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Moshe A. Milevsky, PhD: Planning for Retirement Income

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PLANNING FOR RETIREMENT INCOME

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Moshe A. Milevsky, PhD

Milevsky has published 15 books, more than 60 peer-reviewed scholarly papers, and hundreds of popular articles and blog pieces; his 16th book, In Defense of Annuities: From Accumulation to Decumulation, *was published in late 2021. In addition to being an award-winning author, he is a fintech entrepreneur with a number of U.S. patents and computational innovations in the area of retirement income.* Investment Advisor *magazine named him one of the 35 most influential people in the U.S. financial-advisory business during the past 35 years, and he has received a lifetime achievement award from the Retirement Income Industry Association.*

Milevsky earned a BA in mathematics and physics from Yeshiva University, an MA in mathematics and statistics from York University, and a PhD in business finance from York University. His research interests revolve around the history and evolution of retirement insurance and annuity products over the centuries.

In February 2021, Robert Powell, CFP®, editor-in-chief of the Retirement Management Journal*; Frederick Miller, PhD, CFP®, founder and chief executive officer of Sensible Financial; and Arun Muralidhar, PhD, co-founder of Mcube Investment Technologies, LLC, and client chief investment officer of AlphaEngine Global Investment Solutions, LLC, spoke with Milevsky about the advantages of guaranteed income versus wealth during retirement and the role of mathematics in analyzing retirement-income products.*

Robert Powell: Moshe, how did you get started doing research on retirement?

Moshe Milevsky: The short answer is a combination of three things. Number one: My mother, who is retired, was a gerontologist. She studied old people and how they interacted with the environment. As a kid, I remember her going into houses to see whether the stairways were too high for people who were aging, and she would say things like, "Your banisters need to be lower and have a better grip." So I developed an awareness that older people need things done differently, even though they were doing fine when they were young. I also remember becoming aware of the need for a transition from accumulation to decumulation as well as, perhaps, having fewer stairs.

Number two: In 1988, when I was an undergraduate studying math and physics in New York City, I got a summer internship at TIAA-CREF and spent about four months working at this company that provides retirement-income products and annuities. The actuaries there explained to me that they were designing and selling retirement-income products that would pay people for 50 years. And I thought: "How can you promise that? How do you know how long people are going to live?" So as a college kid, I became curious about these plans.

And number three: When I went to graduate school and studied physics and mathematics, I realized that Robert Merton[1] had somehow magically taken the whole area of mathematical physics—Brownian motion[2] and PDEs [partial differential equations]—and applied that to finance. This was eye-opening. What do you mean a stock can be a martingale?[3] So these three experiences together brought me here.

Robert Powell: As you think back over your career, what has been your greatest contribution to the world of retirement research so far?

Moshe Milevsky: The glib answer is this hasn't happened yet; my greatest contribution is always ahead of me, my next book, my next paper, my next lecture, etc. The non-glib answer is that if you had to, God forbid, write my obituary tomorrow at age 54, and you wanted to include something about my technical work, I would say it's using stochastic modeling to analyze and explain complicated retirement-income products. There's a whole universe of complex products, whether it's annuities or

tontines or longevity insurance, and I've used some advanced mathematics to analyze them, discuss the risks they involve, and just as importantly explain them to the world. It's about explaining to Mom how these products work. Otherwise, she's never going to buy one of them. My Twitter obituary summary would be, "He explained complicated things, easily."

Arun Muralidhar: You've written a number of books on retirement, and we thought it might be useful to our readers if you would walk us through how your thoughts on retirement have evolved and how each of these books fits into that process.

Moshe Milevsky: That's a tough one. I don't think there's a linear or even nonlinear progression. I've written 16 books, and it's difficult to say this one followed from that one. I like to alternate. For example, I'll write a light book—such as *Are You a Stock or a Bond?*—which contains no mathematics and is about human capital as an investment asset class. Then I have to recover from writing a book with no mathematics. So I write *The Calculus of Retirement Income*, which nobody reads and few people understand. Then I'm sick of writing stuff nobody understands, so it's time to write another light book like *Your Money Milestones*. In sum, my books have alternated between technical and nontechnical. One of my latest books, *Retirement Income Recipes in R*, which was published in October 2020, was about teaching students how to write code, which I think is really important these days.[4] That one included a lot of technical stuff.

As for the evolution of my thinking, 20 years ago I thought retirement income was only just a really complicated math problem, echoing recent comments by William Sharpe.[5] I thought if only I could do what Merton or Sharpe did with asset allocation and option pricing in relation to retirement income, then I might solve the retirement problem. It's a math problem. I just have to formulate the PDE correctly. After 20 years I have now realized that retirement is not really a math problem. Retirement is a bunch of different challenges that people face, and one aspect of it—the money—can be thought of within a mathematical context. So when I give talks to students and faculty in math departments, I tell them retirement income is a launch pad for beautiful mathematics, but please don't think that's all that's needed to solve the problem. It's a launch pad. It's an inspiration. It's a motivation. The math can be beautiful, but only some aspects of retirement can be analyzed mathematically. If you really want to help with retirement you'd better talk to a social worker and a gerontologist and a good estate planner and a tax expert as well. And you should consult someone who can discuss family dynamics because, ultimately, that's also part of the retirement-income challenge.

