

A Note on Diversification Effects in Life Insurance Portfolios under Policyholders' Willingness to Pay

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Abstract

The event of an insurer's insolvency can result in serious financial consequences for its customers. To protect policyholders against this risk, the first pillar of the European insurance regulatory framework Solvency II provides solvency capital requirements for insurance companies to ensure a low one-year default probability of at most 0.5 percent. However, there is empirical evidence that even for a very low default probability of e.g. 0.3 percent, if transparently communicated, policyholders could decrease their willingness to pay for certain insurance products by up to 14 percent (see Zimmer, Schade and Gründl, 2009 [5]). This becomes even more relevant, as due to increasing public disclosures forced by insurance regulation and digital transformation, which results in more information available for policyholders. Therefore, when reporting safety levels from an insurer's perspective, not only regulatory requirements need to be considered but also the possible premium reduction due to customers' willingness to pay. This is also supported by the literature on the existence of market discipline in the insurance sector based on real market data. For example, Phillips, Cummins and Allen (1998 [4]) showed that a company's shortfall risk impacts its insurance prices, where the impact can vary between different lines of business, and is particularly pronounced for business with a longer payout tail.

While there exists literature in the context of risk- and value-based management, where policyholders' willingness to pay is directly embedded in an asset-liability model based analysis (e.g. Gründl, Post and Schulze, 2006 [2]; Klein and Schmeiser, 2019 [3]), previous work has not yet specifically focused on how the policyholders' (product-dependent) sensitivity to default risk may impact a life insurer's risk situation in a long run setting with multiple product lines.

Against this background, we aim to contribute to the literature by analyzing the impact of policyholder' willingness to pay with respect to reported shortfall probabilities on a life insurer with different product lines (term life and annuities) using a simulation analysis. We focus on portfolio diversification effects under different portfolio compositions of sold contracts and varying risk sensitivities of policyholders'. In particular, we investigate how diversification effects are affected if the policyholders' risk sensitivities differ between the purchase of term life insurances and annuities.

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For our simulation analysis, we build on a general asset-liability model for a life insurer used in Bohnert, Gatzert and Jørgensen (2015 [1]). This multi-period model contains many real world mechanisms like actuarially priced life insurance products, fair compensation of shareholders by dividend payments and surplus appropriation for policyholders. In our model the life insurer offers term life insurances and annuities in a run-off scenario where the specific portfolio mix can be controlled, which is in line with the majority of the literature. We extend this model by explicitly taking into account the policyholders' willingness to pay. For this, the insurer reports a one-year shortfall probability, as it is done e.g. in case with Solvency II. As a consequence, the premium income is affected depending on the customers' risk sensitivity. We use Monte Carlo simulation to derive numerical results, thereby varying the level of reported default probabilities and the degree of customers' risk sensitivity. For different portfolio compositions of term life insurances and annuities, we estimate risk measures from a long- and short-term perspective that are relevant for the insurer as well as the policyholders.

Our simulation results strongly emphasize that depending on the reported shortfall probability and customers' risk sensitivity, the mechanism of policyholders' willingness to pay can considerably affect a life insurer's risk situation. We further confirm that the "right" portfolio composition from the insurer's perspective can significantly reduce its shortfall probability and thus help to satisfy reported safety levels. The main finding of our research in terms of economic implications for insurers is that "new" or additional portfolio diversification effects arise if policyholders' risk sensitivities are indeed product-dependent as indicated on a business line level by empirical research, and that these diversification effects are strongly influenced by the extent of the deviation of risk sensitivities. We further find strong effects in combination with surplus distribution schemes that increase guarantees and increasing asset volatilities.

Keywords: Life insurance; asset-liability model; portfolio diversification; willingness to pay

References

- [1] Bohnert, A., Gatzert, N. and Jørgensen, P. L. (2015), "On the Management of Life Insurance Company Risk by Strategic Choice of Product Mix, Investment Strategy and Surplus Distribution Schemes." *Insurance: Mathematics and Economics*, vol. **60**, pp. 83-97.
- [2] Gründl, H., Post, T. and Schulze, R. N. (2006), "To Hedge or Not to Hedge: Managing Demographic Risk in Life Insurance Companies." *The Journal of Risk and Insurance*, vol. **73**(1), pp. 19-41.
- [3] Klein, F. and Schmeiser, H. (2019), "Heterogeneous Premiums for Homogeneous Risks? Asset Liability Management under Default Probability and Price-Demand Functions." *North American Actuarial Journal*, vol. **23**(2), pp. 276-297.

- [4] Phillips, R. D., Cummins, J. D. and Allen, F. (1998), “Financial Pricing of Insurance in the Multiple-Line Insurance Company.” *The Journal of Risk and Insurance*, vol. **65**(4), pp. 597-636.
- [5] Zimmer, A., Schade, C. and Gründl, H. (2009), “Is Default Risk Acceptable when Purchasing Insurance? Experimental Evidence for Different Probability Representations, Reasons for Default, and Framings.” *Journal of Economic Psychology*, vol. **30**(1), pp. 11-23.