

# SOLVENCY AND FINANCIAL RISK MANAGEMENT FOR LIFE INSURERS USING REINSURANCE

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**Abstract.** Recent market and regulatory developments have highlighted the growing importance of good solvency and financial risk management for life insurers. This paper demonstrates with concepts and practical applications that traditional reinsurance, often greatly underutilized by life insurers in Asia, can be a simple but quite effective risk management tool for solvency and financial risk management that is available to any life insurer. With proper reinsurance support, even small or new companies can compete head-on with large, established multinational companies to provide a whole range of insurance solutions to consumers. Financial reinsurance with a primary focus on the management of balance sheet and earnings, however, is not covered in this paper.

**Key words:** Solvency, capital, financial risk management, reinsurance, risk/return, embedded value.

## 1 Introduction

In its broadest sense, capital represents the excess of a life insurer's assets over its liabilities. A life insurer needs capital to absorb risk and to avoid insolvency. However, it is not necessarily the case that more capital is always better:

- Regulators and rating agencies will always like to see more capital. A life insurer with more capital usually offers better security for its policyholders and rating agencies usually grant it a higher credit rating.
- Policyholders will generally like to see more capital but only to a certain extent. Though more capital means better security, it also leads to higher premiums policyholders have to pay.
- Shareholders will generally like to see less capital but only to a certain extent. Whereas a smaller capital base possibly offers a higher return on equity (RoE), less capital also means a higher probability of shareholders losing their investments.

So there is a healthy tension among regulators, rating agencies, policyholders, and shareholders. A certain amount of capital is needed in order to promote solvency, but if there is too much capital, the profitability (i.e. RoE) will suffer. Life insurers must carefully balance the needs of all stakeholders and efficiently deploy the capital they have.

Efficient capital management should be built on sound assessments of the capital required to support the risks that the insurer has chosen to underwrite, with due consideration for the regulatory requirements. In their daily work, life insurers are often confronted with a wide range of issues on capital and solvency:

- Weighing the perspectives and influences of policyholders, regulators, rating agencies, and shareholders, what is the optimal level of assets and capital (i.e. optimal target capital) a life insurer has to maintain?
- Once a company has determined its optimal target capital, how does it allocate the actual capital held to the different business units and product lines? What are the profitability and pricing implications?
- How can companies improve their financial and business decision-making to most effectively allocate funds to future business investment? That is, how can a company best spend its excess capital?
- When a company desires to strengthen its capital and solvency position, what are the various alternatives a company has? What are the advantages and disadvantages of each alternative?

This paper will not try to answer all the questions relating to capital and solvency a life company might face. Rather, it primarily focuses on the fundamental capital and solvency needs of a life insurer and discusses how traditional reinsurance can be used in practice to help a life insurer improve its solvency and capital position and its financial risk management ability. With these objectives in mind, we have organized the paper into the following three parts:

- 1) Overview of solvency requirements and current developments across Asia
- 2) Reinsurance techniques for solvency and financial risk management
- 3) Case studies

Since this paper is mainly intended for practising actuaries and financial managers of life insurance companies in Asia, we have selected three cases from local markets to illustrate the use of the three main traditional reinsurance plans, i.e. YRT reinsurance, modified coinsurance, and coinsurance. In all cases, embedded value is used as a common measure for the effectiveness of various reinsurance solutions.

The reinsurance techniques discussed in this paper are limited to traditional reinsurance only. Financial reinsurance techniques with a primary focus on the management of a life company's balance sheet and earnings, though sometimes very effective, are beyond the scope of this paper and are not covered here.

## 2 Overview of solvency requirements and current developments across Asia

Fundamentally, the capital needs depend on the riskiness of the business. The riskier the business is, the more capital a life insurer has to hold. The capital needs also depend on the risk appetite of the company. The more risk averse a life insurer is, the more capital it requires. The capital determined in this context is the so-called "economic risk capital", which is the amount of capital that a life insurer would devote to supporting its business activities after careful consideration of the risk-return trade-off.

Regulatory capital, on the other hand, is a benchmark requirement stipulated by the insurance regulators. All life insurers are measured against this benchmark for their current financial and solvency positions. Due to its simplicity of

determination and objectivity, the regulatory capital standard may not necessarily provide an accurate measure of the risk position of life insurers and their true capital needs.

## 2.1 Current regulatory solvency regimes in the world

Even with the obvious shortcomings, regulatory capital is the one life insurers have to comply with. Many life companies also use a percentage (i.e. 150%) of the regulatory capital to price their insurance products. Currently there are two main types of regulatory solvency requirements used by different insurance markets in the world:

- EU-type

Under the EU-type requirement, the minimum solvency capital a life insurer has to hold for its long-term business is the sum of two components: a certain percentage of mathematical reserve and a certain percentage of capital at risk. The EU-type requirement relates to the liability side of the balance sheet only:

$$\text{Minimum solvency capital} = x\% \times \text{Reserve} + y\% \times \text{Capital at risk}$$

For additional benefits covering risks other than the mortality risk, solvency rules similar to general insurance may apply, requiring a certain percentage of premiums or claims as the solvency margin.

- US-type

Under the US-type requirement, the minimum solvency capital a life insurer has to hold is based on the so-called risk-based capital. The risk-based capital is also a factor-driven formula but takes into account more risk components:

- C0: Insurance subsidiary and off-balance sheet risks
- C1: Asset risk
- C2: Insurance risk
- C3: Asset/liability mismatch risk
- C4: General business risk

$$\text{Minimum solvency capital} = C0 + C4 + \sqrt{(C1 + C3)^2 + (C2)^2}$$

Under both types of solvency requirements, reinsurance results in a partial reduction of solvency capital required.

The EU-type solvency requirement is currently being used by the EU countries and quite a number of Asian countries. This approach is overly simplified with a number of significant weaknesses:

- It is based on the liability side of balance sheet only.
- It makes no distinction between various types of assets.
- The asset/liability mismatch risk is totally ignored.
- Diversification effects are not taken into account.

Consequently, the EU-type solvency capital requirement is not adjusted to the true risks of a life insurer and provides limited incentive for proper risk management. The weaknesses of the EU-type requirements are being recognized by insurance

regulators around the world. With the introduction of the so-called Solvency II standards, the requirement for EU countries will change soon.

Compared with the EU-type standard, the US-type solvency capital requirement is more sophisticated and better reflects the true risks of a life insurer, especially in the area of asset/liability mismatch risks. It also recognizes the likelihood that not all risks will occur at the same time, i.e. imperfect correlation of risks.

However, the US-type solvency capital requirement is still a factor-driven approach and its one-size-fits-all formula leaves some room for company manipulation.

## **2.2 International trends in solvency regulations**

Different capital and solvency requirements in different countries create an additional barrier in today's global economy. In the desire for a global uniform solvency standard, the International Association of Insurance Supervisors (IAIS) is working on a global framework for insurer capital requirements. Acting in support of IAIS, the International Actuarial Association (IAA) has formed an Insurer Solvency Assessment Working Party to propose a Global Framework for Insurer Solvency Assessment.

The working party of IAA has proposed a three-pillar supervisory regime that is quite similar to what EU proposed under Solvency II:

- Pillar I: Minimum financial requirements

This pillar includes the maintenance of appropriate technical provisions; appropriate assets supporting those obligations; and a minimum amount of capital for each insurer. The calculations should reflect a comprehensive view of the insurer's own risks.

