of 1999, Gerling Financial successfully placed $455 million worth of credit-linked notes in the market through a novel structure called SECTRS. In the SECTRS transaction, Gerling was able to lay off large concentrations of European credit risk exposure associated with the firm's credit insurance operations through an indexed structure similar to JP Morgan's Bistro Credit-linked notes. The transaction allowed investors to participate directly in the credit risk performance of small-to medium-sized European companies through an indexed measure of industry default experience based on the default experience of 92,000 European firms. Arranged in the sequential layers, the SECTRS transaction exposed investors to varying levels of risk pegged to the annual and 3-year cumulative default experience of an index of European company defaults.

AQ: Pls. chk. if change Ok

- Tranche A—totaled $245.5 million, was rated AA2, and carried a yield of Euribor + 45 bp.
- Tranche B—totaled $127.5 million, was rated AA2, and carried a yield of Euribor + 82.
- Tranche C—totaled $ 82.0 million, was rated BBB, and carried a yield of Euribor + 170.

The payoff of principal and interest in each tranche was tied to a specific set of default rates based on a European default rate index. The trigger points for annual default rates on Tranche A, B, and C were set to 3.3, 2.6, and 2.1 percent, respectively. Cumulative default rate trigger points for Tranches A, B, and C were set at 6.6, 5.9, and 5.4 percent, respectively. Gerling was left with the responsibility for managing the basis risk between the European industry index and the firm's portfolio exposure, as well as bearing the first layer of loss associated with defaults for the portfolio up to a level of a 2.1 percent annual default loss (approximately $325 million in exposure).

The structure of the transaction was similar to a credit-linked structured note with an embedded portfolio credit default swap. Proceeds from the sale of the structured notes were used to purchase US Treasury securities and AAA-rated German Agency bonds to collateralize and meet the interest and principal payments on the underlying notes. Gerling then purchased an interest rate swap to convert the fixed-rate collateral bonds into a floating rate payment for investors. In the event that a default trigger was pierced, Gerling would be able to liquidate some of the underlying collateral in the trust to cover credit insurance losses within its portfolio. As a result, the reduction in the underlying collateral within the trust would reduce the principal and interest payments to the affected investors of the SECTRs securities.

## Weather-Linked Securities

Another developing market is the market for weather derivatives and for structured notes that embed weather derivatives in an ABS structure. Weather derivatives are another example of derivatives on "exotic underlyings." Although various weather-related indices could undoubtedly be constructed, most contracts traded to date settle on indices of the number of heating degree days (HDD) for contracts hedging against relatively warm temperatures (e.g. a natural gas producer) or cooling degree days (CDD) for contracts hedging against relatively low temperatures (e.g. an electricity producer hedging against low demand for air conditioning). Weather derivatives have been sold over-the-counter, and the Chicago Mercantile Exchange (CME) now offers HDD and CDD futures and options on ten US cities, although transactions volume has been low to date.

As an example of a weather derivative consider a HDD futures contract on the Philadelphia weather index purchased on the CME. The CME HDD index is an accumulation of HDDs over a calendar month, valued at $100 per tick (day). A daily HDD is defined as Max[65° Fahrenheit-daily average temperature, 0]. If the number of HDDs during November in Philadelphia accumulated to 600, the nominal value of a futures contract on the index would be $60,000. A natural gas company might decide to hedge using put options on the index. If it bought December puts with a strike price of 900 (approximately the average HDDs in Philadelphia in December), it would collect the following amount on each option: $P = 100 \times \text{Max}[900 - I^{HDDP}, 0]$, where $I^{HDDP}$ is the realized value of the Philadelphia HDD index for that month. For example, if the actual number of HDDs was 750, the hedger would collect $15,000 per put option. Of course, many other types of derivatives, including swaps, caps, floors, etc., could be traded based on weather related risks.

Asset-backed securities also can be structured with embedded weather derivatives. Similar to the development of the credit-linked note and the CatBond market, weather-linked ABS could be beneficial to both the issuing company and the investor. For the issuer, the note can be structured using a SPV that allows the ceding company to obtain the favorable tax and accounting advantages of insurance. For investors, the structured note would provide a low cost means for taking positions in the weather market that are currently not feasible given the limited market infrastructure for weather derivatives. A market-leader in this area is Koch Energy Trading. In a two-tranche structured note dubbed Kelvin, Koch was able to securitize a $50 million portfolio of weather derivatives tied to degree-day measures in the United States in December of 1999.

- Tranche A—totaled $21.6 million, provided first event coverage, carried a B-rating, and was priced at LIBOR + 1570.
- Tranche B—totaled $23.0 million, provided second event coverage, was rated BBB, and was priced at LIBOR + 870.

Other deals that have been examined but withdrawn or held back include insurance-linked notes tied to rainfall precipitation (e.g. Nicaraguan drought or deluge) and snowmelt and/or river water level exposure (e.g. United Kingdom or Bangladesh).

## Aircraft-backed Debt and Lease Securitization

An interesting class of investments that has flourished recently represents securities backed by aircraft assets and aircraft lease programs. Aircraft-backed securities now come in a variety of forms for investors, but for convenience, we can classify these securities within four basic structures: Equipment Trust Certificates (ETCs), Enhanced Equipment Trust Certificates (EETCs), Aircraft Lease Portfolio Securitizations (ALPS), and securitized pools of aircraft loans. The risks associated with aircraft-backed loans are very unique from other types of loan structures. However, the basic structure of a securitized pool of aircraft loans is the same as a traditional CLO. Our discussion focuses on the first three types of aircraft ABS.

