



AUTOMATIC ENROLMENT RETIREMENT SAVINGS SYSTEM

Simulation Results for Smoothed Investment Returns under a National
Auto-Enrolment Pension Scheme for Ireland

Paper for Discussion with Working Group of Society of Actuaries in Ireland

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Introduction and Summary

The purpose of this paper is to assess the viability of a smoothed approach to calculating investment returns for auto-enrolled pensions (AE). The target audience is a Working Group established by the Society of Actuaries in Ireland to explore investment options for AE, including smoothing of investment returns pre and post-retirement. The paper can be considered as an extension of my submission of 4 November 2018 to the Department of Employment Affairs and Social Protection (DEASP).

The paper is in four sections:

1. The first section sets out the high-level case for why investors should be persuaded to focus more on the long-term and to pay less attention to short-term fluctuations in share prices. The proposed smoothing approach helps achieve that shift of focus.
2. The second section sets out projected cash flows for auto-enrolment and considers how cash flows to the smoothed scheme might be affected by fluctuations in market values of the underlying assets and by the activities of other players in the market (financial advisers and pension companies).
3. The third section looks at projected smoothed investment returns under the proposed approach. The submission of 4 November 2018 back tested the smoothed approach, primarily by reference to UK and US stock market returns over the previous 32 years. As noted by a participant at a meeting on 17 December last convened by the Pensions Authority to discuss the submission, we have only one past; it tells us very little about the future. This paper addresses that omission. It examines 100 simulations of possible future experience. Cash flows as derived in the previous section and investment returns derived from a stochastic model (developed by Brian Woods) are projected over 50 years (200 quarters), thereby generating 5,000 years of simulated future experience.
4. The fourth and final section looks at projected ratios of smoothed value to market value for the 50 years of the projections for each of the 100 simulations and considers the implications of the results for the viability of the proposed approach.

In all one hundred 50-year simulations, the proposed approach delivers the desired outcome of good returns compared with alternative pension products, at lower risk. Returns under the smoothed approach can lag those under an undiluted market-based approach in circumstances where markets perform strongly over long periods, because smoothed returns don't keep pace with fast-growing market values. In all cases, the volatility of returns is considerably lower under the smoothed approach.

The attached analysis enables us to answer with confidence a wide range of questions that have been asked about the smoothed approach:

A. Is the government on the hook if things go awry and the fund doesn't deliver the expected returns to contributors?

In none of the 100 simulations is there a risk that the government (or any other external agency) will have to supplement fund-based returns. Yes, some of the simulations indicate poor future investment returns: the worst result shows market values (net of the 0.5% management fee) at the end of 50 years barely ahead of the risk-free return (net return after charges over the 50 years for this simulation is the equivalent of 2.08% per annum, versus an assumed (gross) risk-free return of 2% a year). Contributors will be disappointed at that result but returns on market-

based products will be equally bad if not worse under that simulation, and smoothed fund contributors will have the consolation of considerably less volatility.

Of course, the conclusions could be different if a more cautious stochastic model was used to project future price movements, but the model used in the projections delivers lower returns, at higher volatility, than many investment experts would consider likely to be realised in future. It assumes no investment in unquoted equities, which should deliver higher returns. Neither does it allow for investment in real estate and infrastructure, which should deliver broadly similar returns to world equities, but with lower correlations across the different asset classes, resulting in lower volatility at the portfolio level.

B. How does the proposed fund differ from the Irish Life Secured Performance Fund, which had to be terminated, as it wasn't able to cope with sustained adverse market conditions?

The rules of the auto-enrolment smoothed fund will prevent the type of anti-selective behaviour that (I understand) caused difficulties for Irish Life's Secured Performance Fund. The proposed rules for the smoothed approach, which must be strictly enforced, include:

- i. no transfers of accumulated account balances out of the smoothed fund or, if they are allowed, they must be spread over several years (three years is the suggestion);
- ii. not allowing employees to contribute to the smoothed fund when it's financially advantageous to do so and switching to a pension product from a different provider when it's less financially advantageous to contribute to the smoothed fund;
- iii. compelling employees to take 25% of the smoothed fund as a lump sum on retirement and the balance as a regular income, with strict upper and lower limits on what can be withdrawn each year during retirement.

