On Quantitative Risk Measures of Life Settlement Investments

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Abstract. Life Settlement market provides life insurance policyholders an opportunity to realize the values embedded in their policies. It offers liquidity to policyholder and at the same time it creates a new asset class for investors seeking uncorrelated risks. The market has been growing rapidly in recent years. In this paper, we will provide a few summary quantitative risk measures for investing in life settlement policies. It is obvious that the risk to the investor reduces as the portfolio size increases. But in this work, we will focus on measures that relate only to individual policy purchases, the percent change in value among 50% mortality hair cut, the ratio of standard deviation to value, and the percent change in value assuming 15% Cost of Insurance (COI) increases. There are many factors underlying the above mentioned three risk measures. In this work, we will define a new indicator, the premium cost ratio. We will see that this new indicator is one of the key drivers for all three risk measures. We conclude that by investing in those policies with smaller premium cost ratio, the investor will have a better risk return profile of the portfolio, and reduce the risk while maintaining the desired return.

Keywords: life settlement, securitization, risk management

1 INTRODUCTION

The United States Life Settlement market has been growing rapidly in recent years. The funding for this market is largely from Europe; Germany in particular entered the market in the beginning. Now there is almost a global participation. If the insured has substantially higher mortality than the policy is priced for, then the policy has a value higher than the cash surrender value of the policy. For those people who no longer need the policy, or are in need of some immediate cash, the Life Settlement market provides an option for them to realize the increased value of the policy. It is difficult to project the impact of a well developed secondary market on the life insurance industry as a whole. But, generally speaking, any kind of increased liquidity is beneficial for the underlying commodity. For more discussions on the topic, see [2] and [3].

There is a simple utility theory argument for life insurance on most actuarial text books. The utility theory argues that an insurance policy creates value (higher utility) for both the insurer and the insured, because the insurer and the insured have two different utility functions. A similar argument could be made that the life settlement transaction creates value for both the insured and the investor.

There have been efforts to securitize this new asset class. Rating agencies have issued guidelines [5]. Some researches are already done on the longevity risk [6]. But so far, there has been no successful public transaction. In the past year or two, a private market seems to be developing. Those transactions are almost solely based on actuarial analysis by the consultants. Majority of the investors to date are in an equity position, making direct investment by holding the policies.

Most of the actuarial science and the analysis are developed based on pooling of large amount of mortality risks. This has worked for insurance companies for hundreds of years, which issues a large amount of policies. But for the life settlement analysis, these methods need to be adapted. See [1] and [4].

Usually, a policy owned by the investors has no cash value. The crediting rates from the carriers on the account value are usually lower than the desired return of the investors. The investor will pay minimum (optimum) premium to keep the policy inforce, and will collect the death benefit (DB) as return on the investment. The minimum premium will be the sum of the Cost of Insurance (COI) and the expense charges. In aggregate, the COI and expense charges by the insurance companies will be the expected death benefit, the operating expenses of the company, and the required profits of the company. If there is no mortality impairment, it is clear there should be no (monetary) economic value (EV) in such a policy.

Currently, the life settlements are priced from an investor's point of view. The offering price from an investor (through an intermediate provider) is usually based on the purchaser's desired internal rate of return (IRR) and the status of the insured's mortality. There are three approaches to pricing for a desired IRR. The simplest method is deterministic. It assumes that the death benefit will be paid at the life expectancy (LE) of the insured. The second method is probabilistic. First, LE is translated to expected mortality (usually in terms of a multiple of an underlying table). Then we use the expected mortality to project an expected cash flow. The expected cash flow should provide the desired IRR. The third method is a stochastic method. At each offering price, the simulations will provide a distribution of

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the IRR. The price that provides an acceptable distribution of IRR will be the offering price.

The trend in the industry has moved from the first method to the second and now from the second method to the third method. It is agreed that the third method is better than the second method, and the second method is better than the first method. The first method is in fact actuarially incorrect. It is interesting that usually the second method produces a lower offering price than the first method. The third method might produce a lower price than the second method. The author wonders about what is the underlying force that drives the method changes; is it searching for a better methodology, or is it the market force?

In the author's view, so far, the risk analysis on life settlement is insufficient. The most advanced technique deployed seems to be the stochastic analysis based on the random maturity time T. There are many risks involved. Some are easily quantified, such as underwriting risk, maturity event risk, and risk of increased COI rates. There are other less quantifiable risks, such as legal and regulatory risks. In this paper, we will focus on the quantifiable risks. We will define three risk measures for each of the three risks mentioned above.

