

Can quants defuse the pension time bomb?

Alex Lipton argues new quantitative methods are needed to solve the looming pension crisis



Time for a rethink: modern portfolio theory has clearly outlived its usefulness

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Otto von Bismarck, Duke of Lauenburg, was a man of many achievements, some of them positive, some negative; however, his greatest contribution to humanity was the invention of the modern concept of retirement.¹ Universal pension, proposed by Bismarck, was a

radical departure from the old ways, when people continued to work until they died.² In Bismarck's times, pensions were not difficult to pay, since life expectancy was roughly equal to the pension age. However, recent demographic trends – people living longer, fertility steadily declining, lacklustre investment returns and unnaturally low interest rates – have bankrupted several private pension plans, and put many others on the brink of bankruptcy. The term "pension time bomb" has even been coined to describe the looming crisis. This dire situation calls for new quantitative methods to alleviate the problem.

With time, pensions became ubiquitous in the developed world, until they eventually encumbered both governments and private companies with enormous liabilities, mostly uncovered. The percentage of workers participating in traditional defined benefit (DB) pension plans, paying a lifetime annuity, has been steadily declining over the past 30 years, because of mammoth expenses. In contrast, the percentage of workers covered by defined contribution (DC) pension plans, paying money from investment accounts owned and controlled by employees, has been steadily increasing.

In many instances, DB plans are administered by elected officials or public servants, who hire professional asset managers, including hedge fund and private equity firms, to do their bidding. In contrast, DC plans delegate investment responsibilities to employees, who are often ill equipped to shoulder them.

Passive index and exchange-traded fund investing is a promising approach, particularly if management fees are low, but the choice of instruments to invest into is anything but obvious. Many asset managers use modern portfolio theory (MPT), notably in the form proposed by Black-Litterman, to make investment decisions.

Unfortunately, MPT clearly outlived its usefulness. The reasons for this harsh, but inescapable, conclusion are manifold: the impossibility to calculate requisite expected returns, the highly unstable optimal weights, which are extremely sensitive to the measurement error of returns, the infeasibility of justifying investment views of a portfolio manager, the lack of rebalancing, the non-Gaussian nature of returns, and the unrealistic and inflexible objective function, to mention just a few.

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In fact, Harry Markowitz, the father of MPT, understood the limitations of the theory well enough, and never used it for making personal investment decisions. When asked about his pension investment strategy, he said: "I visualized my grief if the stock market went way up and I wasn't in it – or if it went way down and I was completely in it. So, I split my contributions 50/50 between stocks and bonds."

Moreover, most hedge funds and active asset managers fail to consistently outperform the market for long enough periods, as required for pension investments. In general, returns generated by hedge funds and private equity firms, who rely on a secret sauce to make investment decisions, lag major indexes, particularly, when their astronomical fees are counted in.

How can quants help to defuse the pension time bomb? There is an urgent need to develop a new, robust and intuitive asset management framework. The key to accomplishing this task is to be able to maximise the probability of achieving one's investment goal in the real-world measure, given investment constraints, rather than trying to find the celebrated (and elusive) efficient frontier based on unverifiable assumptions. This goal is similar to solving the celebrated 'beat the dealer' task of overcoming the house advantage by card counting in the game of blackjack. One obvious complication is that asset returns are not just random, but also non-stationary, so additional insights are necessary. The other one is that the problem is multi-period, hence portfolio rebalancing must be explicitly considered.

So, while fixing the crumbling pension edifice is a multi-faceted and rather complex problem requiring hard political decisions and sacrifices, quants can make a non-trivial contribution to solving it. However, whether new quantitative methods are used or not, greater pension contributions by both employees and employers might still be necessary.

¹ *With Bismarck's encouragement and brinkmanship, in 1881 the Reichstag passed a law guaranteeing financial support from the government to the older members of society, starting at the age of 70.*

² *Military pensions have been known since antiquity: Augustus, the first Roman Emperor, offered a pension to legionnaires who had served for 16 years (later 20), in the form of cash or land equal to 12 times their annual salary. This offer proved to be ruinously expensive, eventually bankrupting the empire. The rest is history.*