- Pillar II: Supervisory review process

This pillar is intended to ensure not only that insurers have adequate capital to support their business, but also to encourage insurers to develop and use better risk management techniques that reflect the insurer's own risk profile. The supervisory review process enables the regulator to intervene if a life insurer's capital is not sufficient for its risks.

- Pillar III: Measure to foster market discipline

This pillar serves to strengthen market discipline by introducing disclosure requirements. It is expected that through these requirements industry "best practices" will be fostered.

The proposed framework is risk focused and reflects the relevant risks that a life insurer faces:

- The minimum capital prescribed will serve as an effective buffer to absorb losses. With greater transparency, it will facilitate comparisons across insurance companies. It will also provide clearer information on the financial strength of insurers and facilitate early and effective intervention by the regulators, if necessary.

- A total balance sheet approach that measures the assets and liabilities of a company on a consistent basis using realistic values is proposed. Ideally, the capital needs should be independent of the accounting systems.
- Reinsurance is highlighted as one of the most important risk management tools available to all life insurers. Despite the reduction in expected earnings, buying reinsurance makes good economic sense. For many life insurers, the cost of buying reinsurance is generally lower than the economic cost of putting up the additional required capital.

The proposed solvency framework favors the “economic risk capital” approach, goes beyond the pure solvency requirements, and offers insurance companies incentives to truly measure and better manage their respective risk situations.

### 2.3 Solvency regulations in Asia

Many Asian markets, with the exception of Japan and most recently Taiwan and Singapore, have been using the EU-type solvency standard. Below is a summary of the current regulatory solvency requirements for a number of Asian markets:

- Japan

Japan was the first Asian country to adopt the US-type RBC standards probably for very good reasons. The prolonged stock market decline and low interest rates have caused the failure of a number of life insurance companies.

The current RBC standard effective since April 1, 1996 covers (a) insurance risk, (b) interest rate risk, (c) asset adequacy risk, and (d) management risk. The risk-based capital is calculated as follows:

$$\text{Risk-based capital} = \sqrt{a^2 + (b + c)^2} + d$$

Stochastic tests have to be performed by the appointed actuary to confirm the adequacy of asset-backing reserves. In addition, the credit risk is specifically analyzed.

Recently, a new solvency guideline for variable annuity (VA) products with guaranteed minimum death/maturity/income/surrender benefits has been put in place. This guideline would impose a significant amount of additional capital on the writers of VA products with such investment guarantees.

- Taiwan

Before July 2003, life companies in Taiwan needed to maintain a minimum net worth of 45% of registered capital, irrespective of the company size and amount of risk exposed. Since July 2003, the US-type RBC standard has been in place after a lengthy discussion.

The current RBC standard covers asset risk for related parties (C0), asset risk for unrelated parties (C1), insurance risk (C2), interest rate risk (C3), and other risk (C4). C1 risk is further divided into C1s for stocks and C1o for other asset classes. The risk-based capital is calculated as follows:

$$\text{Risk-based capital} = 0.4 \times \left[ C0 + C4 + \sqrt{(C1o + C3)^2 + (C1s)^2} + (C2)^2 \right]$$

Under the new solvency standard, some life insurers may be under capitalized.

- Singapore

Before 2005, Singapore followed the EU-type standard, with x% of reserve (i.e. 3% for non-participating business and 2% for participating business) and y% of capital at risk (i.e. 0.2% for policy terms more than two years and 0.1% for policy terms less than two years). Since 2005, the US-type RBC standard has been applied.

Risks arising from an insurer's assets and liabilities are grouped into the following three components: insurance risk (C1), asset and interest rate risk (C2), and asset concentration risk (C3). The risk based capital is calculated as follows:

$$\text{Risk-based capital} = C1 + C2 + C3$$

The solvency regime consists of two requirements: the Fund Solvency Requirement (FSR), applicable to each insurance fund; and the Capital Adequacy Requirement (CAR), applicable to the whole company.

- Hong Kong

Hong Kong follows the EU-type standard, with x% of mathematical reserve (i.e. 4% of non-linked business and 1% of linked business with investment risk) and y% of capital at risk (i.e. 0.3% for policy terms more than five years, 0.15% for policy terms between three and five years, 0.1% for policy terms less than three years). The minimum required solvency margin is subject to a minimum of HK\$ 2 million.

There is currently no mechanism – such as an early warning system required by the regulation – to assess the ongoing financial stability of a life insurer. However, in 2004 the Actuarial Society of Hong Kong released a guidance note requiring life companies to perform dynamic solvency tests.

- China

China follows the EU-type standard, with x% of reserve (i.e. 4% of non-linked reserves and 1% of linked reserves) and y% of capital at risk (i.e. 0.3% for coverage periods of more than five years, 0.2% for coverage periods of three to five years, and 0.1% for coverage periods of less than three years). It also developed a number of monitoring indexes similar to the US practice as an early warning system. With the quick development of the life insurance market and the growing number of new companies, the appropriateness of these indexes is questionable.

Currently, the regulators in China are examining the various solvency regimes around the world, and the US-type RBC standard is expected to be introduced in the near future.

- India

Currently India follows the EU-type standard, with x% of policyholder reserve (i.e. 4% of non-linked reserves, 2% of linked reserves with guarantee, and 1% of linked reserve without guarantee) and y% of capital at risk (i.e. 0.3% for

non-linked business and 0.2% for linked business). At all times, a company must maintain a minimum solvency margin of INR 50 Crores (about €10 million).

The US-type RBC standard is being considered for future introduction.

The various solvency requirements differ somewhat across Asia even within the same solvency regime (i.e. EU-type or US-type). This is understandable because risks in each market and the reserve standard may be different.

Whether an Asian country has adopted a risk-based capital system or not, with the whole world moving toward such a system Asian countries will follow this trend. The implications of the adopting a risk-based capital system include:

- Risk management will be the focus of regulators and insurers.
- Investment risk and asset/liability management (ALM) risk will be emphasized for life insurers.
- Capital requirements for different product lines will change.
- Value-based management such as embedded value will become an important performance management tool.
- The role of reinsurance in risk management will become more important.

The implementation of a risk-based capital system can be an agonizing process and it requires significant investments from the life companies. However, it will change the way that many life insurers conduct business and will make them more risk focused and value orientated. In the long run, life insurers will increase their profitability and become more attractive to investors.

### 3 Reinsurance techniques for solvency and financial risk management

In the course of providing risk protection for policyholders, life insurers face a number of risks themselves. These risks can be broadly grouped into one of the following four categories according to the US RBC terminologies:

- C1: Asset default risks
- C2: Insurance risks
- C3: Asset liability mismatch risks
- C4: Other business risks

In modeling risks, actuaries usually pay special attention to three key risk components: volatility (i.e. random fluctuation of loss frequency or severity), uncertainty (i.e. misestimating the loss frequency or severity), and extreme events (i.e. low frequency but high-impact losses). The risk management techniques are designed to reduce one or more of these risk components, thus improving the capital and solvency position of a life insurer.