### *Equipment Trust Certificates*

For airline companies, a substantial portion of their debt funding capacity historically has been tied up in the financing of aircraft purchases (e.g. Boeing 747s). Furthermore, the funding costs of aircraft purchases have been tied directly to the credit rating of the airline company. The question for the airline companies, therefore, was whether there was a means to leverage the residual value of a purchased aircraft to reduce the debt funding costs associated with the purchase? The answer was ETC.

In issuing ETCs, an airline company uses an arms-length SPV to issue secured debt to private investors to finance the purchase of aircraft assets. In the transaction, however, the airline company transfers its interest in the property rights of the aircraft and all related property rights (e.g. lease returns) to the SPV trust as security for repayment of the limited-recourse notes.[17] Investors are then granted a first priority perfected security interest in the aircraft and any associated collateral, and are entitled to secure the benefits of favorable payment treatment in the event of a bankruptcy by the airline.[18] The investor interest in the aircraft collateral translates into enhanced recovery rate prospects on the debt in the event of a default by the sponsoring airline. As such, the secured debt is usually rated 1–2 notches above the corporate rating of the airline and the airline benefits from a lower-cost financing of the aircraft purchase. Northwest was one of the first airlines to issue ETCs in 1994, but several large deals followed the Northwest deal as more airlines took advantage of this lower cost funding mechanism.

*Enhanced Equipment Trust Certificates*

Given the funding cost savings that were realized through the issuance of ETCs, the airline companies started to explore alternative structuring options in an attempt to further enhance the credit rating of the debt securities and lower the acquisition costs of aircraft assets. What evolved out of this exploration was a more highly levered secured debt structure known as EETCs. While the basic premise behind the EETCs remained consistent with the original ETCs, these new structures used tranching and flexible payment terms to convert the collateral of the aircraft into a reduced probability of default—as opposed to an improved recovery rate in the event of default. This approach yielded more favorable credit ratings and lower funding costs.

The main features that were added to EETCs to effect this trade-off of collateral enhanced ratings were as follows:

1. Debt tranching—providing various levels of over-collateralization.
2. Dedicated liquidity facilities that could continue debt service (usually just interest only) payments during the time required for the trust to repossess and sell aircraft collateral to payoff the debt obligations in the event of a default—up to a maximum of 18 months.
3. Soft amortization terms that allowed an extension in the repayment of principal up to a maximum final maturity date.
4. Reliance on improved legal mechanisms for assuring access to the underlying collateral.

The basic advantage of the last three features listed above was to give the trust sufficient flexibility to determine the optimum timing of selling repossessed assets into the market place. Early ETC and portfolio securitization transactions that resulted in asset repossession and liquidation demonstrated the risk associated with trying to accomplish a forced asset sale during a down market in the value of airline assets. The flexibility accorded to the trust in an EETC was an attempt to avoid an asset "fire sale," thereby recognizing greater value in the transaction.

*Aircraft Lease Portfolio Securitization*

While airline companies were looking for novel ways to lower their cost of aircraft acquisition, aircraft manufacturers and aircraft leasing companies also were exploring ways to securitize leasing programs. In an aircraft lease program, the aircraft manufacturer leases a plane to an airline for commercial use over a fixed period of time on an operating lease basis. During this period, the airline company has an option to put the plane back to the aircraft manufacturer before the end of the lease term under conditions of financial stress. As a result, aircraft lease programs carry significant contingent market risks for the manufacturer, especially since the development of adverse circumstances for lessees is likely to be correlated with airline industry recessions when releasing and residual aircraft values are lower. With roughly 2,500 of the 12,500 total outstanding commercial aircraft worldwide being financed through lease programs, the extent of this risk—and the opportunity for cost savings with a new ABS structure—was substantial. As a result, the industry developed ALPS (Bowers, 2002).

Under an ALPS, the aircraft manufacturer issues securities through a SPV that grants investors rights to the lease receivables of a portfolio of leased aircraft, as well as the net residual value of the aircraft in the lease portfolio at lease termination. In the transfer, the special purpose trust retains the property rights to the lease income and the residual value of the aircraft to support the payment of debt service to investors. Meanwhile, the investors accept the contingent liability of the lease program. The main risk to investors, therefore, is the joint event where airlines default on their lease obligations during a period in which the value of the leased aircraft falls below a level needed to meet debt service obligations.

A key distinction between ALPS and ETCs, however, is that the credit quality of the transaction is not tied a rating of the underlying sponsor, but instead it is based on the level of diversification in the lease portfolio (i.e. number of airlines, aircraft types, and countries), the robustness of the aircraft technology, the reputation of the manufacturer, the quality of the lease servicer, and the expected market liquidity for the aircraft assets. Furthermore, while the trust has the authority to sell the aircraft to support debt service payments to investors, the presumption in a lease securitization is that lease terminations will be replaced with new leases. Other structuring options have evolved in a similar fashion to EETCs.

The first portfolio securitization of airplane receivables was a $521 million issue in June of 1992 that was called Aircraft Lease Portfolio Securitization Limited 92-1 ("ALPS 92-1"). In this transaction, the sponsor (the GPA Group) securitized the lease receivables associated with fourteen different planes, fourteen different lessees, and twelve countries. The aircrafts were sold to ALPS 92-1 in "true-sale" format and the SPV issued $417 million in senior (three classes) and mezzanine debt. The ALPS 92-1 debt was to be repaid from aircraft sales in the last 18 months of the program, but failure to meet aircraft sales goals eventually forced a refinancing of the debt in 1996 (ALPS 96-1) (Bowers, 2002). The experience of ALPS 92-1 was important in illustrating the risks in an aircraft securitization structure based on the residual value of the aircraft—the risks that the market value of the leased aircraft will fall below a level required to finance the payment of the securities financing the structure.

