Securitization of Senior Life Settlements: Capturing Value from Early Death

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In January 2004, the first securitization of senior life insurance policies was issued in the market. It was a $63 Million of class A senior life settlement-securitization backed by $195 million in face value of life insurance policies, issued by Tarrytown Second, LLC. The second senior life settlement securitization transaction, for an amount of $70 million was issued in April 2004 by Legacy Benefits as a private placement. The securitization of life insurance policies is not new. In the early 90s those with terminal diseases and a life expectancy of no more than two to three years could sell their life insurance policies at discount from face value to different companies, who in turn would securitize them (viaticles). Viaticles lost their popularity when, particularly *viators* affected with aids experienced extension in their life with the development of new drugs. Companies had to convert from buying life policies from terminally-ill *viators* to buying life policies from senior life *settlers*. It is only in 2004 that the securitization of senior life settlements was introduced to the market. The valuation of this type of securitization remains tricky because of the underlying asset that can generate negative cash flows early on and its unusual type of risk: *life extension risk*. We develop a model that incorporates *life extension risk*, we develop a new security, the *sure-death class* to protect investors from life extension risk, and we propose an innovative approach to measure the sensitivity of the senior life settlement-backed securities' value to changes in number of years lived above settlers' life expectancy, the *t-duration*. The *t-duration* will be a necessary measurement for investors in senior life settlement-backed securities.

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1. INTRODUCTION

The idea of securitizing life insurance policies is not new in itself. Viaticle settlements started in the late 1980's when companies such as Legacy Benefits or Dignity Partners purchased life insurance policies from people with terminal diseases, i.e. aids, when no treatment was yet available.

People with terminal diseases have a hard time paying premia on their life insurance policy and often have high expenses due to medical bills and to the need of additional medical assistance. When approached by companies such as Dignity Partners, those with terminal diseases had the opportunity to sell their life insurance policies at a discount from the face value to be received by the beneficiaries, and were at the same time able to shift the responsibility of paying the life insurance premia to the companies buying their policies, by making them the new beneficiaries of the policy. The companies only contacted those with a life expectancy of maybe two to three years. In July 1996, papers presented at the International AIDS conference in Vancouver, had documented strong clinical evidence that a new class of drugs known as protease inhibitors, used in combination with AZT, would reduce substantially and even eradicate the level of Human Immunodeficiency Virus (HIV) detectable in the blood of persons previously diagnosed with AIDS. The research presented at the Vancouver conference was a shock and was reflected in the collapse of Dignity Partner's value and the significant increase in the discounted amount from face value paid to viators for their policies. From a high of $14.5 in 1996, the price per share of Dignity Partners fell to $1. Policies that prior to the Vancouver conference were selling between 50-80 cents on the dollar fell as low as 30 cents.

Life settlements are similar to viaticles in the sense that both *viators* (insured with terminal disease) and *life settlers* (insured with a life expectancy of ten years or less because of age) sell their life insurance policy at a discount from face value of benefit.

Longevity risk, (or extension risk) is the key to the cash flow valuation of securitized pools of life settlements. Just like mortgage-backed securities, whose value is mainly affected by prepayment rates, the value of life settlements-backed securities is fundamentally affected by death rates. Many proprietary models have been developed to value mortgage-backed securities, only few have been developed to value life settlement-backed securities.

We develop a model that can accurately value life settlement-backed securities. Mortality risk rather than prepayment risk is the determining parameter in the model. Just as with mortgage-backed securities, credit risk, interest rate risk and prepayment risk can be redistributed to some investors, away from others; extension risk in life settlement securitization can be allocated to one group of investors, away from those not willing to absorb it. We develop new structures for this innovative type of securitization.

