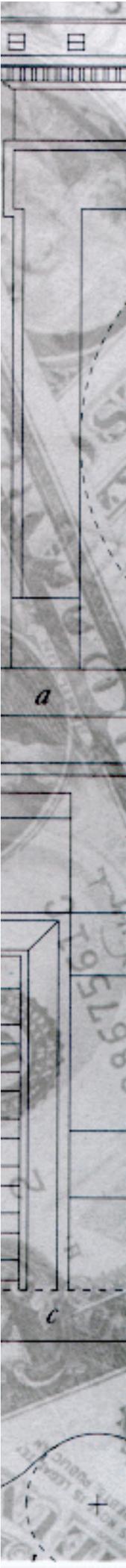

**Financial
Institutions
Center**

*Securitization of Life Insurance Assets
and Liabilities*

by
J. David Cummins

04-03



The Wharton Financial Institutions Center

The Wharton Financial Institutions Center provides a multi-disciplinary research approach to the problems and opportunities facing the financial services industry in its search for competitive excellence. The Center's research focuses on the issues related to managing risk at the firm level as well as ways to improve productivity and performance.

The Center fosters the development of a community of faculty, visiting scholars and Ph.D. candidates whose research interests complement and support the mission of the Center. The Center works closely with industry executives and practitioners to ensure that its research is informed by the operating realities and competitive demands facing industry participants as they pursue competitive excellence.

Copies of the working papers summarized here are available from the Center. If you would like to learn more about the Center or become a member of our research community, please let us know of your interest.



Franklin Allen
Co-Director



Richard J. Herring
Co-Director

*The Working Paper Series is made possible by a generous
grant from the Alfred P. Sloan Foundation*

Securitization of Life Insurance Assets and Liabilities

Submitted to:

TIAA-CREF Institute
January 3, 2004

By

J. David Cummins
The Wharton School

Please address correspondence to: J. David Cummins
625 New Gulph Road
Bryn Mawr, PA 19104
Phone: 610-520-9790
Fax: 610-520-9690
Email: cummins@wharton.upenn.edu

Securitization of Life Insurance Assets and Liabilities

By

J. David Cummins
The Wharton School

January 3, 2004

1. Introduction

Securitization is one of the most important innovations of modern finance. The securitization process involves the isolation of a pool of assets or rights to a set of cash flows and the repackaging of the asset or cash flows into securities that are traded in capital markets. The trading of cash flow streams enables the parties to the contract to manage and diversify risk, to take advantage of arbitrage opportunities, or to invest in new classes of risk that enhance market efficiency. The cash flow streams to be traded often involve contingent payments as well as more predictable components which may be subject to credit and other types of counterparty risk. Securitization provides a mechanism whereby contingent and predictable 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 and liabilities with tradeable financial instruments.

The securitization era began in the 1970s with the securitization of mortgage loans by the government sponsored enterprises (GSEs) Fannie Mae, Ginnie Mae, and Freddie Mac. These agencies were created by the Federal government with the objective of facilitating home ownership by providing a reliable supply of home mortgage financing. The securitization process enabled mortgage originators such as banks, thrift institutions, and insurers to move mortgage loans off their

balance sheets, freeing up funds for additional lending. In the process, a new class of highly rated, liquid securities were created, enhancing portfolio opportunities for investors. Since 1970, trillions of dollars worth of mortgages have been securitized, and new issue volume reached \$1.5 trillion by 2002. Following mortgaged-backed securities, the next major development in securitization was the introduction of asset-backed securities (ABS) based on other types of assets. This market began in 1985 with the securitization of approximately \$1 billion in automobile loans and later expanded to include credit card receivables, commercial mortgage loans, home equity loans, aircraft-backed loans, and numerous other asset classes, reaching a volume of about \$450 billion in new issues by 2002 (Cummins and Lewis 2003, Thompson Financial 2003).

Although the insurance industry in the U.S. accounts for approximately \$4 trillion in assets with corresponding liabilities and equity capital that would seem to be candidates for securitization, in fact securitization has been relatively slow to catch on in this industry. The first securitizations involving insurers took place in 1988 and involved sales of rights to emerging profits from blocks of life insurance policies and annuities (Millette, et al. 2002). Another innovative development occurred in 1992 when the Chicago Board of Trade (CBOT) introduced futures contracts that securitized property losses arising from natural catastrophes such as hurricanes and earthquakes. The past decade has witnessed the development of other types of catastrophic risk securities including (CAT) bonds as well as an increasing volume of life insurance and annuity securitizations. However, the volume of insurance transactions is still a very small in comparison with other types of asset-backed securities.

In spite of the relatively small volume of insurance transactions to date, securitization has significant potential to improve market efficiency and capital utilization in the insurance industry,

enabling insurers to compete more effectively with other financial institutions, increase return on equity, and improve other measures of operating performance. Securitization offers insurers the opportunity to unlock the embedded profits in blocks of insurance presently carried on balance sheet and to provide an alternative source of financing in an industry where traditional financing mechanisms are often restricted due to regulation. Securitization also offers a mechanism whereby insurers can separate the insurance policy origination function from the investment management, policy servicing, and risk bearing functions, thereby enabling insurers to utilize equity capital more efficiently. Securitization also can add transparency to many on-balance sheet assets and liabilities traditionally characterized by illiquidity, complexity, and informational opacity. However, because most life insurance asset and liability accounts are complex and opaque, securitization poses relatively difficult problems for these cash flows in comparison with the thriving securitized markets for assets such as mortgages. In addition to improving liquidity and transparency and providing a new source of finance, securitized transactions also offer new sources of risk capital to hedge against adverse underwriting more efficiently than with traditional techniques such as reinsurance and letters of credit.

The objective of this paper is to analyze securitization in the insurance industry with an emphasis on the lessons to be learned from prior securitizations as well as techniques that can be employed to mitigate the remaining impediments to the more widespread securitization of insurance risk. Because the securitization of catastrophic property risk has been discussed in numerous prior publications (e.g., Froot 2001, Lane and Beckwith 2002, Cummins, Lalonde, and Phillips, 2004), this paper focuses on securitization of life insurance and annuity cash flows and risks. The paper begins with an overview and analysis of the rationale for and structure of asset-backed securities.

This is followed by a discussion of securitization as a potential source of value-creation in the insurance industry. The principal life insurance and annuity securitizations that have been conducted in recent years are then discussed and analyzed, followed by a discussion of remaining impediments to securitization and possible approaches to overcoming these problems.

2. Overview of Securitization

This section provides an overview of securitization to set the stage for the analysis of securitization in the life insurance industry. The section begins by providing a generic model of the structure of asset-backed securities, which applies to nearly all of the securitizations that have been conducted to date. The discussion then turns to an analysis of the economic rationale for securitization, considering the advantages to both issuers and investors.

The Structure of Asset-Backed Securities

Although asset-backed securities (ABS) have been issued based on a wide range of different cash flows and a variety of marketable securities, the overall design structure of an asset-backed transaction is reasonably generic. Such a structure is illustrated in Figure 1, which incorporates the major components of a typical ABS transaction. The transaction begins with an originator, which initiates the contracts giving rise to the cash flows that are ultimately securitized. Originators include banks and thrift institutions, which generate residential and commercial mortgages and other types of loans, financial institutions such as credit card companies that issue installment debt, life insurance companies selling insurance policies and annuities, and industrial firms such as automobile and aircraft manufacturers that sell their products under various types of financing agreements. The originator provides a product to a customer or client, who agrees to make a series of payments over some future period of time. The present value of the principal and interest

payments constitutes an asset of the originator such as a mortgage or loan for a bank, an insurance policy or annuity for an insurance company, or a financing loan for a manufacturer.

In a conventional commercial or financial transaction, the originator keeps the asset generated from the sale of its product on its balance sheet. The innovation created by the ABS market is the ability of the originator to move the asset off-balance-sheet through securitization. This is usually done by transferring the asset to a special purpose vehicle (SPV), a passive financial entity that exists solely to house the asset and issue securities with the asset as collateral. The transfer to the SPV may be a “true sale,” in which case all rights to the asset are transferred to the SPV, with the originator retaining no residual interest, or the originator may retain some residual interest and/or credit obligation under the ABS arrangement. The SPV issues securities to investors, who contribute funds to the SPV. The SPV then remits all or part of the proceeds from the securities issuance to the originator in return for transferring the asset or otherwise committing the rights to the cash flows to the SPV.

Securities issued by SPVs are usually structured to appeal to various classes of investors in recognition of the different investment tastes of institutional investors, hedge funds, and high wealth individuals. Consequently, in most ABS transactions there are several classes or tranches of securities, which often have differing degrees of seniority with respect to the underlying cash flows. In many cases, it is desirable pay a floating rate of interest to the holders of the SPV securities, even though the underlying assets may pay interest at a fixed rate. Thus, it is common for the SPV to enter into a swap transaction, either over-the-counter or through an exchange, whereby the assets’ fixed rate of interest is swapped for a floating rate tied to a widely used index such as LIBOR. The swap counterparty then becomes another participant in the transaction.

ABS transactions usually involve some form of credit enhancement. This is designed to protect investors from two types of risks: (1) the risk that the originator will default on its obligations to the SPV in cases where a residual interest or obligation is retained by the originator and/or (2) the risk that defaults among the originator's customer/clients are higher than expected or the risk that other contingencies will occur that reduce the market value of the assets in the SPV. A wide range of credit enhancement mechanisms is available, which can be broadly categorized as *internal* and *external*. An example of internal credit enhancement is *over-collateralization*, whereby the value of assets transferred to the SPV is larger than the amount of securities that are issued to investors. Another common form of internal credit enhancement is *subordination*, whereby several classes or tranches of securities are issued by the SPV some of which are subordinated, i.e., designated to absorb abnormal credit events, and others with varying levels of seniority, which are protected from default risk by the presence of subordinated classes. External credit enhancement mechanisms include surety bonds, other types of credit insurance, parental guarantees, and letters of credit from financial institutions such as banks, insurers, and reinsurers.

In most ABS transactions, it is also important to have a servicing institution, which provides service to the customer/clients, monitors their payments of principal and interest, and generally maintains the integrity of the cash flows and payment process. This function is particularly important for life insurance and annuities, where policy persistency is an important determinant of the feasibility and success of an asset-backed structure. In many cases it makes sense for the originator to retain the servicing function, especially for complex financial products such as life insurance and annuities that are not fully standardized across originators. For more generic products such as residential mortgages, a specialist servicing firm may be equally or more effective.

Although Figure 1 provides a useful overview of an ABS transaction, there are many important variants of the basic structure and many important details that are not included in the figure. For example, investment banks play an important role in underwriting and marketing the securities issued by the SPV. In some transactions, there is another entity such as a trust that buys assets from the SPV and then repackages the cash flows and sells the resulting securities.¹ In addition, there are usually several classes or tranches of securities that are issued, often with very complex governing criteria regarding priority of receipt of the cash flows on the underlying assets. In some transactions, such as CAT bonds and mortality bonds, there may be no transfer of assets from the originator to the SPV. In this type of transaction, discussed in more detail below, the originator pays a premium to the SPV in return for an option which triggers payment from the SPV to the originator on the occurrence of a defined contingency such as a catastrophe or an unexpected spike in mortality. The investors contribute proceeds to the SPV and are compensated by investment earnings on the proceeds plus the option premium paid by the originator. It is also possible to combine an asset transfer to the SPV with the sale of an option to the originator, and numerous other variations on the basic theme can easily be envisioned.

To place the insurance ABS transactions discussed below in perspective, Figure 2 provides data on the issuance of asset-backed securities from 1998-2002. The figure shows asset-backed securities other than mortgage backed securities. The figure shows that ABS issuance increased from \$268 billion in 1998 to about \$450 billion in 2002. The largest category of ABS in 2002 consisted of home equity and manufactured housing loans (HEL/MH), followed by auto loans and credit card loans. Insurance securitizations are included in the category of other ABS in the figure. Clearly,

¹The separate trust entity is often used to meet legal or regulatory requirements.

the insurance industry has a long way to go to catch up with securitization trends in other sectors of the economy. Reasons for the slow growth of insurance transactions are discussed below.

Economic Rationale for Securitization

Like financial intermediation and hedging transactions undertaken by widely held corporations, the existence of securitization is difficult to explain in terms of the pure theory of finance. In the pure theory of finance, assets are traded in frictionless and complete capital markets. In such a world, the value of a stream of cash flows is determined by the amount, timing, and risk characteristics of the cash flows; and, in fact, each cash flow has a unique value regardless of its ownership. In the context of a corporation such as an originator of ABS, the Modigliani-Miller capital irrelevancy theorem, which also posits the existence of frictionless and complete capital markets, implies that the way the firm's cash flows are apportioned among various classes of claimants is irrelevant to the value of the firm. Hence, in a purely theoretical world, transferring cash flows to a SPV and apportioning them in various ways among tranches of security holders would have no impact on the overall economic value of the flows. Therefore, because securitization is costly, ABS transactions would not be undertaken in frictionless and complete markets.

The existence of widespread securitization in real world capital markets suggest that violations of the assumptions underlying perfect market finance theory are likely to be responsible for the existence of gains from trade in ABS transactions. Among the important underlying assumptions is that markets are frictionless and complete, with no transactions costs or other market imperfections, and that bankruptcy costs do not exist. Perfect markets theory also assumes that markets are free of agency costs, i.e., managers and employees of firms are assumed to pursue the objectives of the firm's owners and other claimants. Markets are also assumed to be informationally

transparent such that there are no informational asymmetries between the buyers and sellers of securities and other types of financial products. Finally, the perfect markets model does not allow for the existence of taxation and regulation, both of which can provide motives for securitization.

There are a variety of market frictions relating to transactions costs, agency costs, informational asymmetries, taxation, and regulation which provide opportunities for value-creating using asset-backed securities. Specific discussion in the context of life insurance transactions is presented below. However, it is useful to provide some general discussion of the value creation attainable through securitization. The existence of bankruptcy costs provides one important rationale for securitization. As a firm's financial condition deteriorates, it is likely to suffer financial rating downgrades which increase its cost of capital and increase the difficulty of raising new funds. In addition, firms in deteriorating financial health are likely to incur costs because of the loss of relationships with key employees, suppliers, and customers. Regulated financial institutions are especially susceptible to financial distress costs because they incur increased regulatory scrutiny, operating restrictions, and, in the extreme, seizure by regulatory authorities as their financial condition deteriorates. The sensitivity of capital and regulatory costs to financial distress provides an important motivation for securitization. In many instances, the firm can reduce its leverage, manage risk, and otherwise enhance its overall financial strength by entering into securitization transactions. One important reason for this is that securitization can be used to create off-balance-sheet entities that house assets and liabilities, with favorable capital structure implications for the originator. A number of the insurance securitization transactions discussed below have accomplished this objective.

Securitization can also help firms manage overall firm risk by providing an alternative

mechanism to deal with interest rate risk. For example, banks tend to have mostly short-term liabilities such as demand deposits, creating a source of interest rate risk if they hold long-term assets such as mortgages on their balance sheets. Securitization enables banks to utilize their expertise in originating mortgages without having to deal with the interest rate risk problems created by holding the mortgages until maturity.

