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Killing the Law of Large Numbers: Mortality Risk Premiums and the Sharpe Ratio

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Abstract

We provide an overview of how the law of large numbers breaks down when pricing life-contingent claims under stochastic as opposed to deterministic mortality (probability, hazard) rates. In a stylized situation, we derive the limiting per-policy risk and show that it goes to a non-zero constant. This is in contrast to the classical situation when the underlying mortality decrements are known with certainty, per policy risk goes to zero. We decompose the standard deviation per policy into systematic and non-systematic components, akin to the analysis of individual stock (equity) risk in a Markowitz portfolio framework. Finally, we draw upon the financial analogy of the Sharpe Ratio to develop a premium pricing methodology under aggregate mortality risk.

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