A second major ALPS issuance in 1994, Aircraft Lease Portfolio Securitization 94-1, presented an important improvement on the original aircraft lease securitization model. ALPS 94-1 was a $854 million issue backed by a lease portfolio of twenty-seven aircrafts, twenty-two lessees in fourteen countries. Legally, the structure was similar to ALPS 92-1. However, in the event that low market valuations of the leased aircraft did not support the scheduled retirement of the trust's debt, the trust had the authority to extend the maturity of the debt at a higher interest rate. This feature allowed the trust to avoid a forced sale of the leased aircraft in a down market—exacerbating the decline in the residual value of the aircraft and forcing a restructuring of the debt.

Another major hurdle in aircraft securitization was crossed in 1997, with the $4.1 billion securitization issued by Airplanes Trust Delaware and Airplanes Limited Jersey ("Airplanes Group"). This deal, which marked the largest to date, involved the lease securitization of 229 aircrafts on lease to 83 lessees in 40 countries. The novelty in this transaction was that the structure involved the transfer of bankruptcy-remote SPVs that held the aircraft as opposed to the physical transfer of the aircraft themselves. (Similar deals are also taking place with respect to automobile leasing programs.)

In terms of the yield opportunity for investors, we can look at the 1997 ALPS issued by Pegasus Aircraft Lease Securitization and the June 2001 issue by Triton-ABD.

1. Pegasus issued $119 million in 7-year securities backed by airplane lease receivables in May of 1997. The issue was divided into a BBB-rated tranche of $99 million and a BB-/Ba3-rated tranche of $20 million. The BBB-rated tranche carried a fixed rate of interest of 8.6 percent; while the junior tranche had a rate of 11.76 percent. The interesting aspect of the Pegasus transaction was that fortunate circumstances in the timing of lease terminations and aircraft sales in a strong aircraft market actually generated unexpectedly strong returns for investors. Unfortunately, the prospect of these high returns is also informative of the potential for strong negative returns in down markets.
2. Triton issued $805 million in 25-year securities backed by airplane lease receivables. The transaction covered a geographically diverse portfolio of lease receivables with the top 5 markets being France (15 percent), the United Kingdom (14.4 percent), the United States (14.3 percent),

Canada (10.6 percent), and China (5.2 percent). The transaction was divided into six-rated classes ranging from AA-rated paper to Ba2/BB-rated paper, along with an un-rated equity piece worth $85 million. In terms of yield opportunity, the AA-rated securities carried a return of LIBOR + 70 bps, the AA-rated securities offered LIBOR + 150 bps, and the Ba2/BB-rated paper had a stated return of 300 bps over LIBOR.

*Insurance-linked Aircraft Receivables*

In 1998, the first insurance-linked structure based on the residual value of aircraft leases was completed. In this transaction, BAE (formerly British Aerospace) purchased $3.8 billion worth of financial risk insurance to cover two key aspects of the company's risk exposure:

- Lease Portfolio Cover—the risk that the actual lease income on a fixed portfolio of aircraft leases, adjusted for costs, is less than a predetermined target level of income: and
- Aircraft Portfolio Cover—the risk that the residual value of repurchased aircraft under the lease contracts is less than BAE's contractual price for aircraft repurchase.

The insurance protecting this exposure was then securitized through the issuance of structured notes privately placed in the market through an SPV similar to an ALPS structure. The structure used by BAE was later replicated by both SAAB and Rolls Royce. The SAAB deal was a 15-year transaction covering $1.3 billion worth of portfolio lease protection where investors were given a stated return of LIBOR + 367 bps.

## Stranded Cost Securitization

One area that is quickly becoming a main ABS product is the securitization of the "stranded costs" of public utilities. Stranded costs refer to power producer costs that were historically built into the traditional regulatory cost-plus system, but currently cannot be passed on to consumers due to the competitive marketplace created by industry deregulation. Before deregulation, power producers undertook significant investments in a wide variety of capital expenditures designed to improve baseline production. These expenditures included investments in high-cost nuclear and fossil plants, deferred and capitalized operating costs, conservation and economic development, nuclear decommissioning costs, and long-term contractual obligations with high cost non-utility generators. Under the traditional cost-plus regulatory system, these investments were encouraged and passed on to consumers in the form of higher energy costs (Standard & Poor's 1998).

With the passage of the National Energy Policy Act of 1992 (NEPA), the United States began a national program of deregulation in the energy sector with the goal of creating a competitive marketplace in the production or generation of power. The introduction of a competitive marketplace, along with falling power generation costs, caused the wholesale price of power to fall well below the traditional mark-up pricing rates used historically. As a result, existing power plants had little ability to immediately recoup the costs of their capital expenditure investments—leaving them saddled with "stranded costs" that threatened their profitability and even solvency. State utility regulators passed legislation that enabled the utilities to set rates to recover stranded costs (and any interest, servicing, or issuance costs of debt used to finance stranded costs) from customers, but only when amortized over a 30–40 year period. As a result, utilities looking to remain competitive in the wholesale generation market turned to securitization to expedite the recovery of these costs.

In a securitization of stranded assets, the utility company transfers both its stranded cost liability and its interest in the state regulatory fees designed to cover stranded costs (and associated financing charges) to a SPV. The SPV then issues secured fixed-rate debt to investors, with the principal proceeds being used to repay the utility company. In exchange for their investment, investors receive an overcollateralized interest in the nonpassable, usage-based, per kilowatt hour charges payable to the utility by residential and commercial customers for the amortization of the stranded costs. As structured, the fees supporting the secured debt are designed to yield sufficient revenue to amortize the notes funding the SPV after adjusting for any servicing and issuance fees.

