# A New Approach to Auto-Enrolment Higher Pensions for Half the Cost

**Colm Fagan BA, MSc (Mgt), FSAI**

***Presented to the Society of Actuaries in Ireland, 20 January 2021***

***Disclaimer:*** *The opinions expressed in this paper are those of the author and not necessarily those of the author's employer(s) (if any) or the Society of Actuaries in Ireland. The Society of Actuaries in Ireland does not accept any responsibility or liability for any errors and/or omissions herein, including any errors and/or omissions in the data on which this paper is based. This paper does not constitute advice and should not be relied upon as such. The Society of Actuaries in Ireland and the author do not accept any responsibility or liability for any loss to any person or body as a result of any action taken, or any decision taken not to act, on foot of any statement, fact, figure, expression of opinion or belief contained in this paper.*

# A New Approach to Auto-Enrolment
# Higher Pensions for Half the Cost

**Colm Fagan BA, MSc (Mgt), FSAI**

***Presented to the Society of Actuaries in Ireland, 20 January 2021***

## Executive Summary

1. A reporter once asked Will Sutton, an American bank robber, why he robbed banks. "That's where the money is", he replied[1]. Someone saving for a pension should invest in equities for exactly the same reason: "That's where the money is." There is definitely none in cash on deposit. In the Eurozone, interest rates are now down to zero, they are negative for large deposits. The story is the same for money invested in other safe havens. Yields on Eurozone government bonds are below zero for durations up to 30 years.
2. Historically, investment returns from equities have been approximately 4% a year more than from bonds or cash. The paper assumes similar excess returns in future. I am in good company. The Society of Actuaries in Ireland's Actuarial Standards of Practice LA-8, PRSA-2 and PEN-12 estimate future average returns on equities 4½% a year more than on cash and 3½% more than on bonds.
3. Higher investment returns can transform the retirement prospects of contributors to Defined Contribution (DC) pension arrangements, especially if the higher returns are earned when the fund is at its maximum, close to retirement. An extra 2% a year in the ten years before and the ten years after retirement results in a 45% higher pension. That is more than two-and-a-half times the 17% pension uplift from earning the same 2% extra in the first twenty years as a contributor.
4. The almost universal advice to members of DC pension plans is to invest a high proportion of their savings in equities for the majority of the accumulation phase of retirement planning. So, why are they advised, particularly under so-called 'lifestyle' asset allocation strategies, to do exactly the opposite, to move their savings from high-yielding equities to lower-yielding bonds and cash, in the run-up to, and in, retirement?
5. The advice to take a cautious approach in later years, when account values are at their highest, is understandable. There is more to lose and less time to recover losses close to retirement. No-one likes losing money. And losses can be painful, as can be seen from Figure 7 below, which charts monthly changes in the UK's FTSE All-Share Index since 1986.

[1] Sutton claimed that the conversation never took place, that the reporter invented the story. If he did, it was not the first time, and would not be the last, that truth was sacrificed on the altar of a good story.

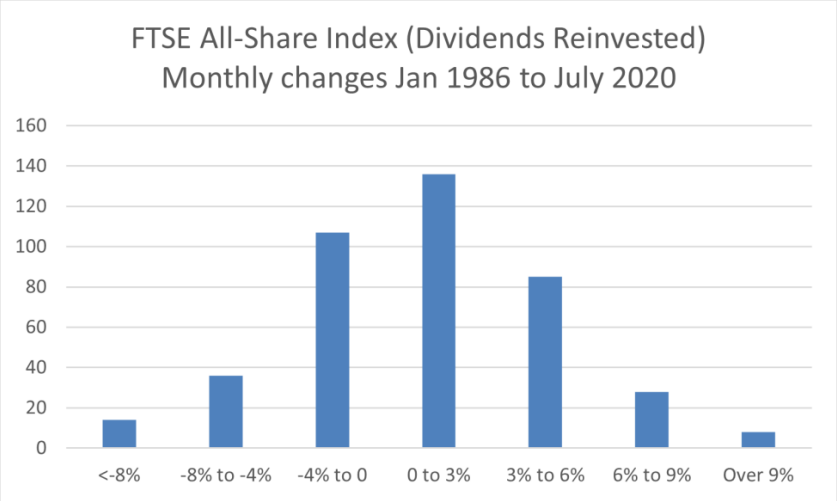


Figure 7

6. On 14 occasions in the 36½ years to July 2020, market values fell by more than 8% in the space of a month, the worst being October 1987, when they fell 26.5%. The second worst was a 15.1% fall in March 2020, which could have been far worse: at one stage, the market was down more than 25% from the start of the month, before making a partial recovery towards month-end. Overall, investors would have seen the value of their investments fall more frequently than one month in every three. So, while the average return over the entire period was a reassuring 8.6% a year, that would have been of little consolation to a contributor approaching retirement, who was fully invested in the stock market at the start of March last. They would have seen their account value tumble by 25% before the month was out.

7. The emphasis on taking a cautious approach in the lead-in to retirement is exacerbated by the tendency of pension consultants and life assurance companies to see retirement date as an endpoint rather than a staging post on the retirement journey. Too much emphasis is placed on reducing the volatility of account values at retirement, with consequential reductions in expected investment returns, even though only a portion of the total pension pot is claimed at retirement: the bulk of it is taken as a pension in subsequent years.

8. The apparent conflict between earning good investment returns and reducing the risk of loss is a false dichotomy. It results from putting too much emphasis on market values, which are largely irrelevant for the committed long-term saver. Contributors to an auto-enrolment pension scheme fall firmly into this category. The dichotomy is resolved by establishing a national auto-enrolment pension scheme, the rules of which state that members' transactions with the scheme, both as contributors and as claimants, take place not at market values but at smoothed values. The transformation wrought by this change can be seen in the comparison of market returns (figure 14) and smoothed returns (figure 30) for the 'favourable' scenario of Section 7 (a repeat of the 30 years from 1990 to 2019 for the UK market):

