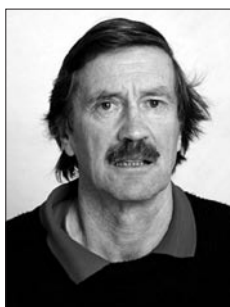


# Preservation of lump sum capital under pension drawdown

Most self-funding lump sum retirees take pensions by regular drawdown from a managed fund. But is drawdown too risky? This paper indicates that when an indexed pension is taken from a lump sum invested in a market index fund, the probability of retaining the original value of the lump sum in real terms (or better) reduces in direct proportion to the amount of the annual starting pension. It proposes an alternative retirement income strategy that is generally preferable to drawdown if term annuities can be purchased at a reasonable price, particularly if guaranteed by government.



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## Private pension schemes

Most countries with nationally coordinated private pension systems in place provide accumulation or defined contribution (DC) schemes. Employees contribute to an investment fund over their working life and exit with a lump sum with which to provide income for retirement.

Available evidence suggests that lump sum retirees are, for the most part, providing themselves with income by regular drawdown from managed funds with a high proportion of equity holdings. In the pension phase, many governments around the world provide either guidance or tax incentives to use account-based pensions. In Australia, where the total funds under management in the Superannuation Guarantee Scheme (SGS) is just over one trillion dollars (ASFA 2009), 'New Pensions' offer tax-free income if minimal drawdown conditions are fulfilled. Over the 12 months to March 2007, sales of account-based pensions and annuities totalled about \$1.39 billion compared with sales of life annuities of just \$29 million (Clare 2007, p. 7). Retirees (perhaps, understandably) are reluctant to relinquish control of, or access to, their capital.

The global financial crisis (GFC) has exposed retirees to unprecedented market volatility with catastrophic consequences for pension account balances. In most countries, the national bourse share price indices fell by more than 50% from high points in November 2007 to March 2009.

## Preservation of capital in long-term drawdown

How likely is it that a self-funding retiree will preserve sufficient capital to provide stable inflation-adjusted income throughout residual life? We approach this question via an example and simulation.

Analogous studies have been carried out for DC funds in their accumulation phase. Blake, Cairns and Dowd (2001) used stochastic simulation to compare end-of-term accumulation under a number of investment strategies across six asset classes over the 40 years of contributions of a salaried UK worker. One of their main conclusions was that over the long-term investment horizon, a static asset allocation strategy with high equity weightings outperformed any of the dynamic (switching, rebalancing) strategies that they investigated. The significance of this is that the use of 'lifestyle strategies', the cornerstone of many DC plans, in which high equity holdings are gradually replaced by bonds and cash as fund members near retirement, is contra-indicated.

More recent research by Basu and Drew (2009) has substantially reinforced this finding. They concluded that by switching to conservative assets in the later years of a DC plan, lifecycle strategies sacrifice significant growth opportunity and prove counterproductive to the participant's wealth accumulation objective. They concluded that this sacrifice does not seem to be compensated adequately in terms of reducing the risk of potentially adverse outcomes to which portfolios with high equity weightings may be subject.

### Modelling share market returns

Extensive econophysics research has shown that stock index returns have heavy tails when returns are calculated over periods of up to four days (Gopikrishnan et al. 1999). For individual stocks the period is about 16 days (Plerou et al. 1999). Further, these short-term returns have long-range dependence and intermittency properties. Over longer periods, stock and stock index returns exhibit 'aggregational Gaussianity' – the returns progressively assume properties of normal variates – and are either uncorrelated or autocorrelations are insignificant (Cont 2001). Thus, a reasonable assumption about annual index returns is that they are independently and normally distributed. This fact is used as a basis for simulation investigation of retirement income stream (RIS) portfolios in this study.

We illustrate the RIS portfolio performance using the case of a current Australian retiree with what might be regarded as an adequate termination lump sum to fund retirement.

### Example

A retiree aged 65, a homeowner with no substantial outstanding debt, has a lump sum of \$600,000 with which to provide for retirement.