Of course, the actual retirement of the collateralized notes depends on the actual usage and fee rates earned by the utility during the term of the note. Lower usage rates than projected (e.g. warmer winters or cooler summers) or lower overall revenue (e.g. adverse demographic changes) could result in total collections falling below levels needed to support the repayment of the structured debt. To mitigate this risk, the securitization structure incorporates a "true-up" mechanism whereby the utility must go to the state regulatory commission to secure an adjustment in the regulatory tariffs charged to power consumers to cover any shortfall. As such, the risk to investors associated with insufficient tariff revenue is minimized. At the same time, if revenues exceed projections, the "true-up" mechanism could lower tariffs for energy customers and mitigate the prepayment risk of the debt. These structures also attempt to protect investors against sponsor insolvency—requiring that any company acquiring the sponsor assume responsibility for meeting the terms of the securitization. Given the true-up mechanism, the bankruptcy protection, and the collateralization of the debt service payments, stranded cost securitizations consistently have been rated AAA.

The securitization of stranded costs was initiated when the three big Southern Californian Public Utility Companies (Southern California

TABLE 13-6 Other Noteworthy Securitizations (Volume in $ US Millions)

| *Issuer* | *Year* | *$ Millions* | *Risk* |
|---|---|---|---|
| PGE,SCE, SDGE | 1997 | 6,000.0 | Stranded costs |
| Bowie Bonds | 1997 | 55.0 | Music royalties |
| FHLMC—MODERN's | 1998 | 243.0 | Mortgages |
| Toyota—Gramercy Place | 1998 | 566.0 | Residual value |
| Toyotal Motor Company | 1998 | 4,000.0 | Auto residual value |
| British Aerospace | 1998 | 3,770.0 | Plane lease residual value |
| Gerling—SECTRS | 1999 | 455.0 | Credit |
| ResidenSea LTD | 1999 | 260.0 | Surety bond |
| Swiss Re—ELF | 1999 | 330.0 | Credit |
| Koch Energy—Kelvin | 1999 | 50.0 | Weather |
| PEAK | 1999 | 106.0 | Trade receivables |
| Criterion Healthcare | 1999 | 100.0 | Health care receivables |
| Swiss Re—ELF II | 2000 | 330.0 | Credit |
| SAAB | 2000 | 1,300.0 | Plane lease residual value |
| Triarc Companies | 2000 | 290.0 | Franchise royalty |
| Rolls Royce | 2001 | N/A | Plane lease residual value |
| | Total | 17,855.0 | |

*Sources*: Authors' computations from Swiss Re (2001), Lane (2000, 2001).

Edison, Pacific Gas and Electric, and San Diego Gas and Electric) effectively securitized $6 billion of their estimated $28 billion in stranded costs. In this securitization, each utility issued multiple AAA-rated tranches of secured debt with varying maturity dates and fixed rates of interest. Southern California Edison, for example, issued seven classes of debt with maturities ranging from 3 years to 12 years and fixed rates of interest ranging from 5.98 to 6.42 percent. Following this transaction, the securitization of utility stranded costs quickly spread across the United States and now serves as a key financing strategy for public utilities in a variety of states, including Washington, Pennsylvania, Connecticut, and Massachusetts. The California stranded cost securitization and some other noteworthy transactions are summarized in Table 13-6.

## Future Cash Flow Securitization

Other important ABS structures that have been successfully placed in the market over the past several years include structured notes linked to firm royalties, tobacco settlement payments, and tax lien receivables.

### *Royalty Bonds*

Whether backed by revenue from future record sales (e.g. Bowie Bonds), franchise profits (e.g. Triarc's Arby's Revenue), ticket sales (e.g. UK football clubs), or sports stadiums, a variety of ABS coming to the market are structured based on the valuation of future cash flows. In each of these cases, the issuer is attempting to monetize a future flow of rental income through the use of a securitization—effectively transferring the economic risk of cash flow variability to the investor.

1. In the case of the "Bowie Bonds," investors purchased the rights to the future flow of David Bowie's royalty payments from song and record catalog copyrights for $55 million. In exchange, investors will receive all royalty payments owed to David Bowie until the principal plus 8 percent interest is repaid (Benz, 2001). From the issuance of these securities to June 2001, approximately $210 million in similar deals were structured and issued into the market.
2. In the case of Triarc, Swiss Re was able to help the firm securitize $290 million worth of future franchise royalties associated with Triarc's Arby's fast-food restaurants through an SPV vehicle Triarc Franchise Trust. In the transaction, which was settled in December of 2000, Triarc issued 20-year non-recourse fixed rate notes at a rate of 7.44 percent. The notes were credit enhanced by a first loss insurance policy issued by Swiss Re and an excess-of-loss insurance policy provided by Ambac Assurance Corporation. With the insurance, the notes carried a AAA-rating from both Moody's and S&P.[19]

*Government Revenue Securitization*

Starting in the early 1990s, state and local municipalities starting exploring the securitization market as a means to monetize receivables associated with outstanding tax collections (e.g. tax liens). Early success in this market has since encouraged the spread of this public sector financing strategy to other types of receivables, ranging from the tobacco settlements in the United States to social security receivables in Italy.

*Tax Lien Securitization*—Starting in 1993, New York City started securitizing tax lien receivables in an effort to monetize the expected recovery value of these tax receivables. Over the period 1996–2001, New York City successfully completed seven deals with an average annual volume of approximately $138 million. Each deal also included several differently rated classes, typically ranging from a AAA-rated layer to a BBB-rated layer. For example, the 2001 transaction included four separate classes ranging from AAA-rated to BBB-rated with fixed rates of interest ranging from 5.59 percent (AAA) to 6.29 percent (BBB). Given New York's success, many other states and localities have followed suit. In fact, in 1997, several private companies were established to facilitate multistate tax lien securitizations, opening up the market for smaller states and localities.