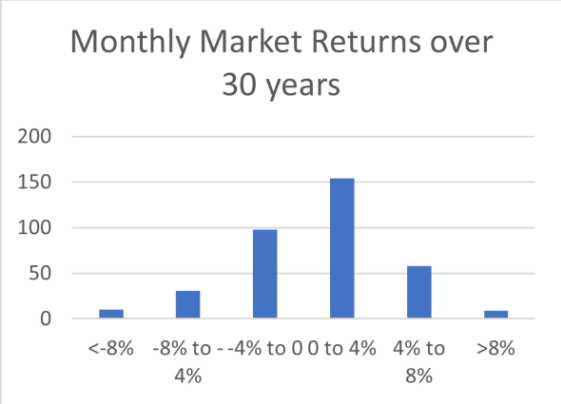


Figure 14

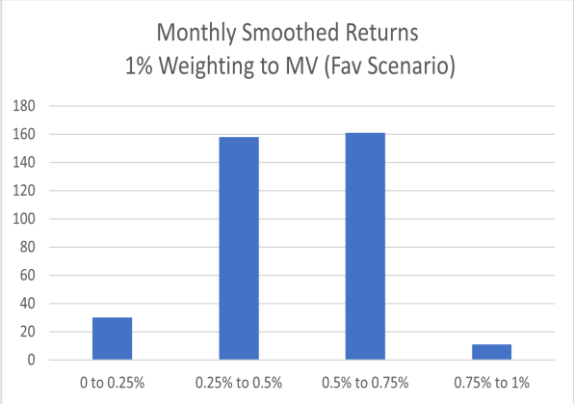


Figure 30

9. The contrast between the two graphs is striking. Monthly market returns vary from a low of -13.2% to a high of +11.3%. Monthly smoothed returns vary from a low of +0.03% to a high of +0.87%, i.e., they are positive each month of the entire 30-year period. The range from lowest to highest reduces from 24.5% for market returns to 0.84% for smoothed returns. The stability of smoothed returns makes it possible to invest 100% in equities for the entirety of a member's investing lifetime, from date of joining until death.

10. The smoothed approach also results in lower costs and charges. The paper assumes the same charges under both approaches pre-retirement, equivalent to a yield reduction of 0.5% per annum. Post-retirement, the charge is assumed to increase to 1.5% under a 'lifestyle' approach while remaining unchanged at 0.5% under the smoothed approach. The higher post-retirement charge under the 'lifestyle' approach is because the retiring employee must leave the group arrangement, losing the discounts negotiated by the trustees on members' behalf, and buy a more costly individual product, which generally includes an extra margin to cover the cost of ongoing investment advice in retirement. Under the smoothed approach, the transition from pre-retirement to post-retirement is seamless and costless. Retirees' funds are invested in exactly the same assets as those of active employees and earn exactly the same smoothed returns, so there is no need for investment advice.

11. The impact of higher investment returns and lower expense charges under the smoothed approach can be seen in the two graphs in Section 10.23 (reproduced below). These compare fund value with contributions paid pre-retirement and with fund value at retirement less accumulated pension withdrawals post retirement.

**Lifestyle approach**

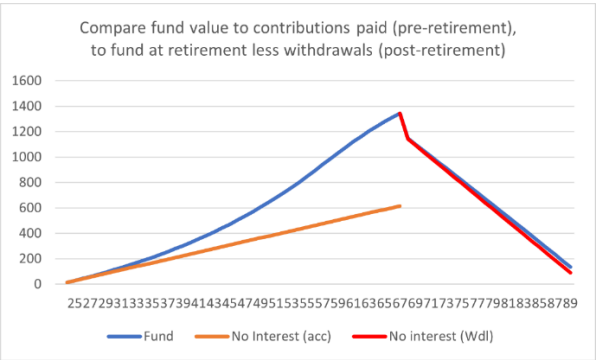


*Figure 9*

**Smoothed approach**

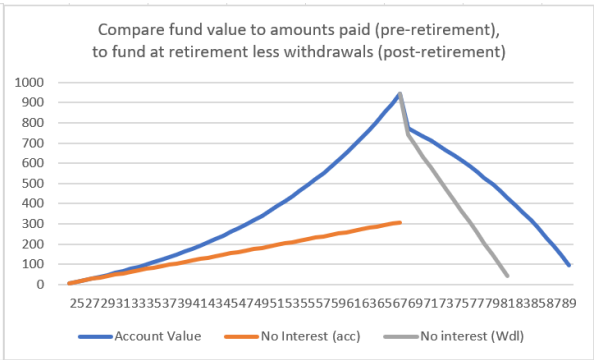


*Figure 29*

12. The impact is particularly noticeable from retirement date onwards (right-hand side of both graphs). The gap between the blue line and the red line post-retirement under the 'lifestyle' approach in Figure 9 is almost invisible, while there is a big – and growing - gap between the blue line and the grey line post-retirement under the smoothed approach in Figure 29. The end result is that the value for money of the smoothed approach is more than double that of a lifestyle approach. The pension provided by a total contribution of 7% of earnings (3% employee, 3% employer, 1% state) under the smoothed approach is higher than that provided by a contribution of 14% (6% employee, 6% employer, 2% state) under a 'lifestyle' approach.

13. Strict rules are required to ensure the integrity of the smoothed approach and to prevent financially astute scheme members from exploiting differences between smoothed values and market values to profit at the expense of fellow members. (The scheme's mutual nature means that gains by one group imply losses by others). The rules should not be unduly constraining for normal transactions, i.e., contributions, retirement gratuities, pensions, deaths. They are a price well worth paying for the reward of twice the value for money compared to alternatives that permit investments to be moved from one asset manager to another, from one provider to another, or between one asset type and another. In any event, very few members of conventional DC pension arrangements avail themselves of those permissions. In the UK's NEST (National Employment Savings Trust), 99% of members take the default option.

14. The proposed scheme will be financially durable and resilient. Two thousand Monte Carlo simulations of possible future experience were completed over a 60-year period. All of them showed the scheme remaining solvent for the entire period. Two of the 2,000 simulations indicated that the scheme was likely to run out of cash sometime after year 60 but the projected investment trajectories giving rise to the two adverse outcomes were highly implausible. Furthermore, even in those two scenarios, there will be additional protections from the 'buffer account' as outlined in the next paragraph.

15. The scheme will face new challenges when cash flows eventually turn negative, projected to occur sometime after year 50. A buffer account will be established to address them. The buffer account will be funded from margins in the 0.5% annual management fee. The margins are estimated at 0.2% per annum, possibly more, from year 20 onwards. By year 50, the buffer account is projected to have grown to over 3% of assets under management and by year 60 to close to 5% of assets under management. Approximate calculations indicate that the buffer account (the "Estate" in with-profits parlance) should be comfortably able to meet the cost of smoothed payments in excess of market values to net exits when cash flows do eventually turn negative. As an additional safeguard, the trustees should be authorised to increase the annual management fee to more than 0.5% in extreme circumstance, but only with the approval of the regulator. All these measures will ensure the scheme's long-term solvency and durability, even in the most difficult financial circumstances, and without any need for government support or a state guarantee.