The reduction of informational asymmetries provides another important role for securitization. Financial institutions such as banks and insurance companies tend to be rather opaque in the sense that there are significant informational asymmetries between the financial institutions and investors with respect to the characteristics of bank loan portfolios and insurer life insurance and annuity portfolios. In addition, life insurers invest heavily in privately placed bonds, which are not transparent to investors. Securitization permits institutions to create pools of relatively homogeneous assets such as mortgages, privately placed bonds, and insurance policies, which can be separated from the originators' other operations by segregating them in SPVs. To the extent that the institutions are willing to disclose sufficient information about the cash flows that are committed to the SPV, financial engineers and actuaries can develop simulation models that provide information to the investment community to help mitigate the informational asymmetries inherent in these otherwise opaque institutions. This in turn tends to raise the credit rating of the securities issued by the SPVs, enabling the originators to realize greater proceeds from the securitization.

The existence of agency costs also provides a rationale for securitization. Agency costs arise when the managers of the firm pursue their own interests rather than the interests of the owners of the firm. The owners' objective is to maximize firm value, whereas the managers are also motivated to maximize their own compensation and net worth, consume perquisites, and protect their

job security. This may lead to managers to forgo positive net present value projects that would add to firm value but create risks that might threaten managerial compensation or job security. Managers may also take on questionable projects in order to increase the scale of the firm because compensation tends to be highly correlated with firm size. Although mechanisms such as stock options and compensation systems are available to provide incentives for managers to behave optimally with regard to maximization of firm value, no such system is perfect and unresolved agency costs always exist. Investors tend to require higher costs of capital to provide equity or debt capital to originators to compensate them for anticipated agency costs. Such costs are likely to be relatively high in large complex organizations such as the multi-national financial conglomerates that now dominate the financial services industry, because monitoring and controlling managers is more difficult in firms that operate in a diverse range of businesses and geographical areas.¹

Securitization can help to resolve investor concerns about agency costs by isolating a block of assets or rights to cash flows in a special purpose vehicle. Because the SPV exists only to hold the assets and is a passive entity which is not “managed” for any other purpose, the investors in the SPV’s securities can focus primarily on the assets that are included in the SPV and generally can be assured that the assets are relatively insulated from the originator’s other business activities. Even in instances when the originator retains a residual interest in or credit obligation to the SPV, investors can be reassured that their interests are protected through the use of tranching and credit enhancement. Thus, even when the costs of structuring and credit enhancement are considered, securitization may represent a relatively attractive way for the originator to raise capital.

¹For further analysis of the relationship between agency costs and securitization see Iacobucci and Winter (2003).

Financial institutions can utilize securitization to reduce deadweight costs to the firm's owners arising from regulation. Both banks and insurers are subject to regulatory capital and accounting rules that do not always accord with market realities and hence create costs for the firm. Securitization can often be used to move off-balance-sheet some of the asset and liability accounts that have especially onerous capital requirements, thus freeing up capital for the firm to use in its other operations and reducing the expected costs of regulatory intervention arising from any deterioration in these asset and liability accounts. Regulatory requirements have proven to be an especially powerful motivation for securitization transactions in the life insurance industry, as will be seen in the discussion below.

Another general benefit of securitization is creation of new classes of securities that appeal to investors with different appetites for risk. In the limit, securitization can create non-redundant securities that enable investors to improve portfolio efficiency by increasing the level of achievable return for each level of risk. Securities based on catastrophic property, mortality, and longevity risk are non-redundant because the covered events are not otherwise traded in securities markets. Securities based on these risks also are likely to have relatively low covariance with market systematic risk, making them even more valuable for diversification purposes. Thus, investors can improve portfolio efficiency by adding these securities to their portfolios.

Even in cases where securities on an underlying are already traded, securitization can reduce investor transactions costs and improve portfolio efficiency by enabling investors to take on only those components of a particular asset's cash flows that accord with their preferences and portfolio needs while taking a position in assets that may otherwise be unavailable or at least difficult to replicate. For example, prior to the development of the asset-backed securities market, it was

difficult for most investors to take an optimal position in automobile loans. Investors could buy shares in auto makers such as General Motors, but would be subjected to the overall risk of GM rather than just investing in the auto loan portfolio. Moreover, GM stock is “lumpy” in the sense that a share of GM represents value-weighted proportional shares in all of GM’s various operations. Investors desiring a different weighting on the auto loan component of GM would have had a difficult time in optimally structuring their portfolios. The same reasoning applies to bank loans, credit card loans, aircraft loans, and many other assets now securitized through the ABS market. To the extent that investors find that securitized assets improve portfolio efficiency and reduce transactions costs, they are willing to take on the risk of investing in these assets for a lower capital cost than would be required to maintain the assets on the balance sheets of the originators, allowing originators to add value by undertaking the transaction. Of course, in the limit, such “arbitrage-type” gains will be competed away as the market continues to converge towards full efficiency; but the level of activity in the ABS market and low penetration of securitization in the insurance industry suggests that significant gains will continue to be available for the foreseeable future.

Securitization also can add value for investors and hence for originators by facilitating the acquisition of specialized investment information. The costs of evaluating potential investments are not zero, particularly when considering the specialized cash flow patterns and “waterfalls” that comprise complex ABS such as commercial mortgage-backed securities. By structuring an asset-backed transaction into tranches with varying degrees of seniority and informational complexity, securitization allows investors with relatively low levels of expertise to take positions in the more senior securities offered by the SPV, leaving the more complicated and risky tranches to be evaluated by specialists who can exploit informational economies of scale and recover their

investment in information over a wide range of transactions. This benefits both the senior and subordinated tranche investors and hence adds value to the transaction (Plantain 2002).

Of course, the gains from securitization cannot be obtained without incurring costs. The number and complexity of the transactions implicit in the generic ABS structure shown in Figure 1 create significant costs to undertaking such a transaction. The SPV must be established and capitalized with attendant legal and administrative costs. Financial engineering and actuarial modeling of the SPV asset cash flows must be conducted to provide information to investors. The transaction must be evaluated and given a rating by the financial rating agencies. The securities to be issued by the SPV must be designed, underwritten, and marketed; and the swap counterparty must be compensated. Direct or indirect costs must be incurred to provide credit enhancement and ongoing servicing of the assets placed in the trust. Ultimately, the transaction will be undertaken only if the expected benefits as outlined above and elsewhere in this paper outweigh all of the attendant costs. So far, expected benefits apparently have been significantly larger than expected costs for a wide variety and large volume of asset-backed security transactions (Figure 2). It remains to be seen whether this will prove to be the case in the life insurance industry.

3. Securitization in the Life Insurance Industry: General Considerations

This section provides an overview of the opportunities and driving forces behind securitization in the life insurance industry. The discussion begins by considering some of the assets, liabilities, and cash flows that are candidates for securitization for life insurers. Next, I discuss the principal economic and regulatory forces providing the impetus for securitization in insurance. The section concludes with a discussion of the traditional model of insurers as financial intermediaries serving a *risk warehousing* function and interpret securitization as a step in the

evolution away from a focus on risk warehousing and towards a model of *risk intermediation*. The rationale for this proposal is that it may ultimately be more efficient for many types of traditionally insured risks to be traded on capital markets rather than held on-balance-sheet in risk warehouses.

Candidates for Securitization

The assets and liabilities that comprise an insurance company's balance sheet represent estimates of the present values of cash flows inherent in each asset and liability account. In principle, any such account or any series of cash flows is a candidate for securitization. To provide an overview of the potential for securitization in life insurance and annuities, this section briefly discusses the cash flows and asset and liability balance sheet items that are the most likely targets for securitization activity.

Table 1 shows the principal cash flows arising from operating a life insurance and annuity business. Principal cash inflows include premiums and annuity considerations from both new and in force business, as well as investment income and proceeds from investment sales and maturities. Insurers also increasingly receive fee income from universal life and variable life insurance and annuity products. Fees typically are received for mortality and ongoing expenses as well as investment fees equal to the difference between the investment yield rate and the rate of return credited to policyholders (net interest margin).

Outflows include policy death benefits, annuity payments, and policy surrenders. Among the expense outflows, the expenses of policy origination are particularly important as the acquisition costs for insurance and annuity policies tend to be front-end loaded. Hence, insurers make an investment to put policies on the books and then amortize the acquisition costs out of the premiums, investment income, and fee income received over the policies' lifetime. This amortization process

has provided the motivation for a number of securitizations in the life insurance industry. A problem that arises with respect to the front end loading of expenses is that regulators in many countries require insurers to establish reserves for newly issued policies and usually do not fully recognize the prepayment of expenses as an offsetting asset item on the balance sheet.² Accordingly, writing new business generates a need for cash to fund the costs of acquisition and also reduces the insurer's regulatory capital, exposing the insurer to potential regulatory costs and growth constraints. Insurers also incur cash outflows for taxes, with income taxation usually imposing the most serious burden, at least from a modeling perspective.

There are a number of risks associated with the cash flows shown in Table 1 that can be managed through securitization. Among the most significant are the risks of mortality and longevity. An increase in mortality rates would adversely affect the amount and timing of death benefits paid by the insurer, while an increase in longevity would increase the cash outflows due to annuity payments. Although many insurers are hedged to a degree against mortality and longevity risk because they issue both life insurance and annuity contracts, the hedging is rarely complete, leaving many insurers exposed to adverse mortality deviations. Mortality risk traditionally has been considered relatively unimportant by life insurers because of long-term secular trends towards lower mortality and the ease of diversifying mortality risk by issuing policies to large pools of insured risks. However, the exposure to epidemics as well as the increased probabilities of mass mortality events due to nuclear, chemical, or biological terrorism suggest that insurers' traditional approach to mortality risk may be somewhat shortsighted. Longevity risk is also a concern, given the long-

²Prepaid expenses are recognized through a deferred acquisition cost asset account in U.S. GAAP accounting.

term improvements in mortality and the shift in emphasis of retirement plans in many countries away from public and towards privately funded pension schemes.

Persistency risk is also an important consideration in evaluating life insurance and annuity cash flows. As mentioned, the expenses of issuing insurance and annuity contracts are heavily front end loaded and are amortized over time out of premium and fee cash flows. To the extent that the proportion of contract holders choosing to voluntarily surrender their policies is higher than expected, future cash inflows are reduced and prepaid expenses may not be fully recovered. Policy surrenders tend to be correlated with interest rates and other economic conditions, such that potential changes in persistency tend to create both interest rate risk and market systematic risk for insurers.

Most insurance and annuity contracts also contain embedded options that create cash flow risks for insurers. For example, many contracts contain minimum interest rate guarantees, whereby the insurer agrees that the rate of interest credited to the investment component of the policy will not fall below a particular level such as 4%. Such guarantees are put options on interest rates, which impose costs on insurers even when the options are out of the money and expose insurers to significant risk, which is exacerbated by the non-linearity of the option payoff function.

In many insurance securitizations, an entire block of insurance or annuity policies is securitized. In such instances, the value of the securitization transaction reflects all of the underlying cash flows of the contracts and is exposed to all of the attendant risks. As explained below, the motivation for most whole-block securitizations undertaken to date has been to facilitate demutualization and/or to capitalize the expected future profits from the policy block. Evaluating the economic value of a policy block using modern financial concepts is equivalent to corporate capital budgeting and asset valuation. The cash flows arising from the block are estimated and then

discounted using risk-adjusted discount rates that reflect the anticipated term structure of interest as well as adjustments for market risk.³ Contingencies can be recognized by including discounting factors for mortality and persistency. The modeling can also be conducted using dynamic financial analysis, which facilitates the evaluation of risk using scenario modeling.

Various asset and liability accounts carried on-balance-sheet by insurers are also candidates for securitization. For example, many life insurers invest heavily in privately placed bonds. Such bonds tend to be illiquid, and it may be advantageous under some circumstances to liquidate private placements through securitization. Commercial mortgages originated by insurers are also candidates for securitization and, in fact, commercial mortgage transactions by insurers are commonplace. Receivables from agents, reinsurers, and other creditors also can be securitized. On the liability side of the balance sheet, various accounts are candidates for securitization. Regulation can create the need for securitization if reserve requirements do not accord with the true economic value of the liability subject to reserving or if reserving places undue strain on the insurer's regulatory capital. For example, as discussed below, term insurance reserve requirements under Regulation XXX in the U.S. have motivated at least one important securitization transaction.

Drivers of Demand for Securitization

A number of recent developments in financial markets have motivating increasing insurer interest in securitization. Perhaps the most important development in financial services market of the past two decades is the integration of the financial services sector. Deregulation and economic forces have led to the breakdown of the "fire walls" that traditionally separated financial

³Models of fair market values for blocks of insurance and annuity policies are developed in Girard (2000, 2002), Perrott and Hines (2002), and Reitano (1997).

intermediaries such as commercial banks, thrift institutions, investment banks, mutual fund companies, investment advisory firms, and insurance companies. The European Union gradually deregulated the financial services sector through a series of banking and insurance directives, culminating in the virtual deregulation of financial services in the Second Banking and Third Insurance Directives of the mid 1990s (see Group of 10, 2001). In the U.S., banking deregulation took place through a series of regulatory rulings and law changes. Among the most important from an insurance perspective were the rulings during the 1980s by the Office of the Comptroller of the Currency (OCC) allowing banks to sell (but not underwrite) annuities and life insurance. These rulings, later upheld by the U.S. Supreme Court, permitted bank entry into the life insurance business. Also important was the Riegle-Neil Interstate Banking and Branching Efficiency Act of 1994, which permitted interstate branching and facilitated the creation of the first national commercial banks in the U.S. The most important U.S. legislation affecting both banks and insurers is the Gramm-Leach-Bliley Act of 1999, permitting the formation of financial holding companies, which can own all types of financial subsidiaries, including banks and insurance companies.

The result of the European and U.S. deregulation has been an unprecedented wave of financial services sector consolidation, resulting in the creation of large, multi-national financial conglomerates offering all types of financial services (Group of 10, 2001). This development, along with bank entry into the annuity and life insurance market during the 1980s, subjected life insurers to increasing competition from “non-traditional” competitors including multi-national conglomerates, banks, mutual fund companies, and investment advisors (Cummins and Santomero 1999). The result was the elimination of the “safe haven” previously enjoyed by life insurers, leading to severe downward pressure on insurance prices and profits. Financial services consolidation and

the disappearance of the safe haven motivated a wave of demutualizations during the 1990s as mutuals sought to convert to the stock ownership form in order to compete more effectively with the international financial conglomerates in raising capital and participating in the mergers and acquisitions market. As discussed below, demutualizations often are accompanied by the securitization of blocks of insurance business previously written by the mutual insurer. For the stock insurers, including converted mutuals, the disappearance of the safe haven motivated insurers to focus on rationalizing their capital utilization in order to continue to maximize value for shareholders. As mentioned, securitization provides a mechanism that insurers can use to improve capital efficiency.

Financial sector convergence also has intensified interest in securitization because of a shift in the types of products offered by insurers and their competitors. The market has evolved away from traditional participating whole life insurance contracts and towards universal life and variable life insurance and annuity contracts. The deemphasis on traditional insurance and annuity contracts has motivated insurers to consider securitization of older blocks of insurance policies in order to realize embedded economic values and free up funds to invest in new ventures. In addition, growth in activity in the newer life insurance and annuity products has placed a capital strain on many insurers due to accounting requirements relating to prepaid acquisition costs. This is particularly an issue with variable products because the full amount contributed by the policyholder in initial premiums or annuity considerations generally is credited to the policyholder's investment account, with acquisition costs and other origination expenses recovered later from fee income and contingent deferred sales charges. The reduced margins available in these products due to intensified competition implies that the acquisition costs may be recovered more slowly than on traditional

products, providing another motivation for securitization. Insurers are also motivated to free up capital from existing blocks of business in order to invest in new distribution networks and in sophisticated information technology systems to keep pace with competitors in providing services to customers.