*Tobacco Settlements*—With large liability awards granted to the states as part of the US tobacco company settlements, states had a new annuity stream of cash flow payments. Before long, states were again looking for an inexpensive financing mechanism for monetizing their interest in these tobacco settlement payments. Recognizing their success in tax lien securitizations, states quickly turned to the ABS market with tobacco settlement bonds--issuing over $4 billion in tobacco settlement payment ABS through the end of 2001. These tobacco settlement bonds were securitized using a variety of structures with ratings on senior tranches ranging from A1-Aa3 depending on the rating of the underlying tobacco firm and the level of collateralization.

## Evaluating Non-Traditional ABS and Other New Securities

This section discusses the advantages and disadvantages of holding non-traditional ABS and other new assets. We also consider the important related issue of how to evaluate the risk-adjusted return of these securities.

### The Advantages and Disadvantages of ABS

Non-traditional ABS have two principal advantages for investors. First, by securitizing cash flow streams that have not previously been traded in securities markets, ABS can create a non-redundant security that provides a new source of diversification for investors—improving portfolio efficiency. Second, particularly in the early stages of the market, non-traditional ABS can offer superior risk-adjusted returns in comparison with comparably rated conventional securities. As the market develops, however, one would expect arbitrage trading to eliminate any abnormal returns from holding these investments. Nevertheless, the diversification benefits of these assets would persist even if arbitrage opportunities were not present. Most ABS are also structured in such a way that investors can choose the risk-return tranches that are most appealing in terms of their investment strategies or can obtain access to opportunities not available in conventional securities.

Non-traditional securities also have some potential disadvantages, which can be expected to diminish in importance as the market continues to develop. Because most ABS and non-traditional securities issued to date have been privately placed, secondary market trading has been limited, exposing investors to liquidity risk. In addition, because such securities are often complex relative to conventional assets, they are more difficult to evaluate, raising transactions costs and exposing investors to an additional source of uncertainty.

Another key risk that investors have to evaluate with non-traditional ABS is the potential for moral hazard, adverse selection, and other forms of risk-shifting within the transaction. In addition to the potential for risk shifting in the underlying assets (e.g. making loans to customers in a credit transaction), the potential exists for the actual structure to induce risk shifting by the issuer. For example, a bank that securitizes its credit risk exposure to a specific sector through a structured note in order to obtain additional lending capacity may then expand lending activities within this same sector—increasing the overall debt burden and riskiness of that sector. Moreover, if the bank can "substitute" assets into a structured pool, the bank may have the incentive to substitute "bad loans" into the securitized pools and keep the higher-performing loans on the bank's balance sheet. The same process can occur in the area of property insurance, where the structured note payouts are closely linked to the insurance company's insured properties (i.e. the insurer may place higher risk properties into the pool). As a result, investors must be careful to evaluate, control, and price for moral hazard opportunities in each ABS structure.

The limited experience so far in trading some types of cash flow steams incorporated in ABS also suggests that such securities may be subject to risks that are presently unforeseen by issuers and investors. Non-traditional swaps and options, which are not asset-backed, are subject to all of these potential disadvantages as well as the additional regulatory and market risks of undertaking off-balance sheet exposures. Finally, because of the types of cash flows covered by some of these securities and the fact that they usually contain embedded options, conventional valuation methods are not likely to be adequate to evaluate the risk-return trade-offs provided by many of these securities. The next section proposes a valuation methodology that may overcome this last limitation.

## Evaluating the Risk-Adjusted Returns of Non-traditional ABS

With an understanding of the dynamics underlying non-traditional ABS and other new products, we now turn to the issue of how pension fund managers should value these securities. As discussed above, the first objective in evaluating any security with an embedded option is to ensure that the security's return at least compensates the investor for the expected value of the loss being transferred. While few would argue with this presupposition, prospective investors often find the process of evaluating the expected loss transferred under these transactions challenging.

### *Measuring the Expected Loss Transfer*

The rating agencies have tried to bring some clarity to the process of measuring expected losses on non-traditional ABS in their assignment of ratings. Specifically, the rating agencies generally apply the same "probability of default" methodology to structured transactions as applied to credit transactions. As an example, we consider the corporate bond default rates from 1990 to 2001, shown in Table 13-7. Since a BB-rated corporate credit is expected to have an average annual default rate of approximately 1.2 percent, a Ba-rated ABS should be expected to have an average probability of loss of 1.2 percent. Moreover, since most of the options embedded in non-traditional ABS represent low frequency/high severity risks, market participants often assume a 100 percent severity and use this approach to examine the expected loss of each transaction. As such, a ratings-based approach, while not a substitute for a full analysis of the underlying risk, provides a good first approximation in evaluating the return structure of an ABS deal.

Although bond ratings provide guidance when evaluating non-traditional ABS, they need to be supplemented by other sources of information that allow the investor to understand the financial, economic, and physical processes underlying the potential losses on each contract. For example, if we look at the estimated annual expected losses of five BB-rated CatBonds issued during 1999, the estimated annual expected loss on each transaction ranged from 0.30 to 0.75 percent, with three of the deals estimated pegged to the 0.42–0.45 percent range (Lane, 2000). Thus, the pricing of these securities imply that either the probability of an event or the expected loss given an event occurs is less than for comparably rated securities with different underlying risks. A straight application of a ratings-based approach would have overestimated the actual amount of loss transfer in these securities, understating the true expected return on the bonds.

Within a given asset-class, ratings provide a more uniform standard. Nonetheless, investors need to understand the underlying risk dynamic of each risk. Investors in CatBonds need to understand the dynamic processes underlying catastrophe risk; investors in weather-linked securities need to understand the physical processes associated with degree-days; and investors in credit-linked notes need to be comfortable with evaluating the financial and economic conditions that influence defaults. As such, investing in non-traditional ABS involves a significant investment in education and risk measurement tools by the investor—an investment that often forces investors to concentrate their expertise into just a few non-traditional markets.