Further, we will study the source of economic value of the settled policy. We will define a new indicator (premium cost ratio). The premium cost ratio is defined as the mortality multiple underlining the pricing of the policy based on 2001 Valuation Basic Table (2001 VBT) and 7% interest rate. It could also be referred to as the break even multiple of the premium cost. Using an example, we will show that it is one of the key drivers for all three risk factors.

2 THE RISK MEASURES

The result of the latest large scale mortality study done on the US insured population is the 2001 VBT. It is perceived as the best estimate mortality of the US insured population. Some smaller, and less formal studies revealed that the actual mortality for calendar year 2005 and 2006 is at 85-90% of the expected of 2001VBT. Based on those studies, some investors use 80% of 2001VBT and 1% of morality improvement as a conservative estimate. Whatever the case might be, 2001VBT provides a valuable bench mark for life settlement analysis. See [7].

The major risk for the investor is the underwriting risk. Some people call it the longevity risk. In an effort to quantify the risk, the rating agency introduced a concept of mortality haircut, which reduces the excess (over 100%) mortality multiple.

The rating agency approaches are similar. We follow AM Best [5]. First, from the life expectancies (LE), we solve for a mortality multiple (MM), based on the 2001 VBT select and ultimate (Age Nearest Birthday) ANB table. The haircut adjusted mortality multiple (AMM) is AMM = 1+.5*(MM-1). We will define the first risk measure RM1 as the percent of change in value under this mortality hair cut adjustment.

RM1= (Value (based on MM) – Value (based on AMM))/ (Value (based on MM)).

RM1 could range from 10% to 40% for policies in the settlement market. On average, for a portfolio, it ranges between 25%-30%. Many factors impact RM1. We will see later that the premium cost rate is one of the more important factors.

The other two easily quantifiable risks are risk of randomness of the mortality itself, and the risk of COI increases. Even if the investor has the baseline mortality rate of the pool correctly, the mortality event is always a random event. This risk reduces as the pool size increases. The third risk, the risk of COI increases, is considered a remote risk. Generally, carriers are reluctant to increase the COI charges. But as the Life Settlement market grows, the author believes that it is possible that some smaller and less credit worthy carriers may become financially stressed from the settlement market. They are likely to take an action to diminish the return on settlements policies, by increasing the COI charges for older ages.

If the underlying mortality rate is true, the mortality date will be a random variable (T) from a known distribution. Given the discount rate, the economic value for the policy will be EV(T) = PV(DB paid at T) - PV(Premium paid up to time T).
It is clear that EV = E(EV(T)) = PV(E(DB)) - PV(E(Prem)), where E(DB) is the array of the expected death benefits. Denote V(EV(T)) as the variance of the random variable EV(T). It could be computed based on the definition in a closed form. Studying the basic nature of the distribution of EV(T) will be an interesting project. For example, one question is which parametric distribution best fits the distribution of EV(T).

Let N be the number of policies in a portfolio. The economic value of the portfolio is a dependant random variable of the N maturity dates T_i, and

$$\mathrm{EV}\left(T_1,\ldots,T_N\right)=\sum_i EV\left(T_i\right).$$

When N is large enough (i.e. few dozens), and the policies are relatively similar, the distribution of $\mathrm{EV}\left(T_1,\ldots,T_N\right)$ is close to a normal distribution based on the general promise of the large number theorem. Simulations done by the author suggests the same. If we disregard the possible correlation from the same impairment, there should be no

correction between the mortality dates T_i between policies. Further if we disregard the correlation of the risk from the carriers, we have

$$\mathrm{V}(\mathrm{EV}(T_1,\ldots,T_N)) = \sum_i V(EV(T_i)).$$

There are some general concerns on the concentration risk on impairment and carrier. To the best of the author's knowledge, there is no quantitative study done yet on the possible correlation between policies as a consequence of such concentration.

Focusing on the characteristic of an individual policy, we define the second risk measure as

RM2 = (Standard Deviation)/EV.

The RM2 varies widely from policy to policy, from .5 to 4. The average for portfolios in the market could be between 1 and 2. One thing that is interesting and surprising is that the standard deviation is relatively insensitive, when compared to EV itself, to discount rate, and to mortality multiple. The RM2, calculated for a portfolio of identical policies, reduces by roughly $\sqrt{N}$, for a portfolio of size N.