### 3.1 Overview of risk management tools and techniques

To manage the risks associated with its business, a life insurer has a number of options such as risk reduction, risk diversification, risk hedging, and risk transfer. Common risk management tools and techniques include accumulation/limit control, hedging, securitization, and reinsurance. All these risk management tools have their advantages and disadvantages and the effectiveness varies greatly:

- Accumulation/limit control

A life insurer can reduce its risk exposure by setting limits in its business activities. For example, on the product side, it can limit its production volume of various product lines and geographic locations as well as set a maximum cover per life. On the investment side, it can set limits in various asset categories and maximum amounts in each individual asset. A company adopting the limit control approach in general would also have some negative impact on its growth and profit potential.

- Hedging

A life insurer can use hedging techniques to reduce its risk exposure. For example, it can buy derivative instruments to hedge interest and equity risks in its insurance products. It can also create an internal hedge by selling products with offsetting exposures. However, investors in general would not reward a company pursuing an internal hedging strategy because it would guarantee a mediocre result. Also, there are no perfect hedges available in the marketplace to hedge interest and equity risks embedded in the insurance products. A number of life companies in the USA incurred significant losses by using derivative instruments to hedge interest and equity risks in early 2000s.

- Asset/liability management

To reduce asset/liability mismatch risks, a good asset/liability management process is the preferred approach. Such process could provide the company some insight into the possible future developments of its business under various scenarios. However, it should be mentioned that there are some practical difficulties in successfully implementing such a process for many life insurers: It is very costly to build and maintain an disciplined ALM process and the effectiveness of such an ALM process is sometimes overly exaggerated (i.e. "garbage in and garbage out"). Furthermore, restrictions concerning the availability of certain asset classes in the marketplace may limit the company's ability to achieve an adequate matching position.

- Securitization

A company can reduce its risk exposure by securitizing a block of business. If done successfully, securitization can transfer the risk associated with this block to the investors. Unfortunately, due to the complexity of insurance products, market interest in an investment asset backed by the profit from a block of insurance policies is very limited.

- Reinsurance



A life insurer can reduce its risk by transferring a portion of its risks to a reinsurer. Reinsurance refers to the insurance purchased by a life insurer for itself. In the reinsurance transaction, the insurer cedes to the reinsurer either proportional amounts of risk exposures through quota share and surplus arrangements or losses exceeding a preset limit through non-proportional arrangements such as catastrophe excess of loss covers. From a life insurer's perspective, the only concern in a reinsurance arrangement is the credit risk of the reinsurer; therefore, selecting a professional and financially strong reinsurer is the prerequisite for a successful reinsurance strategy.

Among all the tools and techniques a life company can use, we believe reinsurance is the simplest, most flexible, yet very effective risk management tool available to all types of insurers and insurance. Reinsurance is the natural choice for the reduction of all three major risk components: volatility, uncertainty, and extreme events. Moreover, reinsurance can be used as an effective capital and financial management tool of the company in situations such as new business financing and surplus management.

Next, we focus on the use of reinsurance to support the capital and financial risk management of a life insurer.

### **3.2 Use of reinsurance**

Reinsurance has three main functions: (a) as a risk management tool, (b) as a financial management tool, and (c) as a provider of product and underwriting expertise. Proper use of reinsurance has a positive impact on the solvency and capital position of a life insurer.

#### **(a) As a risk management tool**

The most common reason for a life insurer to buy reinsurance is to reduce claims fluctuations. Without reinsurance support, a life insurer is subject to adverse claims fluctuation because of single large claims, or the claim accumulation in one catastrophic event, or a large number of claims in a year. Large claims fluctuation leads to volatile profit and an uncertain solvency position, especially for small or new insurers without the cushion of a large free surplus. This volatility is disliked by the shareholders, the policyholders, and the regulators.

Reinsurance allows a life insurer to issue insurance policies with larger coverage amounts that it would otherwise have to decline, e.g. the increasingly popular insurance products for high net worth clients in Hong Kong and Singapore.

Surplus reinsurance is commonly used to protect a life insurer against single large claims while a catastrophe excess of loss cover can limit the impact of claim accumulations due to a single catastrophe such as the recent tsunami in Southern Asia.

Moreover, reinsurance allows a life reinsurer to assume new types of risk of experimental nature. Reinsurers with global potential for diversification can support a life insurer to safely enter into such a line of business and to build up experience.

Recent regulatory development in Asia points to the use of risk-based capital that rewards life insurers for proper risk management. A properly structured

reinsurance program is a perfect risk management solution that can significantly reduce a life insurer's risk exposure resulting in the reduction of its risk capital requirements. Consequently, a life insurer can write much more business with the same amount of capital at hand.

(b) As a financial management tool

In order to maintain growth, a life insurer needs to have enough capital to cover the new business strain. New business strain arises when the selling expenses (primarily in the form of commissions), together with the reserves to be set aside, exceed the premium received. This strain in the initial years is recouped during the lifetime of the policy.

With the finite amount of capital a life insurer has, the new business strain significantly reduces the company's capacity to write new business. This is especially true for many young and growing life insurers in Asia.

Coinsurance or modified coinsurance is often used to alleviate the new business strain by paying to the life insurer a larger portion of acquisition cost often called "reinsurance commission". The reinsurer gradually recovers the initial financing through profits emerging in later years.

By financing the new business strain, the reinsurer provides temporary surplus relief to the life insurer until it builds up a comfortable level of capital and surplus. Genuine risk transfer has to take place for this to be classified as a reinsurance transaction. Compared with equity financing, reinsurance financing costs less and better matches the life insurer's need for temporary capital and surplus relief.

In addition to seeking new business financing, life insurers are constantly looking for ways to increase their capital base in order to support promising new business opportunities. For example, due to conservative pricing and reserve requirements, an old in-force block of whole life policies has built up a large mortality margin. The life insurer may want to realize the expected future mortality gains from this block and to free up some risk capital.

A modified coinsurance arrangement can help the life insurer to do just that. Here the reinsurer pays the life insurer an up-front consideration often called the "purchase price" that relates to the embedded value of the expected future mortality gains from the in-force business reinsured. In doing so, the life insurer is able to not only lock in the expected mortality gains up front but also to eliminate the future lapse risk.

(c) As a provider for product and underwriting expertise

Besides the use of reinsurance for risk and financial management, life insurers benefit from a wide range of services provided by the reinsurers. A full service reinsurer can meet just about every need of its clients such as life underwriting, product development, actuarial services, claims management, marketing, and market intelligence.

- Life underwriting

Risk assessment in life insurance is an area in which the reinsurer has traditionally provided an excellent and extensive service. A professional reinsurer generally offers its clients a variety of underwriting tools such as

underwriting manuals, underwriting publications, underwriting training, and underwriting reviews.

- Product development

Well-designed and well-priced products are the heart of any successful life insurance company. A professional reinsurer can assist clients throughout the entire product development process, from initial concept to final design as well as from implementation to review.

- Actuarial support

Actuaries have the responsibilities to ensure the profitability of the products and the solvency of the company. Actuarial services that a professional reinsurer can provide include actuarial statistics on special covers or risk factors, development of company-specific pricing and valuation bases, profit testing and financial projection, actuarial seminars and workshops, publications on specific subjects, e.g. ALM.

- Claims management

The primary purpose of claims management is to ensure that any benefit payment made by the insurer is for a valid claim. The function of claims management is particularly important in covers such as disability insurance, long term care, and critical illness insurance. Claims management services provided by a professional reinsurer include claims handling, claims forms and questionnaires, claims review, publications, as well as training and workshops.