The adoption of SFAS 115 in 1993 by the Financial Accounting Standards Board led most insurers to adopt mark-to-market accounting for most assets for purposes of their U.S. GAAP accounting statements, and the International Accounting Standards Board has announced the objective of implementing mark-to-market accounting for insurance liabilities by 2007 (Fore 2003). The adoption of full mark-to-market accounting will place further pressure on many insurers to rationalize their use of capital, perhaps motivating additional securitizations. In addition, because market values of insurance liabilities traditionally have been unobservable due to the lack of a secondary market in insurance contracts, securitization has the potential to provide valuable information that can be utilized in calibrating models for valuing non-securitized blocks of business. In effect, by securitizing parts of its existing insurance product portfolio, insurers may be able to create *tracking securities* that enable them to obtain more accurate valuation of the remainder of their portfolios of outstanding and newly issued contracts. As discussed below, the separate securitization of reserve accounts is particularly promising in this regard.

Insurance product and solvency regulation also will continue to provide situations where insurers can gain value through securitization. The evolution of reserving and risk-based capital standards are likely to create regulatory costs that can be partially mitigated through securitization. Opportunities for “regulatory arbitrage” by financial conglomerates that must satisfy both banking and insurance solvency standards are likely to continue to exist and to motivate securitizations.

Warehousing versus Intermediation: An Evolving Business Model

In a broader context, the growth of securitization is part of the evolution of the financial services sector away from traditional financial intermediaries that originated assets and liabilities that were held on-balance-sheet. The market has been trending towards intermediaries that originate various types of financial instruments that are passed through to capital markets, with the resulting risks being borne directly by investors as part of their portfolios rather than by the originating financial institutions.

The traditional insurer risk-warehousing model is illustrated in Figure 3. For purposes of this discussion, I focus on the case where customers of the insurer are hedging risk such as the risk of mortality shocks rather than purchasing investments. For example, the warehouser might be a reinsurer that writes contracts to help primary insurers hedge mortality risk. However, the same concepts apply to the case of a life insurer that raises funds by selling asset accumulation products to consumers.

Insurers following the traditional risk warehousing approach serve as originators by issuing risk hedging products to client/customers. The customers pay a premium to the insurer in return for payments contingent on the occurrence of the risks covered by the insurance contracts. The insurer then warehouses the risks on-balance-sheet and bears the risk by holding equity capital. Capital markets serve as the ultimate risk-bearer in traditional insurance and reinsurance markets, but this is accomplished through the ownership by investors of insurance company equity. Hence, investors typically do not have the option of investing in particular cash flow streams originated by the insurer as in the case of securitization transactions.

The risk warehousing model tends to have a number of disadvantages. For example,

insurance and annuity contracts held on-balance-sheet by insurers tend to be opaque to the market, making it difficult for equity holders to evaluate the firm and potentially raising the cost of capital. In addition, it is not clear that the most efficient way to provide these types of financial products is through a risk warehouse primarily financed with equity capital. Among other problems, risk warehouses tend to be subject to relatively high agency costs due to their opacity and complexity.

The alternative to the risk warehousing approach is the risk intermediary, which traditionally described the operating strategy of an investment bank. The risk intermediary model is diagrammed in Figure 4. Like the risk warehouser, the intermediary originates hedging or financing products with client/customers. However, instead of retaining the resulting risk on-balance-sheet, the risk intermediary repackages the hedging product for financing in the capital market.⁴ The risk is sold to investors in the form of various types of securities and the funding (in the case of a transaction to raise capital) or contingent payment (in the case of a hedge) reverts to the hedger. Ideally, the risk-intermediary retains little or no risk on the deal, although in some instances it is advantageous for various reasons for the intermediary to take some residual risk in return for an expected return. The intermediary maintains equity capital to bear some residual risk and finance its operations, but the amount of equity is much smaller relative to the scale of its operations than for the risk warehouse.

The risk warehousing model originally developed because regulation and limitations on the available financial and computer technology prevented the direct trading of insurance risk on securities markets. Technology is no longer a barrier, and regulators are gradually becoming

⁴As in Figure 1, there usually but not always would be a special purpose vehicle and/or a trust standing between the intermediary and investors. This detail is suppressed for purposes of the present discussion.

accommodated to the idea of securitization. The primary continuing advantage of the opaque risk-warehouse approach to providing insurance products is that it tends to protect private information on clients, products, and markets that has been developed by insurers over the years. Thus, securitization is most likely to occur where the capital efficiency and financing benefits are sufficient to offset the value of private information lost during the securitization process.

Figure 5 illustrates the convergence of the two models. The evolving warehouse/intermediary in this diagram securitizes part of the risks that had been retained in the warehouse, passing the risks along to the capital markets. The risks where the benefits of securitization most significantly exceed the costs are the first to be securitized. Other risks where the benefit/cost tradeoff is closer to a wash or where costs exceed benefits are retained within the warehouse. These are risks where the information opacity problems are greatest and/or those where the value of private information is especially high. In the evolutionary model, the warehouse/intermediary still retains a significant amount of equity capitalization but the amount of equity is smaller than for the pure risk warehousing model. Capital market investors absorb the risks of the hedgers both through securitized financial instruments and through holding equity shares in the risk warehouse. In this case, investors have the opportunity to invest in the company's equity, the performance of which reflects the overall fortunes of the enterprise, but also have the ability to invest in dedicated securities that depend upon specific cash flows that are more or less insulated from the company's overall performance.

In the context of financial intermediation, the special purpose vehicle can be viewed as a type of passive financial intermediary. This intermediary exists only to receive the proceeds of designated cash flows and pass them along to investors. Thus, the SPV probably represents the

ultimate stage of evolution away from the traditional risk warehouse model of insurance and reinsurance and is a significant step in the direction of the world envisioned by perfect markets finance theory where individual cash flows (primitive securities) are traded independently of intermediaries. In this case, of course, the active intermediary (insurer or investment bank) still exists to execute the transaction and the passive intermediary (SPV) has an important role to play in isolating the rights to a particular set of cash flows from the operational and credit quality of the originator. However, securitization and SPVs represent an important step away from the intensively managed, complex, and opaque institutions that presently dominate the insurance industry.

4. Life Insurance and Annuity Securitizations

This section discusses several of the most important insurance and annuity securitizations that have taken place over the past decade. It does not attempt to present an exhaustive list of transactions but rather focuses on transactions that are typical, innovative, and/or likely to serve as models for future transactions. The discussion emphasizes transactions that involve some degree of insurance risk, cover some elements of past and present insurance and annuity contracts, and/or are primarily undertaken as part of insurer business financing strategies.

The most significant securitizations of recent years fall into five primary categories: (1) Securitization of future cash flows from a block of business. Transactions falling into this category include so-called “value in force” securitizations, which securitize a block of insurance or annuity business to achieve a business objective such as capitalization of prepaid acquisition expenses, recovery of embedded value from the block, or exit from a geographical area or line of business. This type of transactions also includes closed block and open block securitizations undertaken to support demutualization. (2) Reserve funding securitizations. Securitizations also have been

undertaken to ease regulatory reserve requirements such as Regulation XXX which increased reserves for U.S. term life insurance policies with long-term premium guarantees. Other such transactions could be undertaken to reduce risk-based capital requirements or achieve other regulatory or risk-financing goals. (3) Life insurance risk transfer securitizations designed to protect life insurers or reinsurers against deterioration in mortality or conversely to protect writers of annuities against increases in longevity. The two final categories are (4) pure asset securitizations such as those involving commercial mortgages issued by insurers; and (5) viatical and life settlement securitizations.

Transactions falling into these five categories account for nearly all of the life insurance and annuity securitizations conducted to date. However, I do not discuss pure asset securitizations such as commercial mortgage backed securities or GIC-backed securities issued by insurers because such transactions have been extensively analyzed in the finance literature. In addition, viatical and life settlement securitizations are not included in the analysis because they have somewhat different motivations and objectives from the insurer risk-hedging and financing securitizations that are the focus of the present discussion.⁵

⁵Viatical and life settlement securitizations have been conducted in an attempt to generate a secondary market in insurance and annuity policies. In these transactions, an intermediary, often a broker or entrepreneur, will buy up life insurance policies from policyholders who would like to realize cash for their life insurance policies rather than holding them until they mature as death benefits. Often, the sellers of the policies may be suffering from a serious disease such as AIDS (this type of transaction is a viatical), but in other cases may merely seek to obtain cash by selling their insurance policy, either because it is a term insurance policy with no cash value or the broker offers the insured more than the cash value of the policy (this transaction would be a life settlement). The policies purchased by the broker or entrepreneur may be placed in a trust and then securitized for sale to investors. For further discussion see Life Office Management Association (2000) and Conning and Company (1999). An example of a life settlement transaction is a 2002 securitization by AMP Life of Australia. AMP raised \$176 million by securitizing superannuation policies created by stripping the cash value component of life

Block of Business Securitizations

Because the expense of writing new life insurance policies is generally incurred by the insurer in the first policy year and then amortized over the term of the policy, 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.

From 1996-2000, American Skandia Life Assurance Company (ASLAC) issued thirteen securitization transactions designed to capitalize the embedded values in blocks of variable annuity contracts issued by ASLAC. The trusts issuing the notes are collateralized by a portion of future fees, expense charges, and contingent deferred sales charges (CDSC) expected to be realized on the annuity policies. In its 2000-2001 GAAP annual report, the company listed twelve outstanding issues from 1997 through 2000 with total initial issue value of \$862,000. Some of the details of the transactions are shown in Table 2. The maturity of the bonds was in the range of seven to eight years, and the spreads over Treasury suggest a rating somewhere in the Baa category. The primary objective of the transaction was to provide financing for the acquisition of new business during a period when ASLAC’s variable annuity business was growing rapidly. The company received debt treatment of the issues for U.S. GAAP but favorable regulatory accounting treatment for the parent company in Sweden.

insurance policies purchased in the Australian secondary market (creating endowment policies).

In a series of transactions (known as L1-L4) dating from 1998 through 2000, Hannover Re has used “closed block” securitizations to sell four large blocks of life, health and personal accident reinsurance in the market. The sales, which totaled, 431 million Euros, were motivated by Hannover’s growth opportunities. Hannover Re achieved substantial growth in its international life and accident reinsurance business over the past few years. The company also sought to achieve continued high growth rates in certain target reinsurance markets. However, because German accounting rules require that acquisition costs from life and health reinsurance business have to be written off immediately in the year in which they are incurred, Hannover’s growth imposed a heavy burden on its profit and loss account and regulatory capital position. The company sought to capitalize the acquisition costs and future profits on specified blocks of business through securitization. The initial securitization in 1998, “L1,” raised €51 million, primarily to finance growth in Germany and Austria. The second transaction, L2 in 1999, raised €130 million designed to finance continued expansion of its life, accident & health and annuity reinsurance business in Western Europe (including Scandinavia) and North America by acquiring large blocks of existing business in what are known as *bock assumption transactions* (BATs). These transactions were innovative because Hannover was in effect acting as a “consolidator,” buying up blocks of business which provided acquisition cost financing for its client companies and then securitizing the business to recover its own acquisition costs. Consolidation has the benefits of enabling the consolidator to exploit informational economies of scale by conducting multiple transactions, increasing the size of the issue to spread the fixed costs of securitization over a broader investment base, and pooling a larger number of underlying contracts to better diversify mortality and prepayment risk.

The L3 and L4 transactions, both executed in 2000, had similar financing objectives, with

the L3 securitization (€50 million) targeting expansion in Asian emerging markets and the L4 transaction (€200 million) targeting further growth in Western Europe. In the L3 transactions, the insurers seeking capital relief through the transaction as well as the principal investors were located in the subject countries. This has the advantages of reducing informational asymmetries between the capital market investors and originating insurers (since both come from the same nation) and also helps to manage exchange rate risk because the transactions can be denominated in the same currency. In the L4 transaction, Hannover again acted as a consolidator in financing the acquisition costs of European insurers in the fast growing unit-linked life insurance market.

An acquisition cost securitization is diagramed in Figure 6. The figure is based on several transactions that have been done recently but does not represent any particular transaction. It is assumed that an originating reinsurer has created a pool or basket of insurance contracts that have been ceded to the reinsurer by a primary insurer or several primary insurers, as in the case of a consolidation transaction. In originating the policies, the reinsurer has reimbursed the primary insurers for their acquisitions costs, which may substantially exceed the first year's premiums on the policies. The remaining cash flows on the policies are sufficient to amortize the acquisition costs and provide a profit on the business. The insurer seeks to capitalize the acquisition costs and/or profit component of the policies. It enters into a transaction with a retrocessionaire, which may be an actively managed reinsurer or a special purpose vehicle. The originating reinsurer assigns the rights to a significant proportion of the cash flows on the underlying insurance policies to the retrocessionaire, who repackages the cash flows and sells the resulting securities to investors. The principal raised from the investors is passed back to the originating reinsurer to finance acquisition costs and capitalize part of the profit on the underlying policies.

As in the generic transaction outlined in Figure 1, credit enhancement is an important aspect of most acquisition cost securitizations. The consolidation of policies from several originating insurers provides one form of credit enhancement, by creating a more diversified pool of risk than if any of the originating insurers had gone to the market directly. The reinsurer also may be larger and have a better credit rating than some of the originating insurers, potentially reducing the overall costs of the transaction. In addition, the reinsurer may retain part of the securitized block of business for its own account. This may take the form of a simple quota share arrangement or could be a more complicated tranching process where a higher priority in terms of rights to the cash flows is assigned to investors. Either arrangement has the benefit of helping to control moral hazard by giving the originator a strong incentive to performing the monitoring and servicing functions, and the tranching seniority arrangement has the added benefit of providing additional security to the investors. The originating reinsurer also may provide a guarantee to the investors against adverse experience on the underlying policies for mortality, persistency, and other risks. The guarantee could be provided directly by the originator or, as in Figure 6, be purchased from a third-party guarantor. Finally, an interest rate swap could be arranged with a swap counterparty to insulate investors from interest rate risk. Of course, tranching, guarantees, and interest rate swaps add to the cost of the transaction and must be netted out against expected benefits in deciding whether the transaction is economically viable.

A second important type of block of business securitizations has been associated with demutualization transactions. Many demutualizations have resulted in the creation of *closed blocks* consisting of previously issued policies which are assigned assets and liabilities that are treated separately from the insurer's ongoing business. In some instances, the closed block cash flows have

been securitized and sold to investors. Demutualizations have occurred in many industrialized economies, including the U.K., the U.S., and Canada (Swiss Re 1999). Although closed blocks have been created in most demutualizations, only a fraction of these have been securitized. Accordingly, I first briefly discuss the motivation for forming a closed block and then focus primarily on the securitization transaction.

Mutual insurance companies traditionally emphasized so-called *participating* policies, where premiums tended to be set higher than the present value of expected future cash flows under the policies. Policyholders were granted participation rights in the experience of the insurer, whereby they received dividends if mortality, expense, and investment experience were more favorable than the assumptions used in setting the premiums. On the conversion of a mutual to the stock form of ownership, the participating policyholders contractual rights to receive dividends remained unchanged. However, conversion creates a competing set of financial interests, namely those of the converted insurer's stockholders, that did not exist prior to the demutualization (Carroll and Duran 1999). This leads to the classic owner-policyholder conflict that has been so thoroughly analyzed in the academic literature on organizational form (e.g., Cummins, Weiss, and Zi 1999). In particular, the objective of the prior participating policyholders is to receive dividend payments consistent with the practices of the pre-conversion mutual insurer, whereas the objective of the new shareholder-owners is to maximize the value of the converted stock insurer's net worth. This creates a potential conflict, whereby the shareholders would have an incentive to change the company's dividend policy to the detriment of the prior participating policyholders.