I'm not familiar with the details of the Irish Life Secured Performance Fund, but I understand that, while the Fund had rules aimed at preventing anti-selective behaviour, they allowed some flexibility. This flexibility could be and was exploited by financially astute financial advisers/ employers/ employees, to such an extent that anti-selective behaviour, or the risk of such behaviour, was a major contributor to the difficulties that led to its closure.

C. How will the scheme be prudentially regulated and what are the capital requirements?

The scheme is unlike anything that exists today, so new legislation and new regulations will be required governing its operation and solvency monitoring.

Like all financial entities, it must be able to demonstrate its ability to meet its commitments at all times. The fund's balance sheet will always show assets and liabilities at market value. The book value of the liabilities, i.e. the total smoothed value of the fund, will simply be a memorandum item, which will indicate the direction of smoothed returns in future: if smoothed values exceed market values, future smoothed returns will lag market returns until the gap is bridged and conversely if smoothed values are less than market values. Where the smoothed value of the fund exceeds its market value, the trustees will have to satisfy themselves and external agencies/ regulators that the excess over market values can be recouped from future investment returns in all reasonable circumstances. This will involve projecting future cash flows and smoothed and market returns on the assumption that the rules of the scheme will be strictly enforced, whilst recognising that employees are likely to act in their own selfish interests within those rules. The solvency assessments, which must be made publicly available, must be

sufficiently detailed to demonstrate that the fund will be able to meet its liabilities as they fall due with a ruin probability of (say) one in 500. This is a more demanding solvency standard than that required of life assurance companies under Solvency II. The analysis in this paper indicates (but doesn't prove) that the trustees will always be able to meet that standard of solvency without needing additional capital. Additional detailed analysis by independent professionals will be required to confirm this conclusion.

The rules of the scheme must allow the trustees to take additional measures if the 1 in 500 ruin probability is not satisfied. For example, the trustees may be allowed in those circumstances to increase the weighting given to current market value in the smoothing calculation from 4.5% to (say) 5%. The purpose of a provision on these lines is to ensure that it will never be necessary to call on government for assistance. It should be made very clear, however, that a rule change on these (or similar) lines will only be possible if the scheme faces a real threat of insolvency, and not in other circumstances.

D. Does smoothing involve intergenerational transfers?

No. Having said that, I'm not sure how we would recognise if there are intergenerational transfers and, if there are, how we could correct them. For example, if the Equity Risk Premium is going to be lower in 20 years' time than it is now, is it part of our remit to try to anticipate that future reduction, or is it just the luck of the draw?

The assumed ERP of 3.5% per annum in the smoothing formula (giving a total net return of 5% per annum, assuming a bond yield of 2% per annum and a management fee of 0.5% per annum) is lower than has been realised in the past and is lower than some experts' future estimates (e.g. KPMG Netherlands expect that the ERP will be 5.5% per annum in future). If the ERP turns out to be closer to those experts' assessments, then smoothed returns will lag market returns in the early years (on average) but Table 4 in Section 3 below indicates that the effect of the ERP used in the smoothing calculation will have largely washed through after 20 years or so. This is a relatively short time, bearing in mind that, 20 years from now, an "older" contributor, someone now aged 50, will probably have another 10 years of smoothed returns to look forward to at that time.

In particular, the proposed scheme does not imply intergenerational transfers of the type inherent in pay-as-you-go pension schemes. On average, market values and smoothed values are broadly equal throughout the projection period.

E. Is this a free lunch – high returns at low risk?

There is no such thing as a free lunch, so how do contributors pay for the high return at low risk? They pay by accepting restrictions on their freedom to contribute what and when they want to the scheme and to withdraw what they want when they want it. They also pay by ceding investment decisions to the trustees. Having said that, the restrictions are reasonable for someone who wants to save regularly while working and to withdraw those savings gradually during their retirement.

F. If this is so good, why hasn't someone else done it already?

I'm not aware of an approach on these lines having been implemented anywhere in the world, but that doesn't mean it hasn't been implemented somewhere. More importantly, to the best

of my knowledge it hasn't been considered and discarded because it has been shown not to work.

If this is a first, then government must consider all the issues carefully, but it doesn't mean they have to reject it. Someone must be first to adopt the approach. Why not Ireland? After all, Ireland supposedly has the highest number of actuaries in the world per 1,000 of the population. That should give us the right to come up with something new in the pension/ actuarial field!