- Marketing

Effective marketing is the efficient distribution of products that meet consumers' needs. A professional reinsurer can offer seminars and workshops in areas such as organization and management of the marketing division, market research, agency systems, alternative distribution channels, and sales support.

- Market intelligence

A global reinsurer often has a closely knit information network that enables it to recognize and analyze new developments worldwide at an early stage and prepare information on these according to the clients' objectives. Market intelligence services of a professional reinsurer include market and product analyses, distribution channels, advice on economic, legal, actuarial and political aspects. In addition, a reinsurer can actively support its clients in their expansion into new geographical areas or new market segments.

Compared with the similar services provided by a consultant, a reinsurer does not charge the life insurer up front but only recoups its investment through participating in the reinsurance when the company is successful. This provides the added confidence and support to the insurer.

### 3.3 Reinsurance techniques

Reinsurance provides simple tailor-made solutions to a life insurer's risk and financial management needs. Which method of reinsurance to be used naturally depends closely on the purpose of a particular reinsurance program. Below is a brief overview of the most commonly used reinsurance types and plans.

(a) Proportional vs. non-proportional reinsurance

Basically, reinsurance can be grouped into two main types: proportional reinsurance and non-proportional reinsurance, where proportional reinsurance covers on a per policy basis and non-proportional reinsurance covers on a portfolio of risks basis.

- Proportional reinsurance

Under proportional reinsurance the reinsurer follows the cover and the fortunes of the primary insurer for all policies reinsured. Furthermore, the proportion of the risk reinsured is determined at issue according to a fixed formula on a per policy basis. The period of reinsurance and the term of the policy are usually identical, though the absolute amount reinsured can vary by duration.

The proportional reinsurance is often arranged in the form of quota share or surplus reinsurance. Quota share and surplus reinsurance will be explained in more detail later.

- Non-proportional reinsurance

Non-proportional reinsurance is usually applied under special circumstances to protect the whole portfolio of a primary insurer. In this case the overall portfolio, its structure and exposure, is of importance rather than the consideration of individual policies. The common non-proportional reinsurance arrangement used by life insurance companies is the catastrophe excess of loss cover.

Catastrophe excess of loss reinsurance covers an unexpected accumulation of losses due to a catastrophic event such as airplane crashes, earthquakes, windstorms, floods and other natural catastrophes. Such a cover would be in addition to a normal proportional reinsurance cover and would provide for further protection of the retained part of the portfolio. Here the reinsurer's liability depends on the overall claims arising from a particular event rather than on a per policy basis.

With a catastrophic event a life insurer could be faced with paying a large number of claims if a number of its policyholders are simultaneously affected. Even if the proportional reinsurance is fully adequate under normal circumstances, a rare catastrophe can pose a threat to the solvency of a company in respect of the retained proportion of the risks.

This form of reinsurance does not identically follow the fortunes of a ceding insurer. It covers only a part of losses under restricted and clearly defined circumstances. Also, it is annually renewable. Since catastrophes as defined happen very infrequently, the premiums are low and a lack of claims even for decades is fully expected and already taken into account in the calculation basis used.

(b) Surplus vs. quota share

Under proportional reinsurance, the amount of coverage to be reinsured must be determined in advance. The two approaches used to determine the amount ceded are the surplus and the quota share bases.

- Surplus

When reinsurance is ceded on a surplus basis, the ceding company reinsures amounts in excess of those specified in its retention schedule. The retention schedule may be the normal schedule for the company or product-specific.

- Quota share

A quota share arrangement is a form of reinsurance where the ceding company states its retention in terms of a level percentage of the risk on each policy issued up to a maximum amount.

The quota share arrangement will result in more reinsurance being ceded on a given block of business than under the surplus arrangement, as a portion of each policy issued is reinsured rather than only a portion of those policies that have amounts in excess of the retention limit.

A quota share arrangement can be used in situations

- where the ceding company plans to write a large number of policies needing reinsurance. This may be because of large amounts per life, or because significant surplus strain is expected and the ceding company needs financial assistance.
- where the ceding company is entering a new product line or new market. An experienced reinsurer can be used to assist it entering the market and is compensated by a portion of the business generated.
- where it would be inconvenient or impossible to individually identify amounts reinsured in excess of a certain limits. In its purest form, a quota share agreement is the most convenient method to provide surplus relief on a block of in-force policies as the ceding company can simply apply a level percentage to its premiums, claims, and reserves to determine the reinsurer's share.

In most instances, quota share reinsurance applies to the first dollar of coverage. However, quota share can be used in combination with a surplus risk arrangement.

(c) Plans of traditional reinsurance

The primary proportional reinsurance plans in the traditional market are (a) risk premium reinsurance, frequently referred to as yearly renewable term or YRT, (b) coinsurance, sometimes referred to as original terms reinsurance, and (c) modified coinsurance, frequently referred to as mod-co.

- Yearly renewable term (YRT)

Under the YRT reinsurance, the sum at risk for the reinsured part of the insured risk is calculated annually. This sum at risk is then multiplied by the reinsurance premium which corresponds to the mortality of the

insured person at the attained age. The reinsurer therefore covers the mortality risk only and receives each year the premium corresponding to reinsured sum at risk.

The features of a YRT reinsurance include the following:

- Among the three reinsurance plans, YRT reinsurance is the simplest to administer.
  - The YRT reinsurance premium rates are not directly related to the office premium rates of the original insurance.
  - The amount reinsured in any one year is not based on the face amount of the policy, but rather on the net amount at risk.
  - The reinsurer covers the mortality risk only; therefore, the reinsurer does not need client/plan specific records for premiums, allowances, cash values and reserves.
  - YRT rates do not have to vary by product as long as the reinsurer believes that the mortality is relatively consistent among the products.
  - The ceding company retains the full responsibility for establishing the policy reserves, managing the investment risks, and paying all policyholder liabilities.
  - YRT reinsurance is usually cheaper for the ceding company because administration is simpler and the lapse and investment risks are smaller.
- Coinsurance

Under the coinsurance arrangement, the reinsurer receives its proportionate share of the gross premium from the ceding company and pays its proportionate share of the policyholder liabilities such as death benefit, surrender benefit, and maturity benefit, if any. In addition, the reinsurer provides a reimbursement to the ceding company in recognition of the commissions and other issue expenses in the form of a reinsurance commission.

The features of a coinsurance arrangement include the following:

- The reinsurance coverage ceded to the reinsurer on a policy is in the same form as that of the direct policy issued to the policyholder.
- The reinsurer shares in the new business strain. The reinsurance commission may exceed the actual commission and expenses of the ceding company, providing additional new business financing.
- The reinsurer establishes its proportionate share of the policy reserves and bears the investment risks inherent in the product.
- The reinsurer shares proportionately in the risk of loss due to excessive mortality or morbidity, lapses, and cash surrenders.
- The administration is relatively complex due to the calculation of reinsurance commission and the maintenance of reserves, etc.

Coinsurance is commonly used today for reinsuring term products with little or no cash value build-up and, therefore, minimal investment risk.

However, coinsurance can be used with cash value products if there is a desire to pass new business strain or investment risk to the reinsurer.

