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# Lapse rate modeling: a rational expectation approach

Domenico De Giovanni 

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## Abstract

The surrender option embedded in many life insurance products is a clause that allows policyholders to terminate the contract early. Pricing techniques based on the American Contingent Claim (ACC) theory are often used, though the actual policyholders' behavior is far from optimal. Inspired by many prepayment models for mortgage backed securities, this paper builds a Rational Expectation (RE) model describing the policyholders' behavior in lapsing the contract. A market model with stochastic interest rates is considered, and the pricing is carried out through numerical approximation of the corresponding two-space-dimensional parabolic partial differential equation. Extensive numerical experiments show the differences in terms of pricing and interest rate elasticity between the ACC and RE approaches as well as the sensitivity of the contract price with respect to changes in the policyholders' behavior.

Keywords:

JEL Classification Codes:

G21

G22

## Notes

1. We need to further assume some smoothness and integrability conditions.
2. Specifying the condition at  $r=0$  is a delicate issue. Zvan et al. ([1998](#)) let the partial differential equation be satisfied at that boundary. Barone-Adesi et al. ([2003](#)) use a Neumann boundary condition. Having experimented both alternatives, we align with Zvan et al. ([1998](#))'s choice which seems to be more robust.
3. A better solution would be to let  $\theta^l$  depend on some economic indicators giving information about the financial difficulties of the policyholders such as the unemployment rate, rather than keeping it constant (see Kuo et al. [2003](#), Kim [2005](#)). However, the introduction of such variables considerably affects the simplicity of the model, since a new source of risk that cannot be hedged away should be taken into account.

### Related Research Data

[An Empirical Study on the Lapse Rate: The Cointegration Approach](#)

Source: Journal of Risk & Insurance

[Endogenous model of surrender conditions in equity-linked life insurance](#)

Source: Insurance Mathematics and Economics

[On the Risk of Insurance Liabilities: Debunking Some Common Pitfalls](#)

Source: Journal of Risk & Insurance

[Modeling Surrender and Lapse Rates With Economic Variables](#)

Source: North American Actuarial Journal

[On accounting standards and fair valuation of life insurance and pension liabilities](#)

Source: Scandinavian Actuarial Journal

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