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Dynamic hybrid products in life insurance: Assessing the policyholders' viewpoint

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ABSTRACT

Dynamic hybrid life insurance products are intended to meet new consumer needs regarding stability in terms of guarantees as well as sufficient upside potential. In contrast to traditional participating or classical unit-linked life insurance products, the guarantee offered to the policyholders is achieved by a periodical rebalancing process between three funds: the policy reserves (i.e. the premium reserve stock, thus causing interaction effects with traditional participating life insurance contracts), a guarantee fund, and an equity fund. In this paper, we consider an insurer offering both, dynamic hybrid and traditional participating life insurance contracts and focus on the policyholders' perspective. The results show that higher guarantees do not necessarily imply a higher willingness-to-pay, but that in case of dynamic hybrid contracts, a minimum guarantee level should be offered in order to ensure that the willingness-to-pay exceeds the minimum premium the insurer has to charge when selling the contract. In addition, strong interaction effects can be found between the two products, which particularly impact the willingness-to-pay of the dynamic hybrids.

1. Introduction

Innovations in the life and pension industry have become increasingly important, especially against the background of demographic changes and as an alternative or supplement to public state-run pension schemes. However, the currently low interest rates and volatile capital markets make providing long-term guarantees increasingly difficult for insurers. In addition, the industry faces increasing regulation and cost pressure, and consumer preferences for stability, upside potential and flexibility must be taken into account when developing new contracts. In this context, dynamic hybrid life insurance products have recently been introduced in the German market.[1] Instead of explicitly (externally or internally) hedging the guarantees embedded in the contract or by means of capital, the guarantee is ensured implicitly by means of a dynamic reallocation of the dynamic hybrid account value between three funds: the policy reserves (i.e. the premium reserve stock), a guarantee fund, and a (risky) equity fund, following the idea of constant proportion portfolio insurance (see Bohnert and Gatzert, 2014). In this paper, our aim is to study these products in depth from the policyholders' perspective by taking into account the preferences and willingness-to-pay of consumers. We thereby also focus on the interaction effects that arise due to the fact that dynamic hybrid funds are periodically shifted to and from the conventional policy reserves, e.g., in times of adverse capital markets.

Dynamic hybrid products have first been modeled in the scientific literature by Kochanski and Karnarski (2011), who derive solvency capital requirements for static and dynamic hybrids using a rules-based shifting mechanism, but without focusing on possible interaction effects with other products. The latter has been studied in depth by Bohnert and Gatzert (2014), who present a comprehensive model framework to assess and demonstrate the (strong) interaction effects between dynamic hybrid products and traditional participating life insurance policies at the company level, thereby focusing on the insurer's risk situation and the policyholders' net present value. A comprehensive overview of the German market of dynamic hybrid products is further provided in Bohnert (2013), who shows the variety of options embedded in

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[1] Currently about 20 life insurance companies in Germany (out of roughly 100) provide dynamic hybrid products (see Bohnert, 2013). Life insurers in Japan are considering introducing dynamic hybrid products as well.

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the contracts and the implications of different shifting mechanisms by studying risk-return profiles provided by the industry. Thus, the scientific literature on dynamic hybrid products is still rather scarce.

In contrast, the consumer perspective on guarantees embedded in life insurance contracts in general has received increasing attention in the literature. Gatzert et al. (2012), for instance, use a theoretical model and a simulation study to compare the perspective of the insurer and the policyholder. They derive the willingness-to-pay for participating life insurance contracts using mean–variance preferences for different assumptions regarding the diversification opportunities of the policyholder and identify contract specifications that – while keeping the contract value fixed for the insurer – maximize customer value. The authors show that increasing the guaranteed interest rates does not necessarily maximize customer value. Broeders et al. (2011) use a similar approach based on a power utility function for the policyholder and study two types of annuity providers (defined benefit pension funds and life insurers) that differ according to the extent of risk sharing between beneficiaries and shareholders, demonstrating the need for regulation to provide a level playing field for providers. Schmeiser and Wagner (forthcoming) consider the consumers' perspective when deriving minimum solvency capital requirements, and thereby illustrate how minimum interest rates should be defined by the regulator in order to maximize the policyholders' utility level.