Recognizing the potential for agency conflicts, regulators have tended to require the creation of closed blocks of insurance consisting of participating policies that existed prior to the

demutualization. However, there are also sound business reasons for the creation of a closed block, as will be seen below in the context of the Prudential Insurance Company demutualization. These include the realization of the embedded profits from the closed block for use in other activities and the removal of the prior participating business from active management, freeing managers to focus on the company's current strategic objectives. The latter benefit is particularly important in the life insurance industry, where the market has moved away from traditional participating life insurance products and towards more sophisticated asset accumulation products such as variable life insurance and annuities. A final potential benefit is that creating a closed block may improve the insurer's credit rating, leading to lower costs of capital. The credit rating can be improved if rating agencies can be convinced that the closed block has been structured such that it is clearly self supporting and is not likely to have any adverse credit implications for the converted firm (Puccia, et al. 1999).

A predecessor to the closed block securitizations that have taken place in the U.S. is the "open block" securitization in 1998 of the National Provident Institution (NPI) in the U.K. This first-of-its kind transaction involved the direct sale of interests in an "open block" of life insurance policies underwritten by an insurance company. In an open block securitization of life insurance policies, a Special Purpose Vehicle (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 benefit payments, expenses, and 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 is funded through the issuance of floating and fixed rate structured notes placed directly in the capital markets

to investors interested in taking a position in the present value of future profits on these life insurance policies.⁶ This transaction is considered open-block rather than closed-block because there was no “true sale” of the underlying block of insurance policies, but rather the policies were retained on the books of NPI and hence remained subject to the credit risk of the issuer.⁷

The NPI transaction is diagramed in Figure 7. The securitized block of policies consisted of \$4.08 billion in policy values with an estimated embedded value of £487 million. Against this embedded value, the SPV, Mutual Securitization PLC, issued two amortizing sequential tranches of bonds, Class A1 bond with principal of £140 million and Class A2 bonds with principal of £120 million. The Class A1 bonds are amortized over the period 1998-2012 and the Class A2 bonds over the period 2012-2022. Mutual Securitization PLC loaned the £260 million in proceeds to NPI, enabling it to capitalize a portion of the embedded value of the block. The terms of the bond issuance called for NPI to maintain a £40 million reserve account to back the promise to pay principal and interest on the bonds. Accordingly, NPI realized £220 in funds it could use in its continuing operations, and the loan to value ratio was about 45% after netting out the reserve account (220/487). Because NPI retained the right to issue an additional £30 million in bonds, which were never issued, another relevant over-collateralization ratio was the ratio of potential proceeds to total embedded value (290/487) of about 60%. Actuarial simulations revealed that the “worst case” ratio of proceeds to embedded value would be about 80%. Hence, the bonds were

⁶ “Interest In Life Insurance Securitization Heats Up,” Commentary by Standard & Poors, October 2001.

⁷To provide some protection against credit risk, the bonds issued by the SPV were over-collateralized and the cash flows were subject to a “trigger event,” through which all cash emerging from the subject business would be trapped in a reserve account if the securities suffered a ratings downgrade to Baa1/BBB+ (Millette 2002).

given high ratings by Moody's and Standard & Poor's (A3 and A, respectively) based on the degree of over-collateralization and NPI's claims paying ability.

The NPI transaction is important because it illustrates many of the essential features of an insurance business-block securitization. Among the limitations of the transaction, however, are the lack of a "true sale," such that the bondholders were not insulated from credit events affecting NPI, and the high degree of over-collateralization. The lack of third-party credit enhancement also might have been a limitation if such credit enhancement in a true sale transaction would have been less expensive to NPI than provide the guarantee by heavily over-collateralizing the bonds.

In December 2001, Prudential Financial executed a closed block securitization of participating insurance policies simultaneous with its demutualization. Prudential issued 110 million "class A" shares in its initial public offering, raising approximately \$3 billion, and distributed an additional 456 million shares to policyholders. At the same time, it securitized the closed block by issuing debt securities and "class B" equity, which holds the residual interest in the block. The Prudential closed block transaction is representative of an emerging class of *whole business securitizations*, "through which an entire operating business is isolated, its operations codified in servicing agreements, and its cashflows dedicated to investors" (Millette, et al., 2002, p. 403).

The closed block financing raised an additional \$1.75 billion with issues of \$332.85 million of Series A floating rate insured notes due in 2017, \$776.65 million of Series B fixed rate notes due in 2023, and \$640.5 million of Series C fixed-rate notes due in 2023. The various tranches were offered to appeal to different classes of investors, including investors with preferences for investment grade corporates as well as participants in the asset-backed securities market. Prudential also raised \$175 million by issuing "Class B" stock, a tracking stock designed to reflect the value

of the closed block.

The structure of Prudential Financial after the demutualization is shown in Figure 8. The parent corporation, Prudential Financial, created a downstream holding company, Prudential Holdings, to house the overall company's life insurance business. Prudential Holdings houses both the closed block and Prudential's ongoing life insurance operations. Prudential's other subsidiaries, engaged in various other financial businesses, were separated from its life insurance operations as part of Prudential's shift in business strategy away from an emphasis on life insurance and towards a focus on diversified financial services. The closed block notes and Class B stock were issued by Prudential Holdings.

The structure of Prudential's closed block is diagramed in Figure 9. The closed block was established with \$57.7 billion in statutory assets and \$61.3- billion of statutory liabilities. The excess of liabilities over assets is attributable to the conservative regulatory valuation standards, primarily with respect to interest and mortality assumptions, that were used to calculate statutory liabilities. The actual embedded value of the closed block is expected to be positive. Prudential is required to maintain assets outside of the closed block to cover the difference between statutory assets and liabilities and meet surplus requirements with respect to policies in the closed block. The initial amount of this "surplus and invested assets" account was \$3.7 billion. The surplus and related assets are released over time as the policies included in the closed block are gradually run-off, creating a statutory net gain for the closed block. The statutory gains can be paid to Prudential Holdings as dividends and used to pay interest and principal on the debt. The present value of the release of these cashflows constitutes the embedded value of the closed block.

To shield the bondholders from any shortfall in the flow of dividends from Prudential

insurance, a debt service coverage account (DSCA) was set up within Prudential Holdings using 25% of the proceeds of the bond issue (\$438 million). Thus, the ratio of the bond proceeds to embedded value is 47% gross of the DSCA and 35% net of the DSCA, providing a significant degree of over-collateralization, at least on the basis of the estimated embedded value.

In addition to over-collateralization, a number of other steps were taken to protect the bondholders from deterioration of experience on the closed block. For example, strict investment policy guidelines were adopted for the closed block, constraining investment in a number of ways including requiring a minimum of 90% commitment to investment grade assets. The bondholders also received a pledge of approximately 15% of the shares of Prudential Insurance as additional security. Bondholders are also protected by management's ability to reduce policyholder dividend payments to reflect adverse mortality, investment, or lapse experience. This is an important feature of closed block transactions involving participating life insurance policies. In effect, the objective is to use the dividend scale as a lever to enable the block to runoff to zero by the time the last policy terminates. The bond agreement specified full disclosure by management of the experience of the closed block to ensure that management would not refuse to reduce dividend payments adequately in the event of adverse experience. Numerous bond covenants were also included to provide further protection to investors, including restrictions on Prudential Holdings incurring other types of indebtedness. Finally, the Series A and B notes were insured through a financial guarantee insurance policy issued by Financial Security Assurance (FSA).

The Prudential transaction may have been relatively advantageous to Prudential in comparison to the non-securitized closed block transactions executed as part of the demutualizations of Metropolitan Life and John Hancock. By securitizing the emerging surplus and regulatory capital

emerging from the closed block, Prudential potentially captured more of the embedded value of the underlying policies. Moreover, the capital was released to Prudential at the holding company level, facilitating its deployment in Prudential's other businesses. The Prudential deal also differed significantly from NPI because Prudential did not retain an equity stake in the closed block but rather sold the ownership rights to class B shareholders. On the downside, the Prudential deal was extremely complex and costly to set up. Perhaps such complexity is inherent in the nature of traditional participating life insurance policies, but it is difficult to envision such complex securitizations providing the model for a broader market in insurance asset-backed securities.

MONY life insurance company demutualized in 1998 and set up a closed block at that time. However, it did not securitize the closed block until April 2002, when it issued \$300 million of debt securities with an option to issue \$150 million more at a later date. The debt was in the form of floating rate insured debt securities benchmarked to 3 month LIBOR plus 55 basis points. The notes mature in January 2017 and annual scheduled amortization payments begin in January 2008. The transaction was rated Aaa by Moody's and AAA by Standard & Poor's, partly because of a third-party credit enhancement guarantee by AMBAC.⁸ MONY entered into an interest rate swap agreement, swapping fixed interest payments with a swap counterparty for LIBOR. Including the costs of issuance of \$7.4 million and the insurance premium to AMBAC (75 basis points per annum), the all in fixed interest rate paid by MONY for the notes is 7.36%.

The MONY transaction was structured very similarly to the Prudential transaction shown in Figures 8 and 9. MONY group (analogous to Prudential Financial) formed a downstream holding

⁸J.P. Morgan, *Global ABS/CDO Weekly Market Snapshot* (May 17, 2002). See also Form 10Q for MONY Group, U.S. Securities and Exchange Commission, November 15, 2002.

company, MONY Holdings LLC and transferred all interests in MONY Life to MONY Holdings. MONY life was the demutualized life insurer that housed MONY's closed block following the demutualization, analogous to Prudential Insurance. Of the \$300 million in proceeds (\$292.6 million net after offering and related expenses), \$60 million was placed in a debt service coverage account to provide liquidity and collateral for the payment of interest and principal on the notes. The DSCA will revert back to MONY Holdings if the emerging surplus on the closed block is sufficient to satisfy MONY's obligations to the note holders. As in the case of Prudential, MONY established a surplus and related assets account, in this case \$1.723 billion, held within MONY life but outside the closed block. On March 31, 2002, the closed block assets were \$5.7 billion and closed block statutory liabilities were \$7.5 billion. In effect, the transaction securitized a portion of the future profits from MONY's closed block.

The Prudential and MONY transactions were based on closed blocks of business established as part of the demutualization process. However, similar transactions can be undertaken to realize embedded values from blocks of life insurance and annuity policies that are not part of a demutualization. Such a transaction was undertaken in November 2003 by New Barclays Life. The transaction securitized the emerging surplus from the entire closed book of Barclays Life. Barclays Life was created to house the business of two prior Barclays subsidiaries which had originated the business but had ceased issuing new policies.

The Barclays transaction is diagramed in Figure 10. The emerging surplus from New Barclays life is paid to a newly created special purpose vehicle, Barclays Reinsurance Dublin Ltd. Barclays Reinsurance in turn passes the funds to Gracechurch Life Financial, which issued £400 million in floating rate secured notes due in 2013. The proceeds of the notes are passed by

Gracechurch to Barclays Reinsurance and used to finance a reinsurance contract with New Barclays Life. As part of the transaction, Barclays Bank also made a subordinated loan of £357 million to Gracechurch Life Financial. The subordinated loan was designed to satisfy obligations to the noteholders in the event of deteriorating experience on the closed life insurance block. In addition, the issuer entered into an insurance agreement with AMBAC to guarantee the notes. As a result of these credit enhancements and the general credit quality of Barclays Bank, the notes were rated Aaa by Moody's (see Moody's Investors Service 2003, Kane, et al. 2003). In effect, Barclays Bank reduced its contingent loan exposure to its life business by £400 million and obtained regulatory capital relief. This is an innovative transaction partially motivated by regulation and partially by the quest for more efficient financing mechanisms. By establishing the reinsurer off-balance-sheet, Barclays was able to obtain financing without adversely affecting its capital structure as would have been the case had the notes been issued directly by Barclays Bank.

Reserve Funding Securitizations

Another important emerging class of life insurance transactions consist of reserve funding securitizations. In these transactions, the life insurer seeks relief from regulatory reserving requirements and/or seeks to reduce its leverage in order to finance new business or reduce its cost of capital. Few such transactions have been conducted to date. However, in July 2003, First Colony Life Insurance Company, a subsidiary of GE Financial, concluded a \$300 million deal through a special purpose vehicle, River Lake Insurance Company, to obtain reserve relief under Regulation Triple X. Regulation XXX requires redundant excess reserves on certain types of level premium term life insurance policies with long term premium guarantees. The reserves are based on very conservative valuation assumptions and typically build up and disappear over the premium

guarantee period, creating a “hump-backed” capital strain for insurers writing significant amounts of this type of coverage. Insurers have sought alternative ways to mitigate the effects of Regulation XXX after finding that their original solution, letters of credit, were becoming increasingly expensive and difficult to obtain.

A hypothetical reserve funding securitization is diagramed in Figure 11. The transaction has many elements in common with the other asset-backed transactions discussed above. Debt investors purchase notes with a high credit rating due in part to a third party guarantee. The proceeds are paid into a special purpose vehicle. In this model, the SPV also has equity investors, which provide a specified amount of residual risk bearing capacity. The SPV enters into a swap transaction so that it can pay floating interest to the investors while charging the insurance company a fixed premium. The funds in the SPV are pledged as collateral for the term insurance policies issued by the life insurer, reducing the insurer’s required XXX reserve. The notes could be designed to amortize over a period of time as the statutory reserve requirements under the reinsured policy block are gradually discharged. If adverse mortality experience were to develop on the underlying insurance policies, funds would be released from the SPV to cover any shortfall. The cost to the insurer is the premium percentage paid on the debt, and the transaction presumably would be undertaken if the premium plus costs of setting up the structure is less than the costs of a letter of credit or conventional reinsurance. The transaction not only provides reserve relief but also does not adversely affect the capital structure of the insurer because the collateral account is held off-balance-sheet.

Risk Transfer Securitizations

The final type of securitization transaction that will be considered in this paper consists of pure risk transfer securitizations. Such securitizations can be used to protect an originating insurer

against adverse mortality risk in the case of life insurance or adverse longevity risk in the case of annuity and pension products. For example, it would be possible to set up an asset-backed structure where the insurer would make payments equal to the expected mortality costs under a block of policies to a SPV and receive payments based on the actual mortality experience under the block. The SPV would be funded, as usual, by issuing notes to investors, who would receive LIBOR plus a risk premium to compensate for bearing the mortality risk. The bond could be structured to track the experience on a specified block of life insurance policies. However, unlike the closed block transactions discussed above, the structure would cover only the mortality risk and not the other risks affecting the overall profitability of the policy block. Although it has been argued that such transactions would have maturity structures that might not appeal to investors (Millette, et al. 2002), in fact the maturity would not need to extend until the entire policy block had expired but only for the period when the mortality risk is relatively high.

Another approach to a mortality risk securitization is a new product, which can be called the *mortality risk bond*, and covers the insurer for higher than expected mortality. A similar product also could be structured to cover longevity risk. The mortality risk bond is very similar to a CAT bond, which covers losses from property catastrophes (e.g., Froot 2001, Lane and Beckwith 2002), except that it is triggered by adverse mortality experience. The mortality trigger could be based on the experience of a specified insurer or reinsurer or it could be based on a mortality index.