2. THE UNDERLYING ASSET: SENIOR LIFE SETTLEMENTS

In order to have a diversified pool and reduce the life expectancy correlation amongst life settlers, A.M. Best (A.M. Best is a worldwide insurance-rating and information agency founded in 1899 by Alfred M. Best) recommends that the statistical distribution of diseases be limited to the following before securitizing such pool (Exhibit 1):

Exhibit 1

Disease Diversity

Disease or Category	Examples	Limits
Cardiovascular	Coronary Artery Disease, Arrthymia, Other (e.g. Heart Valve Disease)	30%
Cerebrovascular	Stroke, Carotid Artery, Transient Ischemic Attack	10%
Dementia	Alzheimer's, Multi-Infarcts	15%
Cancer	Lung, Prostate, Breast, Hematological, All Other Cancers	15%
Diabetes		10%
Respiratory Diseases	Emphysema,Asthma,Sleep Apnea Chronic Obstructive Pulmonary Diseases	10%
Neurological Disorders (Excluding Alzheimer's)	Parkinson's Disease, Lou Gherig's Disease (ALS)	15%
Other/No Disease	Renal Failure, Peripatetic Vascular, etc.	20%
Multiple		20%
HIV/AIDS		0%

In the event of the development of new drugs for a specific disease, life settlers with the same disease would experience an increase in life expectancies, correlation must be minimized.

Other requirements A.M. Best has, before a pool of senior life settlement be securitized are:

a) the pool should have a minimum of 200 settlers;
b) a life benefit should not exceed 3.33% in face value of the entire pool's face value;
c) insurance companies providing life insurance must have *Financial Strength Ratings* (FSRs) of "B+" or higher;
d) the aggregate face value of the policies issued by any one insurance company should not exceed 15%;
e) each senior life settler must have had an evaluation by at least two independent medical examiners in the last twelve months before entering the pool, to obtain an estimate of its life expectancy.

Exhibit 2 shows the typical distribution of life expectancies of senior life settlers, and we will use it as a base case for our simulated underlying pool of life settlers being securitized.

Exhibit 2

Typical Distribution of Available Life Expectancies

Life Expectancy (LE)	**% of Insured in LE Category**
LE<= 36 months	1
36 months<LE<=72 months	12
72 months<LE<=108 months	30
108 months<LE<=144 months*	30
144 months<LE<=180 months	17
180 months<LE<=216 months	8
LE>=216 months	2

*As a practical matter, the life expectancies that are found most commonly in life settlement transactions are normally 12 years or less. Source: A.M. Best, October 2004.

Following the "Typical Distribution of Life Expectancies" from Exhibit 2 and assuming we securitize a pool of 100 life settlers (m_0), the number of settlers from the pool dying at each point in time (d_t) is computed over a total of n periods (n = 225) as follows in Exhibit 3:

Exhibit 3

$d_1, \ldots, d_{36} = 1/36 = .02778$

$d_{37}, \ldots, d_{72} = 12/(72\text{-}36) = .3333$

$d_{73}, \ldots, d_{108} = 30/(108\text{-}72) = .83333$

$d_{109}, \ldots, d_{144} = 30/(144\text{-}108) = .83333$

$d_{145}, \ldots, d_{180} = 17/(180\text{-}144) = .47222$

$d_{181}, \ldots, d_{216} = 8/(216\text{-}180) = .22222$

$d_{217}, \ldots, d_{225} = 2/(225\text{-}216) = .22222$

The rate of death based on the "Typical Distribution of Life Expectancies" (which we call scenario 1 throughout the paper) is graphed in Exhibit 4.

Exhibit 4: Death rate over time based on "Typical Distribution of Life Expectancies"