- Modified coinsurance

As in coinsurance, the reinsurer receives its proportionate share of the gross premium from the ceding company and pays its proportionate share of the policyholder liabilities such as death benefit, surrender benefit, and maturity benefit, if any. In addition, the reinsurer provides a reimbursement to the ceding company in recognition of the commissions and other issue expenses in the form of a reinsurance commission.

However, under modified coinsurance, the statutory reserve on the ceded portion of the policy is deposited with and held by the ceding company, rather than by the reinsurer. The reinsurer is responsible for funding any increases in the reserve, less a credit for investment income.

The features of a mod-co arrangement include:

- Assets equal to the reserve are deposited back and kept by the ceding company.
- The reinsurer does not usually share in the investment risks; rather, a fixed interest is received on the deposited reserve.
- The reinsurer shares in the new business strain. The reinsurance commission may exceed the actual commission and expenses of the ceding company, providing additional new business financing.
- The reinsurer shares proportionately in the risk of loss due to excessive mortality or morbidity, lapses, and cash surrenders.
- The reinsurer is not usually responsible for the policyholder dividend.

The reasons for the use of the mod-co arrangement include:

- Some jurisdictions do not allow the ceding companies to take credit for reserves on policies reinsured under coinsurance. The mod-co arrangement eliminates the reserve credit problem.
- Some ceding companies believe that they could realize a better investment return on the assets underlying the reserves than the reinsurer would assume in its pricing.
- Mod-co eliminates the problem of participation in policyholder dividends by the reinsurers as the ceding company holds the assets.
- Mod-co allows the ceding company to maintain a higher level of assets and therefore attain a higher comparative asset ranking than would coinsurance.

Modified coinsurance is used primarily in reinsuring products which develop cash values. The main drawback of mod-co is that it is somewhat more complicated to administer than coinsurance because of the reserve adjustment calculation.

## 4 Case studies

Three cases from the Hong Kong market are modified and presented below to illustrate how traditional reinsurance is used in practice for the solvency and financial risk management of a life insurer. When reviewing these cases, the reader should bear in mind the following:

- All the figures and some aspects of the real cases have been intentionally altered to avoid the resemblance to the actual transactions. However, the basic concept remains sound.
- These cases are derived from the real cases in the Hong Kong market. Due to different regulatory or tax systems, some of these solutions may not be allowed in some markets at this moment and even if allowed, the effectiveness may vary from market to market.
- Due to different risk profiles and company priorities, the effectiveness of these solutions can also vary from company to company within the same market.
- These cases are for illustrative purposes only and may be overly simplified. Detailed, rigorous mathematical treatment of the cases has not been pursued for the sake of comprehensibility by a wider readership. Those insurers that are interested in pursuing these solutions should consult a qualified reinsurer first.

In addition to demonstrating how reinsurance can improve the capital and solvency position of a life insurer, we also show that despite the reduction in expected profits, buying reinsurance makes good economic sense. For many life insurers, the cost of buying reinsurance is generally lower than the economic cost of putting up the additional required capital.

To demonstrate the value-adding capability of various reinsurance solutions, we have chosen “embedded value” (EV) as the common performance measure because embedded value:

- quantifies risk and value creation;
- makes the comparison of various alternatives easier;
- promotes the efficient use of capital;
- rewards good performance.

Embedded value has been widely used by European life insurers and reinsurers and it is gaining popularity in the USA and some Asian markets.

### 4.1 Case 1 - Risk management using YRT reinsurance

#### A. Case background

Company A is a medium-size local life insurer that specializes in group business (group life and medical). Over the last few years, the company has successfully built up a large portfolio of group medical business with annual premium of about €50 million. However, the yearly renewable group life portfolio is considerably smaller with annual premium of about €5 million.



The group life market, with thin profit margins, is very competitive and is dominated by a few very large multinational players. Due to volatile underwriting results, large risk capital needs and conservative pricing, Company A cannot compete effectively in the group life market.

After reviewing last year's performance, Company A's management has concluded that the group life portfolio must grow to support its group medical business. In addition, Company A would like to achieve the following:

- Maintaining or improving its profit margin
- Reducing the volatility in underwriting results
- Reducing the risk capital needs
- Retaining as much business and profit as possible

#### B. Reinsurance solution

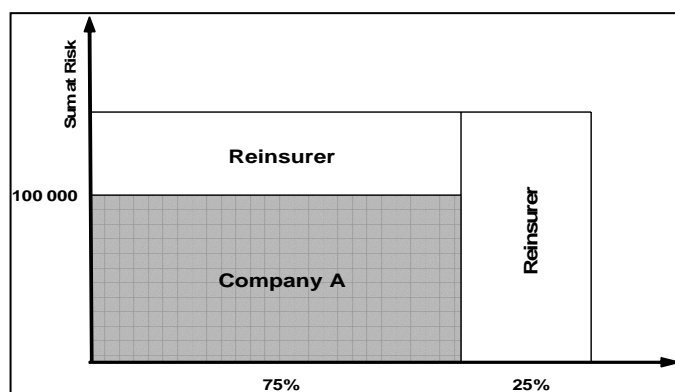
The reinsurance solution proposed in this case is YRT reinsurance with 75%/25% quota share and surplus. The arrangement can be summarized as follows (see the graph below):

##### Company A

- is responsible for 75% of any claim amount up to a maximum retained amount of €100,000 for each life;
- receives 100% of gross premium but pays a risk premium to the reinsurer;
- is responsible for 100% of commissions and administrative expenses.

##### The reinsurer

- is responsible for 25% of any claim amount plus 100% of any claim amount in excess of Company A's maximum retention for its 75% share;
- receives for the reinsured portion the risk premium, which in this case is equivalent to the gross premium less insurer expenses (5%) and broker commission (12.5%);
- pays a profit commission (if any) to Company A.



The main reasons for the YRT reinsurance proposal :

- For each life, Company A's maximum exposure is limited to €100,000. This effectively limits the impact of large single claims.

- Company A keeps most of the business written and technical profits, i.e. about 65% of business is retained.
- Company A can improve its pricing competitiveness by relying on the reinsurer's experience in the group market.
- With a 50%/50% profit sharing, Company A participates in the good claims experience of the reinsurer but is protected from poor claims experience.
- Company A only needs to set up the risk capital for its retained business and due to improved risk profile, the risk capital required can be further reduced.

#### C. Portfolio information

Company A's group portfolio can be represented by five benefit plans with number of participants, face amount, mortality rate (qx), and office premium rate as follows:

Plan	Number of participants	Face Amount	qx	Office premium rate
1	35.000	100.000	0,076%	0,102%
2	4.000	150.000	0,089%	0,119%
3	750	200.000	0,102%	0,135%
4	200	1.000.000	0,095%	0,127%
5	50	5.000.000	0,083%	0,110%

Here the office premium rate is set as  $qx/(1 - 25\%)$ . The 25% loading consists of 12.5% for broker commissions, 5% for administrative expenses, and 7.5% for expected profits.

Assuming that each participant represents an independent random risk with probability of claim (qx), the distribution of the total portfolio claim would be close to a normal curve. The following table shows the total office premium, retained premium, total claim volatility, and retained claim volatility:

Plan	Office premium	Retained premium	Total claim volatility	Retained claim volatility
1	3.556.308	2.667.231	266.519.832.823	149.917.405.963
2	711.262	474.174	79.945.786.817	35.531.460.808
3	203.218	101.609	30.451.666.205	7.612.916.551
4	254.022	25.402	190.335.012.624	1.903.350.126
5	275.190	5.504	1.031.112.389.202	412.444.956
Total	5.000.000	3.273.920	1.598.364.687.671	195.377.578.404

Under the proposed reinsurance arrangement, Company A would retain about 65% (= 3,273,920/5,000,000) of premium and technical results.