The first known mortality risk bond was issued by Swiss Re in December 2003. The Swiss Re transaction is diagramed in Figure 12. To carry out the transaction, Swiss Re set up a special purpose vehicle, Vita Capital Ltd. Vita Capital issued \$250 million in mortality index notes, retaining an option to offer \$150 million in additional notes. The notes mature on January 1, 2007

and carry a premium of 135 basis points over LIBOR. Vita Capital executed a swap transaction to swap Swiss Re's fixed premium payment for LIBOR. In return for paying the premium to Vita Capital, Swiss Re obtained a call option on the proceeds in the SPV. The option is triggered by a mortality index based on general population mortality in the U.S. and four European countries, with mortality weighted by country as shown in the Figure. If cumulative adverse mortality exceeds 130% of the actual number of deaths in the indexed pool in 2002, Swiss Re would be permitted to withdraw proceeds from the SPV. The full amount of proceeds would flow to Swiss Re if cumulative adverse mortality reached 150% or more of the actual number of deaths in 2002, with proportionate payment from the SPV for adverse mortality falling between 130% and 150%. The contract is thus structured as a call option spread on the index with a lower strike price of 130% of 2002 mortality and an upper strike price of 150%.

The Swiss Re transaction is noteworthy because it focuses directly on mortality risk and hence is much simpler to model and understand than transactions involving all of the cash flows on whole blocks of life insurance policies. Perhaps because of its simplicity and transparency, the transaction did not require a third-party guarantee to obtain a high credit rating. Basing the payoff on population mortality rather than the mortality of a specific insurer has the advantage of reducing investor concerns about moral hazard and also of basing the payoff a large and geographically diversified pool of risks. The downside of index transactions, of course, is that they expose the issuing insurer to basis risk, i.e., the risk that the insurer's mortality experience could deteriorate significantly more than that of the index. For this reason, mortality index bonds are likely to appeal primarily to large, diversified multi-national insurers or to reinsurers whose business is broadly diversified geographically.

5. Securitization: Generalizations and Prospects

It is possible to draw some generalizations from the life insurance and annuity securitizations that have taken place to date and perhaps draw some conclusions about future prospects for these transactions. One important conclusion that can be drawn from this analysis as well as from the prior financial literature on insurance (e.g., Froot 2001, Cummins, Lalonde, and Phillips 2004) is that securitization has the potential to increase the efficiency of both insurance and financial markets. Securitization can increase the efficiency of insurance markets by utilizing capital more effectively, thus reducing the cost of capital and hence the cost of insurance, for any given level of risk-bearing capacity and insolvency risk. Securitization can accomplish this goal by spreading risk more broadly through the economy rather than by warehousing risk in insurance and reinsurance companies, which have lower capacity and diversification potential than the capital market as a whole. Efficiency can also be improved by transferring risk to securities markets to the extent that removing risks from the insurance industry reduces transactions costs, agency costs, and regulatory costs. Securitization can improve the efficiency of securities markets by creating non-redundant securities, such as mortality risk bonds, which have low covariances with market systematic risks, by making other types of cash flows, such as insurance policy embedded values, available to wider classes of investors, and by creating pure play securities on these cash flows by removing them from the balance sheets of insurers.

A second important generalization is that, in spite of the potential efficiency gains from securitization, most of the transactions conducted to date have been driven in whole or in part by regulation. This is the case for the largest transactions, i.e., the U.S. closed block securitizations associated with demutualizations; but it is also true of the embedded value securitizations of

Barclay's Bank and the Regulation XXX securitizations discussed above. This situation contrasts with the market for CAT bonds and other catastrophic event-linked securities, which have been primarily motivated by risk financing needs rather than regulatory requirements. Even where regulation is not a driving force behind securitization, the fact that life insurers are heavily regulated implies that regulatory approval will be required and regulatory costs will be incurred in most securitization transactions in this industry. Thus, one important conclusion is that regulation should be restructured to facilitate securitization transactions that have the potential to enhance market efficiency, while providing less intrusive mechanisms for protecting policyholders against insolvency and management conduct risk.

A third generalization that can be drawn from the foregoing discussion is that the life insurance securitization transactions executed to date have tended to be quite complex. This is perhaps inevitable when securitizing an entire block of insurance and annuity policies, where the underlying cash flows are determined by numerous contingencies including mortality, persistency, administrative expenses, regulatory risk, insurer policy dividend decisions, and other factors. The actuarial and financial modeling undertaken in support of insurance securitizations is also quite complex and unfamiliar even to sophisticated investors. Each layer of complexity increases the degree of informational asymmetries between the investor and the issuer, reducing credit ratings and adding to costs. As a result, most extant insurance securitizations have been heavily over-collateralized and also have required the purchase of third-party guarantees. For the insurance securitization model to reach its full potential, it is important that more creative approaches be adopted than can simplify the process and increase the transparency of the transactions. In this regard, the Regulation XXX and mortality bond transactions are encouraging and perhaps suggest

that a fruitful approach in the future will be to securitize particular cash flows and contingencies rather than entire blocks of business. Although the securitization of emerging surplus will continue to remain attractive in some circumstances, stripping out particular risks and particular flows is a promising idea that may reduce costs and permit volume to increase.

Besides regulation, perhaps the greatest impediment to the growth the ABS market in life insurance and annuities is the traditional complexity and opacity of insurance and reinsurance risk warehouses. Complexity and opacity benefit insurers by enabling them to protect private information on underwriting standards, contract design, and actuarial modeling. However, in the long-run, it is likely to be advantageous to some insurers and to the market as a whole to forgo some of this private information in order to develop a more efficient market for risk-management and risk-transfer. One reason why spread costs tend to be somewhat high in insurance transactions and costs must be incurred for third-party guarantees, etc., is that significant informational asymmetries are present between risk-warehousing insurers that would like to securitize and the securities markets. This creates a classic adverse selection or “lemons” problem, which means that the market will not function optimally and in the extreme market failure may occur. Moral hazard, in terms of maintaining the originating insurer’s incentives to properly monitor and service the cash flows arising from blocks of policies, also constitutes an important impediment. To a significant degree, it may be possible to overcome these adverse selection and moral hazard problem by devising creative tranching structures for future insurance securitizations. The transactions could be structured with senior tranches that are designed to be relatively information-insensitive, which are backed by thorough disclosure and actuarial modeling, along with information-sensitive tranches, which are sold to specialist investors and/or retained by the originator. The retention of the riskier

elements of the cash flows also helps to mitigate the originator's moral hazard problem. Hopefully, the future will witness a range of transactions, some of which will unbundle and market specific risks or cash flows, and others which will use creative tranching arrangements to overcome with information problems.

A final concluding comment is that life insurance and annuity securitizations will not achieve the level of success of mortgage-backed securities and other types of asset-backed securities until a substantial volume of transactions reaches the public markets. The transactions to date have almost exclusively been private placements. By definition, such transactions do not access the entire capital market and hence do not fully exploit the potential for diversification and efficiency. In addition, private placements tend to be obscure to the investing public in general such that investors in general do not become familiar with the securities and novelty premia are likely to continue to inflate the costs of securitized financing mechanisms. For a public market to develop, some degree of standardization and simplification of transactions will be required, and market participants should keep this objective in mind when structuring future transactions.