Fortunately, since the early 1990s, significant advances have been made in the modeling of non-traditional risks. During this period, considerable research has been devoted to the development of pricing models for catastrophe risk (e.g. Dong, Shah, and Wong, 1996; Cummins, Lewis, and Phillips, 1998; Aase, 2001), weather risks and power risks (e.g. Lucia and Schwartz, 2002), and mortality-linked securities (e.g. Blake and Burrows, 2001). Moreover, firms such as Applied Insurance Research, Risk Management Solutions, and EQECAT have entered the

TABLE 13-7 Annual Default Rates on Corporate Bonds: By Rating

| *Rating Class* | *1990* | *1991* | *1992* | *1993* | *1994* | *1995* | *1996* | *1997* | *1998* | *1999* | *2000* | *2001* | *Average 1990–2001* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aaa | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00 |
| Aa | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00 |
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.17 | 0.01 |
| Baa | 0 | 0.29 | 0 | 0 | 0 | 0 | 0 | 0 | 0.12 | 0.11 | 0.39 | 0.3 | 0.10 |
| Ba | 3.37 | 5.43 | 0.31 | 0.57 | 0.24 | 0.7 | 0 | 0.19 | 0.64 | 1.03 | 0.91 | 1.19 | 1.22 |
| B | 16.18 | 14.56 | 9.05 | 5.86 | 3.96 | 4.99 | 1.49 | 2.16 | 4.15 | 5.88 | 5.42 | 9.35 | 6.92 |
| Caa-C | 53.33 | 36.84 | 27.91 | 30 | 5.26 | 12.07 | 13.99 | 14.67 | 15.09 | 20.05 | 18.15 | 32.5 | 23.32 |
| Investment grade | 0 | 0.07 | 0 | 0 | 0 | 0 | 0 | 0 | 0.04 | 0.04 | 0.14 | 0.17 | 0.04 |
| Speculative grade | 9.9 | 10.47 | 4.98 | 3.61 | 1.99 | 3.41 | 1.7 | 2.09 | 3.43 | 5.65 | 5.88 | 10.2 | 5.28 |
| All corporate | 3.73 | 3.45 | 1.42 | 1.02 | 0.61 | 1.1 | 0.54 | 0.68 | 1.26 | 2.2 | 2.34 | 3.77 | 1.84 |

*Source*: Derived from Moody's Investor Services, Default and Recovery Rates of Corporate Bond Issuers (February 2002).

market with simulation models to evaluate the risks being transferred within securities backed by a variety of natural phenomena. Historical weather data are available to help develop prices for weather-linked securities. However, the fact that non-traditional methodologies and databases must be used in evaluating these securities and the absence of traded market prices for these securities increases the costs of valuing their risk-return trade-offs and imposes a steeper learning curve on investors in comparison with securities based on more familiar cash flows.

The learning curve is less steep for institutional investors entering the credit-linked ABS market. Significant progress has been made in evaluating credit risk and pricing credit-linked securities. The credit risk pricing methodologies are available to address wide variety of asset-types and pricing requirements. For traded assets, these credit risk tools include simple rating migration models, term structure models of credit-spread risk, reduced form term structure models of default risk, and structural models of default risk. Furthermore, these models are readily available from commercial vendors such as CreditMetrics, Kamikura Corp., and KMV Inc. For non-traded assets, statistical hazard rate models, discriminant analysis, and neural network techniques have been applied to evaluate the credit risk profile of a portfolio of assets classes. Thus, while no one credit risk pricing model has been accepted as the dominant methodology, sufficient technology exists today for pricing a wide variety of credit-risk sensitive products. For the interested reader, Kao (2000) provides a brief overview of these different credit risk methodologies.

*Estimating Risk-Adjusted Returns*

Once the pension fund manager understands the portion of the return in excess of the risk-free rate going to compensate for the expected loss transferred, he can analyze the risk-adjusted return for underwriting this type of risk. To analyze the risk-return trade-offs of alternative investment strategies, most pension fund managers look to the traditional one-factor CAPM to assess the risk-adjusted return required for investing in any particular asset class. Based on the assumption that either all asset returns are normally distributed or that investors have mean–variance preferences, the CAPM model shows that, in equilibrium, all assets will yield the same equilibrium *risk-adjusted* rate of return. As a result, the expected return on any asset or portfolio can be computed as a simple combination of the risk-free rate of interest and a market risk premium based on the asset's estimated beta:

$$E(r_a) = r_f + \beta_a[E(r_m) - r_f] \tag{13.1}$$

where $r_a$ = the return on a given security or portfolio; $r_f$ = the risk-free rate of interest; $r_m$ = the return on the market portfolio; and

$$\beta_a = \frac{Cov(r_a, r_m)}{Var(r_m)} \tag{13.2}$$

The significance of the traditional CAPM model in the pension investment world is highlighted by the fact that fund manager performance is regularly evaluated based on the ability to consistently outperform specific market benchmarks. "Outperform" is usually measured directly in terms of the fund manager's ability to generate $\alpha$-return, defined by.

$$\alpha_a = E(r_a|\Theta) - \beta_a[E(r_m) - r_f] - r_f \tag{13.3}$$

In Equation (13.3), $E(r_a|\Theta)$ represents the expected return on a given asset/portfolio based on the information set used by the investment manager ($\Theta$). Hence, in equilibrium, the $\alpha$-performance of any investment fund manager should be zero unless the manager has superior information on investments. Alternatively, positive indicates that a given pension investment fund manager is adding value in comparison to passively-managed index investment strategies.