Frederick Miller: You spoke of sinking down in writing your soft or light books and then ascending, if you will, to the math. I wonder if there's a different way to describe that, given what you've just said about retirement income as one of a constellation of issues.

Moshe Milevsky: I don't mean to disparage the mathematics or the soft stuff. This is just my personal style—how I like to write. I'll write a book that makes my mother say, "I don't understand a word here." And then I write an alternative type of book, that she (claims she) read and enjoyed. To go back to the same idea I stated above, if you put a quant in a room with a retiree, there's a limit to how much the quant can help. In the past year or so, many retirees have experienced the loneliness associated with COVID isolation—they're staying home, they have Zoom, they have Facebook, they're getting all their food delivered. They are safe, but they're lonely. And spending money on what? I don't mean sinking down in the sense that these are degrading problems; they're just outside the scope of how mathematics can help. To put it differently, mathematics can certainly help with most of your decumulation problems, but not with all your retirement problems.

Arun Muralidhar: Your latest book focuses on helping retirement quants gain the requisite skills, especially in the use of the programming language R to conduct the calculations necessary for retirement planning. Given that our readers are investment advisors with large amounts of assets under management, would you talk about how this book could help them? And who specifically do you think could become a retirement quant?

Moshe Milevsky: Let me explain my motivation for writing that particular book, and then I'll answer your question about who can use it. Remember, my day job is teaching young university students, and this involves some challenges. No matter how much I try, I have a hard time making retirement and pension planning interesting to 20-year-olds. These topics bore them to death. I'm describing an event that might be half a century away. Older people talk all the time about required minimum distributions and at what age you should claim Social Security benefits, but these subjects are simply mind-numbingly irrelevant to university students. I have to make these subjects interesting or they won't sign up for my course, and then my course gets canceled, and I'll be stuck teaching corporate finance or something awful. In addition, universities are facing immense pressure from industry to teach our business students how to code, how to work with big data, how to analyze enormous quantities of information—and not to do it in Excel but to be able to code in Python, R, C++, and C Sharp. Now, we used to be able to say: "We teach business students. We're not developing programmers. Go to the math department. Go to computer science." Employers then say to us, "Okay, we're going to computer science to hire talent, and we're going to stay there." In other words, to be competitive, I need graduate students who can do something that's also responsive to what the industry is asking for, which is coding. That's where this book comes

in—making retirement-income planning a coding course, making it interesting by boiling the material down to problems students can solve.

When I ask 20-year-olds, "When do you think you should apply for Social Security benefits?" they get bored. But when I formulate this as an optimal-stopping problem, that's much more interesting to them; it's mathematics. So that's how I'm using the book, as well as teaching our students how to code. If you ask me how the industry can use this information, I believe there's a growing need for people to code up the forecasted behavior of retirement-income products because of the complexity of the underlying models. If you have a software tool that tells you which accounts to deplete first, and when you should buy an annuity, and whether you should choose a joint-life policy or a single-life policy, you'll want to know that some quants developed this software properly. I'm hoping to train these quants, which goes well beyond traditional actuarial science. So when recruiters from the big broker-dealers or the big insurance companies come to campus and say, "We need business students who understand the retirement challenge," I tell them I have students with that background. That's where my motivation comes from, but I don't think an RIA [registered investment advisor], a broker-dealer, or an insurance agent is going to pick up my book and say: "Oh, this is helpful. I can sell more annuities now." Never. Maybe they will buy the book and put it on the coffee table, which is good, too.

This course is now being co-opted by our financial engineering program. On a side note, traditional financial engineering students have ignored insurance for years. They can price a complicated multicurrency swaption,[6] but they don't know the difference between a mortality table and a kitchen table. Still, they'll price derivatives until the cows come home. And that's another aspect of my motivation for teaching these skills. COVID, unfortunately, helped. How do you model mortality? An academic colleague of mine, in the traditional financial engineering area, recently emailed and asked me: "Hey, how do you guys handle death? Do you have any good references?"

Arun Muralidhar: The traditional goal for retirement has been to target a certain amount of wealth, but you would argue that the goal should be guaranteed retirement income. How can we change an industry that has been largely focused on wealth to one that is focused on retirement income?

Moshe Milevsky: I think part of the answer is the compensation structure in the financial industry—assets under management, assets under administration.

If compensation is driven by basis points, the last thing you as a financial advisor want is for your clients to decumulate, that is, deplete their investments, because that reduces your compensation. This is the fundamental conflict inherent in retirement-income planning in the 21st century. In the area of corporate finance, we teach about agency theory, which argues that managers and owners are by definition conflicted. An entire theory is built around this conflict with regard to corporate finance. I think decumulation involves an equivalent conflict associated with a different agency. You're not going to want your clients to spend down because that means you'll get paid less. Ergo, you'll always think the 4-percent rule is too high. Let's bring it down to 2 percent. Heck, let's bring it down to zero. Give me more money to manage.

