ISSN 2090-3359 (Print)
ISSN 2090-3367 (Online)

ΑΔΣ

Advances in Decision Sciences

Volume 26
Special Issue in Honour of Michael McAleer
2022

亞洲大學
ASIA UNIVERSITY

Published by Asia University, Taiwan

A Study on the Risk and Return Sharing Mechanism for Interest-sensitive Life Insurance Products under IFRS 17 Accounting

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Received: December 29, 2022; First Revision: January 5, 2023;

Last Revision: January 25, 2023; Accepted: January 26, 2023;

Published: February 2, 2023

Abstract

Purpose. This paper analyzes how the share mechanism of interest-sensitive life insurance products affect the investment risk and returns for insurer and policyholders.

Design/methodology/approach. For this purpose, we use the idea of contract service margin and loss component in IFRS17 and Monte Carlo simulations, this study provides some numerical results of return and risk sharing under different share mechanism by setting various minimum crediting rates and share portions.

Findings. Given a minimum crediting rate and share portion, the numerical results can show that what average IRR policyholders could have and what average profit the insurer can obtain. The results also indicates that the part of market risk belongs to the insurer. Finally, the market risk-adjusted return can be calculated for the insurer.

Originality/value. Our approach, results and conclusions are original and new in the literature.

Keywords: Interest-sensitive Life Insurance, Share Mechanism, Contract Service Margin, IFRS17

JEL classification: G11, G52

1. Introduction

Life insurance products can attract policyholders not only through insurance protection but also through financial benefits (Tsendsuren, et al., 2018; Wong, et al., 2023). After long periods of low-interest rates for traditional life insurance, the development of variable life insurance and interest-sensitive life insurance products can be attributed to their higher average financial returns (Alghalith, 2021; Sahoo and Kumar, 2021).

For traditional life insurance products, insurers normally promise the policyholders a fixed rate of financial return and take the investment risk if the investment return rate falls short of the fixed rate. However, for variable life insurance products, policyholders bear a major part of the investment risk. The insurers play the role of an asset manager. They take some fixed management fee or a small percentage of the invested asset value as a management fee. Even though insurers can provide some guaranteed minimum benefits, the investment risk they take is relatively smaller than the policyholders.

Interest-sensitive life insurance products are something in between. By setting the crediting rate policy, the investment risk can be divided more evenly between the insurer and policyholders than the traditional or variable life insurance products (Wong, et al., 2006; Aye, 2021; Aye, et al., 2021). That is, the investment outcome can be more evenly shared under interest-sensitive life Insurance products (Gupta, et al., 2021). This sharing mechanism is studied in this paper.

The sharing mechanism in interest-sensitive life Insurance products was investigated by Lee et al. (2020) under a principle-agent framework. In the framework, the policyholder and the insurer play as a principal and an agent, respectively, and the share of the investment outcome is regarded as an incentive for the insurer to elicit efforts. They focused on finding the optimal sharing mechanism for the policyholder and the insurer.

This paper analyzes the sharing mechanism mainly from the insurer's point of view. As there often is a guaranteed minimum crediting rate for interest-sensitive life Insurance products, the sharing mechanism should consider two elements, the minimum crediting rate and the sharing portion (Trang, et al., 2021; Chang, and Zhang, 2022). In addition, in the contracts, a lower minimum crediting rate normally comes with a higher sharing portion while a higher minimum crediting rate normally comes with a lower sharing portion (Pham, et al., 2022; Mahmood, et al., 2022; Mou, et al., 2018). Thus, it is interesting to study the tradeoff between the minimum crediting rate and the sharing portion (Pierdzioch, et al., 2022).

The minimum crediting rate and the sharing portion setting in the contracts also implies risk sharing between the policyholder and the insurer. A higher minimum crediting rate and a lower sharing portion give the insurer a higher risk share while a lower minimum crediting rate and a higher sharing portion give the insurer a lower risk share. Thus, studying the sharing mechanism can lead to the analysis of the reward-risk tradeoff for contract design.