16. The scheme's unique nature means that it is unlikely to be possible to accommodate it within the EU's Solvency II regime as currently documented. Changes will be required to the text of the regulations, without diluting the underlying Solvency II principles. The reward for overcoming what I see as a purely technical hurdle will be vastly superior outcomes for contributors, the benefits of which can be extended in due course to members of automatic enrolment schemes in other EU member states, and beyond.

17. I am asking actuaries and professionals in related finance, investment, and economic disciplines to complete detailed studies of the proposals in this paper, to evaluate their soundness,

suggesting modifications and enhancements where necessary. Assuming those studies confirm their viability, I would like the Society of Actuaries in Ireland to carry the banner for the smoothing approach to automatic enrolment with regulators (domestically and at EU level) and government. The prize for the success of those endeavours is significantly better retirement outcomes for current and future generations of workers.

# 1. Introduction

1.1. The Irish government has promised to introduce Auto-Enrolled (AE) pensions. It is proposed that employees not already in pension schemes that meet certain minimum criteria will be automatically enrolled in a Defined Contribution (DC) scheme. They may opt out if they wish, but the hope is that inertia alone will ensure high take-up rates. There will be matching contributions from employees and employers, and the state will pay a top-up contribution.

1.2. The previous government's 'strawman' proposals envisaged contributions starting modestly but increasing to a combined 12% of earnings (6% from employees, 6% from employers) after six years, plus a state top-up of 2%, for a total contribution of 14% of earnings.

1.3. The coalition government that took office in 2020 retained the commitment to AE, but the wording of the commitment in the programme for government was lukewarm: *"Taking account of the exceptional strain both employers and employees are now under, we will seek to deliver gradually …; phased roll-out, over a decade; …."* The apparent lack of enthusiasm was almost certainly prompted by a concern in government that combined contributions of 12% from employees and employers, even if they took a few years to build to those levels, were too much to ask in these difficult times. I can understand government's concern.

1.4. This paper proposes a new national pension scheme to deliver on the government's promise. The scheme will be a mutual arrangement, established under trust and administered by independent trustees on a not-for-profit basis. It will deliver higher benefits than those envisaged under the previous government's strawman proposals, at half the cost. The proposed contribution rates are 3% from employees and employers – 6% in total (down from 12%) - and 1% from the state (down from 2%). The better value results from a combination of factors, which are explored in the paper.

1.5. The main contributor to the superior outcome is a sharing of the risks and rewards of equity investment across generations, a form of sharing which has similarities to what is known in Irish as a meitheal, which were common in my home village in County Mayo when I was young. Farmers in the townland where I grew up helped each other at harvest time, following the threshing machine from one farm to the next. No-one kept tabs on who was winning or who was losing from the arrangement. Everyone gained in the long run. That, in essence, is the approach proposed in this paper.

1.6. It also has the advantage of simplicity. Members' pension accounts will look just like high-interest bank or credit union accounts. Everyone will be credited with the same 'interest rate' each month or quarter. The accounts will be completely transparent. It will be possible to track their progress from the date the first contribution is paid, through retirement and pension withdrawals, until the member draws their final breath. Returns credited to accounts will be positive the vast majority of the time and will be considerably less volatile than returns under more conventional DC pension arrangements.

1.7. A further advantage of the new approach is that, after retirement, members will enjoy considerable freedom in the rate at which they draw down their savings. They will also have the option, on reaching 75, of choosing longevity protection. This will eliminate the risk of outliving their savings if they survive to extreme old age, but without having to

sacrifice any of their retirement pot, as would be the case for an annuity bought from an insurance company.

1.8. The higher benefits will be achieved without any need for the state to underwrite the benefits or to make any additional financial commitments or guarantees. Administration and investment management will be straightforward, so it should be possible to start enrolling employees and employers from the start of 2023, less than two years from now.

1.9. The paper does not propose that the proposed national scheme should enjoy a monopoly on auto-enrolment (AE); however, the likelihood is that existing financial institutions will decide not to participate, because they will be unable to match the benefits provided under the national scheme.

1.10. There will still be a market for private sector pensions:

- Pensions for earnings in excess of the upper earnings limit for auto-enrolment (€75,000 a year under the previous government's proposals) will be covered by private sector schemes. The self-employed will also be excluded from auto-enrolment (initially at least).
- For tax reasons, private pensions may be a better option for high earners. Under AE, the proposed state top-up is equivalent to tax relief at 25%, irrespective of an individual's personal tax status. Relief at 25% could be significantly less than the tax a high earner would pay on withdrawals in retirement, since all pensions, irrespective of source, will be taxed at the individual's highest marginal tax rate. The paper implicitly assumes that tax reliefs on contributions to private pensions will remain as at present.
- Private pensions will continue to have a role where the employer pays significantly higher contributions than those mandated under AE. That will be true particularly for Defined Benefit (DB) pensions.
- Private pensions may also be a better option for employees who wish to have a say in where their savings are invested and/or who want to be free to move funds between investment managers. All investment decisions for the national AE scheme will be taken centrally by the trustees. Also, whilst employees will be allowed to leave the national scheme, their accumulated savings will remain in it until their retirement, and even then, can only be withdrawn in instalments in accordance with the rules of the scheme.

1.11. The proposals in the paper stem from personal experience of managing my own pension, which is entirely DC, over the last 25 years, first in the accumulation stage and then in drawdown since my 'retirement' over ten years ago. The three key lessons from that experience are:

a) To invest in enterprises which are expected to generate considerably higher returns, on average, than cash or bonds.

b) To try not to get too elated or depressed by short-term fluctuations in market values; to treat both rises and falls with a degree of scepticism, almost contempt; in the words of Rudyard Kipling, to *"treat those two impostors just the same"*.

c) Share prices are more than numbers on a spreadsheet. They tell part, but only part, of the story of real businesses trying to add value through their products and services.

1.12. These three lessons are illustrated through my investment in Renishaw, a UK engineering company. I bought my first Renishaw shares in October 1998 at £4.05 a share. I liked the company's commitment to constant improvement and innovation: every year, through good times and bad, it reinvests approximately 15% of sales revenues back into the business, in the form of spending on research and development (R&D). The bulk of this investment is treated as a cost in the profit & loss account, the same as if it were wasted. I liked the company's aversion to debt – it has no borrowings, a bulging bank balance, and owns rather than rents many of the properties from which it operates. My decision to invest may also have been influenced by the fact that Sir David McMurtry, Renishaw's co-founder, is a Dubliner. Now into his 81st year, he still chairs the Board of Directors.