The solution isn't a better product. The solution isn't a more-efficient tax system. So how do we solve this? Is it with fee-only planning by the hour? Is it with some other metric? Perhaps, like stability of income, you'll be paid on the basis of how stable your income stream is. The closer you are to the Modigliani-Friedman consumption path, the more you get paid.[7] This is part of the reason consumers aren't very good at converting wealth into income—the advisors don't want them to do it.

In fact, a growing body of literature on this subject is being published in top-tier academic journals like the *Journal of Finance* and the *Journal of Financial Economics*. These articles demonstrate that compensation is becoming problematic because the data on financial advisors show that they're steering clients toward funds that pay them more. We knew this, but the research now shows that financial advisors don't tailor portfolios to the client's risk tolerance or the client's balance sheet. They just recommend whatever they personally think is best. As awareness of the problems related to compensation grows, I think we eventually have to change compensation practices—and before the regulators get involved and say, no, we can't. I know some are RIA-focused and don't like commissions. RIAs want assets under management, and they consider themselves pure. Until their clients reach retirement, they're absolutely right. There is perfect alignment. After retirement, though, the goals diverge.

Arun Muralidhar: What are the implications of shifting the retirement goal from wealth to income?

Moshe Milevsky: There's an increasing awareness that we're using the wrong metrics. We're using metrics that were designed for accumulation. Merton had a great article in the *Harvard Business Review* a number of years ago in which he claimed the risk-free asset should be the guaranteed income that a retiree is receiving, not the amount of money that's fluctuating. It's not just that we have to change compensation or change how people are thinking. We also have to report things differently. Stop showing people how much money they have. The 401(k) statement should report how much money the client has in a small font and in a much bigger font how much income this will generate to age 95 or 100. What will this

generate in a decumulation mode? This is why the recent SECURE Act rules that mandate disclosure of lifetime income are a very good move in the right direction.[8]

Historically, for thousands of years, wealth was not measured in dollars and cents or British pounds or Turkish lira. Wealth was measured in how much income it generated. Jane Austen's idea of wealth was how many pounds a property generated per month. Using the mark-to-market system of valuing assets has benefited us in many ways, but it is harming us when it comes to the retirement-income industry. People are marking their portfolios to the market without realizing they're not wealthier than they were five years earlier. They say: "What do you mean? But my Fidelity account is up." I spend a lot of time convincing people with big numbers in their accounts that they're not as wealthy as they think because the account tells them only how much money is there. I tell them to look at the dividends they're getting, or the interest, or the annuity they're going to get. We need to change the reference point. I call it moving from the numerator, which is wealth, to the denominator, which is the factor needed to convert wealth into income.

Robert Powell: But the Department of Labor requires plan sponsors to disclose how much is in a 401(k) account.

Moshe Milevsky: How the statement looks makes an enormous difference in its effect. Shlomo Benartzi has done a lot of work on how information is displayed.[9] If some information is bigger and some is smaller, clients look at the bigger type first and make a decision on the basis of that information. Once somebody is forced to disclose a number, and you get beyond the methodological issue, then it becomes a matter of compliance. Are we disclosing it properly? No. And if we comply by sending people 20 pages of information, trust me, they won't read it.

What we need to do is change the language in every article we write. History can demonstrate part of the answer as well. There are many interesting examples of people being deceived by the value that was assigned to an asset when, in fact, the income it generated went down.

I'll give you a 60-second example. In the 16th century, Henry VIII dissolved the Catholic monasteries. He told the monasteries: "You guys are too wealthy. I want the land, so I can sell it." The crown took over the land, started to parcel it out to dukes and earls and lords, and began to sell it. Once the monasteries were no longer owned by the church, they went into the hands of private individuals. Why is this interesting? Because the question is how did they determine the price by which to sell these properties? Thomas Cromwell, King Henry's chief minister, came up with an ingenious plan. He sent out estimators—chartered business valuators using the modern parlance—who were charged with estimating how much income a given property would generate in terms of rent. A property in Sussex was estimated to generate 200 pounds a year, and a property in York was expected to generate 150 pounds a year, etc. After the survey, the estimators came back with a list of all the properties and an estimate of how much income each one was expected to generate. Okay, then how did they sell them? Cromwell said multiply by 20. If a property generates 100 pounds a year, multiply by 20, and charge 2,000 pounds. That valuation was quite simple, but an enormous amount of science went into figuring out how much rent would come from each of these properties. The estimators also reported whether a property had a problem—for example, there's a default risk with this property because it's on a cliff.

After a couple of years, as the income started to decline, people complained that they had been overcharged. What Henry's henchmen did then was brilliant. Five years later, they stopped multiplying by 20, started multiplying by 15, and lowered the price. Still, the income was what mattered to people, and they wanted numbers. "What is the income?" was the main question for years. Today, in the 21st century, the questions are the exact opposite. What's the stock worth? What was its value at the 4 p.m. bell? What's it worth overnight at 2 a.m.? What's it worth if I wanted to sell it? But what really matters when it comes to retirement is how much income it's going to generate.

Frederick Miller: People care about income, but they also care about what they can leave to their children. This is an internal conflict that not only my clients, who are wealthy, but all parents struggle with.