The assumptions underlying the traditional CAPM model, however, generally do not hold with respect to assets like ABS, whose return distributions are often highly skewed. First, the return distribution of ABS are usually a function of a collateral pool and a short call option that allows the issuer to transfer losses to the holder of the ABS under certain low frequency/high severity events. Portfolios with embedded options of this type generally are not normally distributed. Secondly, as highlighted by Kraus and Litzenberger (1976), investors value positive skewness in evaluating alternative investment strategies. As such, assuming that investor preferences are completely defined using a simple mean–variance framework will lead to asset mispricing for assets with non-symmetric return distributions.

Leland (1999) highlights the importance of this asset mispricing and demonstrates that any mispricing ultimately manifests in biased estimates of the investment fund manager's $\alpha$-return. Thus, measuring a fund investment manager's performance under a traditional CAPM model will lead to biased estimates of excess returns. More importantly, the traditional CAPM measure could provide incentives for the investment manager to purchase too much or too little non-traditional ABS for the pension portfolio, moving the fund return away from the efficient security market return line. Fortunately, Leland (1999) also demonstrates how a correction to the traditional CAPM model can provide unbiased estimates of investment fund performance without the need to develop more sophisticated valuation

TABLE 13-8 Estimated Excess Returns Representative ABS (1999)

| *Issuer/Asset Class* | *Term (Years)* | *Security Rating* | *Volume ($ US Millions)* | *Estimated Excess Return* |
|---|---|---|---|---|
| CatBonds | | | | |
| Domestic Re (Kemper) | 3 | BB+ | 80 | 3.24 |
| Concentric Re (Oriental) | 5 | BB+ | 100 | 2.72 |
| Residential Re | 1 | BB | 200 | 3.27 |
| Golden Eagle CatBond | 2 | BBB− | 50 | 2.28 |
| Credit Risk | | | | |
| Gerling SECTRS—C | 3 | BBB | 82 | 1.00 |
| Weather Risk | | | | |
| Kelvin 2nd Event | 3 | BBB− | 23 | 4.52 |

*Source*: Lane (2001).

*Note*: Excess return represents spread over risk-free rate and premium for expected loss.

models. Specifically, he shows that the discrete time asset-pricing model developed by Rubinstein (1976) can be used to adjust the traditional CAPM model to account for investor preferences for higher moments of the return distribution. The key assumptions for making this adjustment are that the return on the market portfolio is independent and identically distributed at any moment in time and that the market is complete in the sense that the law of one price holds and all relevant risks are traded in the market. Both assumptions are consistent with assumptions used in conducting empirical research on market returns and the notion that a representative investor values higher moments of any given return distribution (e.g. skewness and kurtosis).[20]

Following Leland, we can evaluate the risk-adjusted returns of alternative asset classes like non-traditional ABS by evaluating the return dynamics of the underlying asset portfolio and adjusting for a modified measure of the market price of risk. Using this approach provides a better criterion for evaluating the attractiveness of these assets within a portfolio for a pension fund. It also provides a better measurement framework for assessing the performance of fund managers relative to benchmark returns.[21]

Table 13-8 provides a useful illustration of the value of this approach. Here we examine six different ABS deals that include three traditional catastrophe bonds, the catastrophe bond issued for the Oriental Land company, Gerling's European credit risk structure, and the Kelvin Weather derivatives structure. With the exception of the USAA transaction, all of these deals were multi-period, carried ratings between BB+ and BBB, and had a notional value in the range of $23–$100 million. Moreover, using information from Lane (2001), we computed the excess return over the estimated expected loss associated with each transaction. What is striking about this comparison is that the excess returns built into the CatBonds and weather derivatives are 250–450 bps in excess of the expected loss, whereas our pricing approach would suggest that these zero-b securities should be priced at or near the expected loss being transferred. At the same time, the excess return offered on the Gerling transaction—a transaction with significant systemic risk (positive b)—is relatively thin as compared with other ABS structures. This result, which is consistent with other studies, illustrates the value in correctly pricing these securities and the potential benefits of including a portion of these securities in a pension fund's asset allocation strategy.

## Conclusion

Financial innovation has led to the creation of several new classes of securities that provide opportunities for institutional investors to improve the efficiency of their portfolios. Our objective here has been to provide information on the design and valuation of some of the more promising and innovative securities that have been introduced. We focus primarily on non-traditional ABS and also discuss several innovative derivative securities on non-traditional underlying assets and cash flows.

Securitization of non-traditional cash flows and risks has been driven by both demand and supply factors. Demand for new securities arises when new risks appear and when existing risks become more significant in magnitude. Risk expansion helps to explain the development of mortgage backed securities during the 1970s and 1980s, catastrophic risk bonds and option in the 1990s, and many other financial innovations. Supply factors driving the market include the development of modern financial models, which enable investors to price and value the new securities, as well as technological and communications advances that give more flexibility and modeling power to financial engineers. These factors have combined to permit the securitization of cash flows that were previously held on-balance sheet by financial intermediaries and industrial firms as well as the securitization of cash flows that were not previously considered viable candidates for financing or trading.

The development of non-traditional ABS and derivatives on non-traditional underlyings provides significant opportunities for pension fund investment managers. These securities provide a new source of diversification, often have attractive yields in comparison with comparably rated conventional securities, and enable managers to take positions in risk-return tranches that are consistent with their investment objectives to a greater extent than in the past.

Some caution is in order in approaching this market because some of the securities are complex and may be subject to unforeseeable risks.

In addition, at the present time, many of these new derivatives are relatively illiquid. Most of these non-traditional ABS and the new derivative contracts also are characterized by highly skewed returns such that the traditional CAPM benchmarking techniques are likely to give misleading results.