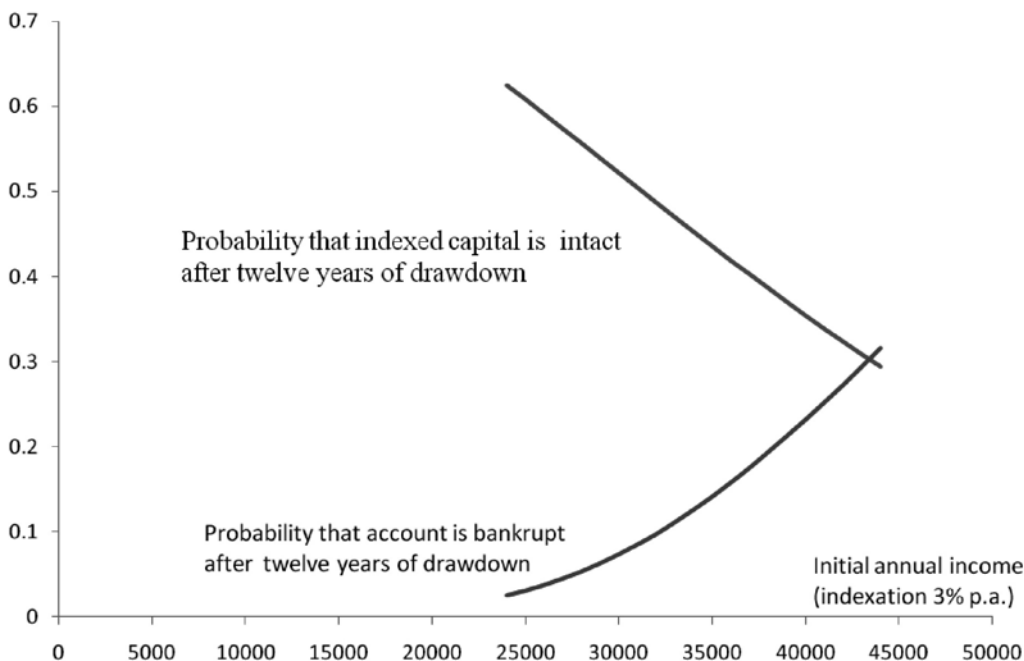
The national bourse accumulation index is supposed to provide long-term annual returns that are approximately normal with a mean of 13% and standard deviation of 20% (taken from Vanguard's asset class performance, available from the Vanguard website, see references), and using the normality assumptions affirmed in the references above.

Inflation is expected to average 3% p.a. long-term. The retiree intends to take an annual pension, which is chosen in the range from \$24,000 to \$45,000. The selected annual income is payable monthly and indexed at 3% p.a. at the start of each year. What are the retiree's prospects of surviving on this drawdown pension long-term? Evidently the more modest the pension, the better the chances that the lump sum will provide income for the residual life of the retiree.

In Figure 1, the upper curve depicts the probability that at the end of a 12-year period the indexed lump sum ( $\$600,000 \times (1.03)^{12} = \$855,457$ ) or more, remains in the drawdown account when varying amounts of annual starting pension are taken from the account. The lower curve represents the probability that the drawdown account becomes insolvent over the 12-year term.

Each data point is based on a simulation sample of the end-of-term accumulation after drawdown, of one million 12-year terms. For this calculation, the following approximation is used. Over any year of the 12-year term, the previous year's account balance less half the indexed annual pension of that year is exposed to market risk, and

FIGURE 1: Probability of reinstating real capital (upper curve) versus probability of bankrupting the account during drawdown



**What are the retiree's prospects of surviving on this drawdown pension long-term? Evidently the more modest the pension, the better the chances that the lump sum will provide income for the residual life of the retiree.**

is then reduced by the indexed annual pension consumed that year. This is analogous to the methodology of both simulation papers mentioned above.

Intriguingly, the reinstatement probability decreases nearly linearly to insolvency. The probability that the original real capital (at least) is intact in the fund equals the probability of account insolvency when annual indexed income starts at \$43,000. Annual market index returns are assumed to be uncorrelated and normally distributed with a mean of 13% and standard deviation of 20%.

### Preservation of capital in a competing strategy

A retirement income stream strategy that is optimal under the mean-variance criterion involves splitting the lump sum into two parts. The first part purchase is a guaranteed indexed medium-term annuity while the remainder is invested in the national bourse accumulation index. The principle involved is analogous to the Tobin Separation Theorem or Mutual Fund Theorem of Modern Portfolio

Theory, which asserts mean-variance optimality of an investment portfolio comprising only cash and the market portfolio (a proof of the extended separation theorem applicable to annuity and other bonds is available on request from the author or, for a similar result, see Gay 2008). As with the Tobin result, the precise investment term remains unspecified.