Moshe Milevsky: Again, I point to history. Reversionary annuities, which were popular in the 17th and 18th centuries, addressed exactly the point you just made. The way a reversionary annuity works is you would buy it from an insurance company or from the government, and, in return, you would receive a promise that when you pass away, your loved ones, your spouse, your kids would receive income for the rest of their lives. This income wasn't a death benefit. It wasn't a lump sum. The issue wasn't how much money you were leaving. It was how much income your beneficiaries would receive for the rest of their lives after you were gone. I agree that people have bequest motives, but what do they really want to leave their kids—money or a source of income for the rest of their lives?

I want to leave my spouse and my kids a guaranteed source of income. I don't want my wife to have a large sum of money. I don't want a bunch of advisors to prey on her for permission to manage that money. I certainly don't want the neighbors to think she's rich. Instead, I want her to have a source of income, and that's the reason reversionary annuities were so popular.

I learned this when I was visiting Soweto, South Africa, about two years ago. A company was launching a tontine scheme, and I asked to tag along with them to help gather data. I spent

a couple of days going through the neighborhoods there in Soweto, where people were selling products designed to generate income after a person passed away. I couldn't understand why these products were so popular. I wondered why people would buy something so that when they passed away, the family member would receive income or why people would buy something that gives their beneficiaries income rather than a lump sum.

The motivation for these products came from employers in Johannesburg who wanted their domestic help to have some income when they retired. I asked those employers: "Why don't you just give them some money when they stop working for you? Why are you buying something that gives them an income? Just give them a lump sum. Isn't that more efficient?" The response from every one of the employers was identical. If these people go back into their communities with a substantial amount of money, they'll get preyed on because people know they received a lump sum. The money is squandered. It disappears. But if these people go back into the community with a guaranteed source of periodic income for a period of time, the income they receive will be small, which is good. The fear of the income stream being mismanaged is gone. I realized that even though mathematically these bequests are the same in terms of present value, behaviorally they're completely different. We just need to move this financial anchor from a lump sum to income.

... I expect more and more people to start asking: "What's going to happen to my money in the 10 years while Junior is waiting to hear if he got into Harvard? If he gets into Harvard, I'll pay for it. But if I'm not around, where's that money going to sit?"

Frederick Miller: I understand that desire for security. But what if my children aren't going to take care of their children, and I want my grandchildren to go to college? That looks more like a lump sum than an income stream.

Moshe Milevsky: Because of where taxes are heading globally, and because of the uncertainty caused by the pandemic, I expect more and more people to start asking: "What's going to happen to my money in the 10 years while Junior is waiting to hear if he got into Harvard? If he gets into Harvard, I'll pay for it. But if I'm not around, where's that money going to sit?" Is that money going to be in your bank account? I'm a little worried about that. Is it going to be in Junior's bank account? I'm seeing evidence that people want something that pays for a service to begin at some future date. I hesitate to use the word "lockbox" because Sharpe has used that term to define something else.[10] I want the money in lockboxes for the future, but for consumption, not wealth.

Many people want to leave something to the next generation. Is it a library? Is it a hospital so they'll be remembered forever? Bequests like these are perpetuities, which, unlike annuities, are expected to last forever.

Robert Powell: Moshe, there are two places where the focus is on income and not wealth. One is Social Security, where on your statement you learn what your monthly income will be, and the other is a defined benefit plan, where you learn what you will get as a monthly pension. We do have those mechanisms in place but not with 401(k) plans.

Moshe Milevsky: I guess this is a good place to roll up our sleeves and get technical. There's a whole group of people who don't need more annuities. They're over-pensionized. Let's say you're a retired firefighter and your spouse is a retired teacher, and you're both getting defined benefit pensions. You know that the present value of those pensions under reasonable mortality assumptions is $2 million, you're receiving small Social Security benefits, and you've got $100,000 in a taxable account. You also own a house, which in some sense is an annuity. God castigate the advisor who sells this couple an annuity. They are already over-annuitized. They have a guaranteed income for the rest of their lives. Perhaps they could use some life insurance. But I would say that 50 percent of the population does not need another dollar of annuity income. Okay, why 50? It's a round number and it's memorable. Maybe it's 42. Maybe it's 57. I don't know. But a large number of people do not need more annuity income.

I'm only half-joking when I like to say that I consider my four daughters to be annuities. I'm very nice to them. I pay for their educations, and they'll have to take me to the doctor in 70 years. I tell them: "I'm already booking you. I'll need the ophthalmologist in 2079. You're in charge, and you'll have to get me to other specialists as well." But if you're an independent contractor, a dentist, a doctor, a lawyer, you don't have a defined benefit pension, and you're in a 401(k) plan created through the SECURE Act, oh boy, do you need more retirement income.

Frederick Miller: Monte Carlo analysis is pervasive in retirement planning, especially if you think about MoneyGuidePro and standard retirement software. What are your thoughts about Monte Carlo analysis, including insurance distributions, how many calculations we should do, and how to measure and interpret the results?