G. The smoothing approach will be difficult to explain.

It is easy to explain how the scheme operates. To the contributor, the AE pension account will look just like a post office, bank or credit union savings account, on which an "interest rate" is declared quarterly. (I suggested monthly interest calculations in my submission of 4 November to DEASP; I now believe that quarterly calculation is more practical.) There are no policy fees or charges (the management fee of 0.5% per annum is deducted before the interest rate is calculated each quarter) and there are no complications at retirement: the contributor simply starts taking money out of the account rather than paying it in. Nothing could be simpler.

It will be more difficult to explain how the interest rate is calculated each quarter, but do many people know how the post office calculates the interest rate credited to depositors' accounts? Do they care? Most importantly, the approach to calculating each quarter's interest rate is fully transparent and objective. There's no black box. It's a completely mechanical calculation that requires just a few inputs. As an aside, I have now decided on a simpler approach to calculating the interest rate than that proposed in the submission of 4 November. I don't think it's necessary to have a crawling peg for the assumed long-term interest rate: it can be left at the bond yield plus (say) 3% throughout.

H. Who determines if/when the "premium" for the LIF needs to be changed?

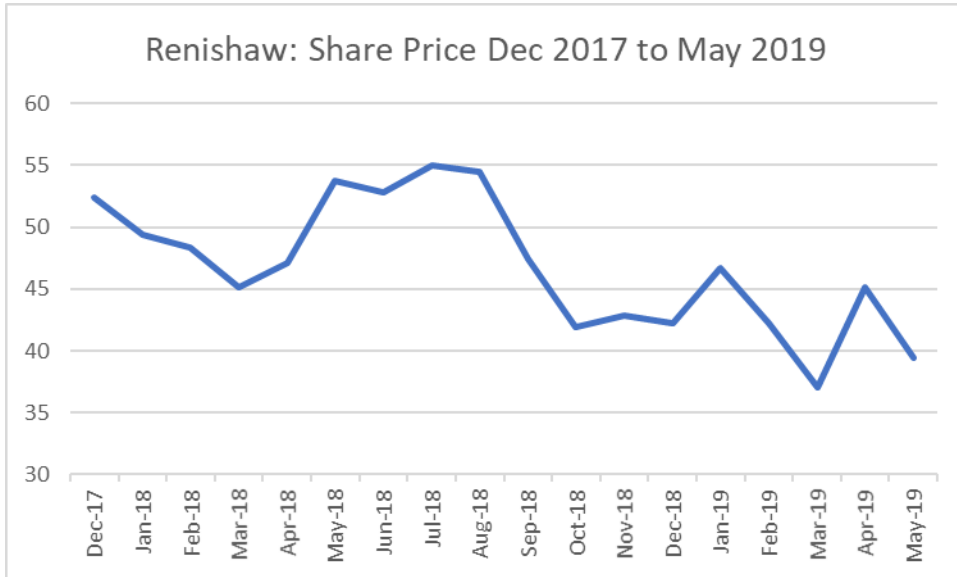
This paper doesn't consider how the Lifetime Income Fund (LIF) will operate, but it is relatively straightforward compared with the smoothing approach to calculating investment returns credited to contributors and involves no new issues of principle.

The premium for the LIF will be calculated on actuarial principles, based on projected survivors to age 90 and on their expected lifespan after age 90. The estimated premium of 2.6% of account balance each year from age 75 quoted in the submission of 4 November was based on the mortality assumptions in Appendix 3 of the submission. These assumed that 590 of every 1,000 75-year olds would still be alive at 90, and that 102 would still be alive at age 100. The reasonableness of these assumptions will have to be tested regularly, probably triennially. The required premium, which is unguaranteed, may change following such valuations. Calculations indicate that a premium adjustment of just 0.1% (from 2.6% to 2.7%) would pay for a significant improvement in projected longevity. If longevity continues to improve as expected, small increases in the required premium rate will be required every seven to ten years. There is a "hidden" margin in the 2.6% estimate. It assumes that everyone opting for the LIF from age 75 will withdraw 1/15th of their account each year. In practice, some will leave a portion of their entitlement in the fund "for a rainy day". Any such balances will be subject to the 2.6% charge, resulting in a windfall for the LIF.