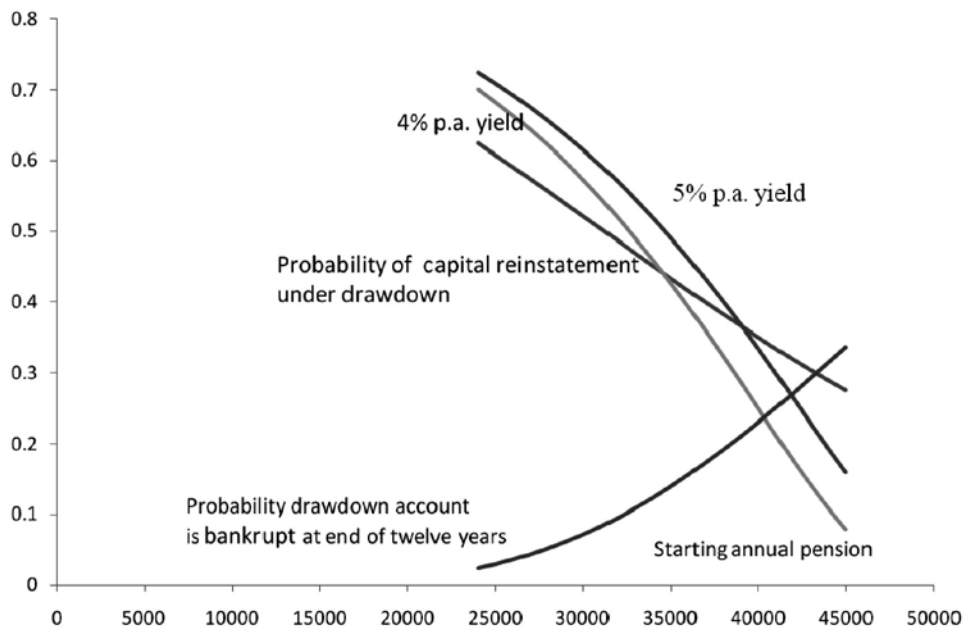
Retirees may adopt pragmatic criteria to determine a suitable initial term (size of lump sum, the required annual pension, the long-term expected return on the market index) or, with longevity risk in mind, the probability that the market investment reinstates the entire original lump sum (in real terms) at the end of the guaranteed income years.

Over a 12-year annuity term, the accumulation in an Australian market index fund is expected to replace the entire original capital in real terms at the end of the guaranteed income years in a high proportion of realisations. Pensions funded in this way are referred to in the remainder of this article as mean-variance efficient (MVE) or annuity/market fund retirement income streams.

For a retiree with \$600,000 able to purchase a 12-year annuity at a yield of 4% p.a., it would cost \$11.1467 per starting dollar of indexed annuity (\$267,520 for a 12-year annuity of \$24,000 p.a. payable monthly, indexed at 3% p.a.). Based on a large simulation sample of 12-year terms, the remaining \$322,480 invested in the index will replace the real capital (\$855,457) in more than 70% of cases.

If the annuity can be purchased at a yield of 5% p.a., the annuity cost is reduced to \$10.5382 per starting dollar; the total cost is \$252,917 for \$24,000 p.a., leaving \$347,083 to invest in the index. The proportion of such 12-year terms in which the indexed capital is replaced increases to 72.5%.

FIGURE 2: Probability of capital reinstatement under drawdown (the decreasing straight line) and under two annuity/market investment strategies that are optimal under the mean-variance criterion



In Figure 2, such probabilities of capital reinstatement using an MVE strategy are superimposed on the drawdown probabilities depicted in Figure 1.

If annuities can be purchased at 4% p.a., then drawdown is preferable to MVE only if the starting annual indexed pension exceeds \$34,000. That is, the MVE capital reinstatement probability curve is above the decreasing straight line until the annual pension taken reaches \$34,000.

If annuities can be purchased at a yield of 5% p.a., drawdown is only preferable to MVE if the annual indexed pension exceeds \$39,000. The lower upward-seeking curve is the probability of bankruptcy and applies only to drawdown. The MVE portfolios cannot become insolvent.

## Government infrastructure for retirement income streams?

One difficulty with implementing the MVE strategy in Australia at present is the need to purchase annuities from commercial providers. While competitive rates are available (Challenger was offering in excess of 5.5% yield in May 2009 for a 12-year term annuity indexed at 3% p.a. if more than \$250,000 was spent on the purchase price) many investors would be concerned about default risk.

The Rudd Government, having incurred enormous debt by virtue of GFC stimulus packages, has indicated that in issuing future public debt instruments, it may be prepared to issue part as annuity bonds (Fells and Brenchley 2009), which would be of great benefit to retirees, especially if accompanied by an education program on how best to utilise them.

## Conclusion

Australian retirees are reluctant to relinquish control of their capital, and generally use new pensions to provide themselves with retirement income by using drawdowns from accounts with a high proportion of equity holdings. From the standpoint of preserving capital, this strategy is best only if pension consumption is quite high. If, in the face of longevity risk, only a prudently modest pension is consumed, a better retirement strategy, which still gives control over capital, is to split the lump sum into two parts, purchasing an indexed annuity with one part, while investing the remainder in the market accumulation index. Such RIS portfolios provide guaranteed indexed income over the medium term, over which undisturbed investment in the market is likely to replace the entire original capital in real terms. Thus the strategy or a modified version of it can be repeated. There is no possibility of bankrupting the account, whereas this is a very real possibility with high consumption drawdown. ☺

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**A retirement income stream strategy that is optimal under the mean-variance criterion involves splitting the lump sum into two parts. The first part purchase is a guaranteed indexed medium-term annuity while the remainder is invested in the national bourse accumulation index.**

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- Returns must be downloaded individually from the Vanguard site.  
See also: [www.crf.com.au/advice-centre/financial-planning/handy-financial-facts](http://www.crf.com.au/advice-centre/financial-planning/handy-financial-facts)