Figure 1: Structure of An Asset-Backed Security

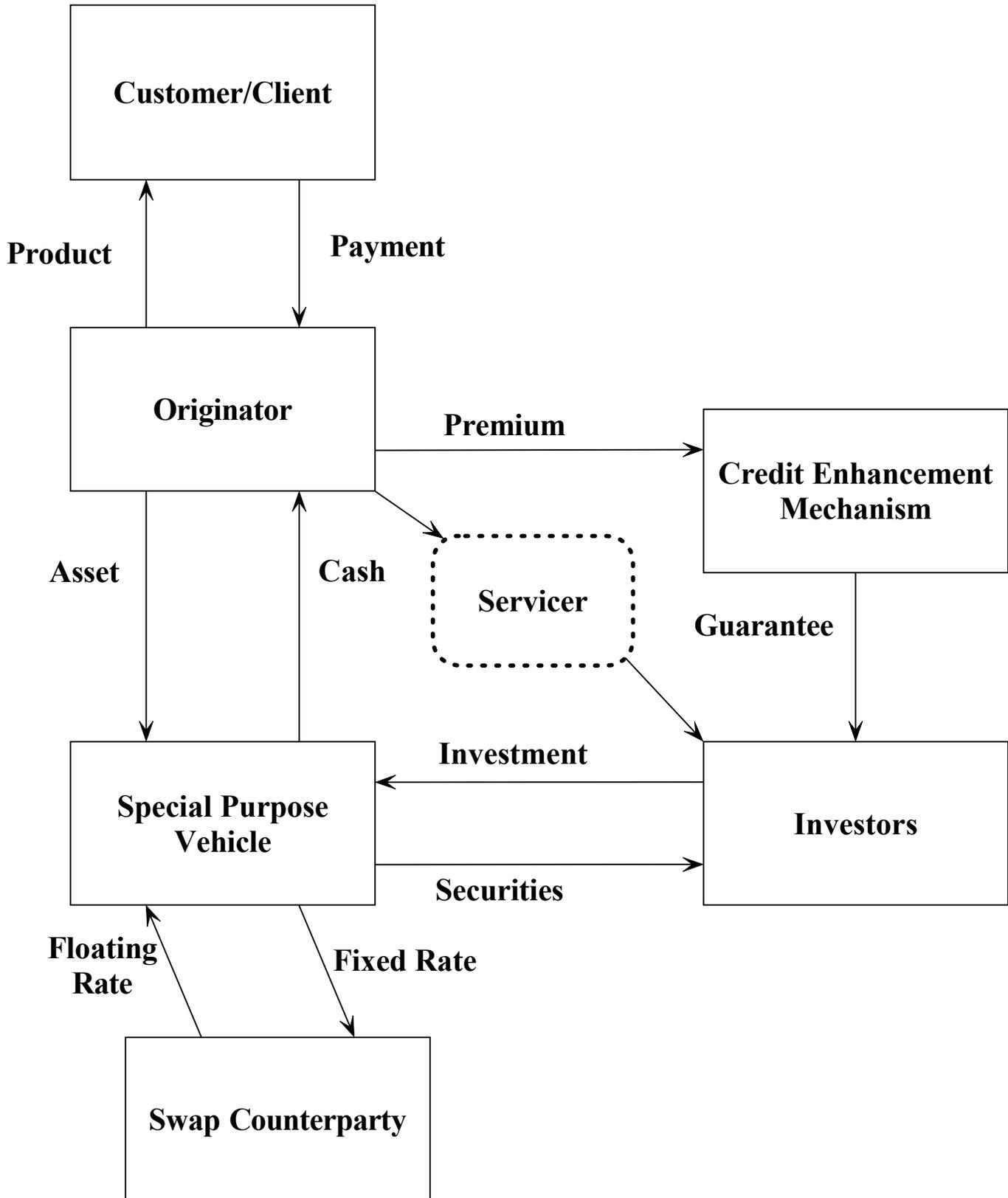


Figure 2: Issuance of Asset Backed Securities

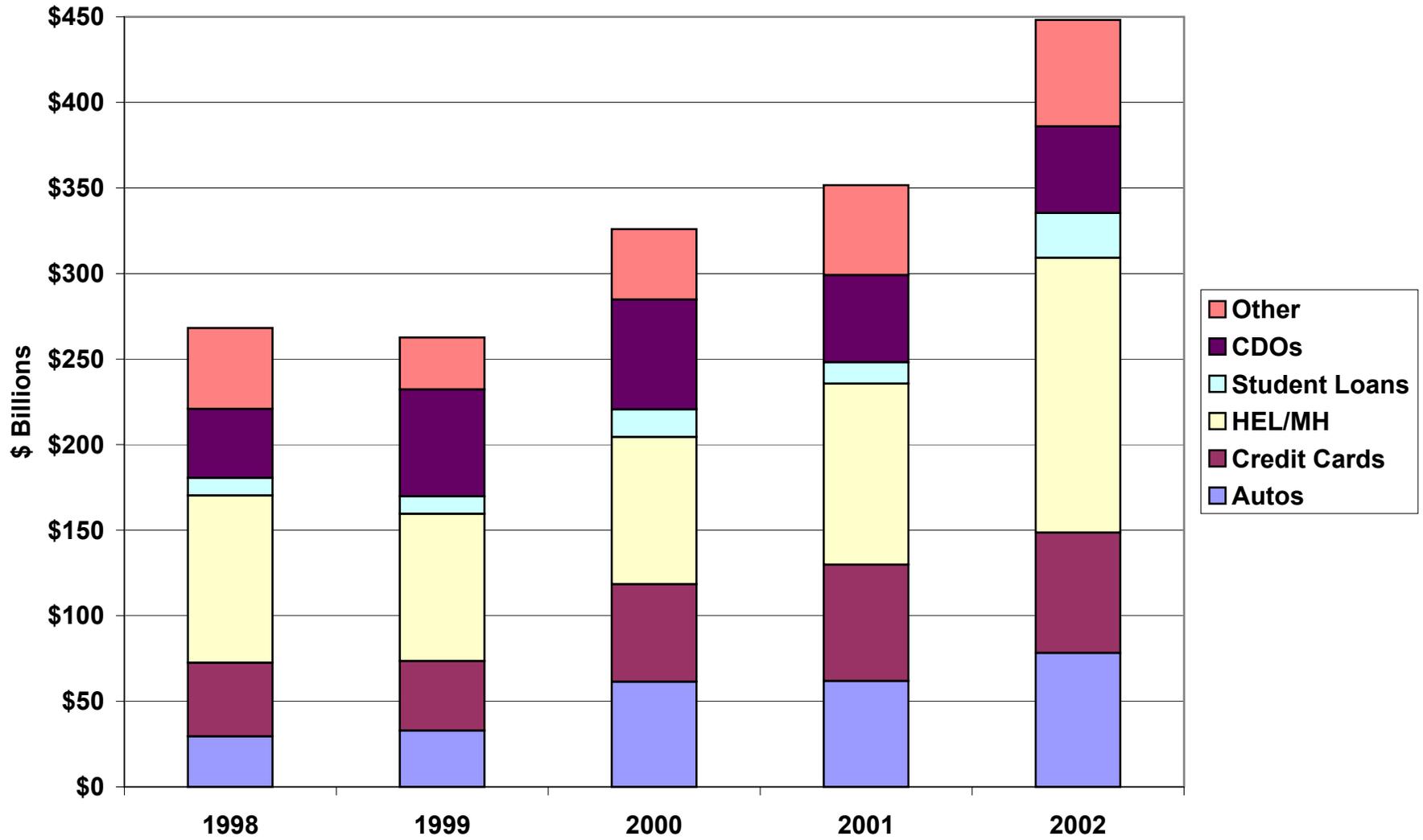


Figure 3: Traditional Insurer Model:
Risk Warehousing and Risk-Bearing

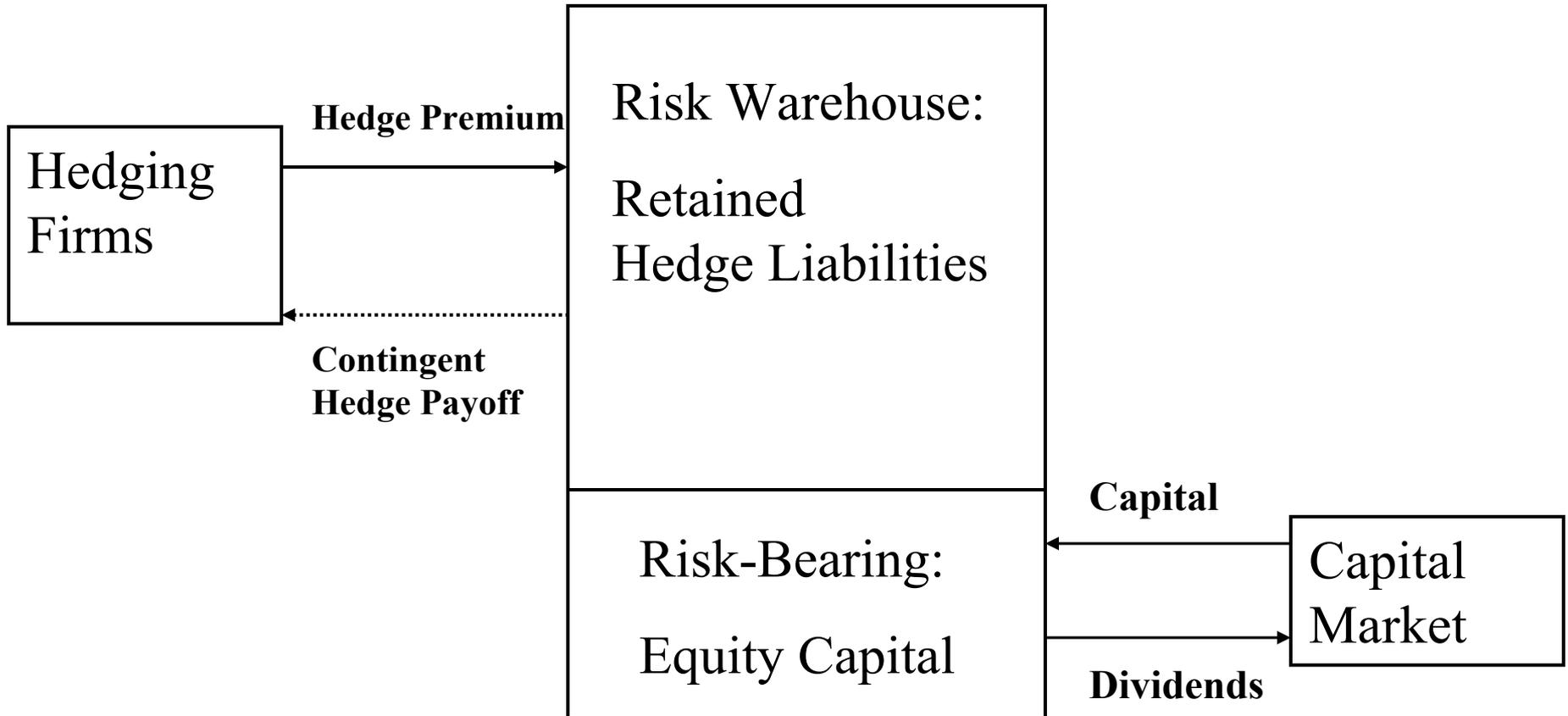


Figure 4: Investment Bank Model:
Risk Intermediation

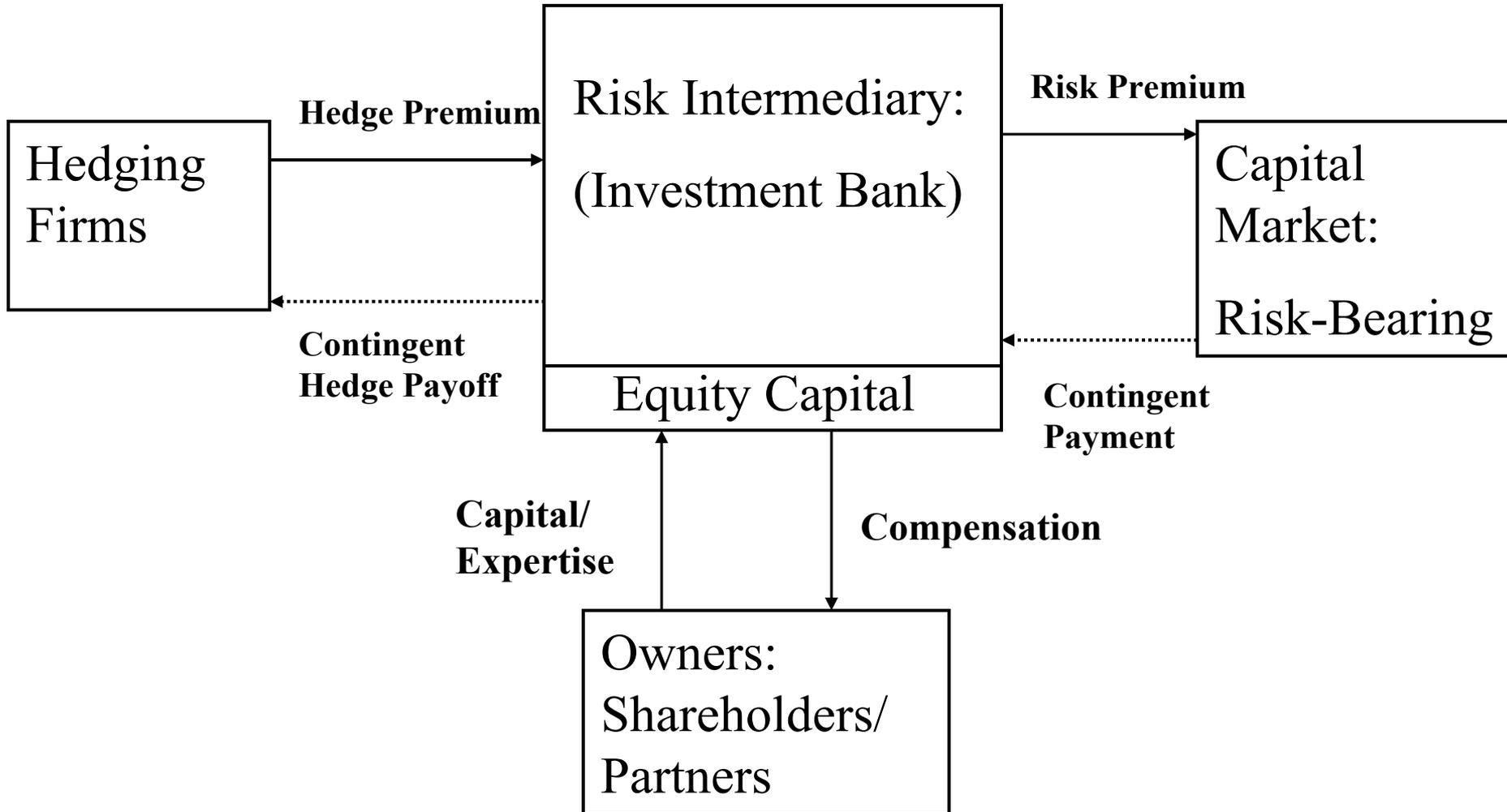