1. Investing: A Sprint or a Marathon?

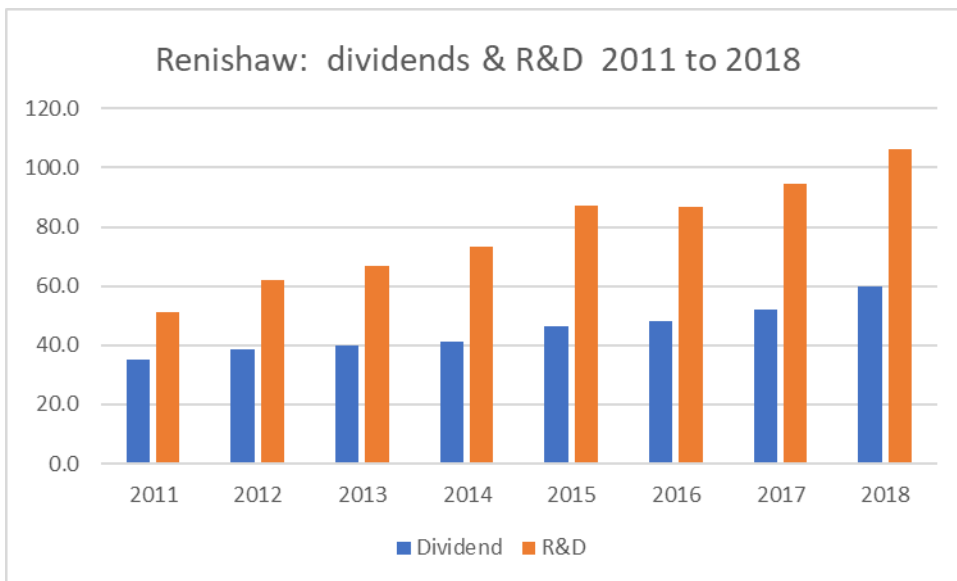
Investing is a long-term activity, but most commentary and analysis focuses on the short-term. The following example, taken from the recent experience of Renishaw, a UK engineering company, which is one of my longest-standing pension fund investments, illustrates the differences between the two ways of looking at investments.

(a) Short-term history of Renishaw share price movements.



The volatility of short-term share price movements – end-month values ranging from a high of £54.95 in July 2018 to a low of £37.00 in March 2019, a 48% difference in just 9 months - contrasts with the long-term stability of dividends and R&D expenditure, as shown in the following graph.

(b) Renishaw's long-term history of R&D expenditure and dividends



Arguably, expenditure on R&D in year “t” is the engine that drives dividend increases in year “t+n”, where “n” is between 1 and 5, and could be even longer. That relationship isn’t reflected in share prices.

Which of the above graphs gives the truer picture of the company's health and prospects? Which graph do analysts devote most attention to? As actuaries, which graph would we prefer them to focus on? Smoothing investment returns over long periods helps keep investors focused on the long-term.

2. Projected Cash Flows for Auto-Enrolment

Auto-enrolment cash flows were projected quarterly for the next 50 years. The assumptions underlying the projections are available on request. They allow for gradual increases in contribution rates (but the assumed ultimate contribution rates are lower than those suggested by government, because higher returns are expected under the smoothed approach, particularly post-retirement, meaning that less needs to be set aside to deliver a specified level of benefit). They also allow for gradual increases in take-up rates as more employers and employees join the scheme (starting with the largest employers, extending gradually to smaller workforces).

Projected cash flows for the first nine years are shown in Table 1 below:

Table 1

Year	1	2	3	4	5	6	7	8	9
Net Income (in € millions)	133	236	350	469	589	707	821	931	1,034
Increase on previous year		77%	48%	34%	26%	20%	16%	13%	11%

Projections for later years are more speculative, but the shape of the progression of cash flows in the early years as shown above is unlikely to be far out. The projections indicate positive net cash flows for the entire 50 years of the projections.

The projections assume that cash flows will not be affected directly by movements in share prices nor in prices of other assets in which the fund is invested. The design of the scheme should ensure this:

- Contributors will be asked to commit to regular contributions of an agreed percentage of earnings. They won't be allowed to vary contributions capriciously or at short notice. In any event, for administrative reasons employers may not be prepared to facilitate requests for frequent changes in contribution rates.
- If employees stop contributing, they lose the benefit of the employer's and the state's contributions;
- Retirees must take 25% of the smoothed account as a retirement lump sum/ gratuity – no option to leave it in the fund. Most employees have little discretion on their retirement date and must give good notice of their intention to retire. Market conditions when an employee retires could be quite different from those applying when notice was given of intention to retire.
- Employees will not be allowed to make withdrawals pre-retirement (although it may be possible to incorporate in the scheme a partial withdrawal facility for first-time house buyers if such a provision is deemed politically and economically desirable; such withdrawals will have low correlations with asset values and will not threaten the stability of the scheme).
- Monthly or weekly "pension" withdrawals by retired contributors must follow an agreed pattern, e.g. 5% of fund annually, with the facility to increase or reduce the withdrawal amount by (say) 10%, on giving good notice.