The risk of increased COI is not in discussions for the most part in the settlement industry. The rating agencies only suggest a 1% of COI increase and capped total increase at 2.5% for a diversified portfolio. The author believes that the risk is currently understated. The settlement market focuses on insured of age 75 and up. It is relatively small portion of the inforce. The author believes that if the life settlement market puts substantial financial stress on the carriers, the carriers might take action. A $20M benefit payment could change the annual financial statement for a small carrier or for its reinsurer. The author thinks that it is unreasonable to assume that the carriers will take a significant financial loss without taking any corrective action. We define the third risk measure as percent change in economic value under the 15% COI increase.

RM3= (EV (based on Current COI) – EV (based on 15% Current COI))/ (EV (based on Current COI)).

This measure varies from 10% to 20% for policies in the market. The main driver of RM3 is the premium cost ratio (PCR) and we will define it.

3 THE PREMIUM COST RATIO

The source of the economic value could be due to the health deterioration since policy issue. It could be also due to, in some sense, mispricing of the policy. The charges (COI and expense) of the policy are set at a level below the expected mortality. For example, the policy might be priced assuming some other sources of earning for the company. An example for a source of earning is from investment spread on the account value.

Generally speaking, there are three major assumptions used in a life insurance pricing process, an interest rate, a baseline mortality table, and the mortality adjustment factor (MAF). The baseline mortality table multiplied with the mortality adjustment factor is the mortality assumption. The pricing assumptions vary widely from carrier to carrier. Often, the interest rate is related to the portfolio rate for the general account of the carrier. The baseline mortality table is an industry table, or table based on carrier's overall experience. The mortality adjustment factor is based on the experience study of the particular line of business.

No carrier will reveal their pricing assumptions. In order to reverse engineer the pricing assumptions based on current premium information, let us assume the interest rate is 7%, and the baseline table is 2001 VBT. The only unknown is the mortality adjustment factor. We define the premium cost ratio (PCR) to be this mortality adjustment factor (MAF). There are many ways to solve for the PCR. We use the following equation.

PV(Expected Premium) = PV(Expected Death Benefit), based on (PCR)*(2001VBT) and 7%.

This ratio is between .6 and 1.3. This is a minimum mortality multiple for a policy to have positive economic value. The PCR less than one means even for a standard risk (insured with 2001 VBT mortality), there is economic value.

The proprietary data of some actual portfolios shows that PCR depends on the carrier and the policy form. In general, PCR is lower for large carriers, and higher for small carriers. It is not surprising; naturally, smaller carriers need more margins for each policy. In other words, large carriers, on an average, provide better value in policies for their consumers. (Smaller carriers might provide value in other forms, such as better customer service, etc.) Large carriers might also have better mortality experience.

We provide a comparative study of the two types of policies with different level of PCR. To make the comparison more accurate, the two policies have the same IRR at 12% and the same settlement price at 20% of the face. The insured is a 75 year old, non smoker male. The assumption here represents a typical policy in today's market place.

But the source of value differs for these two policies. The first policy has PCR =1.02. This means that it is a reasonably priced policy. If the interest rate is 7%, and actual mortality is 80% 2001VBT, then the remaining 22% of 2001VBT table covers operating expense and profits. The

economic value of the policy comes from the mortality factor. The multiple over 2001 VBT is 2.61, LE=115 month.

The second policy has PCR at 0.63. It is a cheaper policy by design. People wonder if this type of policy exists. It does, and it is actually quite common. The heath impairment is not the only factor in the value of such a policy. The mortality multiple is 1.77, LE = 136.

Here is the summary table of above information and result of the three risk measures.

			m1	m2	m3
	PCR	MM	haircut 50%	stdev	115% coi
case1	1.02	2.61	42%	145%	14%
case2	0.63	1.77	23%	126%	10%

We see that there are different risk levels even if the two policies have the same return and price. The PCR is a good indicator of risk levels. The smaller the PRC is, the lower the risk.

4 THE CONCLUSION

Life settlement provides a new asset class for investors. It is uncorrelated to the other traditional asset classes and economic cycles. As a new asset class, there are new risks the investors are unfamiliar with. Actuarial research and analysis is critical in investing in this new asset. This paper provides three risk measures an investor should consider and defines a key driver, Premium Cost Ratio, for those risk measures.

Premium Cost Ratio (PCR) of a policy is the reverse engineered mortality multiple of the 2001 VBT. The policy is priced with 7% interest rate, 2001 VBT as the baseline table, and PCR as the mortality adjustment factor. The measure identifies the policies that are better to invest in. These policies will have smaller risk, relative to the expected return.

Current market practice is focused on the expected return. Superior risk analysis will provide a better risk return profile for the investment. This will provide a competitive edge in navigating the market place for this new asset class.

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