#### D. Technical analysis

##### (1) Expected profit

Because a portion of the group life business is ceded to the reinsurer, the expected technical profit of Company A drops.

Before reinsurance:

$$\text{Expected profit } X_b = 5,000,000 \times 7.5\% = 375,000$$

After reinsurance:

$$\text{Expected profit } X_a = 3,273,920 \times 7.5\% = 245,544$$

Here the expected profit of the insurer drops about 35% after reinsurance.

(2) Standard deviation of the claim distribution

The standard deviations before and after reinsurance can be calculated as:

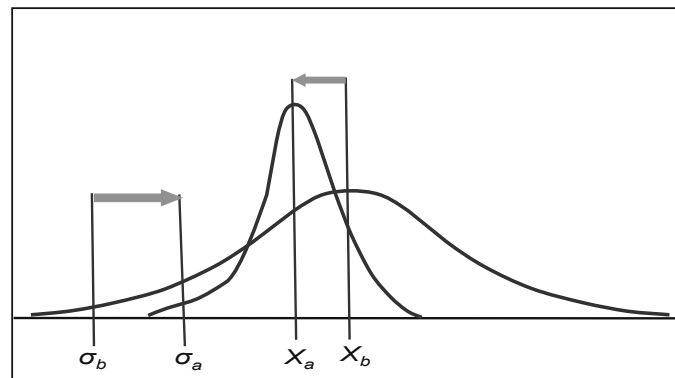
Before reinsurance:

$$\text{Standard deviation } \sigma_b = (1,598,364,687,671)^{0.5} = 1,264,264$$

After reinsurance:

$$\text{Standard deviation } \sigma_a = (195,377,578,404)^{0.5} = 442,015$$

The standard deviation of retained claim is only about 35% of that of the total claim, reflecting a significant reduction in risk retained (see the graph below).



(3) Risk discount rate (RDR)

Investors demand a correspondingly high prospective return (i.e. risk discount rate) if the perceived risk is high. With reinsurance the portfolio risk (i.e. standard deviation) is much lower, therefore, the risk discount rate would be reduced as well.

To estimate the impact of claim volatility on risk discount rate, the Capital Asset Pricing Model (CAPM) can be used:

$$\text{Risk discount rate } = r = r_f + \beta \times (r_m - r_f)$$

where

- $r_f$  = Risk-free interest rate
- $\beta$  = Investment's sensitivity to market movement
- $r_m$  = Expected market return
- $r_m - r_f$  = Market risk premium
- $\sigma_m$  = Standard deviation of market return

Assuming for the general market return,

$$\begin{aligned} r_f &= 4.5\% \\ \beta &= 1 \\ r_m &= 12.0\% \\ r_m - r_f &= 7.5\% \\ \sigma_m &= 15.0\% \end{aligned}$$

Here  $\beta$  equals 1 for an investment with 7.5% of risk premium and 15.0% of standard deviation. The  $\beta$  of the group life portfolio can be estimated as:

$$\begin{aligned} \text{Before reinsurance:} \\ \beta_b &= (1,264,264/375,000)/(15.0\%/7.5\%) = 1.69 \end{aligned}$$

$$\begin{aligned} \text{After reinsurance:} \\ \beta_a &= (442,015/245,544)/(15.0\%/7.5\%) = 0.90 \end{aligned}$$

The above approach to estimate  $\beta$  is intuitively simple but other methods may also be used. In practice, determining the  $\beta$  is more difficult and you cannot expect to be paid big money for doing a simple ratio analysis.

The risk discount rates can therefore be calculated as:

$$\begin{aligned} \text{Before reinsurance:} \\ \text{RDR}_b &= 4.5\% + 1.69 \times 7.5\% = 17.2\% \end{aligned}$$

$$\begin{aligned} \text{After reinsurance:} \\ \text{RDR}_a &= 4.5\% + 0.90 \times 7.5\% = 11.3\% \end{aligned}$$

The risk discount rate has shown a significant reduction after reinsurance.

#### (4) Risk capital

Usually a company has to hold the larger of the regulatory capital and the economic risk capital. In this case, due to the highly volatile results, the economic risk capital is much larger. Here we assume that the economic risk capital is defined using the value-at-risk concept at a 97.5% confidence level:

$$\text{Capital C} = \max(2 \times \sigma - X, 0)$$

The risk capital before and after reinsurance can be calculated as:

$$\begin{aligned} \text{Before reinsurance:} \\ C_b &= (2 \times 1,264,264 - 375,000, 0) = 2,153,528 \end{aligned}$$

$$\begin{aligned} \text{After reinsurance:} \\ C_a &= (2 \times 442,015 - 245,544, 0) = 638,486 \end{aligned}$$

The risk capital required has been reduced by about 70% after reinsurance.

#### (5) Embedded value (EV) added

Embedded value is the present value of the expected profit after capital cost discounted at the risk discount rate:

Before reinsurance:

$$EV_b = (375,000 - 2,153,528 \times (17.2\% - 4.5\%))/1.172 = 86,606$$

After reinsurance:

$$EV_a = (245,544 - 638,486 \times (11.3\% - 4.5\%))/1.113 = 181,606$$

Even with the reduction in expected profit, the EV has more than doubled after reinsurance.

#### E. Summary of results

The above case demonstrates a number of important benefits of YRT reinsurance as a capital and risk management tool:

- YRT reinsurance is an effective risk management tool that can significantly reduce the claim volatility of the retained business, thus reducing the required return on capital.
- YRT reinsurance is an effective capital management tool that can significantly reduce the required risk capital, thus improving the capital position and increasing the business capacity of the company.
- The reduction in risk capital and the reduction in the required return on capital both contribute to the reduction of the cost of capital.
- Group life business is very competitive, with thin margins and low embedded value. For many companies, this line of business is only viable with the support of a reinsurer, i.e. product expertise and greater diversification ability.

The example only considers the current year results and ignores tax and profit sharing. With profit sharing considered, the positive impact of reinsurance on capital reduction and embedded value creation is even greater.

### 4.2 Case 2 – Solvency relief using modified coinsurance

#### A. Case background

Company B is a fast-growing, medium-sized life insurer that specializes in bancassurance selling simple saving-type insurance contracts. The single premium ten-year participating endowment product developed early last year was so successful that it has reaped in over €1 billion of premium for the year. Though the product does not generate new business strain after commission and reserve, the company's management is very concerned about the expected solvency capital required to support this block of business.

Due to very minimal mortality risk involved, the solvency capital requirement mainly comes from the reserve component. According to the local solvency regulation, a life insurer has to put up 6% (150% × 4%) of reserve as the solvency capital to meet the minimum solvency ratio of 150%. The total capital required for this block of business is about €60 million.

Company B has about €35 million of available capital from various internal sources and has ruled out the possibility of raising capital by issuing surplus notes. Other alternatives to providing capital relief of about €25 million have to be found.

For any solution proposed, the company requires no initial cash outflow and minimum ongoing service cost. In addition, the company would like to control its investment and dividend policy and keeps the expected investment gains.

