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The interaction of guarantees, surplus distribution, and asset allocation in with-profit life insurance policies

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Abstract

Traditional life insurance policies in many markets are sold with minimum interest rate guarantees. This paper concentrates on the risk cliquet-style guarantees impose on the insurer, measured by shortfall probabilities under the so-called "real-world probability measure P". We develop a general model and analyze the impact of interest rate guarantees on the risk of an insurance company. Furthermore the paper is concerned with how default risk depends on characteristics of the contract, on the insurer's reserve situation and asset allocation, and on management decisions as well as on regulatory parameters. In particular, the interaction of the parameters is analyzed yielding results that should be of interest for insurers as well as regulators.

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1. Introduction

Traditional (i.e. not variable) life insurance policies in many markets are sold with minimum interest rate guarantees. Quite common are guarantees on a point-to-point basis: at maturity of a contract, the policyholder is guaranteed the amount equivalent to the result of a process which credits a certain minimum interest rate to the insured's account in every single year. However, an insurer's investment underperformance (relative to the guaranteed rate) for some of the years of a contract's lifetime would be tolerable so long as the minimum amount is met in the end. This provides the insurer with the possibility to compensate for bad investment results by positive results in other years. On the other hand, of course, this type of guarantee poses risk on the policyholder as it leaves the insurer with considerable flexibility in crediting interest to specific accounts. In so far as there is discretion with respect to the

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accounts to which interest is credited or with respect to whether returns are passed on to the insureds at all, this type of guarantee sets incentives for meeting short-term obligations while at the same time neglecting "young" contracts.

This incentive problem can be reduced by means of incorporating a different type of interest rate guarantee. In the case of a so-called cliquet-style guarantee, as, e.g., required by the German regulatory framework, any return that is credited to the policyholder's account is locked in: it increases the amount that the guaranteed rate must be applied to in the future. Obviously, the resulting reduction in risk for the policy owner comes at the cost incurred by the reduction of the insurer's flexibility in its investment decisions.

Usually, as long as investment returns are sufficient, life insurers try to provide the guaranteed rate of interest plus some surplus on the policyholders' account every year. Insurers apply a strategy which is often referred to as the *average interest principle* (see, e.g., Grosen and Jorgensen (2000)). Companies attempt to hold the surplus credited to the policyholders' account as constant as possible, in order to signal stability and low risk compared to other personal investment options an insured would have. This is achieved through building up reserves (mostly asset valuation reserves) in years of good returns on assets and using these reserves to keep surplus stable in years of low (or even negative) returns on assets. A reasonable model of the distribution mechanism in with-profit life insurance contracts should include this averaging mechanism.

Superficially, the long-term use of the strategy described above suggests that the minimum interest rate guarantee is obsolete. For a significant period in the past, it seemed as if the minimum guaranteed interest rates required by regulators were so low that insurance companies would exceed these values anyway without at all perceiving the minimum requirement as a restriction. Consequently, it appears that until rather recently life insurers have not charged a premium for an interest rate guarantee (see Grosen and Jorgensen (2002, p. 64)). The process of averaging returns over time worked rather well since market interest rates were, over a long time span, significantly higher than the guaranteed rates. In recent years, however, low market interest rates and plunging stock markets have caused trouble for insurance companies. In the changed environment, they now have to provide comparably high guaranteed returns to accounts to which already a substantial amount of surplus has been credited in the past. Under these circumstances, minimum interest rate guarantees have suddenly become a threat to insurers' solvency.

These developments illustrate the relevance of analyses of the impact of interest rate guarantees on these contracts and their interaction with other parameters. A key rationale for the regulation of insurance markets is to reduce or limit insurers' risk of insolvency. Minimum interest requirements, however, obviously generate a restriction which may increase insolvency risk. Particular emphasis therefore needs to be put on the interdependence between interest rate guarantees and the likelihood of default.

A number of papers have recently addressed interest rate guarantees, such as Briys and de Varenne (1997), Grosen and Jorgensen (2000), Jensen et al. (2001), Hansen and Miltersen (2002), Grosen and Jorgensen (2002), Miltersen and Persson (2003), Bacinello (2003), and Tanskanen and Lukkarinen (2003).

For a point-to-point guarantee framework, Briys and de Varenne (1997) compute closed-form solutions for market values of liabilities and equities. In their model the policy owner receives a guaranteed interest and is also credited a bonus, determined as a certain fraction of net financial gains (when positive). They provide an equilibrium condition, which reflects the interdependencies between these two parameters, assuming fair valuation of the contract in a risk-neutral evaluation framework. The paper also addresses the impact of interest rate guarantees on the company's risk exposure by analyzing interest rate elasticity and duration of insurance liabilities.

Contrasting the just-mentioned approach, Grosen and Jorgensen (2000) consider cliquet-style guarantees and introduce a model that takes into account an insurer's use of the average interest principle. In addition to a policy reserve (the customer's account) they introduce a "bonus reserve", a buffer that can be used to smoothen future bonus distributions. They analyze a mechanism that credits bonus to the customer's reserve based upon the current ratio of bonus reserve over policy reserve. A bonus is paid only if this ratio exceeds a given threshold. Thus, the actual distribution of surplus indirectly reflects current investment results but primarily focuses on the company's ability to level out insufficient results in the future. The authors decompose the contract into a risk-free bond, a bonus, and a surrender option. They compute contract values by means of Monte Carlo simulation, and also calculate contract default probabilities for different parameter combinations. However, they calculate default probabilities under the risk neutral probability measure Q. Since under this measure the value of a contract can be calculated as the expected discounted cash flow, it is also called pricing measure. However, for all events that occur with positive probability, the probabilities under Q usually differ from the probabilities under the real-world measure P, cf. e.g. Chapter 6.1 in