Figure 5: Convergence – Towards Intermediation

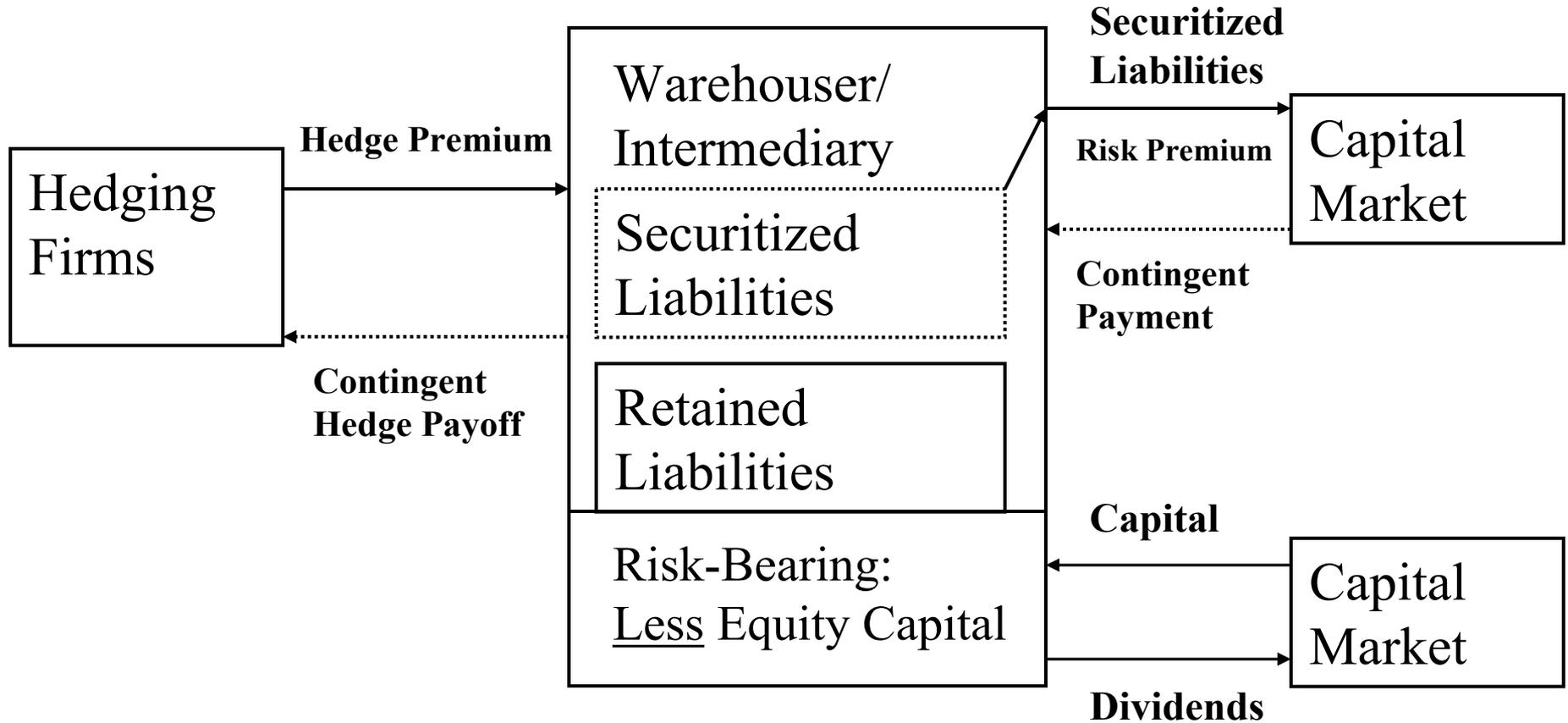


Figure 6: Acquisition Cost Securitization

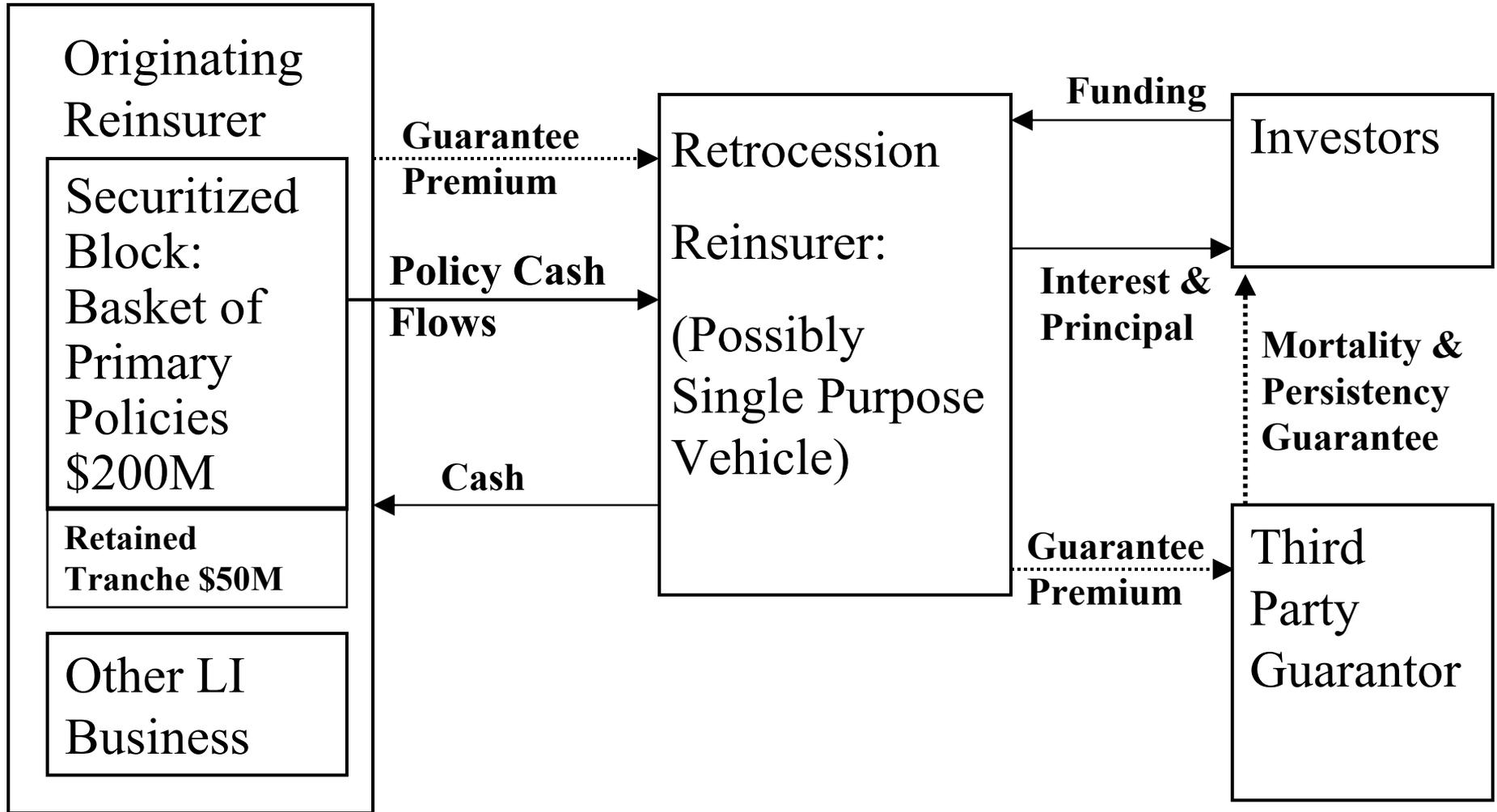
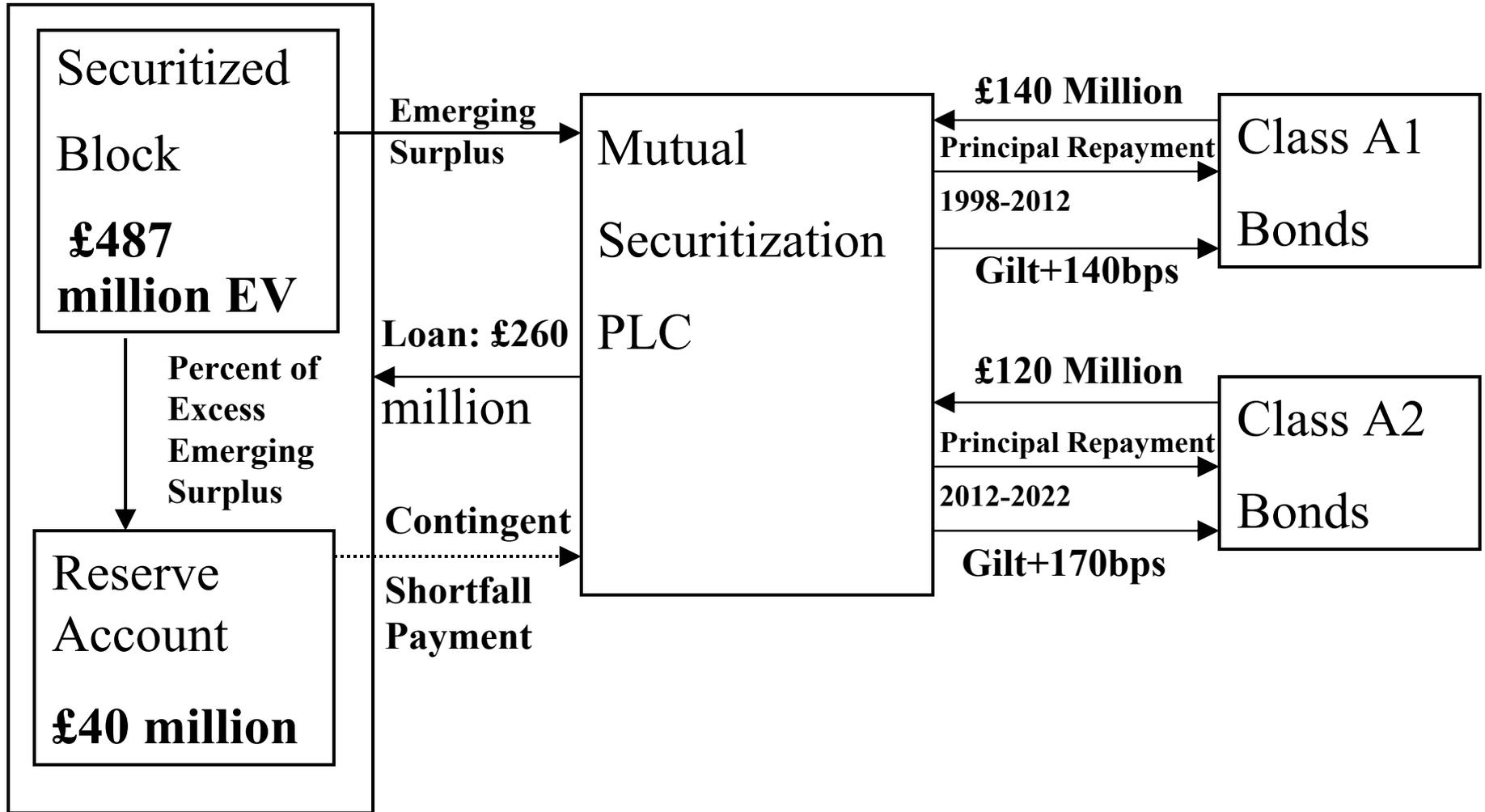
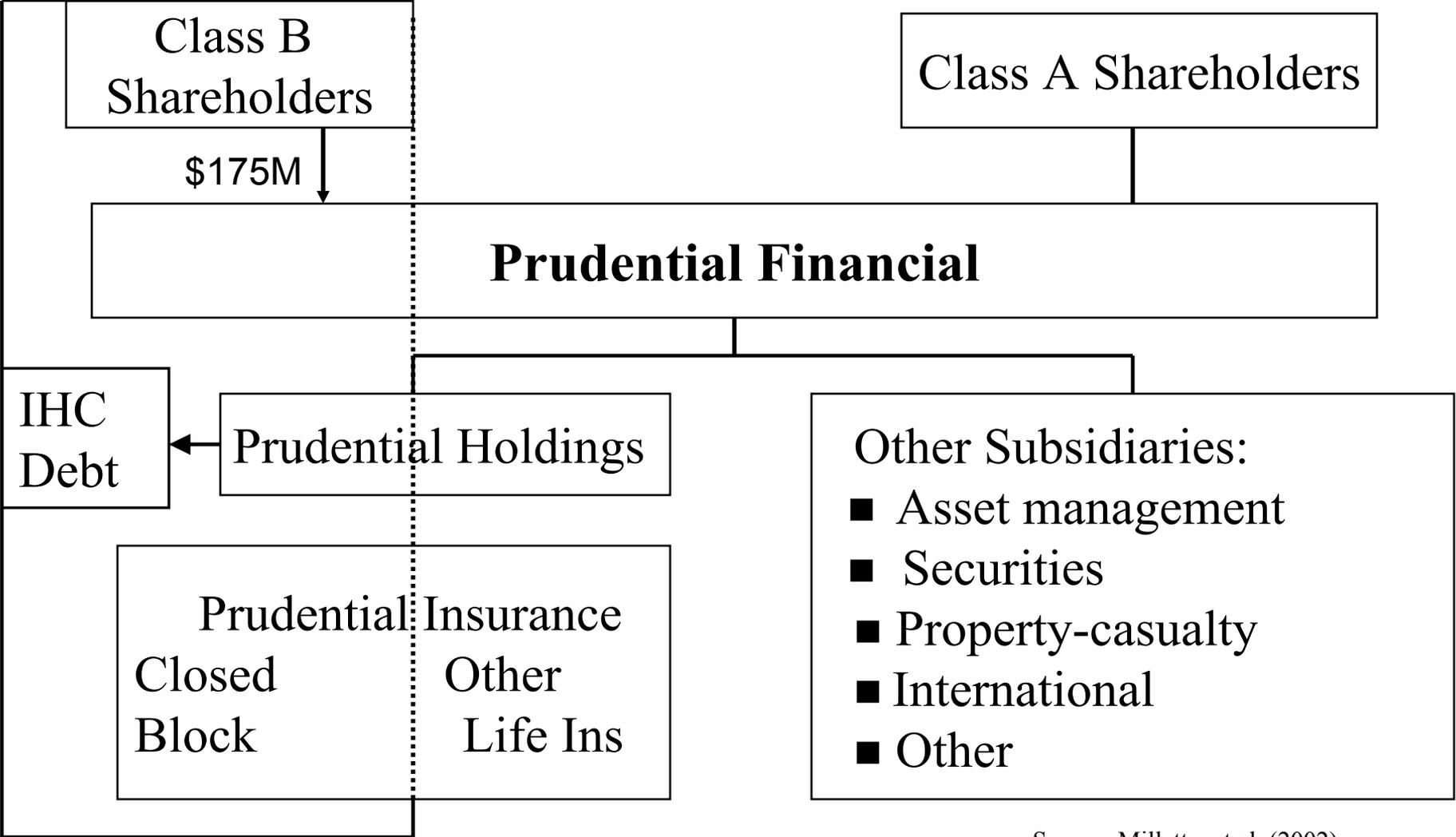


Figure 7: National Provident Institution Securitization



Source: Millette, et al. (2002).

Figure 8: Prudential Financial After Restructuring



Source: Millette, et al. (2002).

