

Immunization Measures for Life Contingencies

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ABSTRACT

The traditional definitions of duration and $\$M^2\$$ for a certain cash flow are extended to cover the contingent cash flow, such as life insurance and annuity products. Essentially, we define a kind of expected duration and expected convexity, where the expectation is taken with respect to the random variable representing the underlying factor of the contingent cash flow. As examples, we derive the duration and convexity for some common life insurance and annuity products by using actuarial symbols. After having mathematically justified the extension, we discuss some properties of the expected duration and $\$M^2\$$ and relate them to the traditional duration and $\$M^2\$$ definition. Numerical examples are given, some managerial aspects of the use of the extension are also considered.