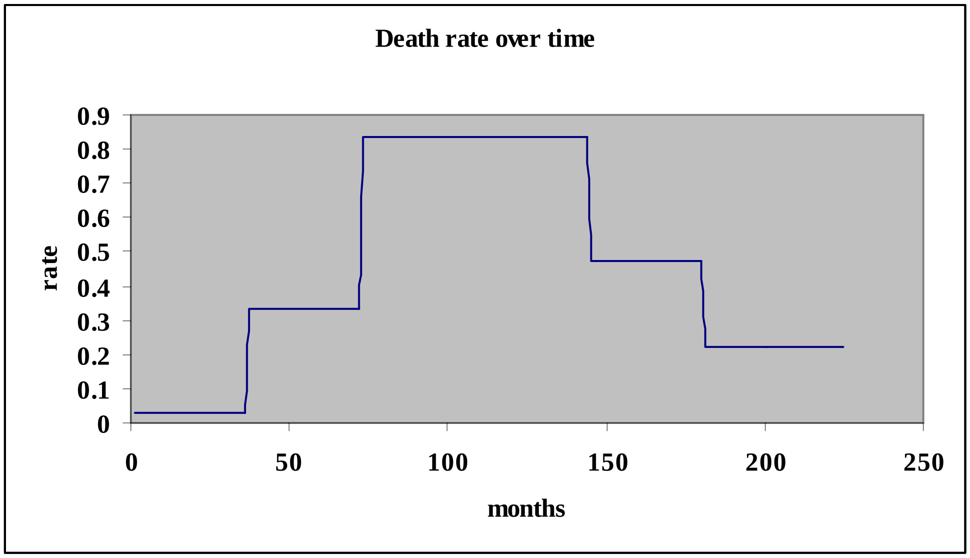
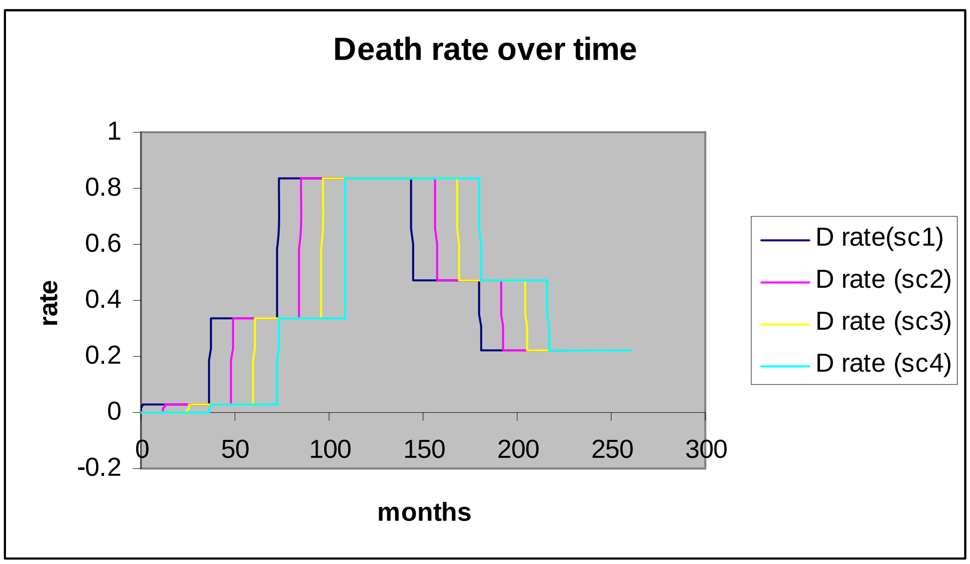


Exhibit 5 graphs the death rate over time under different scenarios. Scenario 1 is the base case, with "Typical Distribution of Life Expectancies"; scenario 2 shifts the distribution of the death rate in scenario 1 by twelve months (life extension by twelve months relative to the base case). Each subsequent scenario shifts/extends the distribution of death rate by another twelve months.

Exhibit 5



Before an asset can be securitized, it is important to understand and being able to estimate the cash flow generated by such asset in order for the issuer to successfully place the asset-backed security in the market. We next estimate the cash flows of the senior life settlements under different simulated scenarios and develop a valuation approach.

3. VALUATION OF SENIOR LIFE SETTELMENTS-BACKED SECURITIES

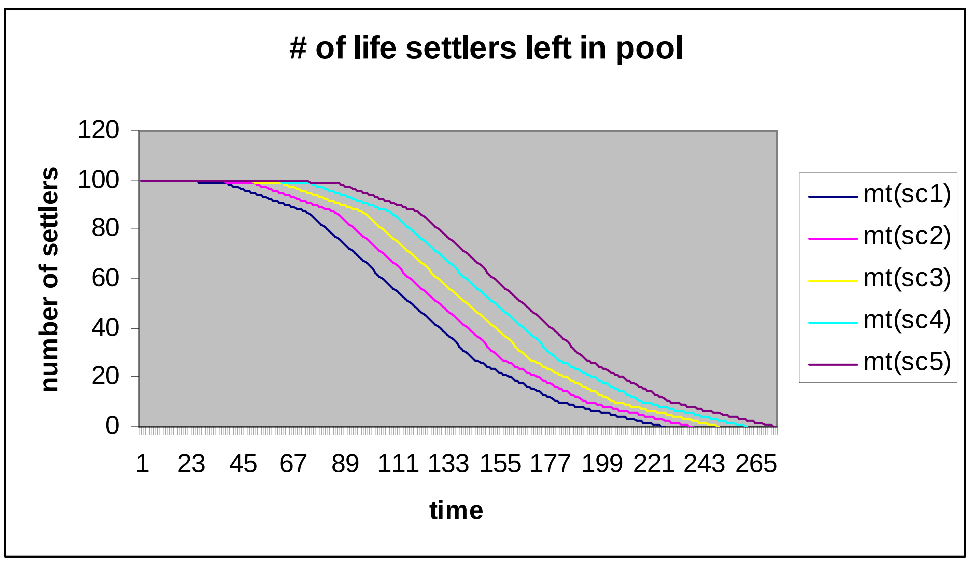
The number of settlers remaining in the pool decreases over time as other die.