Moshe Milevsky: Bob, you just wrote an interesting piece about that issue: Is Monte Carlo analysis a good idea, and how

many analyses should we do?[11] Okay, I want to be crystal clear before I'm critical. In the course I teach on retirement-income models in R, the one related to the book I mentioned earlier, I'm generating simulations of mortality and investment returns starting in week number four of the course. In other words, all we're doing is Monte Carlo analysis. It's all numerical simulations, all the time. I like Monte Carlo, but I would never take my mother to Monte Carlo or Atlantic City or Vegas. Why? What do I mean? I worry about the complexity of a process that will be misinterpreted by users who don't understand its subtleties. When someone says to me, "Can I ask you a Monte Carlo question?" I say, "Yes, but I'm Jewish, so please let me start with a question before you ask me a question." I then ask, "What is a PDF?" And if they say, "It's a type of file," I say: "Go away. We're not discussing Monte Carlo."

For those who say PDF stands for probability density function, I say: "Ah, okay, you can come into the club. Let's talk about distributions, let's talk about bootstrapping, let's talk about analytic expressions." I've been at seminars where an insurance-company annuity wholesaler says, "The probability is 4 percent if you do this, but if you buy my magic medicine, it goes down to 1 percent." I ask: "Can we get it to 0 percent? How about negative?" Many salespeople don't understand what Monte Carlo is. They're simply quoting Monte Carlo results, and they're giving clients a false sense of security. I don't like that. Practically? I recommend that the group that thinks PDF is a file extension should do deterministic analysis. This is the rate at which I think my investments are growing deterministically after taxes, after fees, after inflation. Give your clients a sense of whether, if everything works out deterministically, they will have enough money to last until age 95. Do not simulate anything. That is step number one.

Once you get a sense of whether the discussion of Monte Carlo analysis is going to be productive, then you can have a second-phase conversation in which you outline the risk factors. These are "known unknowns," to quote [former U.S. Secretary of Defense] Donald Rumsfeld.[12] Once the other person understands that and has a mathematical understanding, too, then you can explain the Monte Carlo technique, what it does and how it works. But too many people go straight to Monte Carlo without understanding what it means. They don't understand that I can game the system and come up with a great Monte Carlo number. I can take something from the tail and put it in the middle, and I've reduced the probability. Or they want a hundred simulations, which is really a sad joke.

Stanislav Ulam,[13] the father of Monte Carlo analysis, would choke if he knew people were running a hundred simulations or a thousand scenarios. The developers of the von Neumann-Morgenstern theorem[14] would be appalled. One time, they said it has to go to infinity before it converges. But once I'm involved in an intelligent conversation, I'm a fan of analytic distributions, not bootstrapping. I'm a fan of fat tails. I'm a fan of term structure models, not constant term structures. I want mortality to be stochastic, meaning that two things are random—how long you live and the rate of mortality. That's what I want to help with, but I have that conversation only with people who pass my PDF exam.

I don't know if that answers your questions. I obviously like, use, and rely on Monte Carlo analysis.

For those who say PDF stands for probability density function, I say: "Ah, okay, you can come into the club. Let's talk about distributions, let's talk about bootstrapping, let's talk about analytic expressions."

Frederick Miller: That does answer the questions, but there is precious little in the industry that meets half your criteria. I suppose one could say that 50 years ago all analysis was deterministic. Then we got [William P.] Bengen and his 4-percent retirement rule,[15] and that was an advance, right? So given where we are, what's the next step?

Moshe Milevsky: I'm not suggesting that we go back to the deterministic assumptions of the 1950s. What I'm saying is that knowing your audience is the first and single most-important consideration. There is an old saying in Hebrew that can be loosely translated as "Know before whom you stand." Basically, I speak for a living. If my audience consists of sophisticated, intellectual, thinking financial advisors, we're going to talk detailed Monte Carlo improvements. If my audience is mom-and-pop retirees, I'm not even going to mention that term. Five years ago, I was involved with a company whose leaders wanted to put that term in a TV commercial, and they tested it in focus groups. "Monte Carlo says this is what you should do. We did a Monte Carlo analysis on your retirement plan, and it's looking good." No, no, no. It didn't work.

Frederick Miller: Let's talk about complex investment products. Many fiduciary advisors have a jaundiced view of complex products. Can you share your perspective?

Moshe Milevsky: Is their jaundiced view another way of saying, "It's going to take me a lot of time to understand this, and I don't get paid for my time"? Or is it saying, "This is such a complex product that I need you to explain why you have a negative view of it"?

Frederick Miller: This is another example of the problem of agency. Most of these products are sold by people who are paid

to sell more of them. The products seem purposely opaque, purposely complex, and designed to deceive. Often RIAs, fee-only advisors, take on clients who have bought these products, frequently in retirement accounts, so they're getting no tax advantage. The advisors see such clients as abused and then apply that observation to the whole universe of complex investment products.

Moshe Milevsky: I guess later I'll ask you what you really think about these products.

Frederick Miller: I have a PhD, and I find it almost impossible to understand these products.

Moshe Milevsky: I understand. In fact, you just pre-empted my next comment. When students in our math finance program tell me they need a PhD thesis topic, I pull out the latest Prudential variable annuity (VA) or Jackson or Brighthouse prospectus and say, "This is your thesis." (Actually, Prudential stopped selling annuities.) You could say it solved PDEs till the cows come home to figure out the optimal initiation of benefits. Of course, that's shrouding, which is a fancy term for hiding stuff. What are they hiding? I advise PhD candidates who are working with our RIAs to take advantage of the complexity, to be strategic, and to find a sixth product that the actuaries didn't realize would make you a counterparty to the game.

