



North American Actuarial Journal >

Volume 15, 2011 - [Issue 1](#)

270 | 39

Views | CrossRef citations to date | 1 Altmetric

Original Articles

# The Valuation of Guaranteed Lifelong Withdrawal Benefit Options in Variable Annuity Contracts and the Impact of Mortality Risk

Gabriella Piscopo Ph.D. & Steven Haberman

Pages 59-76 | Published online: 27 Dec 2012

🗨️ Cite this article   🔗 <https://doi.org/10.1080/10920277.2011.10597609>

Sample our  
Economics, Finance,  
Business & Industry Journals  
>> **Sign in here** to start your access  
to the latest two volumes for 14 days



📖 References

🗨️ Citations

📊 Metrics

🖨️ Reprints & Permissions

Read this article

🔗 Share

## Abstract

In light of the growing importance of the variable annuities market, in this paper we introduce a theoretical model for the pricing and valuation of guaranteed lifelong withdrawal benefit (GLWB) options embedded in variable annuity products. As the name suggests, this option offers a lifelong withdrawal guarantee; therefore, there is no limit on the total amount that is withdrawn over the term of the policy because if the account value becomes zero while the insured is still alive, he or she continues to receive the guaranteed amount annually until death. Any remaining account value at the time of death is paid to the beneficiary as a death benefit. We offer a specific framework to value the GLWB option in a market-consistent manner under the hypothesis of a static withdrawal strategy, according to which the withdrawal amount is

always equal to the guaranteed amount. The valuation approach is based on the decomposition of the product into living and death benefits. The model makes use of the standard no-arbitrage models of mathematical finance, which extend the Black-Scholes framework to insurance contracts, assuming the fund follows a geometric Brownian motion and the insurance fee is paid, on an ongoing basis, as a proportion of the assets. We develop a sensitivity analysis, which shows how the value of the product varies with the key parameters, including the age of the policyholder at the inception of the contract, the guaranteed rate, the risk-free rate, and the fund volatility. We calculate the fair fee, using Monte Carlo simulations under different scenarios. We give special attention to the impact of mortality risk on the value of the option, using a flexible model of mortality dynamics, which allows for the possible perturbations by mortality shock of the standard mortality tables used by practitioners. Moreover, we evaluate the introduction of roll-up and step-up options and the effect of the decision to delay withdrawing. Empirical analyses are performed, and numerical results are provided.

---

---

## Related Research Data

### [Variable Annuities](#)

Source: British Actuarial Journal

### [Mortality derivatives and the option to annuitise](#)

Source: Insurance Mathematics and Economics

### [Survival models in a dynamic context: a survey](#)

Source: Insurance Mathematics and Economics

### [Uncertainty in mortality projections: an actuarial perspective](#)

Source: Insurance Mathematics and Economics

### [The fair valuation problem of guaranteed annuity options: The stochastic mortality environment case](#)

Source: Insurance Mathematics and Economics

### [The effect of modelling parameters on the value of GMWB guarantees](#)

Source: Insurance Mathematics and Economics

### [The Titanic Option: Valuation of the Guaranteed Minimum Death Benefit in Variable Annuities and Mutual Funds](#)

People also read

Recommended articles

Cited by  
39

Information for

- Authors
- R&D professionals
- Editors
- Librarians
- Societies

Opportunities

- Reprints and e-prints
- Advertising solutions
- Accelerated publication
- Corporate access solutions

Open access

- Overview
- Open journals
- Open Select
- Dove Medical Press
- F1000Research

Help and information

- Help and contact
- Newsroom
- All journals
- Books

Keep up to date

Register to receive personalised research and resources by email

 Sign me up

