

The Effect of Loss Aversion on Equity-Linked Life Insurance with Surrender Guarantees

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Equity-linked life insurance contracts combine a classical term life insurance and a savings account, which invests the policyholder's premiums in equity. Many equity-linked life insurance products include a guarantee to protect the capital plus a minimum interest rate guarantee, which is usually below the risk free rate, and the option to surrender the contract. A large literature considers how to price and hedge equity-linked life insurances with surrender guarantees. Most of the literature prices the surrender option of the insurance as an American option. Recently, researchers address suboptimal surrender in the light of empirical evidence of Kuo, Tsai, and Chen (2003), who link the policyholder's surrender behavior to the unemployment rate, that is, a reason exogenous to the insurance policy, and the interest rate. The interest rate gives the policyholder a surrender reason which is directly dependent on the contract features. Li and Szimayer (2014) include bounded rationality into the pricing of the equity-linked life insurance, but treat the surrender behavior as a random distortion of the financially optimal behavior. However, why the policyholder deviates from the financially optimal surrender behavior has not been explained so far.

In this paper, we explain the policyholder's surrender behavior for equity-linked life insurance contracts with surrender guarantees by her risk preferences. The literature on behavioral finance has pointed out the importance of risk preferences on financial decision making. The policyholder cannot price and hedge the surrender option as in the previous literature because

the policyholder has limited access to the financial market. We consider a representative policyholder in spirit of Albizzati and Geman (1994) who considers her life insurance contract in isolation of her other investments, that is, who frames narrowly, to price and hedge equity-linked life insurance contracts with surrender guarantees.

The policyholder surrenders her insurance policy according to her risk preferences, which are given by her utility function. We assume the policyholder follows the non-standard preferences of Tversky and Kahneman (1991)'s utility function. Thus, she considers her life insurance in comparison to a reference point, for example her expectation of the contract's outcome, which splits the outcome of the equity-linked life insurance contract into gains and losses. Empirically, losses loom larger than gains. The preferences exhibit diminishing sensitivity of returns, which produce in combination with loss aversion the famous S-shape of the policyholder's utility function. As a special case, we also consider standard expected utility theory with a classical power utility function.

The main contribution of this paper is twofold: Firstly, we derive a partial differential equation for the expected utility of the policyholder under non-standard preferences by applying the partial differential equation approach of Ahn and Wilmott (1998). Secondly, we endogenize the surrender behavior of the policyholder and explain the exogenously assumed surrender behavior of policyholders in the literature, for example, by Li and Szimayer (2014), by non-standard preferences.

In my model, the policyholder has a different surrender behavior compared to the optimal surrender behavior because the policyholder evaluates her utility function instead of a hedging or pricing based argument. The policyholder deviates from the optimal surrender behavior in two ways.

Firstly, the policyholder surrenders contracts earlier if she is sufficiently risk averse. The life insurance's embedded guarantee usually offers a lower return compared to the risk free return. If the underlying fund of the equity-linked contract performs poorly, the policyholder surrenders earlier to secure the risk free return for her premium, but the potential chance to receive gains from a recovery of the fund plays a small role.

Secondly, we show the importance of the reference point in combination with loss aversion to the policyholder's surrender behavior. The reference point controls an important part of the surrender behavior: Over the lifetime

of the contract, the surrender becomes relatively less attractive because the policyholder receives higher risk free rate for a shorter period of time compared to the guaranteed rate of the contract. If the reference point is a reasonable expectation of the contract's performance, the surrender benefit will switch from being a gain to a loss because it decreases over time. A reference point is reasonable if for the final outcome both a gain and a loss have high probability. At the time when the surrender benefit switches from gain to loss, the policyholder's loss aversion triggers surrender for higher fund levels. This surrender happens because the policyholder wants to secure that the contract ends up as a gain. Finally, we quantify the losses the policyholder incurs because of her risk preferences.

References

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