Equation (1) illustrates the number *mt* of settlers left in the pool at time *t*, computed by deducting the sum of death occurred over time, up to time *t*, from the original number *mo* of settlers.

$$m_t = m_0 - \sum_{j=1}^{t} d_j \qquad (1)$$

In Exhibit 6 we graph the number of life settlers remaining in the pool under five different death scenarios, with scenario 5 being the one with the greatest life extension life.

Exhibit 6



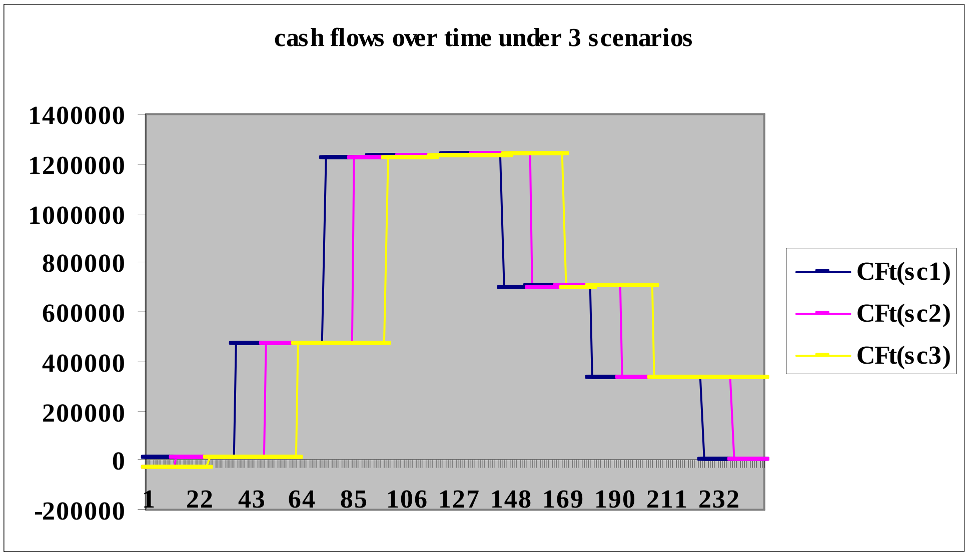
We define premium paid at the end of each month as *P* and the life benefit received by the beneficiary at the time of the senior life settler's death, as *B*. The number of premia paid to life insurance companies is a function of the number of life settlers left in the pool at each point in time (m_t), and the number of life benefits paid by life insurance companies at each point in time is a function of the number of settlers dying in that period (d_t). For simplicity we assume that *P* and *B* are the same for each of the policies in the pool.

$CF_1 = -m_0P+d_1B$
$CF_2 = -m_1P+d_2B$

.
.
.

$$CF_t = -m_{t-1}P + d_tB \qquad (2)$$

Exhibit 7



Under scenario 1 the cash flows are positive from the very beginning; under scenario 2 the cash flows are negative for the first twelve months and then as life settlers start to die, the life benefits create positive cash flows by outweighing the negative premia; under scenario 3 it is only after twenty four months that cash flows become positive.

Because of the nature of the pool of life settlements with only few death occurring early on, and therefore creating negative cash flows early on, a liquidity facility must be provided to the issuer of the senior life settlement-backed securities.

If at the time the asset-backed security matures there still are life settlements outstanding in the pool, the issuer has to sell/liquidate them in order to fully pay the investors.