For measuring the reward and risk in the sharing mechanism, this paper uses the ideas of contract service margin and loss component developed in the International Financial Reporting Standard 17 (IFRS17) for insurance contract accounting. Contract service margin and loss component are measures for expected profits and losses of a group of insurance contracts, respectively.

The rest of this paper is organized as follows: Section 2 addresses the concept of contract service margin and loss component in IFRS17. In Section 3, a case study presents Monte Carlo simulations for generating the distributions of contract service margin and loss component under some sharing mechanism. The reward-risk evaluation for the sharing mechanism is presented and discussed in Section 4. Section 5 concludes the paper.

2. Contract Service Margin and Loss Component

An insurance contract is that an insurer must pay claims for compensating the policyholder upon the occurrence of the insured event that adversely impacts the policyholder, and the policyholder is obliged to pay the premium in advance. For long-term insurance contracts and their uncertain nature, the timing and amounts of claims payments could be very different from those of premium payments. Thus, how determining the amount and timing of revenue and costs for insurance businesses would have a significant impact on the entities' financial statements. IFRS 17 is the first comprehensive accounting principle to provide a systematic way of recognising the profits or losses of insurance contracts over time.

Under IFRS 17, an entity shall recognise profits as and when insurance services are provided (rather than when premiums are received). The measurement is based on a group of contracts subject to similar risks and managed together. Thus, the unearned profits, by the term, contractual service margin (CSM), must be measured at the inception and amortised over the insurance period. Subsequent CSM measurement is also necessary when the contract liabilities are evaluated by using new information in each reporting period. (Palmborg, et al., 2021; Yousuf, et al., 2021)

For a group of insurance contracts, the CSM is defined as the estimated present value of cash inflows minus the estimated present value of future cash outflows and risk adjustment. The discount rate used should reflect the time value of money and the financial risk related to the cash flows. The risk adjustment is a kind of risk premium of non-financial risk for the insurer. In this paper, risk adjustment is combined into CSM. Thus, this total is a measure of expected profits for a group of insurance contracts. When expected losses happen (CSM is negative), The loss component (LC) is used instead of CSM. Thus, LC is a measure of expected losses for a group of insurance contracts.

3. A Case Study of Sharing Mechanism

To illustrate how sharing mechanism affects the expected profits and risk of an insurer issuing interest-sensitive life insurance policies, a single premium interest-sensitive life insurance product case is created as follows:

a. 1000 policies issued for policyholders aged 40 with a premium per policy = NT$1,000,000
b. Expense per policy = NT$80,000
c. Initial account value (AV) = (Premium – Expense) per policy times the number of policies issued
d. AV grows with investment return rates.
e. Policy reserve per policy = NT$920,000 when the policy is activated, and it grows with crediting rates
f. Death benefit per policy is 1.4 times the policy reserve by the Taiwan regulation[1]
g. Minimum credit rate =1.25%
h. Credit rate = Maximum of half of the investment return rate and the minimum credit rate
i. Death rates and investment return rates for each year are in Table 1.
j. Death benefit and surrender payments are from AV.
k. Except for death, no lapse is assumed, and all policies left at the end of seven years are surrendered.

Table 1 lists assumed death rates, and hypothesized investment return rates for each year. Also, the crediting rates which are calculated from the investment return rates are based on the minimum crediting rate and the share portion 1/2. Later, different scenarios of the share mechanism are further studied. In the table, death benefits and surrender values are reported. They grow with the credit rates.

[1] 1.4 times over death benefit are the minimum requirement.