#### B. Reinsurance solution

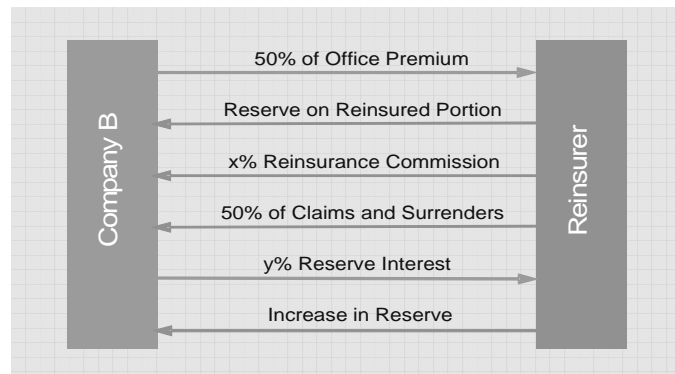
The reinsurance solution proposed in this case is 50%/50% modified coinsurance. The arrangement can be summarized as follows (see the graph below):

##### Company B

- retains 50% of office premiums;
- is responsible for 50% of surrender, death, and maturity benefits;
- is responsible for 100% of commissions and dividend payments;
- credits the reinsurer with a prescribed interest on the deposited reserve.

##### The reinsurer

- receives 50% of office premiums;
- is responsible for 50% of surrender, death, and maturity benefits;
- deposits back the reserve for the reinsured business with Company B but receives a prescribed interest on the deposited reserve;
- pays a reinsurance commission to Company B to compensate it for the issue expenses and to provide new business financing (if any);
- funds the reserve increase for the reinsured business.



The reasons for the modified coinsurance proposal include the following:

- After reinsurance, Company B's capital requirement can be reduced by about €30 million, which exceeds the capital shortfall of €25 million.
- Modified coinsurance would not involve the transfer of the reserve to the reinsurer; therefore Company B can take full control of its investments and expected investment gains.
- Since this is a participating product, the mod-co arrangement would allow the company to manage the dividend policy easier.
- In general, the cost of capital relief through reinsurance is lower than through equity financing. With different capital requirements and tax situations of the insurer and the reinsurer, reinsurance financing could be even more attractive.

C. Portfolio information

Unlike YRT reinsurance, where the reinsurer is mainly concerned about the mortality risk and underwriting, the mod-co arrangement puts the reinsurer in a very similar situation as the insurer; therefore, a careful analysis of the product features and a parallel profit test for the insurer and the reinsurer are necessary. The key portfolio information and profit test assumptions for the insurer are listed below:

(1) Product features

Product type:	Single premium ten-year endowment
Office premium:	As stated in policy
Target dividend:	1.50% per year
Persistency bonus:	Years 5 and 10
Cash value:	As stated in policy
Reserve basis:	3.5% interest and 120% of HKA01

(2) Profit test assumptions

Business volume:	€1 billion
Acquisition expense:	7.5% of premium
Maintenance expense:	€10 per policy
Investment return:	5.75%
Mortality:	100% of HKA01
Lapse rate:	2.5% in all years
Tax rate:	1% on premium
Risk capital:	6% on reserve (= 150% x 4%)
Profit margin:	5% of premium
R/I arrangement:	50%/50% modified coinsurance
R/I commission:	7.5%
Reserve interest:	3.6%

D. Technical analysis

(1) Baseline results

A profit test model is constructed to run the profitability of the block. From Company B's perspective, the profit margin and embedded value before and after reinsurance are as follows:

	<u>Profit margin</u>	<u>Embedded value</u>
Before reinsurance:	3.3%	€33 million
After reinsurance:	7.8%	€39 million

In this case, despite the fact that 50% of business is ceded to the reinsurer, the profit margin is more than doubled while the embedded value has increased by €6 million from €33 million to €39 million.

Further analysis shows the costs and benefits of various components of reinsurance:

(+) Reduction in the cost of solvency capital:	€4 million
(-) Increase in cost of reinsurance:	€3 million
(+) Reduction in tax liability:	€5 million

The total embedded value gain from this transaction is therefore €6 million (= 4-3+5). Here we have assumed a very low cost of capital for the company; otherwise, the savings on capital cost would be much larger.

The 50%/50% mod-co arrangement provides Company B with 50% reduction in required solvency capital (about €30 million). The relief exceeds the company's capital shortfall of €25 million.

(2) Sensitivity tests

Final profitability of this business depends on the actual investment return and lapse rate. Sensitivity runs based on different levels of investment return and lapse rate are performed to make sure that under reasonably adverse market conditions, both parties can still achieve acceptable returns.

E. Summary of results

The above case demonstrates a number of important benefits of modified coinsurance as a capital and risk management tool:

- Mod-co is an effective capital management tool that can proportionally reduce the required solvency capital thus improving the capital position and increasing the business capacity of the company.
- Mod-co using reserve interest and reinsurance commission, can be an effective financial management tool that allows the company to flexibly manage its new business strain (if any) and profit emergence.
- Mod-co allows the company to take total control of its investments and to retain the full expected investment gains.
- Due to different solvency requirements and the required return on capital for the reinsurer, reinsurance financing is actually cheaper for the insurer than putting up its own risk capital.
- Reinsurance can sometimes be a very effective tax planning tool. Due to different tax situations of the insurer and the reinsurer, the insurer may realize additional (sometimes substantial) savings on taxes from reinsurance.

Profit sharing, not included in the above analysis, can also be arranged to return more profit to the company.

**4.3 Case 3 – Deficiency reserve reduction using coinsurance**

A. Case background

Company C is a small local life insurer that only sells traditional life products through brokers. Recently the company developed a very competitively priced level term product (10/15/20/30-year) using the preferred lives concept.

The product offers four non-smoker classes (Preferred Plus, Preferred, Standard Plus, and Standard) and two smoker classes (Preferred and Standard). To select the preferred risks, every applicant has to go through a complete paramedical/medical exam with full blood and urine tests. Due to the rigorous underwriting and premium structure, the best non-smoker premium rate is only about 50% of the standard non-smoker rate.



In the first year, the company has sold about €1 million of premium mostly within the best two premium classes. After the year-end valuation, the company realizes that it needs to set up a deficiency reserve of about €10 million, ten times of the first-year premium.

The deficiency reserve, sometimes controversial, arises when the gross premium of a policy is less than the corresponding valuation net premium. Due to limited experience in this preferred term product, the company valuation mortality bases are very conservative for all premium classes. Since most policies are issued in the best two premium classes, the gross premiums are considerably lower than the valuation net premiums for these policies, resulting in significant deficiency reserves.

The company does not have enough free capital and the company's solvency position and the survival of the product are in jeopardy. The company believes that this product is vital for the company to compete as a successful niche player in the marketplace and it intends to promote this product. A solution is needed to eliminate a large portion of the deficiency reserve from this product. If possible, the company would also like to alleviate some of the new business strain due to high commissions and issue expenses.