Fortunately, relatively straightforward models have been developed that generalize the CAPM to give meaningful risk-adjusted return valuations for the new financial instruments. Investment managers who make the commitment to learn how to evaluate and price these contracts will be well positioned to take advantage of this important market as it continues to evolve and expand. Investment managers can expect to have access to a growing volume of privately placed contracts as well as more standardized and liquid publicly traded contracts on non-traditional cash flows.

## Notes

[1]The volume of financial transactions also has increased significantly, reflecting economic growth as well as the process of moving many assets and liabilities off-balance sheet. For example, the value of international debt instruments outstanding quadrupled during the 1990s to nearly $7.5 trillion, and the notional value of outstanding derivatives (open interest) rose from less than $1 trillion in 1986 to nearly $25 trillion at the end of 2001 (Bank for International Settlements).

[2]The collapse of Long-Term Capital Management in 1998 and Barings Bank in 1995 provide object lessons in types of disasters that can occur when various types of risks are not foreseen or appreciated.

[3]The Bond Market Association, <www.bondmarkets.com/research/mbsdat2.shtml>.

[4]Data based on "Summary of Worldwide Securitization in 2001," *Asset-Backed Alert*, <http://www.abalert.com>.

[5]Only about 60 percent of all ABS are publicly traded securities and the bulk of these are residential (RMBS) or commercial mortgage-backed securities (CMBS).

[6]Readers should be cautioned that, while we have taken extreme caution in ensuring quality of the information reported in this chapter, the information is limited in breadth and depth to what was obtainable from reliable sources. Actual deal lists and transaction detail may differ from the information reported herein.

[7]These figures are based on the definition of a catastrophe devised by Swiss Re, which defines losses as catastrophic if they exceed specified dollar valued thresholds that vary by type of catastrophe. For insured property catastrophes other than marine and aviation, Swiss Re defines a catastrophe for 2001 as an event causing at least $35.1 million in insured property loss (Swiss Re, 2002).

[8]In fact, the perception among insurers that CAT index securities are subject to unacceptable levels of basis risk has been identified as the primary obstacle to the more rapid development of the CAT-loss securities market. For an analysis of the basis risk of index-linked CAT-loss derivatives, see Cummins, Lalonde, and Phillips (2002*b*).

[9]Nine indices were available—a national index, five regional indices, and three state indices (for California, Florida, and Texas). The indices were based on PCS estimates of catastrophic property losses in the specified geographical areas during quarterly

or annual exposure periods. The indices were defined as the total accumulated losses divided by $100 million. For example, a 20/40 Eastern call spread would be in the money for a catastrophic loss accumulation in the Eastern region of more than $2 billion (20 points). Each index point was worth $200 on settlement so that one 20/40 call would pay a maximum of $4,000 (20 points times $200 per point).

[10]Over-the-counter options also have been traded, although these usually settle on insurer-specific loss criteria (Swiss Re, 2001).

[11]To better target investor appetites, USAA's notes were actually divided into an A-1 Class of $164 million that was principal protected, rated AAA, and priced at LIBOR + 273 bps; and an A-2 Class of $313 million that had both principal and interest at risk, was rated BB/BB-, and priced at LIBOR + 575 bps.

[12]USAA actually purchased private reinsurance to cover a large portion of these "retained" exposures.

[13]Surplus notes are a quasi-debt security issued by insurers in the United States that are treated as equity capital for regulatory purposes, provided that they satisfy the appropriate regulatory criteria.

[14]In addition to these deals, American Skandia has entered into a series of transactions (e.g. ASLAC Trust I and II) designed to securitize their interest in money management fees from managed mutual fund portfolios. While American Skandia is entitled to earn these fund management fees at the inception of an account, the recognition of the fee income must be accrued over the life of the fund. To expedite the recognition of these fees, Skandia has effectively sold its interest in this fee income.

[15]See for example, Capital Markets Report, Dow Jones & Company, May 1998.

[16]See, for example, BondWeek, November 19, 2001.

[17]Technically, the ownership of the aircraft assets are transferred to the SPV trust to secure the interest of investors. The trust then enters into a lease agreement with the airline for the use of the aircraft assets and provides the airline sponsor with an equity interest sized by the initial deposit for the aircraft being purchased.

[18]For more information on Aircraft Securitizations, see S&P rating criteria for aircraft securities.

[19]"Arby's Completes Innovative Securitization of Franchise Royalty Payments," TRIARC Press Release, November 22, 2000.

[20]Under these assumptions, Leland shows that the expected return formula can be re-specified as follows:

$$E(r_a) = r_f + \beta'_a[E(r_m) - r_f] \tag{13.4}$$

where

$$\beta'_a = \frac{Cov[r_a, -(1 + r_m)^{-b}]}{Cov[r_m, -(1 + r_m)^{-b}]} \tag{13.5}$$

The parameter $b$ is the market's price of risk when the return on the market portfolio is lognormally distributed (as implied by the first model assumption), and can be determined from observable market factors:

$$b = \frac{in[E(1 + r_m)] - in(1 + r_f)}{Var[in(1 + r_m)]} \tag{13.6}$$

where $in[\bullet]$ refers to instantaneous parameter estimates. Thus, the coefficient $b$ is the market's instantaneous excess rate of return divided by the variance of the market's instantaneous rate of return. Parallel to the traditional CAPM model, Leland shows how to derive an adjusted $\alpha$-estimate that differs only in the specification for the market's price of risk.

$$\alpha_a' = E(r_a|\Theta) - \beta_a'[E(r_m) - r_f] - r_f \tag{13.7}$$

[21] This approach also is superior to the comparison of Sharpe ratios since Sharpe ratios—like the traditional CAPM model—are only relevant when investors have mean–variance preferences.

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