1.13. The dividend in my first year was 11.44p a share, equivalent to an 'interest rate' of 2.8% on my investment. This was less than the 4½% or so I could have got at the time from a government bond, but I was confident that Renishaw's commitment to R&D would pay off in the long-term.

1.14. Have things worked out as I had hoped? I will start with a report card prepared for a different audience towards the end of 2019, then update it for developments in 2020. There are lessons in both.

1.15. By 2019, the dividend per share had increased to 60p, more than five times the 11.44p I got in 1999. The virtuous cycle of higher R&D leading to higher sales, higher profits and higher dividends is shown in the following graph, which charts dividends and R&D expenditure per share in the nine years 2011 to 2019:

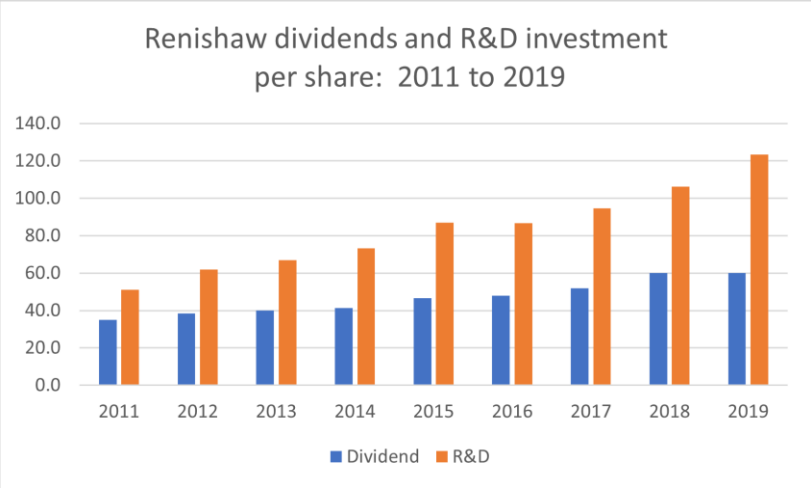


*Figure 1*

1.16. The next chart, which shows fluctuations in Renishaw's share price in just fourteen months, from August 2018 to October 2019, tells a very different story:

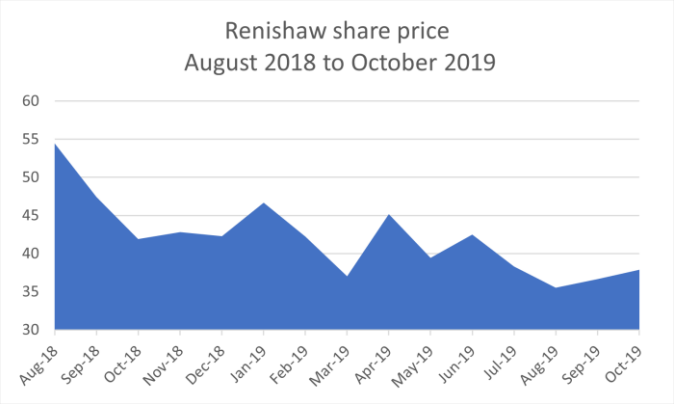


*Figure 2*

1.17. The gentle climb towards ever-sunnier uplands of the first chart has been transformed into a terrifying landscape of jagged cliffs and precipices. In just two months, between August and October 2018, Renishaw lost almost a quarter of its market value. By March 2019, just seven months later, the fall had extended to close to a third. The price was lower again by August 2019. Why the sudden fall from grace? The answer is that the first chart tells of real-world events while the second reflects the fickle views of stock market traders and speculators.

1.18. As actuaries who claim to know something about long-term forecasting, which of these two charts should we use as the starting point for forecasting what the Renishaw share price might be 10 or 20 years from now? Which do we actually use? Sadly, the answer, even for actuaries, is usually the second. That cannot be right.

1.19. The last twelve months provide an interesting update on the 2019 presentation. In 2020, Renishaw went through the horrors, like most manufacturers reliant on well-functioning export markets. Not all of its problems stemmed from Covid-19. Brexit and the prospect of a serious trade war between China and the US also cast a cloud over its share price. (A significant proportion of Renishaw's sales are in China).

1.20. The updated chart of dividends and R&D, including 2020, is as follows:

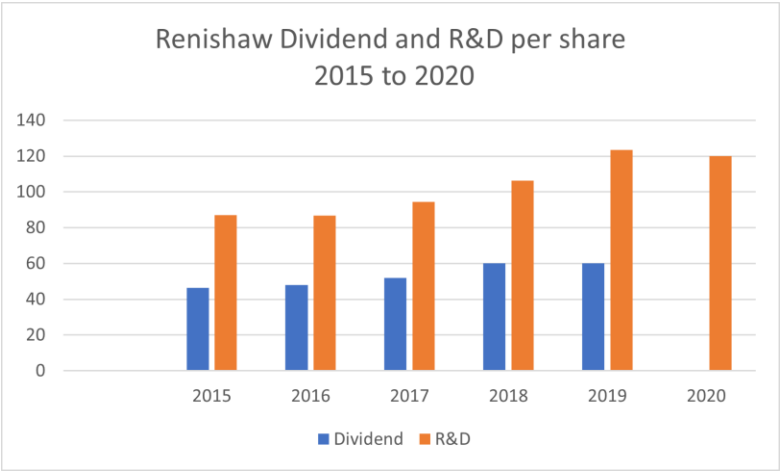


*Figure 3*

1.21. No, your eyes are not deceiving you. The blue line, showing dividends, has disappeared completely for 2020. The Directors decided to cut the dividend to zero. The first thought is that this should have spelt bad news for the share price, but the opposite

happened. Here is the graph of share price movements between October 2019 and September 2020:

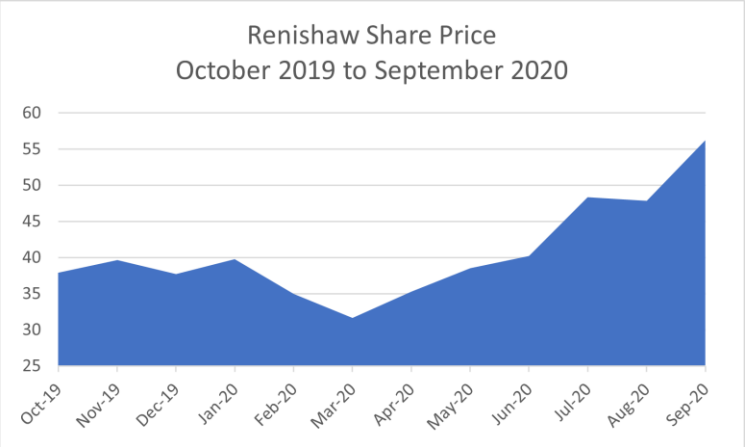


*Figure 4*

1.22. The price fell to a low of £22.76 in mid-March 2020, on fears that the pandemic would disrupt the company's sales and operations, but it then started to increase so that, by end September, it was almost two-and-a-half times its low point in March. The recent share price increases may be due in part to what Alan Greenspan, former Chair of the US Federal Reserve, once called 'irrational exuberance', which is there in bucketloads at the moment for any stock with even a hint of 'technology' in its business model, but is probably due more to a belief in the market that Renishaw's strong financial position, bolstered by its decision to save cash by cancelling the 2020 dividend, and its continued commitment to R&D (the brown R&D line in the graph remained elevated even though the dividend line disappeared in 2020), would allow it to steal a march on its competitors, enabling it to get through the crisis in a much stronger position.

1.23. Investors are probably hoping for a repeat of 2008/ 09. What happened then is shown in the following graph, which charts the pattern of dividend payments in the few years before and after the Global Financial Crisis of 2007/08. The dividend was cut by almost 70% in 2009, then bounced back strongly so that, by 2011, it was almost 40% above its 2008 level.

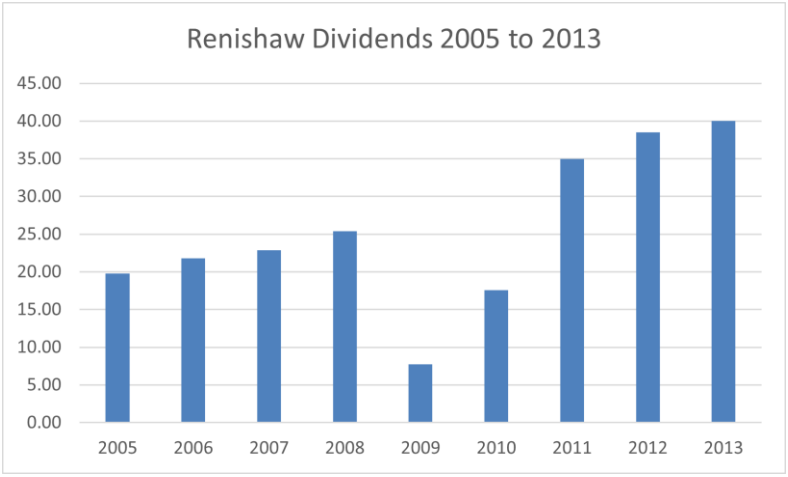


Figure 5

1.24. Looking at the overall return since I bought my first Renishaw shares in 1998, the initial purchase at £4.05 a share has delivered dividends starting at 11.44p a share in 1999,

increasing gradually to 60p in 2019 (with a blip in 2009 and 2010), before falling to zero – temporarily, I hope – in 2020. The share price increased fourteen-fold in the period, to £57 a share. The total return in the 22 years since I bought my first Renishaw shares is equivalent to an annual 'interest rate' of 15%. The equivalent interest rate falls by a relatively small amount, to 13%, if the assumed sale price is a third lower, at £38 a share. If I had put my money instead in a government bond that matured in 2020, I would have earned just 4½%.

1.25. I am not claiming to earn that sort of return from all my investments. Far from it. As anyone who follows my occasional investment blog will know, I have had lots of investment disasters. In the long run, however, returns from investing in real businesses have beaten hands down what I could have earned from bonds. That was true in the past for the vast majority of people who invested in real businesses. It should also be true in future, for the reasons explained in Section 3. If the proposals in this paper are implemented, it will also be true for contributors to a national auto-enrolment pension scheme.

1.26. The remainder of the paper is organised as follows:

- The vision of DC pensions that informs the proposed approach is set out in section 2. It highlights the differences from the conventional view of DC pensions.
- Section 3 outlines the key investment challenges facing DC scheme members, before and after retirement, and the perceived irreconcilability of the two key objectives of (i) earning high investment returns and (ii) reducing the volatility of returns, particularly at older ages.
- Section 4 sets out how 'lifestyle' investing tries to address these conflicting objectives and estimates likely pension outcomes under a lifestyle approach, on stated assumptions for investment returns and charges.
- Section 5 explores what I call the tyranny of market values and asks how market values can be made to serve investors, not be their masters. It shows how smoothing of investment returns allows high equity investment with low volatility of returns.
- Section 6 sets out a formula for calculating smoothed returns, and the required supporting rules, so that the scheme's solvency and financial stability can be maintained in widely differing market conditions, while also ensuring fair treatment of contributors and beneficiaries.
- Section 7 explores how the proposed smoothing approach delivers on its objectives if financial conditions in future are similar to those experienced in the past.
- Section 8 recognises that the future may look very different from the past and demonstrates the resilience of the proposed approach in challenging market conditions.
- Section 9 looks at the sensitivity of smoothed returns to the chosen smoothing parameters.
- Section 10 compares likely costs and charges to contributors under the proposed approach with those under a 'lifestyle' approach and estimates pension outcomes on assumptions consistent with those in Section 4. The comparison shows that the smoothed approach delivers more than twice the value for money of the lifestyle approach. It produces higher benefits at half the cost, with lower volatility of returns.
- Section 11 looks at the challenge posed by longevity and shows how the proposed approach can be enhanced to allow retired scheme members to protect themselves against the risk of outliving their savings.

- Section 12 recognises that, like any financial institution, the national AE scheme must demonstrate its solvency and durability in all plausible circumstances and shows that the scheme can satisfy the most exacting standards under both headings.
- Section 13 concludes by summarising the paper's findings and acknowledging the people without whose help the proposals might never have seen the light of day.