The value of a securitized pool of senior life settlements, *V(SLS)*, is then computed by summing the discounted cash flows to the present at the appropriate rate *r*:

$$V(SLS) = \sum_{t=1}^{n} CF_t/(1+r)^t \qquad (3)$$

Exhibit 8

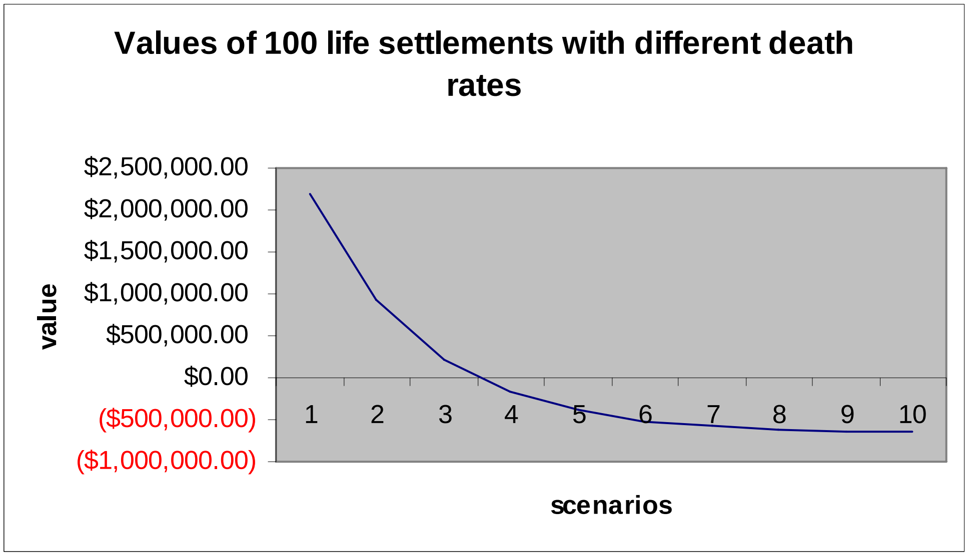


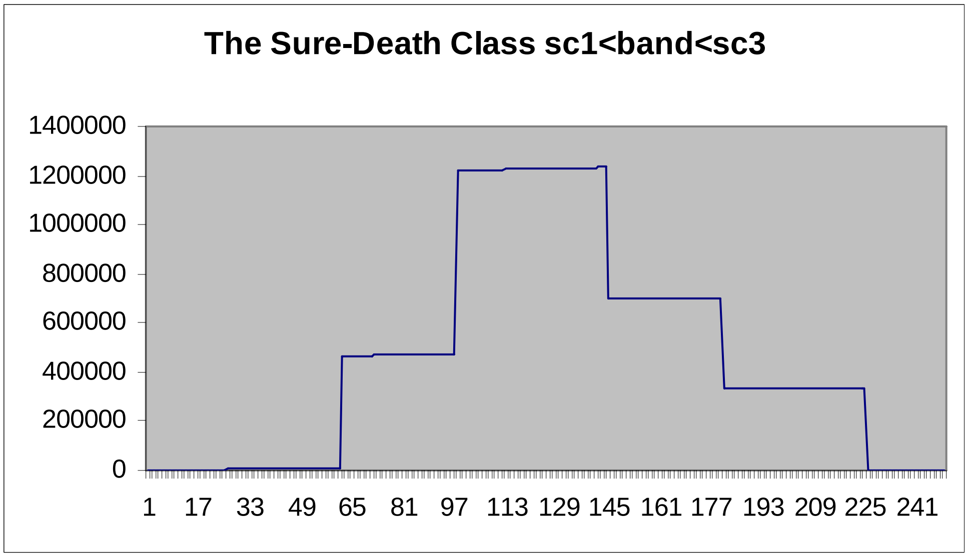
Exhibit 8 graphs the value of a pool of 100 life settlements under ten different death rate scenarios. Scenario 1 is the *base case*, and each subsequent scenario shifts death rate by twelve months.

Notice that we have not taken into account the cost of credit enhancement or other fees because it is not the focus of this paper. The model, however can easily be readjusted by deducting these costs from the cash flows to be received by investors.

4. PROTECTING INVESTORS FROM *LIFE EXTENTION RISK*: THE *SURE-DEATH CLASS* (*SDC*)

Just like investors in mortgage-backed securities can be protected from prepayment risk by creating planned amortization classes (*PACs*) with corresponding companion classes, we propose a new type of security, the *sure-death class* (*SDC*), also, with its corresponding companion class.