These rules should ensure stability of cash flows – provided that the smoothed scheme enjoys a monopoly. The same may not be true if there are other players in the market. For example, suppose a Financial Adviser is advising Ms A, a potential new contributor, between the smoothed scheme and a pension arrangement from another provider. Assume for simplicity that the charges are the same under both schemes. Assume too that, at the time Ms A seeks advice, the smoothed value (SV) is 130% of market value (MV).

If it is a single, once-off investment, Ms A is almost certainly best advised to choose another provider. Why pay €130 for €100 worth of assets? By extension, the best advice for regular monthly contributions is to cherry-pick, deciding each month where to invest that month's contribution: choose the smoothed fund if SV/MV is less than (say) 105%, otherwise choose another provider.

The rules for the smoothed scheme must prohibit such cherry-picking. For example, they could stipulate that, if someone decides not to join at the start, they won't be allowed to join for (say) another three years. Similarly, if they leave the scheme, they won't be allowed to re-join for another (say) three years. The rules will also stipulate that transfers of accumulated funds in or out of the smoothed fund will not be allowed. Alternatively, transfers must be spread over (say) three years.

Even with these rules, there is still a risk that Ms A will be best advised in the circumstances outlined above to choose a different provider, if the ratio SV/MV (currently 130%) is expected to remain above 100% for a sustained period. This possibility will be explored in Section 4 below.

Anticipating the conclusions in Section 4, this will not be a problem. Therefore, it can be stated with confidence that, with rules on the above lines, Ms A is best advised to choose the smoothed scheme at all times, unless she has a high risk appetite and believes that she (possibly with her adviser's help) can choose investments that will deliver superior returns, and/or she wants the greater flexibility afforded by an alternative pension product.

Tax may also have a role to play in the choice of pension provider. Under auto-enrolment, tax relief is effectively granted at the standard rate. Under a conventional pension arrangement, it may be possible to claim tax relief at the contributor's marginal tax rate.

The conclusion from this section, subject to the conclusions in Section 4 below on persistence of smoothed values in excess of market values, is that cash flows to the smoothed scheme will not be materially affected by market conditions.

3. Smoothed Investment Returns

The 50-year cash flow projections in 2 above were superimposed on 100 simulations of investment returns over the same 50 years, resulting in 5,000 years of simulated future experience. Returns were simulated using a Wilkie stochastic model for future investment returns. I'm indebted to Brian Woods for his work on the simulations.

The assumed μ in the model is 5% a year, producing an average yearly return of 5.3%, with high volatility around that average.

The smoothing calculation assigns a 4.5% weighting to the current quarter's market value and a 95.5% weighting to the previous quarter's smoothed value increased by a quarter's interest at the assumed long-term rate, taken to be 5% a year. For the nine quarters starting at the end of Quarter 4 of the projections, the highest and lowest smoothed and actual investment returns (from 100 simulations) over the previous 12 months are as shown in Table 2:

Table 2

Quarter	4	5	6	7	8	9	10	11	12
Lowest <u>smoothed</u> return over previous 12 months	+2.9%	+2.3%	+2.0%	+2.2%	+1.7%	+2.1%	+2.4%	+2.3%	+2.1%
Highest <u>smoothed</u> return over previous 12 months	7.6%	7.8%	9.1%	9.7%	9.6%	10.8%	12.9%	13.5%	12.0%
Lowest <u>actual</u> return over previous 12 months	-25%	-35%	-29%	-30%	-33%	-30%	-32%	-26%	-19%
Highest <u>actual</u> return over previous 12 months	41%	56%	52%	52%	72%	89%	86%	72%	59%

The table shows that, in the early years, the smoothed return never strays far from the assumed long-term return. This is to be expected. For example, in the first quarter, the smoothing formula gives a 95.5% weighting to the assumed long-term return (5%) and only a 4.5% weighting to the actual return in the quarter.