## 2. A seamless vision of DC pensions

2.1. The vision of a DC pension in this paper is of that of a straightforward personal savings account, like a bank, post office, or credit union account. Money is added to the account during an employee's working life and withdrawn in retirement. The entire period from date of joining to death is viewed as a single continuum, and can be represented graphically as follows, assuming a new joiner at 24 who retires at 68 (the proposed state retirement age for someone now aged 24):

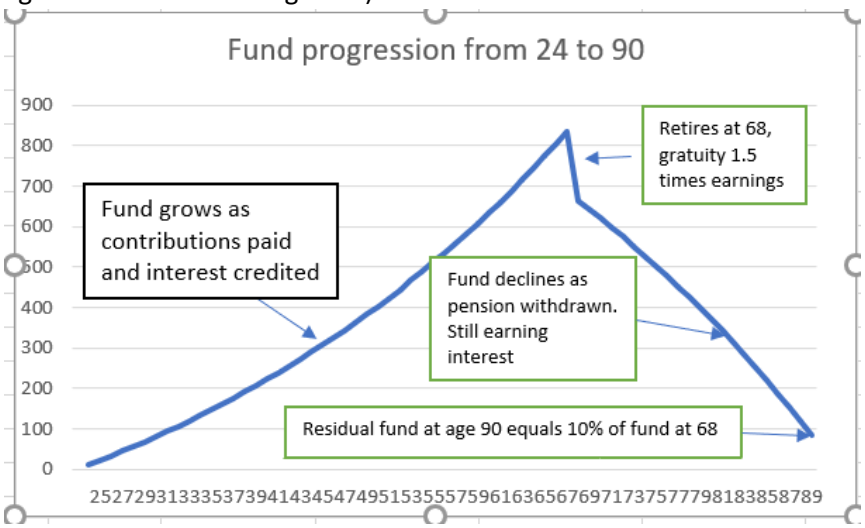


Figure 6

2.2. The graph assumes a constant (positive) interest rate. In practice, the rate of investment return, as measured by changes in market values of the underlying investments, can vary from one accounting period to the next. It will be positive most of the time but could also be negative. This complication will be addressed later.

2.3. For simplicity, the graph assumes that the contributor has constant earnings during their working life and that they contribute a level percentage of earnings. It also assumes zero inflation and a level pension from age 68. Allowing for earnings to vary during the employee's working life and for both earnings and pension to vary with inflation poses no special challenges but equally offers no special insights, subject to the proviso that contributions are invested in assets that will keep their value in real terms if inflation reappears at some future date. That is a key aspect of the proposed approach.

2.4. The account value increases throughout the employee's working life as contributions are paid and interest is added. At retirement, the employee withdraws a gratuity (25% of fund, to a maximum of 1½ times earnings) and starts making regular drawings from the account to provide a pension for life.

2.5. In deciding how much to withdraw each year in retirement, the employee faces a problem in that date of death is unknown, as is the interest to be earned in future. They could die shortly after retirement, or they could live to be a centenarian. The challenges posed by longevity and how they might be surmounted are addressed in Section 11. For the present, it is assumed that, after retirement, the scheme member makes level regular withdrawals such that, if the assumed rate of investment return is achieved, a residual balance will remain at age 90 equal to 10% of the account balance at retirement. This means that, if the pensioner lives beyond age 93 or so, they will run out of money. As noted above, this risk

will be addressed in Section 11. On death (before or after retirement), the balance in the account at that time will be paid to the employee's dependants/ estate.

2.6. This view of a DC pension as a seamless continuum from date of joining, through retirement, to eventual death differs fundamentally from how DC pensions are viewed by the pensions industry (life assurance companies, financial/ pension advisers, asset managers) and by government. They tend to view the pre-retirement (accumulation) stage and the post-retirement (decumulation) stage quite differently. In the industry and government view, the term 'Defined Contribution (DC) Pension' generally refers to the accumulation stage, i.e., before retirement. Under this view, a DC pension arrangement 'matures' at retirement, when a lump sum becomes available. The employee can take part of the lump sum in cash (which is generally tax-free). The balance must be used to buy a new post-retirement decumulation product, either a life annuity (single or joint life) or an 'Approved Retirement Fund' (ARF). Employees are recommended to seek professional advice on which to choose. If they choose an ARF, they also need advice on investment and drawdown options, both at the start and at regular intervals thereafter. This advice, which is often factored into the cost of the ARF, can be costly.

2.7. This view of pensions is reinforced by legislation. Under current legislation, an employee's membership of a DC scheme must cease at retirement. After leaving the scheme, they are on their own. They lose the benefits of bulk discounts on charges for asset management and administration that the trustees have negotiated on behalf of scheme members. Under Auto-Enrolment, at least as implemented in the UK, they also lose the benefit of government caps on administration and asset management charges and also have to pay for personal financial advice (the cost of which is often met by the employer pre-retirement). Partly for this reason, and partly because of the genuine need for ongoing advice post-retirement on asset allocation and drawdown options, charges on post-retirement ARF's are considerably higher than on group pre-retirement DC plans.

2.8. Treating the pre-retirement and post-retirement 'products' as two quite distinct arrangements also has significant implications for investment strategy and investment returns. The fact that the pre-retirement arrangement matures at retirement date tends to cause employees, their employers, and financial advisors to place considerable emphasis on reducing volatility of returns as retirement date approaches. There is a similar phenomenon in reverse when the proceeds of the pre-retirement arrangement are being reinvested in a post-retirement ARF. 'Drip-feeding' money back into the stock market is sometimes advised, in order to reduce exposure to the risk of a sharp market fall shortly after buying the ARF.

2.9. As can be seen from Figure 6 above, the fund is at its maximum just before and just after retirement. This is also when it is at its maximum earning power. An extra 2% a year investment return in the ten years immediately before and the ten years immediately after retirement results in a 45% higher pension. One of the aims of this paper is to allow members of the AE scheme to capture as much as possible of that higher return.

2.10. The paper assumes that pensions legislation will have changed by the time Auto-Enrolment is introduced, so that the vision of a seamless (and costless) transition from pre-retirement to post-retirement can be realised. As an aside, I was able to make the transition relatively seamlessly with my own personal pension fund when I 'retired' over ten years ago. Ownership of the shares in which my pension savings were invested was transferred from the trustee of the self-administered pension (the pre-retirement

accumulation product) to an Approved Retirement Fund (the post-retirement decumulation product) through an in-specie transfer. The in-specie transfer spared me the cost of having to sell the shares in the pre-retirement product and buy them back in the post-retirement product. That cost-saving device is not available to most pension savers. The approach proposed in this paper eliminates completely the need to move assets from one product to another on retirement, so retiring members of the AE scheme will enjoy even greater cost savings.

