On the Limitations of the Diversification Benefit

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1 Introduction

Insurance business is characterized by the inversion of the business cycle. Insurers receive premiums first and pay losses later. Therefore insurers can give financial discounts to the premiums they charge to policyholders. It also implies that insurers must hold an appropriate amount of capital in order to minimize the chance that they become insolvent. Indeed, policyholders do not want to exchange the risks they send to the insurance carrier with default risk.

This paper is devoted to the calculation of the required solvency level. In particular it tackles the diversification benefit.

An insurance company faces a large number of risks. According to the International Actuarial Association (2004), risks may be classified as follows:

- Underwriting risk: this is the risk that there will be a deviation between actual and forecast losses. This may happen because of statistical fluctuations or because the models or parameters used are wrong. A fraction of this risk is typically transferred from insurers to reinsurers through reinsurance agreements. A particular example of underwriting risk, that is usually ceded to reinsurers is the „extreme events“ risk, i.e. the risk of high-impact and low frequency events.

- Credit risk: this is the risk of default and change in credit quality of issuers of securities, counter-parties and intermediaries, to whom the company has an exposure. Reinsurers are typically a particular counter-party for insurance companies.

- Market risk: market risk arises from the volatility of market prices of assets. Market risk involves the exposure to movements in the level of financial variables such as stock prices, interest rates, exchange rates or commodity prices.

- Operational risk: operational risk is the risk of loss resulting from inadequate or failed internal processes, people, systems or from external events.

Actuaries typically concentrate on the underwriting risk. It is however clear that the other risks may be of predominant importance as well. In this paper we will concentrate on underwriting risk and we will make some remarks about the possible stochastic dependence between underwriting risk and other risks.

For a given type of business, policies have a certain volatility: this is the stochastic deviation of the result around the mean. When risks are independent, the coefficient

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of variation of a portfolio decreases with the size of the portfolio. Therefore insurers tend to write large portfolios of independent risks in order to decrease the relative volatility of their business and as a consequence their economic capital. This is why actuaries usually claim that the underwriting risk is diversifiable.

When it comes to the measure of the risk, it is another story. Indeed, the actuary does not know the model which is behind the loss generating process. In fact the measure of the risks is characterized by volatility and uncertainty.

Uncertainty is the risk that the models used to estimate the claims or other relevant processes are misspecified or that the parameters within the models are mismeasured. In most situations the actuary is not in a position that he can translate reality in an exact actuarial model. There always remains a chance that the model is wrong. Uncertainty risk is obviously not diversifiable for the insurance company. Indeed, if the model used is wrong, the measure of the risk of all the policies will be affected by the error. One may argue that the insurer can diversify the model risk across the lines of business he is writing. Unfortunately the number of lines of business being quite small, it will not be possible to reach the kind of diversification obtained for the volatility risk on thousands of policies. Some examples of model and parameter risk are:

- future inflation is badly estimated (all policies of all lines of business will be influenced: in this case diversification across the lines of business is even not possible)
- longevity risk: this is particularly important as it will take a very long time before effectively knowing whether the models used are wrong or not
- using a light-tailed distribution where the distribution is in reality heavy-tailed
- not recognizing that the speed of payment is changing compared to past observations
- not recognizing dependencies between lines of business or policies
- estimated parameters of a distribution may not be correct due to the low size of the sample.

It may be possible for an insurance company to hedge some of the model risks. Longevity risk and mortality risk can compensate each other as soon as the exposures are comparable.

When we analyze the situation of the shareholders of the insurance company we may argue that the uncertainty risk is diversifiable. Since they hold a sufficient number of stocks in their portfolio, they are able to diversify the uncertainty risk. Nevertheless the regulator will demand an amount of economic capital which is based on the situation of the insurance company because its aim is to protect the policyholders against failure of the insurance company.