Table 1. Death rates and investment return rates in the case study

Year	Death rate	Return rate	Crediting rate	Death Benefit	Surrender Value
1	0.003	0.0424	0.0212	1,315,306	939,504
2	0.003	0.0400	0.0200	1,341,612	958,294
3	0.003	0.0288	0.0144	1,360,931	972,094
4	0.004	0.0763	0.0382	1,412,850	1,009,179
5	0.004	0.0102	0.0125	1,430,511	1,021,794
6	0.004	-0.0353	0.0125	1,448,392	1,034,566
7	0.005	0.1103	0.0552	1,528,271	1,091,622

Note: Surrender value is equal to the policy reserve

In Table 2, total premiums and expenses appear in the Year 0 row. Thus, the initial account value is total premiums minus total expenses (=920,000,000). The investment incomes based on the initial account value and the investment return rates for each year are listed under Column "Income." The number of death claims and surrender policies are listed in Columns 4 and 5, respectively. The last column reports the number of remaining policies.

Table 2. Account and Policy Information

Year	Premium	Expense	Income	# of deaths	# of surrender	# of remained policies
0	1000000000	80000000				
1			39,008,000.00	3	0	997
2			38,202,483.00	3	0	994
3			28,490,104.00	3	0	991
4			77,341,269.00	3	0	988
5			11,084,848.00	4	0	984
6			-38,551,573.00	4	0	980
7			115,568,747.00	4	976	0

Table 3 reports the total death benefits and surrender values based on the number of death claims and surrender policies in Table 2. The account value in the second to the last column is computed by adding the investment income of the current year to the account value of the previous year and subtracting the total death benefits and surrender values of the current year. In the second to the last column, CSM (or LC) are computed from discounting the final account value by the investment return rate to the beginning of Year

1. In the final column, the internal rate of return (IRR) is reported based on the surrender value in the seven years.

In the above, given the share mechanism, the numerical results are based on a path of investment return rates. By Monte Carlo simulation, 10,000 paths of investment return rates would be generated, and then 10,000 cases of CSM (or LC) and IRR are computed. From the 10,000 cases of CSM (or LC), the value at risk given a 5% significant level can be figured out as value at risk can be used as a measure of risk capital. Thus, by dividing the average CSM by the value at risk, the risk-adjusted return of the insurance products can be computed under the share mechanism. This risk-adjusted return can be a performance measure for the insurer. In addition, the average IRR can be used as the average annual financial return and the standard deviation of the IRRs as a risk measure for the policyholder. The ratio of the average return and the standard deviation can be a performance measure for the policyholder.

Table 3. Account Value and CSM (or LC)

Year	Total Death Benefits	Total Surrender Value	Account Value	CSM or LC	IRR for Policyholders
1	3,945,917	0	955,062,083	70,675,529	0.0126
2	4,024,835	0	989,239,731		
3	4,082,793	0	1,013,647,042		
4	4,238,551	0	1,086,749,760		
5	5,722,044	0	1,092,112,564		
6	5,793,570	0	1,047,767,421		
7	6,113,085	1,065,423,419	91,799,664		

By setting different minimum crediting rates and share portions, the above simulation analysis can lead to different financial outcomes for the insurer and policyholder under different share mechanisms. Obviously, there is a trade-off between the insurer's and the policyholder's financial outcomes. The above analytic framework provides the numerical financial results of the share mechanism for interest-sensitive life insurance products.

4. Simulated Results of the Case Study

To study the outcome of the share mechanism, 7 scenarios with different minimum crediting and share portions are analysed. There are 1.25% minimum crediting rates combined with the share portions, 0.5, 0.6, 0.7, and 0.8, and 0.5 share portions combined with the minimum crediting rates of 1.5%, 1.75%, and 2%. In addition, the only stochastic factor assumed is the investment return rate. It is assumed to follow a Geometric Brownie motion with a 5% mean rate and a 5 % drift rate. 10,000 paths of annual investment return over 7 years are generated by Monte Carlo simulations.