Figure 9: Prudential – Around the Block

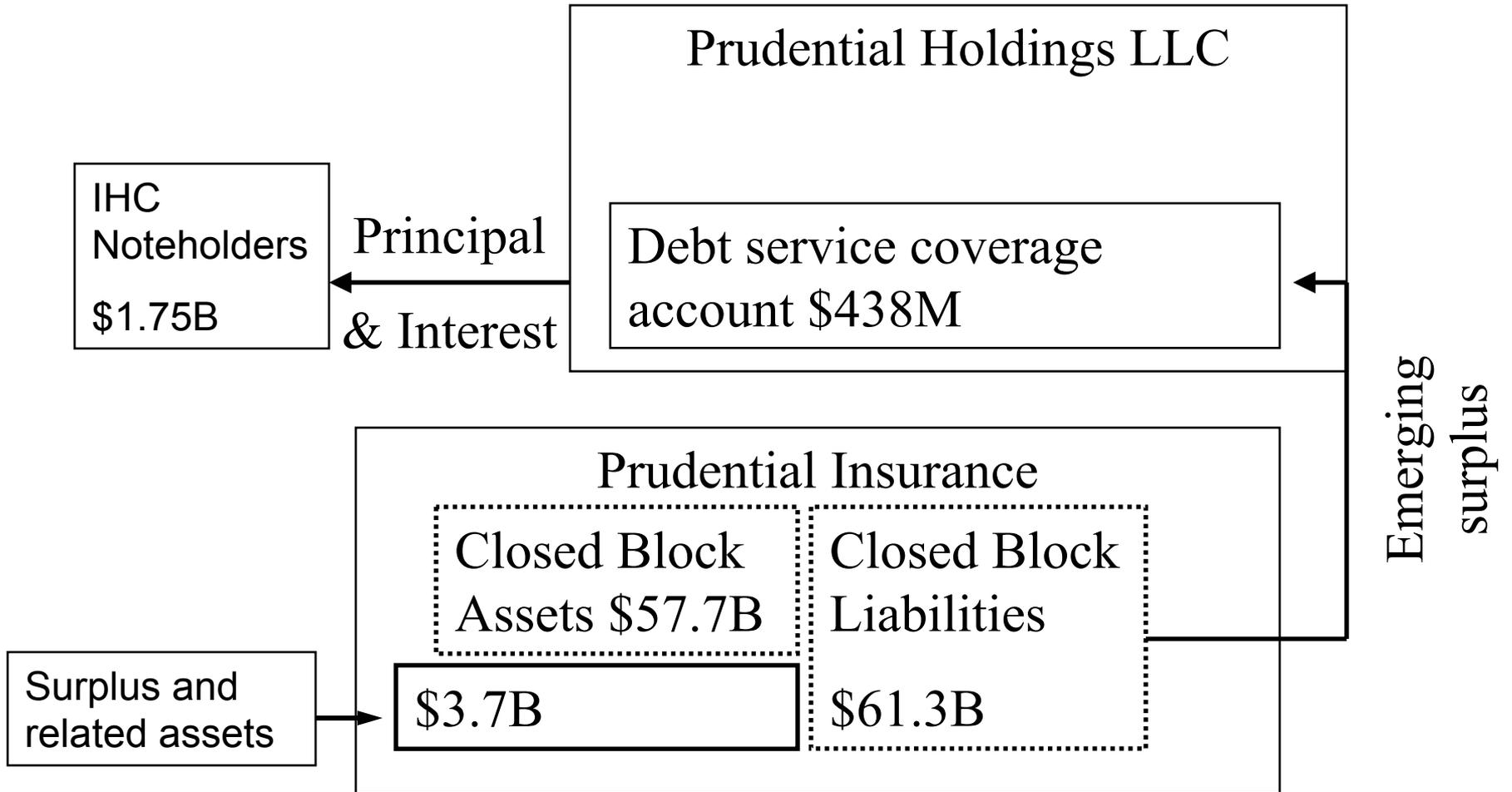


Figure 10: Embedded Value Securitization

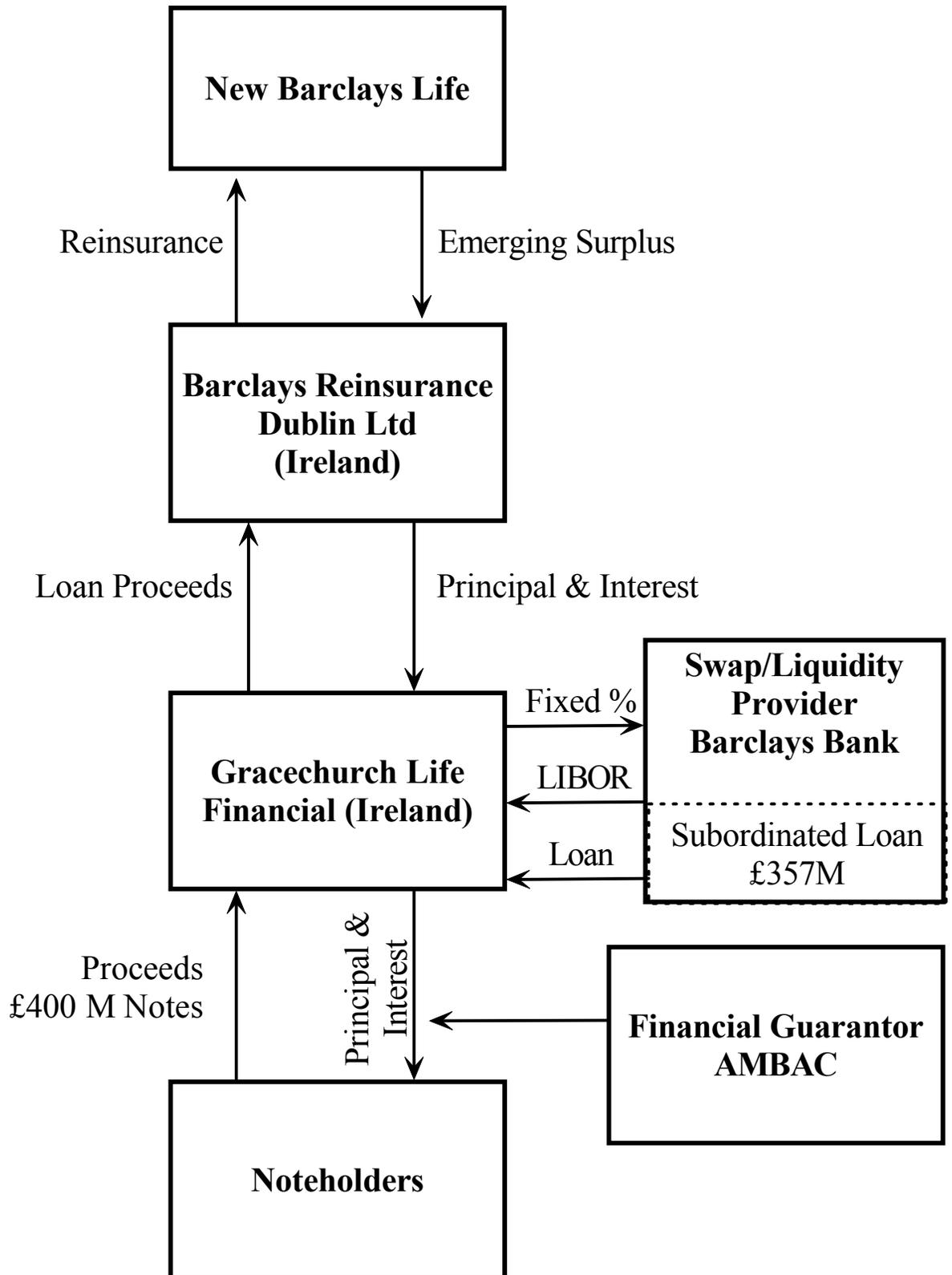


Figure 11: Reserve Funding Securitization

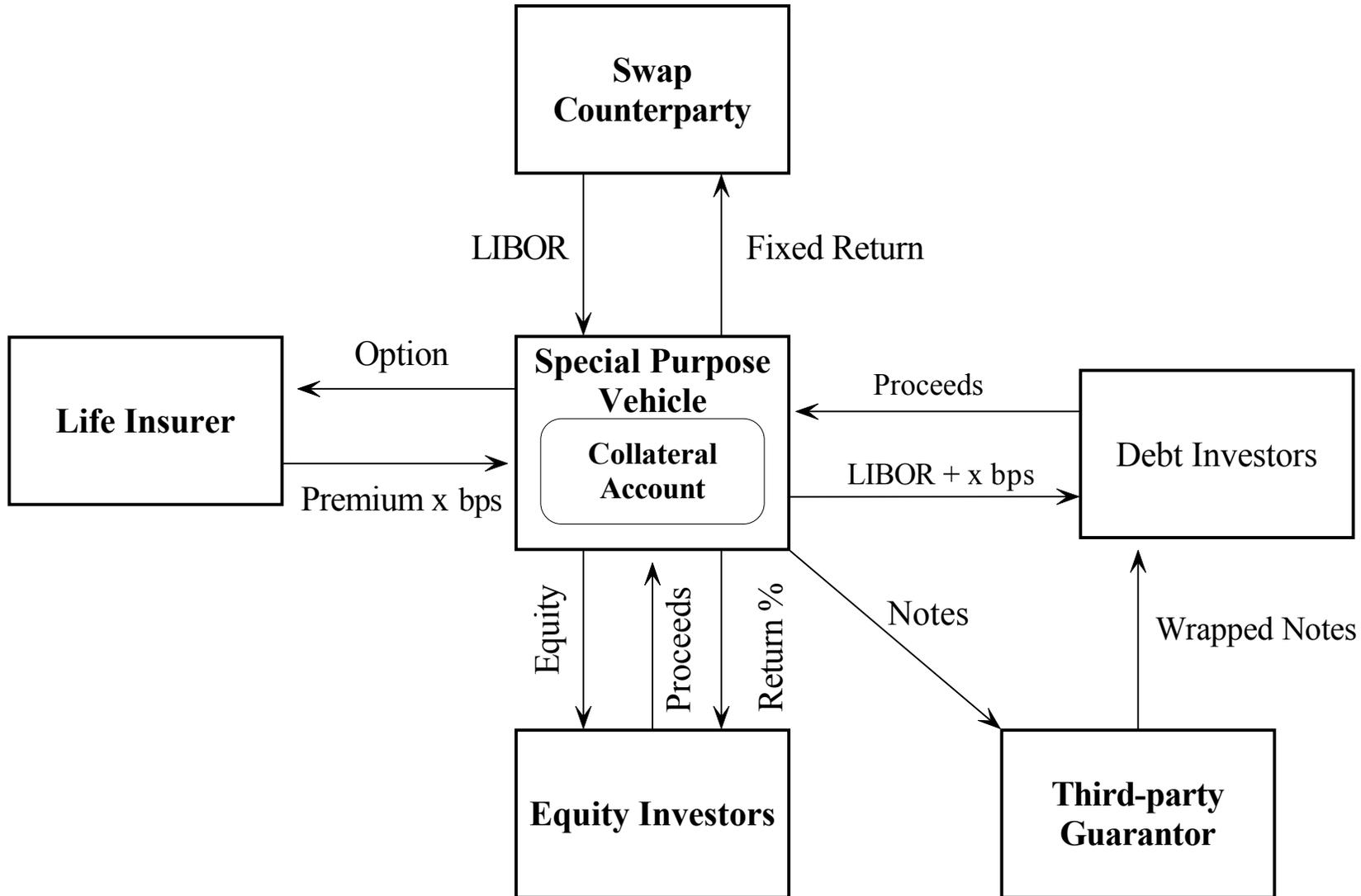


Figure 12: Mortality Index Bond

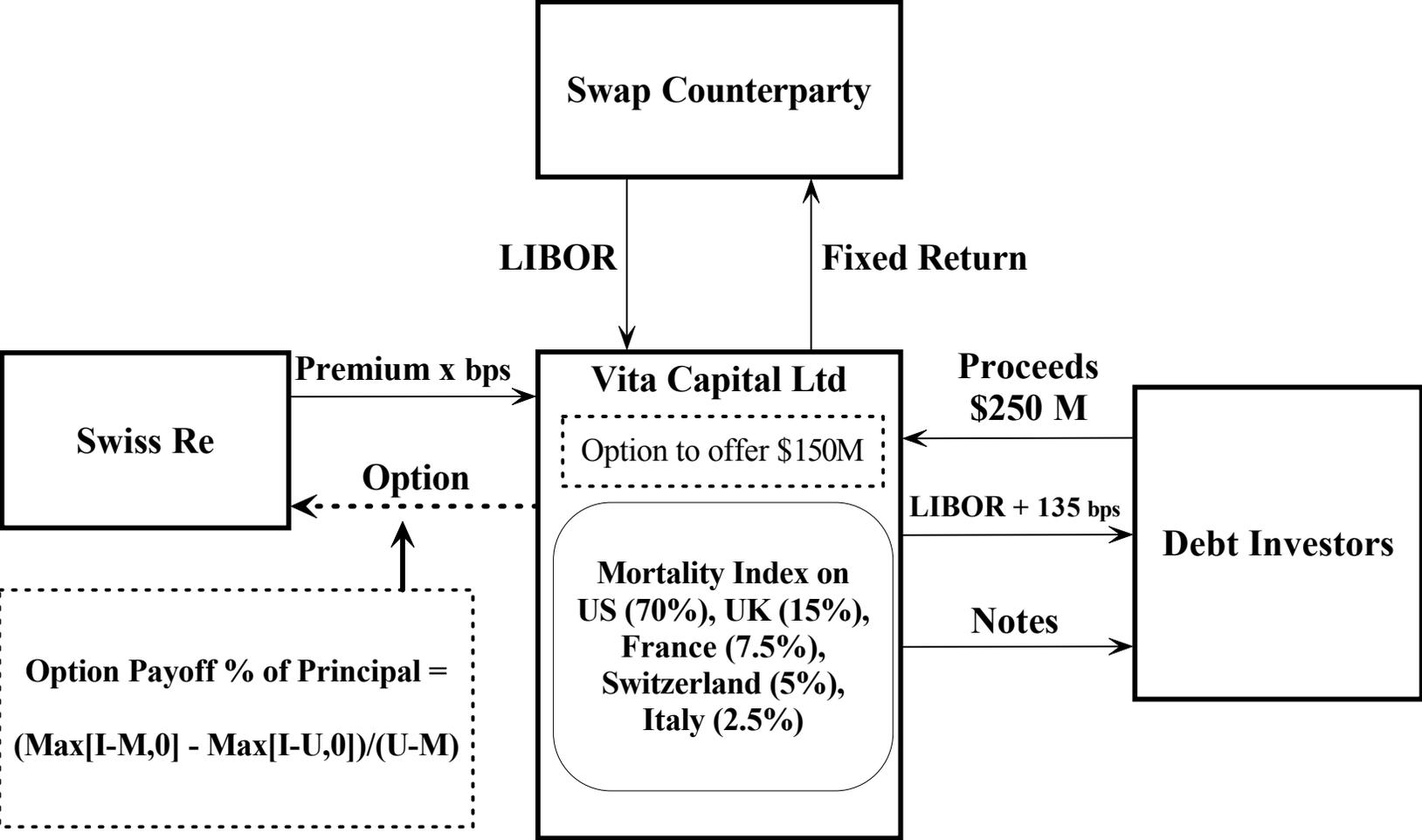


Table 1: Life Insurance Cash Flows

- Inflows
 - Premiums
 - Annuity considerations
 - Investment income
 - Investment sales and maturities
 - Fee income (e.g., variable products)
- Outflows
 - Policy death benefits
 - Annuity payments
 - Surrenders (disintermediation)
 - Expense payments
 - Origination costs
 - Ongoing costs
 - Capital expenditures
 - Taxes

Table 2: The American Skandia and Hannover Re Securitizations

A. American Skandia Notes Outstanding: 2001

Note	Issue Date	Maturity Date	Interest Rate	7Yr Treasury Yield	Spread	Amount
1997-1	7/23/1997	5/15/2005	7.81%	6.27%	1.54%	\$54,350
1997-2	12/30/1997	1/15/2004	7.33%	5.53%	1.80%	\$65,860
1997-3	12/30/1997	11/15/2004	7.35%	5.53%	1.82%	\$44,950
1998-1	6/30/1998	5/15/2005	7.16%	5.52%	1.64%	\$47,940
1998-2	11/10/1998	8/15/2006	6.38%	4.74%	1.64%	\$51,440
1998-3	12/30/1998	10/15/2005	6.42%	4.80%	1.62%	\$28,940
1999-1	6/23/1999	4/15/2007	8.47%	5.97%	2.50%	\$97,315
1999-2	12/14/1999	8/15/2007	8.93%	6.26%	2.67%	\$113,900
2000-1	3/22/2000	2/15/2008	9.16%	6.34%	2.82%	\$125,400
2000-2	7/18/2000	6/15/2008	9.19%	6.12%	3.07%	\$75,100
2000-3	1/1/2001	12/15/2008	7.34%	5.13%	2.21%	\$77,690
2000-4	12/28/2000	11/15/2008	7.49%	5.14%	2.35%	\$78,795
					Total	\$861,680

Source: American Skandia (2002)

B. The Hannover Re Transactions

Transaction	Date	Placement	Amount	Area of Application
L4	Dec-00	Rabobank	€ 200.00	Unit-linked life business, Germany/Austria
L3	Nov-00	Rabobank/Helaba	€ 50.00	New and in force business, special markets
L2	Jul-99	Citibank Intl	€ 130.00	In force (BATs), W Europe and N America
L1	Apr-98	Helaba/CajaMadrid	€ 51.00	New life business, Western Europe

Source: Burow (2001)

References

- American Skandia, 2002, *Consolidated US GAAP Statements: 2000-2001* (Shelton, CT).
- Bank, Jonathan F., Lance A. Warrick, and John L. Ingersoll, 1992, "The Regulation of Reinsurance in the United States," *Journal of Insurance Regulation* 11: 211-233.
- Becker, David, 1999, "The Value of the Firm: The Option Adjusted Value of Distributable Earnings," in Society of Actuaries, *Financial Reporting Section Monograph* (Schaumburg, IL).
- Bütow, Steffen, 2001, *Securitization in Life, Health, and Personal Accident Reinsurance*, Hannover Re's Perspectives – Current Topics of International Life Insurance, Issue No. 7 (Hannover, Germany).
- Carroll, Charles and J. Peter Duran, 1999, "Closed Blocks and Mutual Company Conversions," in Society of Actuaries, *Financial Reporting Section Monograph* (Schaumburg, IL).
- Conning and Company, 1999, *Viatical Settlements: The Emerging Secondary Market for Life Insurance Policies* (Hartford, CT).
- Cox, Samuel H., Joseph R. Fairchild, and Hal W. Pedersen, 1999, "Actuarial and Economic Aspects of Securitization of Risk,"
- Cummins, J. David and Christopher M. Lewis, 2003, "Non-Traditional Asset-Backed Securities as Pension Fund Investments," in Olivia Mitchell and Kent Smetters, eds., *The Pension Challenge: Risk Transfers and Retirement Income Security* (New York: Oxford University Press).
- Cummins, J. David, David Lalonde, and Richard D. Phillips, 2004, "The Basis Risk of Index-Linked Catastrophic Loss Securities," 2004, *Journal of Financial Economics* 63:.
- Cummins, J. David and Anthony M. Santomero, 1999, *Changes In the Life Insurance Industry: Efficiency, Technology, and Risk Management* (Norwell, MA: Kluwer Academic Publishers).
- Cummins, J. David, Mary A. Weiss, and Hongmin Zi, 1999, "Organizational Form and Efficiency: An Analysis of Stock and Mutual Property-Liability Insurers," *Management Science* 45: 1254-1269.
- Dhru, Jayan U., et al., 2001, *Interest in Life Insurance Securitization Heats Up* (New York: Standard & Poor's).
- Duffie, D. and N. Garleanu, 2001, "Risk and Valuation of Collateralized Debt Obligations," working paper, Graduate School of Business, Stanford University.
- Fore, Douglas C., 2003, "The Impact of Fair Value Accounting Standards on the Portfolio Composition of Life Insurance Companies," working paper 13-050103, TIAA-CREF Institute (New

York).

Froot, K., 2001, "The Market for Catastrophe Risk: A Clinical Examination," *Journal of Financial Economics* 60, 529-571.

Girard, Luke N., 2002, "An Approach to Fair Valuation of Insurance Liabilities Using the Firm's Cost of Capital," *North American Actuarial Journal* 6: 18-46.

Girard, Luke N., 2000, "Market Value of Insurance Liabilities: Reconciling the Actuarial Appraisal and Option Pricing Methods," *North American Actuarial Journal* 4: 31-62.

Gora, Jean C., 2000, *Viatical and Life Settlements: The Challenge Facing the Life Insurance Industry* (Atlanta, GA: Life Office Management Association).

Grace, Martin F., Robert W. Klein, and Richard D. Phillips, 2001, "Regulating Onshore Special Purpose Reinsurance Vehicles," *Journal of Insurance Regulation* 19: 551-590.

Group of 10, 2001, *Report on Consolidation in the Financial Sector* (Basel, Switzerland: Bank for International Settlements). <http://www.bis.org/publ/gten05.htm>

Hill, Claire A., 1996, "Securitization: A Low-Cost Sweetener for Lemons," *Washington University Law Quarterly* 74: 1061-1120.

Iacobucci, Edward M. and Ralph A. Winter, 2003, "Asset Securitization and Asymmetric Information," working paper, Faculty of Law, University of Toronto.

International Association of Insurance Supervisors, 2003, "Issues Paper on Life Insurance Securitization," Basel, Switzerland.

Kane, Brian, et al., 2003, *Presale: Gracechurch Life Finance PLC* (London: Standard & Poor's).

Lane, Morton and Roger G. Beckwith, 2002, *2002 Review of Trends In Insurance Securitization* (Kenilworth, IL: Lane Financial).

Lin, Yijia and Samuel H. Cox, 2003, "Securitization of Mortality Risks in Life Annuities," working paper, Georgia State University, Atlanta, GA.

McGeer, Bonnie, 2003, "Innovators Crack the Code on Securitizing Life Insurance," *Asset Securitization Report* (September 29).

Millette, Michael J., et al., 2002 "Securitization of Life Insurance Businesses," in M. Lane, ed., *Alternative Risk Strategies* (London: Risk Books).

MONY Holdings, LLC, 2002, *Form S-4, Registration Statement Under the Securities Act of 1933*,

- U.S. Securities and Exchange Commission, Registration No. 333-96595, July 17, 2002.
- Moody's Investors Service, 2003, "Moody's Assigns Definitive Ratings to Floating Rate Secured Notes Issued By Gracechurch Life Finance PLC," London, November 12.
- Oldfield, George S., 2000, "Making Markets for Structured Mortgage Derivatives," *Journal of Financial Economics* 57: 445-471.
- Oldfield, George S., 1997, "The Economics of Structured Finance," *The Journal of Fixed Income* 7: 92-99.
- Patrino, P.F., et al., 2002, *Exiting the Closed Block* (New York: Fitch Ratings).
- Perrott, Godfrey and William Hines, 2002, "Fair Value Accounting Compared to Other Accounting Systems," *North American Actuarial Journal* 6: 62-90.
- Plantin, Guillaume, 2002, "Tranching," working paper, University of Toulouse and London School of Economics.
- Puccia, Mark, 2001, *Insurance Capital Optimization: Reducing Risk Through the Creation of a Closed Block* (New York: Standard & Poor's).
- Reitano, Robert, 1997, "Two Paradigms For the Market Value of Liabilities," *North American Actuarial Journal* 1: 104-137.
- Siberon, Jose, et al., 2003, *Presale: Vita Capital Ltd.'s Principal-At-Risk Variable-Rate Mortality Catastrophe-Indexed Note* (New York: Standard & Poor's).
- Swiss Re, 1999, *Are Mutuals and Endangered Species?* Sigma, No. 4 of 1999. Zurich.