While these papers use theoretical models to study the consumers' perspective, Gatzert et al. (2011), for instance, also conduct an empirical survey to study the willingness-to-pay for interest rate guarantees in unit-linked life insurance contracts. Their results indicate that customers may not be willing to pay the risk-adequate price for the valuable guarantees as, on average, the willingness-to-pay was significantly lower than the minimum prices derived based on option-pricing theory. At the same time, however, a substantial portion of participants were willing to pay a considerably higher price, thus indicating a higher degree of risk-aversion. Further literature also reveals the importance of such things as customer preferences (e.g., see Døskeland and Nordahl, 2006), demographic characteristics such as income, gender, and education (e.g., see Feldman and Schultz, 2004), and insurer characteristics and operations (e.g., see Marshall et al., 2010) in the determination of willingness-to-pay.

In this paper, we explicitly focus on the policyholders' perspective, thereby studying the willingness-to-pay based on risk preferences as well as risk-return profiles. We thereby extend the model in Bohnert and Gatzert (2014) for a life insurer offering dynamic hybrids and participating life insurance contracts by focusing on different dynamic hybrid guarantee level, varying guaranteed interest rates (to be credited to the policy reserves). We further extend the previous setting by integrating different shifting mechanisms for the dynamic hybrid funds. This analysis is intended to provide insight into the impact of different types of long-term guarantees as well as features and characteristics of these life insurance financial products from the policyholders' viewpoint.

The remainder of the paper is structured as follows. Section 2 presents the model framework of the insurance company offering participating life insurance policies and the dynamic hybrid products including fair valuation and risk measurement as well as the derivation of the willingness-to-pay from the policyholders' perspective. Section 3 contains a numerical analysis and Section 4 provides concluding remarks.

2. Model framework

2.1. Modeling the insurance company—overview

In the following, we consider a life insurer offering two types of products: traditional participating life insurance policies (*PLI*) and dynamic hybrid products (*DHP*). The general model framework for the insurance company is based on the model presented by Bohnert and Gatzert (2014), which is then extended by taking the consumers' perspective, which is the focus of the present analysis. Table 1 shows the simplified balance sheet of the insurer.

Table 1
Balance sheet of the life insurer at time t (see Bohnert and Gatzert, 2014).

Assets	Liabilities
$A_t^{long-term}$	PR_t^{PLI} } PR_t
$A_t^{short-term}$	PR_t^{DHP} } PR_t
GF_t^A	GF_t^L } AV_t
EF_t^A	EF_t^L } AV_t
	B_t
A_t	A_t

Regarding the liability side, policyholders of both contract types are assumed to pay a single up-front premium P^{PLI} and P^{DHP}, implying initial policy reserves (*PR*) of the participating life insurance contracts of

$$PR_0^{PLI} = P^{PLI}$$

and an initial account value (*AV*) of the dynamic hybrid products of

$$AV_0^{DHP} = P^{DHP}.$$

As exhibited in Table 1, the dynamic hybrid products' account value *AV* is thereby composed of up to three parts, including a part that is invested in the insurer's collective policy reserves *PR*, an equity fund (*EF*), and a guarantee fund (*GF*) as described in detail later. The portion of the total policy reserves coming from the dynamic hybrid products is denoted as PR^{DHP}, which, together with the part coming from the traditional participating life insurance contracts PR^{PLI}, sums up to the total policy reserves $PR_t = PR_t^{PLI} + PR_t^{DHP}$.

The contract term T is assumed to coincide with the lifetime of the considered insurance company. At inception of the contract, the buffer B_0, residually given by the difference between assets and liabilities, is filled by the initial contribution of the company's equityholders. The contracts are then calibrated to be fair from the equityholders' perspective to ensure risk-adequate compensation for their investment.[2]

A summary of the various guarantees involved in the following model description is given in Table 2.

2.2. The participating life insurance contract

Participating life insurance contracts feature an annual guaranteed interest rate r^G and an annual surplus participation rate α. The annual policy interest rate r_t^P is declared in advance at the beginning of each year (as is required in the German market, for instance) and given by the smoothing scheme (see Grosen and Jørgensen, 2000)

$$r_t^P = \max\left(r^G, \alpha \cdot \left(\frac{B_t}{PR_t} - \gamma\right)\right),$$

[2] In the present setting, interaction effects between the two contracts are one main reason why the situation is not automatically fair for the policyholders as well. In fact, the value of the policies can considerably depend on the portfolio composition of the insurer, i.e. the portion of dynamic hybrid contracts in the portfolio (see Bohnert and Gatzert, 2014).