Exhibit 9



Investors in securitized senior life settlement may be informed that the valuation of the security and its projected cash flows are based on "scenario 2-death rate". Investors understand that they could be confronted to different scenarios-death rate, and some may want to invest in a security that is minimally affected by changes in death scenario. It is possible to create a security backed by senior life settlement with no uncertainty in cash flows to be received by taking the common area to two different scenarios. For example, going back to Exhibit 7, we can carve out the common area to scenario 1 and scenario 3, and create a separate security, the *sure-death class* (*SDC*), shown in Exhibit 9. As long as death rate is contained between these two scenarios, we for sure can guarantee investors in the *SDC* to receive known cash flows at each point in time. Of course, if death-rates are lower than those in scenario 1 or higher than in scenario 3, the common area is not met. When issuing the *sure-death class*, a *band* of death rates must be provided to investors with the understanding that the cash flows to be received on the security cannot be met when death-rates are below or above that pre-defined *band*. Just as with PACs, a companion class must be created simultaneously with *SDCs*, to shift the extension risk to a group of investors willing to absorb it in exchange for a premium-compensation (see Exhibit 10).

Exhibit 10

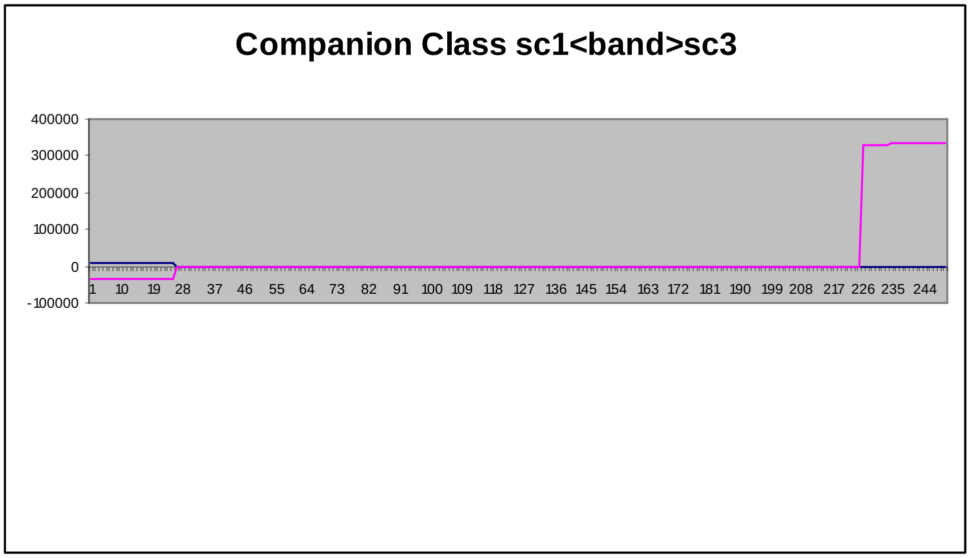


Exhibit 10 displays the cash flows of scenarios 1 and 3 that do not share common areas.

5. *T-DURATION*: A NEW MEASUREMENT

We introduce a new fixed-income securities type of duration, what we call the "*t-duration*". The Macauley and the modified duration are measures of the price sensitivity of fixed income securities to changes in yield. These durations are still valid for securities backed by senior life settlements, but do not capture the "life extension" risk. As shown in Exhibit 8, the value of a securitized portfolio of senior life settlements decreases as life settlers live above life expectancy. How sensitive is the value of these securities can be determined by the *time-duration* which we first derive for an individual senior life settlement as follows:

$$\textit{t-duration} = [\%\delta V(sls)] / [\%\delta t] \quad (4)$$

or

$$\textit{t-duration} = [\delta V(sls)/\delta t][t/V(sls)],$$

which is the first derivative of the value of a senior life settlement relative to changes in *t*, subsequently multiplied by *t* and divided by the value of the life settlement.

The value of an individual senior life settlement is:

$$V(sls) = -P[1/(1+r)^1 + 1/(1+r)^2 + \ldots\ldots + 1/(1+r)^n] + B/(1+r)^n \quad (5)$$

Where *P* stands for "premium" paid each year, *B* is the life benefit at the time of death of the life settler, and r is the discount rate.