That's also what I did. I'm proud that I have three VAs, and I can assure you that the insurance company is making no money off of me. I've optimized the asset allocation and the withdrawal rate, and I've moved the fund, and I'm turning it on at an exact point in time. Do 97 percent of people buy into that? No, they lapse, they exchange, they trade. They don't know what they're doing. These products have been promoted for the exact reasons you described. However, I don't think I personally should shy away from them because I know what I'm doing. Buyers just need to take the time to figure out what really works.

Would I buy any old VA just because it's called an annuity? Obviously not. I'm going to do my due diligence. But I do think advisors should hire one of my retirement quants—one of my undergraduate students who can run these simulations—and outsource the due diligence to them. You're not a tax expert, so you've got a tax accountant. Do you know everything about Medicare and Medicaid or the latest plan options under the Affordable Care Act? No, you know investments. Hire a super quant who's a retirement-income product specialist. I repeat, complexity sometimes means you need more expertise, not that you should avoid the entire field. Taxes are complex, but you can't avoid them, so you get experts.

Frederick Miller: What are the prospects for commercial tontines?

Moshe Milevsky: They are starting to get out there. People just don't know about them because they're not covered on the front page of the *Wall Street Journal* or *New York Times*. One of the benefits of writing a book on some obscure 17th-century instrument is that people from all over the world come out of the woodwork and email you about some of the interesting things they're doing. Now, to be clear, TIAA has been offering something similar since before I was born. It has a participating annuity in which mortality experience is shared. There are countries where the state pension system is a tontine. They'll never call it that, but it passes the DNA test of a tontine. Denmark is a great example. Every year, the Danish government adjusts the payout based on experienced mortality. This will hit the headlines soon because COVID has caused higher-than-average mortality and excess debt, so guess what's going to happen to Denmark's pension payments this year.

This is likely to cause a bit of a scandal there because people will say the government is taking money from dead people. Then somebody will have to explain no, that's the way a tontine works. A number of insurance entities are now entering into arrangements that are effectively driven by "tontine thinking" though the companies won't call them tontines because they don't want to antagonize the state regulators in Texas or New York or California. There's that company I mentioned in South Africa, and I've seen some security filings. But I would never recommend use of the term "tontine." Instead, I like the term "Hamiltonian."

Here's why. As the first U.S. Secretary of the Treasury, Alexander Hamilton struggled with how to pay off the Revolutionary War debt, and he suggested a tontine. He proposed to George Washington that the U.S. government roll over all the state debts into one big debt that would be paid off over time. Hamilton took that idea from the British, who were running a number of big tontines at the time, as were the French. Remember, I'm talking about 1790, the heyday of tontines in Europe, which was like the bitcoin phenomenon today.

But when Hamilton suggested a tontine, Congress hated the proposal. Washington himself did not like the idea. The main complaint was that it sounded too British, so it was nixed.[16]

Frederick Miller: Can you say where these Hamiltonians might be observed in the United States?

Moshe Milevsky: Look, I'm being a bit cagey and cautious here because of nondisclosure agreements. But right now, you can find insurance agents engaged in convincing people who have term insurance to assign the death benefits to a limited partnership. Let's say you have 100 65-year-olds, all of whom have term insurance policies in effect for at least 20 years and who don't really want that insurance anymore. Many people in this situation simply let the policy lapse. But let's say the insurance

agent convinces the 65-year-old not to let the policy lapse. The agent says: "Here's what we're going to do. You'll continue paying premiums, and if you reach age 85 in 20 years, you'll be able to share the money of all the people who survived to age 85."

Now, what money is that? It's the money of the people who died between 65 and 85. It goes into a limited partnership, it gets invested, it grows, and the money gets distributed 20 years later. These are not just tontines—they're the pure alcohol version of a tontine—and these instruments exist right now. There's no lifetime income. There's no decumulation. They're not life settlements. A life settlement is when someone says, "I don't want the policy at all; give me money now." That's not what's happening. In fact, it's the inverse. The policy holder is willing to continue paying premiums in exchange for the reward of sharing a large amount of money 20 years later. However, some complexities are involved. You have to worry about enforcement when the policy holders get sick, so they have a line of credit that's secure. Still, these companies have strong, ironclad legal opinions that say what they're doing is perfectly fine. These are private groups of people entering into an arrangement to assign their insurance benefits to whomever they want. In any state where viatical and life settlements are legal, you can do that. So that's one example in the United States. At TIAA the chief actuary, who retired a couple years ago, always reminded me, "We basically run a tontine; we just don't call it that."

Frederick Miller: I think Denmark and TIAA are more interesting in the context of retirement income than the term insurance schemes you just described.