#### B. Reinsurance solution

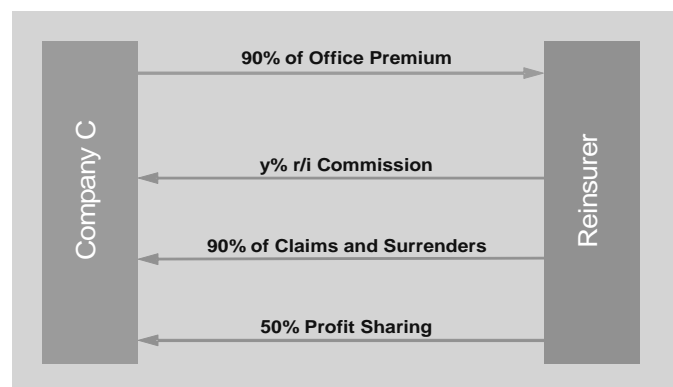
The reinsurance solution proposed in this case is a 10%/90% coinsurance arrangement with 50% profit sharing. The arrangement can be summarized as follows (see the graph below):

##### Company C

- retains 10% of office premiums;
- is responsible for 10% of surrender benefits (if any) and death benefits;
- is responsible for 100% of broker commissions and issue expenses but gets a reinsurance commission from the reinsurer.

##### The reinsurer

- receives 90% of office premiums;
- is responsible for 90% of surrender benefits (if any) and death benefits;
- pays a reinsurance commission to Company C to compensate it for the issue expenses and to provide new business financing (if any);
- pays 90% of the pre-agreed maintenance expenses;
- pays 50% of profit after expenses as the profit commission to Company C.



The reasons for the coinsurance proposal include the following:

- After reinsurance, Company C's basic reserve and deficiency reserve would be reduced proportionally by 90%.
- 90% of the new business strain is transferred to the reinsurer. Additional new business financing could be arranged through a higher reinsurance commission.
- Most of the investment risk (though limited in this case) and lapse risk, would be transferred to the reinsurer.
- Through a 50%/50% profit sharing, the company retains about 50% of profit with only 10% of risk exposure.
- The reinsurer's expertise in the area of preferred underwriting and claims handling could be very valuable to Company C, which has limited experience in such a specialty product.

#### C. Portfolio information

Similar to modified coinsurance, coinsurance puts the reinsurer in a very similar position as the insurer. Therefore, a careful analysis of the product features and a parallel profit test for the insurer and the reinsurer are necessary. The key portfolio information and profit test assumptions for the insurer are listed below:

##### (1) Product features

Product type:	Level premium term (10/15/20/30-year)
Office premium:	As stated in policy
Policy fee:	€50
Reserve basis:	4.0% interest and 120% of HKA01

##### (2) Profit test assumptions

Business volume:	€1 million
Acquisition expense:	€300 per policy
Maintenance expense:	€50 per policy
Investment return:	5.0%
Mortality:	Company pricing mortality
Lapse rate:	10%/5%+
Tax rate:	1% on premium
Risk capital:	150% x (4% of reserve + 3% of capital at risk)
Profit margin:	5% of premium
R/I arrangement:	10%/90% coinsurance
R/I commission:	Actual issue expenses including commissions

#### D. Technical analysis

##### (1) Baseline results

A profit test model is constructed to run the profitability of this block. From Company C's perspective, the profit margin and embedded value before and after reinsurance are as follows:

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	<u>Profit margin</u>	<u>IRR</u>	<u>Embedded value</u>
Before reinsurance:	5.2%	8.3%	€240,000
After reinsurance:	60.5%	15.2%	€270,000

It can be seen that both the absolute profit and the profit margin increase after reinsurance despite the fact that only 10% of risk is retained:

- The profit margin has increased more than ten times to a spectacular 60.5%.
- IRR has increased from an unsatisfactory 8.3% to a respectable 15.2%.
- Absolute embedded value actually grows from €240,000 to €270,000.

The 10%/90% coinsurance arrangement helps Company C to eliminate 90% of basic and deficiency reserve. With additional new business financing through a higher reinsurance commission, the total capital relief to the company can be even larger.

### (2) Sensitivity tests

Final profitability of this product depends on the actual mortality and lapse experience. Sensitivity runs based on different levels of experience mortality and lapse rate are performed to make sure that under reasonably adverse market conditions both parties can still achieve acceptable returns.

### E. Summary of results

The above case demonstrates a number of important benefits of coinsurance as a capital and risk management tool:

- Coinsurance is an effective capital management tool that can proportionally reduce the reserve (basic reserve and deficiency reserve) and solvency capital, thus improving its capital position and increasing the business capacity of the company.
- Coinsurance reduces proportionally the new business strain. Additional new business financing can be arranged through a higher reinsurance commission.
- Coinsurance transfers a large part (i.e. 90%) of the investment risk and lapse risk to the reinsurer but allows the company to retain 50% of profit from positive experience through a profit-sharing arrangement.
- The benefit from the possibly low reserve, low solvency margin, and low capital cost of reinsurer may be shared with the insurer.
- Coinsurance can sometimes be a very effective tax planning tool. Due to different tax situations of the insurer and the reinsurer, the insurer may realize additional savings on taxes.
- The insurer can benefit from the reinsurer's expertise in product development, underwriting, and claims handling.

### 4.4 General comments

The above three cases demonstrate that traditional reinsurance can be a very simple, flexible, and effective capital and risk management solution that

- does not involve fancy terms such as off-balance sheet financing, cashless transaction, and Special Purpose Vehicles (SPVs);

- does not require a team of expensive consultants and several PhDs to develop and to implement;
- does not become headlines on the front page of Asian Wall Street Journal or even the local newspaper;
- does not make the CEO and local regulators sleepless.

Yet, these simple solutions can significantly improve a company's capital and solvency position and save the company millions of dollars. Best of all, they are available to any life company, big or small.

It is often argued that by purchasing reinsurance, the life insurers give away too much business and profit. The above three cases demonstrate that this is totally not true. In all three cases, after reinsurance, the company's embedded value actually increases, even in the case of 90% coinsurance. This is made possible due to the reduction in reserve and capital, the profit-sharing arrangement, and the possible tax benefits.

## 5 Conclusions

As the world moves towards a risk-based capital system with increasing emphasis on company-specific risk analysis and control, the Asian countries are expected to follow this trend. Under the new regulatory approach, good solvency and financial risk management will become the focus of many life insurers in Asia.

Reinsurance is a simple, flexible, and effective capital and risk management tool that is available to any life insurer, large or small. Despite the apparent reduction in expected profits, buying reinsurance actually makes good economic sense. The reduction in capital and capital cost generally outweighs the cost of reinsurance.

Life insurers in other markets such as the USA and Canada have long been relying on reinsurance extensively to support their overall capital and financial risk management strategy. For example, over 80% of mortality risks in the USA are reinsured on quota share basis because of the capital and reserve requirements as well as the very competitive rates offered by reinsurers.

In Asia, so far only a few large multinational life insurers are taking advantage of reinsurance. According to the regulatory filing, 30% of gross premium of the Hong Kong operation of one large multinational life insurer and 50% of business of two multinational reinsurers were reinsured in 2003 for capital and financial risk management purposes. For most other life insurers, the full potential of reinsurance has not been fully explored.

But this situation is changing. With companies striving for continued profitable growth and regulators moving to a risk-based capital system, many life insurers in Asia are beginning to realize the benefits of reinsurance. Reinsurance, as a flexible and effective capital and risk management tool, will definitely play a more important role in the overall capital and financial risk management strategy of many Asian life insurers in the coming years.

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