## 3. Risk and reward

3.1. The 45% boost to pension that comes from earning an extra 2% a year in the twenty years spanning retirement (ten years before and ten years after), as quoted in the previous section, is more than 2½ times the 17% boost that comes from earning an extra 2% during the employee's first 20 years as a contributor. This shows the importance of optimising the investment return when the fund is at its maximum. But this is precisely the opposite of what most pension/ financial consultants and advocates of a so-called 'lifestyle' approach to pension investing advise: their advice is to take the foot off the gas in the years leading up to retirement, and to keep it off it in retirement.

3.2. Their caution is understandable. There is a trade-off between risk and reward. The higher the value of the fund, the more there is to lose. No-one wants to lose money. We are all loss averse.

3.3. Loss aversion, the tendency to prefer to avoid losses than to acquire equivalent gains, is part of the human condition. Our fear of losing may have its origins in evolution: the hunter-gatherer who skulked in a dark corner of the cave, hoping not to be noticed and happy for other members of the tribe to risk their lives tackling wild animals, had a better chance of passing his genes to the next generation.

3.4. Losses are far more powerful, psychologically, than gains. Daniel Kahneman ("Thinking, Fast and Slow") wrote*: "For most people, the fear of losing $100 is more intense than the hope of gaining $150."* As we shall see, the saver's natural loss aversion may be exacerbated by their adviser. Fear of loss means that savers will sacrifice a high expected return (defined mathematically as the probability-weighted outcome), preferring the peace of mind of a lower but less volatile return.

3.5. Loss aversion can lead to behaviour that is economically irrational, but entirely understandable in psychological terms. If someone with €1,000 to invest has to choose between two one-year investments, one delivering a 3% return (€1,030) with absolute certainty, the other having a 2 in 3 chance of returning €1,300, but a 1 in 3 chance of returning just €650, causing the investor to lose more than a third of what they put in, a high proportion of savers will opt for the certain €1,030, even though it means that they lose out on an expected, probability-weighted, return of more than 8%. The calculations are as follows:

| **Outcome and probability** | **Outcome * Probability** | **Expectation** |
|---|---|---|
| | | |
| Outcome 1 €1,030 with absolute certainty: | €1,030 *100%<br>**Expectation** | €1,030<br>**€1,030** |
| Outcome 2. €1,300 with probability 2 in 3:<br>€650 with probability 1 in 3: | €1,300*2/3<br>€650*1/3<br>**Expectation**: | €866.67<br>€216.67<br>**€1,083.33** |

3.6. The adviser, whose role is to help the investor make the 'right' choice, can be part of the problem. Financial/pension advisers can be more loss averse than their clients, for good reason. Staying with the above example, a financial adviser would not relish the prospect of having to meet a client one year from now whose €1,000 had fallen in value to €650, even if it had been objectively, in probability terms, the right decision at the start of the year. Human nature is such that, if the investment does well and increases in value to €1,300 by

the end of the year, the client will give themselves the credit for having made the right choice, but if it turns out badly, they are more likely to blame the adviser. Given these payoffs, discretion is the better part of valour from the adviser's perspective; they are on safer ground recommending the investment that will pay a guaranteed €1,030.

*3.7.* The role played by advisers, and their different pay-off calculus, could help solve the so-called "Equity Risk Premium Puzzle", which postulates that the excess return on equities over bonds is higher than it should be, based on purely theoretical considerations from utility theory. Quoting Daniel Kahneman ("Thinking, Fast and Slow") again:
*"Hindsight is especially unkind to decision makers who act as agents for others – physicians, financial advisers … We are prone to blame decision makers for good decisions that worked out badly and to give them too little credit for successful moves that appear obvious only after the fact. There is a clear outcome bias. When the outcomes are bad, clients often blame their agents for not seeing the handwriting on the wall – forgetting that it was written in invisible ink that became legible only afterwards."*
and:
*"… decision makers who expect to have their decisions scrutinized with hindsight are driven to bureaucratic solutions – and to an extreme reluctance to take risks."*

3.8. Many financial advisers will empathise with this. It is entirely reasonable and logical for them to conclude that it is just not worth the risk advising clients to buy a product that could fall significantly in value.

3.9. Advocates of a safety-first approach have a number of other weapons in their armoury:

- They can claim to be following the advice of Warren Buffett, arguably the most successful investor of all time, who is reputed to have said:
"*Rule number one of investing is never to lose money; rule number two is never to forget rule number one".*
That is utter rubbish, of course. Buffett lost billions in the 2008 crash and did so again in 2020. What Buffett actually meant when he wrote those words will be explored later.
- Another ploy employed by advocates of a safety-first approach is to recount tales of shrewd investors who avoided disaster by getting out of the market at the right time. Probably the best-known is the story of Joe Kennedy, father of President John F Kennedy, who supposedly decided to get out of equities just before the crash of 1929 when a shoeshine boy advised him to buy a particular stock:
*"I know it's time to sell when a shoeshine boy gives me share tips."*
- Another common fallacy is a belief that it is possible to predict stock market highs and lows. The more common prediction by far is that markets are too high and are about to fall. Once again, Warren Buffett, who can always be relied on for a memorable quote on almost any aspect of investing, put it plainly:
*"We've (his partner Charlie Munger and himself) long felt that the only value of stock forecasters is to make fortune tellers look respectable."*
In similar vein, Terry Smith of Fundsmith observed:
*"When it comes to market timing, there are only two sorts of people, those who can't do it and those who know they can't do it. It is safer and more profitable to be in the latter camp."*

3.10. The reality is that the investor's best hope of achieving a good long-term investment return is to forget about trying to time the market, to remain fully invested at all times,

through good times and bad, and to accept the pain of the occasional sharp fall as the cost of achieving those returns. Historically, investors have been well-rewarded for staying the course. Returns on equities (defined broadly to include assets with risk-return characteristics similar to equities) have exceeded those from bonds (also broadly defined to include cash) by more than 4% a year on average:

- In the UK, in the 118 years from 1900 to 2017, equities delivered an average **4.6%** a year more than Treasury Bills and **3.8%** a year more than gilts. In the 72 years from end 1945 to end 2017, the excess was **5%** a year over gilts and **5½%** a year over Treasury Bills (Barclays Equity Gilt Study 2018).
- In the US, in the 92 years between 1926 and 2017 equities returned an average **4.1%** a year over bonds. (Barclays Equity Gilt Study 2018)
- Between 1900 and 2016 global equities returned an average **4.3%** a year more than Bills (Credit Suisse Global Investment Yearbook 2017)
- A 2017 paper for the US National Bureau of Economic Research[2] concluded that, over the 145 years from 1870 to 2015, so-called risky assets (equities and residential real estate) outperformed so-called safe assets (bonds and treasury bills) across 16 advanced western economies by between **4%** and **5%** a year on average.