Moshe Milevsky: We need financial innovation, but it can't be done three leaps at a time. We need to get people comfortable with the idea of assigning a death benefit. We need to get people comfortable with the idea of pooling longevity risk and mortality risks. Sooner or later, people will think: "I don't need a million bucks. If I get to age 85, what am I going to do with that? I want a stream of income." So perhaps they buy SeLFIES[17]—Standard-of-Living, Forward-starting, Income-only Securities—which would be liquid, low-cost, low-risk, government-issued instruments that even the most financially unsophisticated buyers can understand. These innovative pension bonds aren't going to become popular overnight, but everybody understands that with interest rates where they are now, we need to struggle for alpha in a nonconventional way.

Interest rates are close to zero. I need alpha. I need some income. In this situation, mortality credits become very appealing. I like to think of mortality credits as an alpha of about 2 percent. When interest rates were at 7 percent, when a Treasury bond was paying 8 percent, I couldn't get people excited about 2 percent added. When the equity risk premium is higher, forward-looking, you can get people excited about 2 percent. I call these credits longevity contingent claims, which is a fancy way of not saying tontine. The era of longevity contingent claims has arrived.

Robert Powell: Let's talk about retirement security. Which governments do you believe are most advanced in improving retirement security or creating income products? What lessons have we learned from other approaches?

We need to get people comfortable with the idea of assigning a death benefit. We need to get people comfortable with the idea of pooling longevity risk and mortality risks.

Moshe Milevsky: If you had asked me that question a year ago, I would've said Chile, which is new in the market. Milton Friedman and a number of professors from the University of Chicago were hired by the Chilean government in the late 1980s to help reform pensions among other economic issues. Those reforms are currently being reversed. Its entire retirement system is unraveling. People are taking money out; they aren't being forced to buy annuities. I used to point to Chile. Then I would point to the Netherlands for its risk-sharing plans and to Denmark for its tontines. But the Netherlands is having issues right now and it's having to scale back. I used to look at Australia. I loved the idea of 10-percent superannuation, which is the notion that people must contribute to the pot. It's not optional. Everyone must contribute. What an ownership stake this creates. People put money in, they own it, and they have to manage it. Then the pandemic hit, and people were allowed to take money out tax-free. But they didn't know what to do with the money at retirement, so they bought boats and houses. There was no annuity market. In sum, I cannot point to one country that is improving retirement security. I'm sorry. Some people point to the Scandinavians, saying they do everything better. Sorry, but I can't say that either. What we can do is take ideas from different countries, see what failed, and evaluate what we can learn. There are a lot of lessons to be learned from what's happening right now because we're experiencing an emergency about how to design an ironclad pension system. Articles will be written for a long time about pandemic-related lessons regarding retirement-income planning.

Arun Muralidhar: Moshe, I didn't hear you talk about retiree housing.

Moshe Milevsky: For a while, I was enamored with the idea of reverse mortgages. There's a lot of interesting research on this topic. Wade Pfau, professor of retirement income at

The American College of Financial Services, and others on the financial planning side have advocated it. But I'm a bit concerned about people taking on debt at an advanced age, and I'm a bit concerned about abuse. You have this huge asset, and you have this huge liability—and the debt is growing because of compounding interest, but the asset is depreciating if you don't take care of it. If that's the case, the insurance companies will say something like, "We're only going to give you 30 percent or 40 percent of the value of the house," and suddenly this loan doesn't look as appealing.

I think a house is a consumption asset. It defeases the liability associated with where I live. I don't think it's right to view it as a discretionary consumption asset. It's not an investable asset. It's not something you should count on for retirement income. I don't think you're going to sell your house and live off the income, because you have to live somewhere. But if I learned anything from COVID, it's that the house is precious. It's not just where my family and I sleep; now it's a place where we're spending time. It becomes an office, and I'm certainly not going to sell my office. A house is like wealth that's tied up in cars. Let's say you have a beautiful car collection. I'm just not sure that will generate retirement income. Maybe I'm wrong about reverse mortgages, but I don't see Americans signing up for this option en masse.

Frederick Miller: When do you plan to retire, and how are you managing arrangements for your retirement?

Moshe Milevsky: I determined the optimal time for my retirement by using a variety of interest rates and stochastic models—models for equities, models for stochastic mortality—and my optimal time for retiring was determined to be age 122, which is the age at which Jeanne Calment, the oldest woman in France, supposedly died. So the answer to your question is never. I'm gratified by the number of economists who have said the same thing, that they will keep going until they are senile and then until they don't know they're not going anymore. I do, however, believe in decumulation, that is, slowly and optimally spending down wealth, and slowly reducing my workload, business engagements, and commitments. I recently told the dean of my school that I'm currently willing to teach a full course load for full pay, but at age 65 I want to do only three courses a semester. At age 70 perhaps two courses, and age 80, one course, etc. At age 90 I'll do one seminar a year for three hours per month. That's the drawdown.

In terms of how I'll manage my financial affairs, I still have time to figure that out; I have 10 years or so. But I have a collection of annuities, I have a good DB pension at work, and I have a diversified stock portfolio. I'm a big believer in global diversification—so exchange-traded funds for five basis points. And I have a Robinhood account just because it's exciting to see what's going on there when I have nothing else to do. Let's play around.