The simulated results are reported in Tables 4 and 5. Both list the mean and standard deviation (STD) of the insurer's CSM and the policyholder's IRR over 10,000. In addition, the value at risk (VaR) listed is the 5 percentiles of the 10,000 CSMs. As expected, the average CSM, which measures the profitability of the insurer, decreases with the share portion or the minimum crediting rate increasing while the policyholder's IRR, which measures the policyholder's return, increases as the share portion or the minimum crediting rate increases. This indicates, given an investment plan, there is a trade-off between the insurer's profit and the policyholder's return. The final profit and return share plan could not only depend on the insurer's decision. If the insurance market is competitive, the insurer will have to give the policyholder a competitive IRR.

With the minimum crediting rate, the risk share between the insurer and policyholder is asymmetric. Relative to the mean, the STDs of CSM are generally higher than those of IRR. Thus, the insurer often takes more risk. The risk share not only depends on the minimum crediting rate, but also the share portion. Intuitively, a high share portion could give the policyholder more risk share, but less risk share to the insurer. These are supported by the STDs of CSM, which decrease with the share portion increasing. However, due to the minimum crediting rate, the asymmetry could make the STD not a good risk measure. The VaRs of CSM actually increase with the share portion increasing. Thus, the insurer's downside risk really increases as the share portion increases.

The 95% value at risk of initial investment positions 920,000,000, with a 5% mean rate and 5 % standard deviation normal return distribution over 7 years, can be computed as -78,449,441. Because of the share mechanism, this total risk does not belong to the insurer. Depending on the minimum crediting rate and the share portion, the insurer's risk could be 36% and 114% of the total risk, or in between. Thus, under the share mechanism, the market risk share belonging to the insurer could vary a lot. The risk share of the insurer is normally less than one. With a minimum crediting rate and high share portion, it could be close to one or more than one.

The mean of CSM over the VaR can be regarded as a reward-to-risk measure or risk-adjusted performance measure. As VaR can be considered as the risk capital given the default probability equal to one minus the VaR confidence level, the performance measure is a kind of risk-adjusted return on market risk capital. It can be used for comparison with other insurance lines with similar market risk.

Table 4. Simulated Results under 1.25% minimum crediting rate and Different Share Portion

Share Portion	0.5	0.6	0.7	0.8
Mean of CSM	98,255,613	70,499,134	39,838,143	11,809,396
STD of CSM	70,788,749	64,962,627	59,658,216	53,141,289
VaR of CSM	-28,602,435	-48,458,886	-69,353,350	-89,119,610
Policyholder's Average IRR	0.0176	0.0228	0.0278	0.0331
STD of IRRs	0.0069	0.0085	0.0102	0.0117

Table 5. Simulated Results under 50% Share Portion and Different minimum crediting rate

Minimum Crediting Rate	1.25%	1.5%	1.75%	2%
Mean of CSM	98,255,613	93,790,335	89,088,686	82,755,369
STD of CSM	70,788,749	72,210,356	75,100,839	77,499,268
VaR of CSM	-28,602,435	-38,408,819	-46,348,940	-57,821,278
Policyholder's Average IRR	0.0176	0.0185	0.0194	0.0203
STD of IRRs	0.0069	0.0066	0.0063	0.0061

5. Conclusion

This paper analyses the share mechanism of interest-sensitive life insurance products, and how it affects the return and risk of insurers and policyholders as a case study. The profitability of the insurer is measured by using the CSM concept in IFRS 17 and the IRR is used for the investment return of the policyholder. Further, the value at risk of CSM is used for the market risk measure.

By setting different minimum crediting rates and share portions and by using Monte Carlo simulations, the numerical results observed in our paper can show the average CSMs with varying IRR. Generally, higher average CSMs come with lower IRRs and vice versa. This is a trade-off between the insurer's profits and the policyholder's return. From this analysis, the insurer can figure out, given a competitive IRR, what CSM he can obtain and what the minimum crediting rates and share portion are.

The numerical analysis can also provide the market risk analysis under different share mechanisms. The value at risk of CSMs is used for the risk measure. The risk share of the insurer is normally less than one. However, because of the minimum crediting rate, it could be close to one or more than one with high share portion.

Finally, the market risk-adjusted return of the insurer can be computed from average CSM over the value at risk.

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