Life Insurance Investment Guarantees

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Interested students should schedule a meeting to discuss this project prior to selection
*Find updated project listing / availability at https://warwick.ac.uk/mpollock/projects *

Overview

Life insurance companies sell contracts (*policies*) to individuals or groups of persons (*policyholders*). In essence, the policyholder agrees to pay a schedule of amounts to the insurer (*premiums*), and in exchange the insurer agrees to pay to the policyholder a schedule of amounts (*benefits*) contingent on some event (for instance, survival or death of the policyholder). Traditionally, such policies are relatively simple: *Annuities* (*pensions*) typically pay an individual a regular amount for the remainder of their life in exchange for a lump-sum premium (at *retirement*); *Whole Life Assurance* typically pays an individual a lump-sum at death, in exchange for regular premiums throughout the individuals life.

From the perspective of the life insurer there are a number of features of policies which require consideration – foremost is contingency risk (often *mortality* or *morbidity* risk) arising from the event triggering the payment of benefits, and investment risk arising from the mis-match in frequency and timings of the payment of premiums and benefits. Contingency risk is generally very well understood by life insurers, and indeed there is typically little dependency between the large number of policies an insurer has and so accurate exposure can be guaged. For simple products investment risk is only of minor concern as products which have guaranteed benefits can be immunised using fixed-interest rate instruments.

However, innovation and competition within the life insurance sector has resulted in more exotic policies, in which in addition to offering the benefits in more traditional insurance products, policyholders also want products which have an element of *guaranteed* investment return. For instance, in an annuity (pension) product a policyholder may wish to *guarantee* upon a future retirement date that the lump-sum accumulated at that point provides an income no less than some acceptable threshold (a so called *Guaranteed Minimum Income Benefit (GMIB)*). Alternatively, a policyholder of a whole life assurance product may wish a minimum monetary sum to cover costs such as their funeral (a so called *Guaranteed Minimum Death Benefit*). Investment risk for policies with guarantees can not be diversified or pooled in the same manner as contingency risk – unfavourable circumstances will result in benefits being paid to a large proportion of policyholders.

In this project, we will comprehensively review [Hardy, 2003] and [Dickson et al., 2013], identify guarantees being offered in practice, and consider their risk and pricing. Students selecting this project should be interested in financial mathematics, and in particular simulation based approaches to option pricing. Although ostensibly an actuarial project, no particular background in this is required. This project is potentially suitable for a number of students each selecting and reviewing their own investment guarantee. If multiple students select this the initial meetings will be group based reviewing common material.

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References

[Dickson et al., 2013] Dickson, D., Hardy, M. R., and Waters, H. R. (2013). *Actuarial mathematics for life contingent risks*. Cambridge University Press.

[Hardy, 2003] Hardy, M. (2003). *Investment guarantees: modelling and risk management for equity-linked life insurance*, volume 215. John Wiley & Sons.