Letting $a = 1/(1+r)$, Equation (5) can be rewritten as:

$$V(sls) = -P\,[a^1 + a^2 + \ldots\ldots + a^t] + Ba^t \qquad (6)$$

Invoking the geometric series identity [Geometric Series Identity: $1 + a^1 + a^2 + \ldots\ldots + a^n = (1-a^{n+1})/(1-a)$] and after rearranging, we obtain:

$$V(sls) = \{[P/(1-a)] + B\}a^t \qquad (7)$$

We can now take the first derivative relative to changes in *t*:

$$\delta V(sls)/\delta t = [B + P/(1-a)]\, a^t \ln(a) \qquad (8)$$

and after multiplying the first derivative by *t*, dividing it by the value of the life settlement, and replacing *1/(1+r)* to *a*, we obtain the *t-duration*:

$$t\text{-}duration = t\ln[1/(1+r)] \qquad (9)$$

The result of the *t-duration* is negative as we expected. The longer a life settler lives above life expectancy, the less valuable is the senior life settlement.

Investors are interested in finding the percentage change in value of life settlement relative to changes in time, rather than relative to percentage changes in time, so for practicality, we can develop the *modified t-duration* dividing the *t-duration* by *t*:

$$modified\ t\text{-}duration = \ln[1/(1+r)] \qquad (10)$$

Investors in pools of senior life settlements can evaluate the pool's sensitivity to life extension δt using the *modified t-duration* of the pool:

$$[\%\delta V(SLS)] = \delta t \ln[1/(1+r)] \qquad (11)$$

The percentage change in value of the pool [%δV(SLS)] given a change in time due to life extension or reduction (δt) is equal to the pool's *modified t-duration* ln[1/(1+r)] multiplied by the life extension/reduction δt.

For example, if we use a discount rate *r* of 10% and a life extension of two months ($\delta t = 2$), the percentage change in the value of the pool [%δV(SLS)] will be equal to -19%:

$[\%\delta V(SLS)] = 2 * \ln[1/(1+.1)]$

$= 2* (-.09531) = -.19062$

For a discount rate of 5% the percentage change in the pool's value is 2* (-.04879) = -.09758 or -9.75%.

In order to compute the *t-convexity* we take the second derivative of the value of senior life settlement and obtain:

t-convexity:

$$\delta^2 V(sls)/\delta t^2 = [B + P/(1-a)]a^t \ln(a)^2 \quad (12)$$

We have a positive convexity, which means that as a life settler lives less than life expectancy, the value of the settlement increases at an increasing rate.

6. CONCLUSION

As of March 2005 only two pools of senior life settlements have been securitized. The first, in January 2004, issued by Tarrytown Second, LLC was a $63 million of class A 7%-annual-coupon asset-backed bonds, maturing December 2011 (seven-year bond), collateralized by $195 million in face value of life insurance policies, and was assigned aa- rating by A.M. Best Co. The life settlers in the underlying pool had life expectancies ranging from four to seven years.

The second life settlement-backed security was issued April 30th, 2004 by Legacy Benefits Life Insurance Settlements 2004-1 LLC, for a total amount of $70 million. The issue included two tranches, a class A-note ($61,500,000 with a 5.35% coupon) and a class B-note ($8,500,000 with a 6.05% coupon) rated A1 and Baa2 respectively by Moody's, both maturing in 2039. The underlying pool had senior life settlers with an average age of 77. Most of the insurance companies providing life insurance to the senior life settlers had a Aa3 or better rating.

As of December 2004, the statistics are that each year $1.5 trillion in life insurance lapses or is surrendered. It is estimated that $150 billion in face value is eligible for life insurance settlement, with a projected eligible face value of more than $800 billion by 2010. Presently only an amount of $2 billion in face amount is sold through senior life insurance process per year. Securitization is a financing approach for companies investing in life settlements, and with it, it will be possible to re-allocate the different risks associated with life settlements, mainly, *life extension risk*, to different groups of investors, just like it has been done with mortgage-backed securities. Finally, securitized pools of senior life settlements can be used by life insurance companies to hedge their portfolios of life insurances provided to individuals, against the risk of premature death.

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