I enjoy this kind of activity at this stage of my life, but I suspect eventually it will become boring and tedious. At that point, I'm going to want my retirement income to be on autopilot. If I'm lucky enough to get to age 85, maybe I'll still be a little bit active with my portfolio. When I get to age 90, am I going to want to sit with my spreadsheet and figure out if European equities are overpriced? And do you think at age 95 I'll still be rebalancing my portfolio? I want income for the rest of my life, so I won't have to worry about how much to draw down. That's the financial side of how I plan to approach retirement. I also have a lot of books I want to read, so I'll need time to do that.

So that's my retirement plan. And, of course, I still have to write a great book—one that really stands out.

ENDNOTES

1. Robert C. Merton (1944–) is the School of Management Distinguished Professor of Finance at MIT Sloan School of Management, and the John and Natty McArthur University Professor Emeritus at Harvard University. He received the Alfred Nobel Memorial Prize in Economic Sciences in 1997 for a new method to determine the value of derivatives.
2. Brownian motion is the random motion of particles suspended in a medium (a liquid or gas). This pattern of motion typically consists of random fluctuations in a particle's position inside a fluid sub-domain, followed by its relocation to another sub-domain.
3. In probability theory, a martingale is a sequence of random variables (i.e., a stochastic process) for which, at a particular time, the conditional expectation of the next value in the sequence is equal to the present value, regardless of all prior values.
4. R is a programming language and free software environment for statistical computing and graphics. The R language is widely used among statisticians and data miners for analysis.
5. William F. Sharpe (1934–) is the STANCO 25 Professor of Finance, Emeritus, at Stanford University's Graduate School of Business. He received the Alfred Nobel Memorial Prize in Economic Sciences in 1997 (along with Harry M. Markowitz and Merton H. Miller) for his pioneering work in the theory of financial economics.
6. A swaption is an option granting its owner the right but not the obligation to enter into an underlying swap. Although options can be traded on a variety of swaps, the term "swaption" typically refers to options on interest rate swaps (https://en.wikipedia.org/wiki/Swaption).
7. The seminal paper describing the life-cycle model is Modigliani and Brumberg (1954). The permanent-income model is laid out in Friedman (1957).
8. The Setting Every Community Up for Retirement Enhancement Act of 2019 (SECURE Act) was signed into law on December 20, 2019, by President Donald Trump. The far-reaching bill includes significant provisions aimed at increasing access to tax-advantaged accounts and preventing older Americans from outliving their assets (www.investopedia.com).
9. Shlomo Benartzi is a behavioral economist interested in combining the insights of psychology and economics to solve big societal problems. He works on creating digital nudges that leverage technology to achieve massive scale and help millions make better financial decisions. He is a professor emeritus and co-founder of the Behavioral Decision-Making Group at the UCLA Anderson School of Management. He is also a Distinguished Senior Fellow at the Wharton

Behavior Change for Good Initiative, where he works on applied behavioral economics and financial decision-making.

10. See Kerry Pechter, "Bill Sharpe's 'Lockbox' Strategy" (September 7, 2017), https://retirementincomejournal.com/article/bill-sharpes-lockbox-strategy/.
11. Robert Powell, "Opinion: Should you use a Monte Carlo simulation to determine if your retirement savings will last? *MarketWatch* (January 26, 2021, updated February 4, 2021), https://www.marketwatch.com/story/should-you-use-a-monte-carlo-simulation-to-determine-if-your-retirement-savings-will-last-11611607222?reflink=mw_share_email.
12. "There are known knowns" is part of a response United States Secretary of Defense Donald Rumsfeld gave to a question at a U.S. Department of Defense news briefing on February 12, 2002, about the lack of evidence linking the government of Iraq with a supply of weapons of mass destruction to terrorist groups. Rumsfeld said: "There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. There are things we don't know we don't know."
13. Stanisław Marcin Ulam (1909–1984) was a Polish-American scientist who worked in the fields of mathematics and nuclear physics. He participated in the Manhattan Project, originated the Teller–Ulam design of thermonuclear weapons, discovered the concept of the cellular automaton, invented the Monte Carlo method of computation, and suggested nuclear pulse propulsion. In pure and applied mathematics, he proved some theorems and proposed several conjectures (https://en.wikipedia.org/wiki/Stanislaw_Ulam).
14. In decision theory, the von Neumann–Morgenstern (or VNM) utility theorem shows that under certain axioms of rational behavior, a decision-maker faced with risky (probabilistic) outcomes of different choices will behave as if he or she is maximizing the expected value of some function defined over the potential outcomes at some specified point in the future. This function is known as the von Neumann–Morgenstern utility function (https://en.wikipedia.org/wiki/Von_Neumann%E2%80%93Morgenstern_utility_theorem).
15. Bengen, a retired financial planner, developed the 4-percent rule as a guide for withdrawals from retirement savings. His research showed that people could withdraw 4 percent of their investments in the first year of retirement and then withdraw the same amount, adjusted for inflation, for at least 30 years without exhausting their portfolios. See Bengen (1994).
16. For more information about Hamilton's tontine proposal, see Jennings et al. (1988).
17. For more information about SeLFIES, see Merton (2020), Merton and Muralidhar (2020), and Muralidhar (2018).

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