The spread between lowest and highest smoothed returns is greater in later years, when the influence of the assumed long-term return on the smoothed value is less. Table 3 below shows the lowest and highest smoothed returns from Quarter 60 (15 years into the projections) to Quarter 68.

Table 3

Quarter	60	61	62	63	64	65	66	67	68
Lowest smoothed return over previous 12 months	+0.7%	+0.6%	+0.4%	-0.1%	0.0%	+0.2%	0.0%	+0.1%	0.0%
Highest smoothed return over previous 12 months	11.3%	10.9%	11.7%	12.7%	13.7%	13.3%	11.0%	10.6%	10.7%

It is envisaged that, when the scheme is established, the quarterly smoothed interest rate will be the main topic of conversation among contributors (bearing in mind that everyone, irrespective of employer, age, or amount of contribution, will be credited with the same interest rate each quarter). The stability of the smoothed returns in the early years, irrespective of market conditions, will generate confidence in the scheme.

A comparison of Tables 2 and 3 shows that smoothed returns are more volatile in later years. By then, contributors will be comfortable with smoothing and will most likely have years of good returns under their belts, so they will be more prepared to accept the occasional poor return.

Importance of assumed long-term return in the smoothing formula

It's worth touching briefly on the importance of the Equity Risk Premium (ERP) assumed in the smoothing formula.

Simulations were completed on two smoothing formulae, one using an assumed long-term return of 5% (bond yield 2%, ERP 3.5%, management fee 0.5%) in the calculation and the other based on an assumed long-term return of 4.5% (bond yield 2%, ERP 3%, management fee 0.5%).

In year 1, the smoothed return based on a 5% per annum long-term return assumption was 0.47% per annum higher on average across the 100 simulations than the corresponding smoothed return assuming a 4.5% long-term return. The difference between the two sets of smoothed returns reduces in later years, as shown in table 4:

Table 4

	First decade	Second decade	Third Decade	Fourth decade	Fifth decade
Average difference between credited yearly interest rate assuming long-term return of 5% pa and assuming 4.5% pa in smoothing formula	0.35%	0.18%	0.11%	0.06%	0.02%

Smoothed fund values at all durations reflect the cumulative difference in credited smoothed returns up to that point. After 25 years, the smoothed fund value assuming a long-term return of 5% per annum is 2% higher on average than the smoothed value assuming 4.5% long-term return. After 50 years the smoothed value assuming a long-term return of 5% per annum is 2.4% higher than that assuming a 4.5% per annum long-term return.

The conclusion from the above is that the assumed ERP is important in determining the quoted smoothed returns in the early years but is less important as the scheme matures.

4. Ratio of Smoothed Value (SV) to Market Value (MV)

Results from the 100 simulations on the proposed smoothing formula (which gives a 4.5% weighting to current market value and a 95.5% weighting to last quarter's smoothed valued increased by a quarter's interest at the assumed long-term return of 5% per annum) show that the ratio SV/MV is unlikely to remain above or below 100% for long in the early years. Some examples from the simulations illustrate the point.

- i. The worst result at the end of quarter 1 from the 100 simulations is an SV/MV ratio of 121.8% (caused by market values falling 18% in the quarter). For this simulation, the situation is reversed at the end of Q2, when the ratio SV/MV falls to 92.8%, due to market values increasing 19% in the quarter. New monies at the start of Q2 benefit from the strong uplift in market values.
- ii. The worst simulation result at the end of Q2 is an SV/MV ratio of 127.1%. The ratio is a very acceptable 104.7% at the end of the previous quarter and reverts to a similarly acceptable 103.9% at end Q3. The investment returns leading to these ratios are: -3.5% in Q1, -19.5% in Q2, +11.7% in Q3.
- iii. There is a similar story for the worst SV/SMV simulation result of 136.3% at end Q3. The ratio is 94.4% at end Q2 (i.e. smoothed value is less than market value) and after rising to

136.3% at end Q3, the ratio falls back to 120.7% at end Q4 and to 98.4% at end Q5. The quarterly returns leading to these SV/MV ratios are: -29.2% (Q3), +1.8% (Q4), +17.8% (Q5)

In the early years, the high proportion of total funds represented by new money helps bring the ratio SV/MV back towards 100% whenever it strays from it in either direction.

