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## Unlocking the Code of Moshe Milevsky's Latest Book

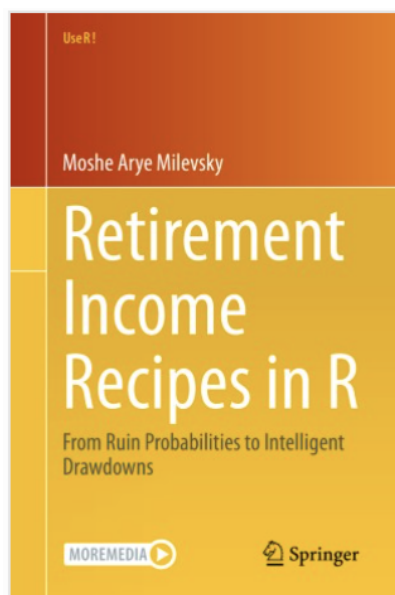
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By George A. (Sandy) Mackenzie     *Thu, Jan 21, 2021*

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*The retirement guru's technical new book shows software-savvy readers how to answer common questions in retirement income planning using his algorithms and "R" code.*

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Moshe Arye Milevsky's latest book, [\*\*Retirement Income Recipes in R\*\*](#) (Springer 2020), is an ambitious and comprehensive review of recent work on the economics of retirement income and pension annuities. As its title suggests, it emphasizes the applications of the relevant algorithms by relying on the widely used open-source software R. (Be prepared to hear *a lot* about programming with software R. I used [\*\*R for Dummies\*\*](#) as an aid.)

The book's basic premise is that we don't know how long we'll live or what the rate of return on our investments will be. Therefore, in planning for retirement, we should try to minimize our risk of outliving our money. At the same time, we should try not to have too much of our money outlive us—unless we want to leave a bequest.



Moshe Arye  
Milevsky

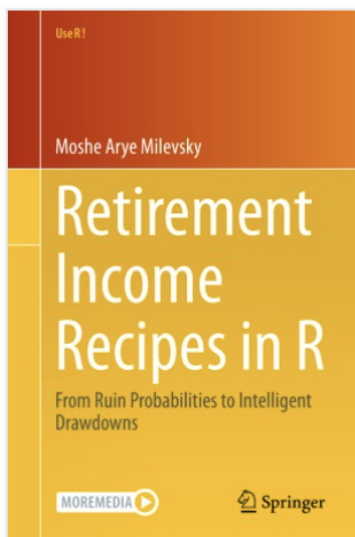
Milevsky's objective is to reveal the economic drivers that determine how long a portfolio will last in retirement. He starts by assuming that the rate of withdrawals and the rate of return on assets are fixed for the duration of retirement. He then derives a formula for "portfolio longevity." The formula illustrates the interplay between the rate of investment return and the rate of withdrawal (for spending) and their joint effects on portfolio

longevity.

The model spans the period from the start of a hypothetical individual's working life to his/her death. A person starts out with a certain amount of financial capital (an initial lump sum) and a certain amount of human capital (the discounted value of expected future earnings). As the years go by, his/her salary and consumption grow at a designated rate. For the sake of maintaining equilibrium, the discounted value of future consumption equals the discounted value of the personal's capital (financial and human). Starting with this framework, Milevsky plugs in real-world features, such as uncertain investment returns.

One of the book's virtues is that Milevsky intersperses his technical exposition (often in the language of R) with thoughtful and sometimes reproving analyses of common approaches to financial planning. (Look for these in the "Final notes" section of each chapter.) In particular, the venerable "4% safe withdrawal rule" really takes it in the shorts. An inflexible withdrawal rate could put the investor under water in an alarmingly small number of years.

In subsequent chapters, Milevsky progresses to more advanced models and covers sequence of returns risk (the risk that years with low or negative rates of return will occur early in retirement, and retirees may need to liquidate depressed assets for income), mortality risk at different ages, and Benjamin Gompertz' eponymous law of mortality, published in 1825, which captures in continuous time the year-to-year decline in survival rates (i.e., increase in mortality rates) as populations age.



The Gompertz function permits a much more sophisticated analysis of lifetime uncertainty as well as the value and pricing of annuities. Later Milevsky addresses the implications of the empirical finding that, ironically, lifespans vary more

widely within groups with shorter average life expectancies (poorer, less healthy populations) than within groups with longer life expectancies (wealthier, healthier populations). He uses this more nuanced approach to longevity when calculating lifetime ruin probabilities (or their complement, lifetime success probabilities) and to the valuation of immediate and deferred annuities.

Key to the financial economists' approach to the demand for annuities, according to Milevsky, is the concept of *longevity risk aversion*. Some persons or households are more averse to an unstable level of consumption over their lifetime than others and would pay to avoid that uncertainty. Risk-averse households would presumably be more willing to reduce consumption during their working lives to raise or maintain their level of consumption in retirement. Longevity risk-averse households are likely to have a stronger preference than other households for life annuities, because annuities can insure against poverty (and the proverbial diet of cat food) in extreme old age.

In the penultimate chapter, Milevsky introduces an idea for a new kind of annuity: the Ruin-Contingent Life Annuity (RCLA). This is a deferred annuity that starts to pay income only when a garden-variety equity index (the S&P 500 Index, for instance) falls below a stipulated threshold. The RCLA, which is embedded in all variable annuities with guaranteed lifetime withdrawal benefits, mitigates both longevity risk and market risk. As a financial product, the RCLA is still at the drawing-board stage. Milevsky regards it as the potential basis of a \$100 billion dollar industry.

In sum, Milevsky's latest book is rich in practical ideas, and is also filled with the algorithms and procedures necessary for anyone to apply R to the creation of their own retirement income planning tools. Like many of his other previous books, *Retirement Income Recipes in R* is also full of fascinating historical asides. This reviewer found the book to be demanding in places, but also a book that will reward any investment in time with a high rate of return.

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**Note:** The opening chapters of the book explain how to download R and the front-end R-studio. This provides screens in which to enter R's functions and data and observe the results of computations, simulations and projections. These chapters also provide simple examples of R's syntax. Each chapter ends with exercises to reinforce the reader's grasp of the material. Some readers might also want to refer to one of the many introductory texts on the R language, such as *R for Dummies*.