The ratio is more likely to stay persistently high (or low) in later years. Completing the same exercise as above for quarters 60, 61 and 62, i.e. 15 years into the projections, the results (from 100 simulations) are as follows:

- i. The worst result at the end of Q60 is an SV/MV ratio of 144.7%. For this simulation, the ratio stays above 100% for 27 successive quarters, from Q53 to Q79 inclusive.
- ii. The worst result at the end of Q61 is an SV/MV ratio of 137.0%. For this simulation, the ratio stays over 100% for 17 successive quarters, from Q55 to Q72 inclusive.
- iii. The worst result at the end of Q62 is an SV/MV ratio of 129.4%. This is the same simulation as (ii) above.

The fact that smoothed values exceed market values for 27 successive quarters, as happens between quarter 53 and quarter 79 in the simulation described in (i) above, may cause some concern, but it's worth remembering that other investments will be going through a rough patch at the same time. In fact, contributors to the smoothed fund will probably value the smoothed approach even more at such times – provided quoted smoothed returns are acceptable. That is generally the case.

As noted in Section 3 above, the quarterly smoothed return will be of far more interest to contributors than the esoteric (to lay people) ratio SV/MV. Throughout the period from Q53 to Q79 for the simulation described in (i) above, when SV is consistently greater than MV, quarterly smoothed returns are negative in only four of the 27 quarters, and then only marginally so (-0.2% in Q60, -0.4% in Q63, -0.1% in Q64 and -0.2% in Q77). Quite acceptable positive smoothed returns are sprinkled throughout the period (e.g.+1.2% in Q56, +0.9% in Q53, +0.7% in Q70). Thus, a long sequence of quarters in which the ratio SV/MV exceeds 100% is not of itself a problem.

Of greater concern to contributors is a long sequence of negative smoothed returns. The longest sequence of negative 12-month returns is 9 quarters (in 5,000 years of simulated experience). In the simulation giving rise to this result, the sequence of negative returns over the previous 12 months starts at the end of Quarter 136 (34 years into the projections). The worst 12-month return in this period is -1.5%; the second worst is -0.9%.

I believe that contributors would find this result acceptable, particularly as it happens after 34 years, by which time the scheme will have proven its worth in delivering high long-term returns consistently.

If the consensus view is that a sequence of negative smoothed returns extending over 9 quarters is unacceptable, even if it happens only once in 100 simulations of 50-year returns, there are at least two ways to address the problem:

1. One is to reduce the volatility of the portfolio by investing a portion of the fund in bonds and similar lower-risk investments. Whilst this reduces volatility, it also reduces expected long-term returns. Investing in other types of real assets, the returns on which have low correlations with equities (e.g. international real estate, infrastructure), also reduces

volatility but without sacrificing expected yield. The stochastic model of future investment returns assumes that the assets of the fund are invested entirely in equities.

2. A second way to reduce the risk of SV/MV exceeding 100% for a prolonged period, with knock-on implications for smoothed returns, is to increase the weighting given to current market value in the smoothing formula. In the simulations, the current quarter's market value gets a weighting of just 4.5%, with a 95.5% weighting to the previous quarter's smoothed value increased by a quarter's expected return. Increasing the weighting given to current market value has the drawback of making smoothed returns more volatile and more likely to fall below zero from time to time.

Another possibility is to hold back some of the excess returns in good years, to create an "estate" to cushion the impact of adverse returns in bad years. This brings us into the realm of conventional with-profits, which has positive and negative aspects. Creating an estate means holding back some returns from current contributors, with no guarantee that the amounts held back will be distributed to future generations. The analysis in this paper indicates that there is no need for a safety net, as none of the 100 simulations of 50 years' experience shows the smoothed fund experiencing financial difficulties that cannot be surmounted. If a safety net isn't needed, why go to the bother and expense of creating one?

The fact that the risk of insolvency doesn't materialise in the 50 years covered by the 100 simulations doesn't mean that it doesn't exist. Financial difficulties are more likely when cash flows turn negative, which is unlikely to happen until after 50 years. An argument could be made for holding back a small amount in good years when net cash flows are positive, for possible distribution when cash flows eventually turn negative, if the fund runs into financial difficulties. A deduction of (say) 5% of the excess return in any year over the risk-free rate plus 10% (i.e. 5% of the excess return over 12%, assuming a risk-free return of 2% throughout) would have a very small negative impact on smoothed returns credited to contributors and would, over time, create a safety net for future generations.