3.11. Similar equity outperformance is expected in future:

- In 2015, the Federal Reserve Bank of New York estimated an Equity Risk Premium (ERP), defined as the excess return from equities over that from risk-free assets, of **5%** to **6%** a year, based on a combination of retrospective and prospective models.
- The website market-risk-premia.com produces regular estimates of prospective risk premia for various markets. At time of writing, estimates of the equity risk premium for a selection of major economies are: **7.2%** (UK), **4.1%** (US), **6.6%** (Japan), **3.7%** (China).
- Up to recently, KPMG Netherlands published quarterly estimates of the Equity Risk Premium (over long gilts). Its last estimate (July 2019) was **5.75%**.

3.12. No-one can predict the equity risk premium, particularly over the next 70 years or longer, which could be the investment horizon for a young employee joining a DC pension arrangement. Furthermore, whatever ERP is assumed is likely to be wrong. The only thing we can be sure of is that it must be positive in the very long-term because loss aversion by investors and, possibly more importantly, by their advisers will keep pushing people towards low-risk investments. The expected return from riskier investments will have to be considerably higher to persuade them to forsake the safer option.

3.13. Whatever the theory about investors getting a higher return, on average, by putting their faith in riskier assets, the average investor, who has a limited investment horizon, cannot live their life by averages. The falls on the way towards the happy long-term result can be painful. The following chart shows monthly changes in the FTSE All-Share Index (dividends reinvested) between January 1986 and July 2020. The average return over the entire period (34 years 7 months) was a healthy 8.6% a year (0.69% a month), but the variations around that average are not for the faint-hearted.

[2] "The Rate of Return on Everything 1870-2015" by Oscar Jorda, Katharina Knoll, Dmitry Kuvshinov, Moritz Scheularick and Alan M Taylor.

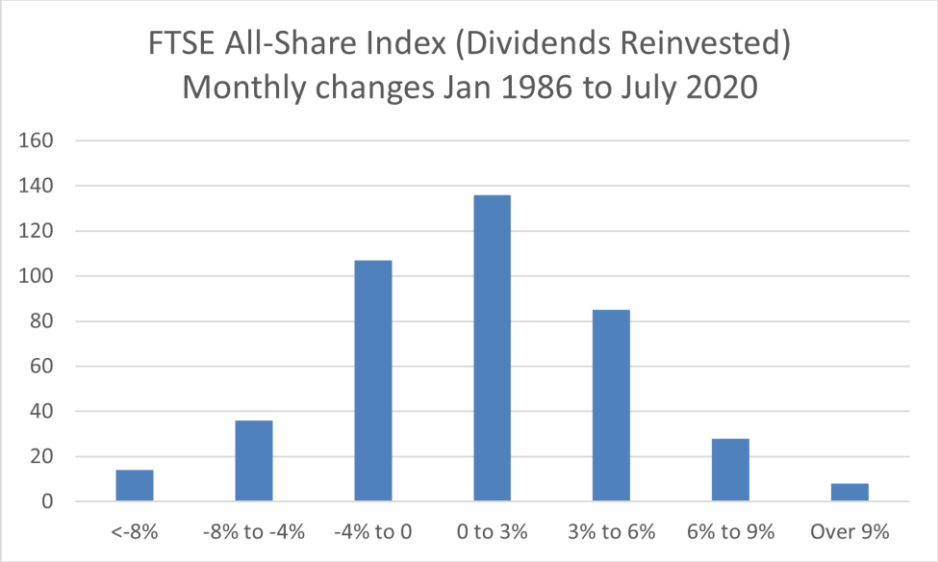


Figure 7

3.14. On 14 occasions, the index fell by more than 8% in a month, the worst being October 1987 when it fell 26.5%. The second worst was a 15.1% fall in March 2020, which could actually have been far worse: at one stage in the month, it was down more than 25% before recovering to end the month 'just' 15.1% down. On another 36 occasions since 1986 market values fell by between 4% and 8% in a month. Overall, investors would have seen the value of their investments fall more frequently than one month in every three. So, while the average return over the entire period was a reassuring 8.6% a year, that would have been of little consolation to a contributor approaching retirement, who was fully invested at the start of March last. They would have seen their account value fall 25% before the month was out.

3.15. Yearly returns also show considerable volatility. The UK market returned an average 9.1% a year in the 118 years to end 2017 but fell by more than 10% in 11 of them, the worst being 1974, when values halved (although it should be added that they doubled in the following year, 1975).

3.16. Equity underperformance can extend over many years, even over decades. For the UK market, the real return on equities, with income reinvested, was negative for the first part of the last century, between 1900 and 1920, despite the index doubling in nominal terms in the period. That poor performance can be blamed partly on the First World War. No such excuse is available for its end 1974 value in real terms being just over half what it was 15 years earlier, at the end of 1959, though the added information that the index more than doubled between 1957 and 1959 and practically doubled again in 1975 would have made the fall less painful for the long-term investor. At end 2019, the Japanese market was more than 10% below its level of 30 years previously.

3.17. Even the US market has underperformed over long periods. The real value of the US Index at the end of 1941 was a quarter below its 1928 level, 13 years previously, although here again the declaration of war on Japan at the end of 1941 could be cited as an excuse, as could the fact that the end 1928 level was close to the top of the 1920's stock market boom, and was followed by the depression of the 1930's.

3.18. A key lesson from the above is that advocates of an equity only strategy must allow for the risk of sustained underperformance, possibly extending over many years.

Diversification across geographies, industries, markets, and asset classes – possibly including private equity and other assets with equity-like risk-return characteristics - helps the situation but cannot eliminate the risk entirely.

## 4. Lifestyle investing and resulting retirement outcomes

4.1. Pension savers, especially those close to or already retired, cannot live by the laws of probability. Revisiting the earlier hypothetical example of a contributor having to choose between two €1,000 investments, one returning a guaranteed €1,030 at the end of twelve months, the other returning €1,300 with a 2 in 3 probability, but with a 1 in 3 chance that they will only get back €650 of their original €1,000 investment, an employee due to retire a year from now cannot blithely ignore the risk that their retirement fund and gratuity could be down 35% by then, despite the odds being in their favour. It is quite natural and reasonable for them to take steps to protect the current value of their pot. Similarly, an employee already retired will not want to put the security of their future income at the mercy of a fickle market.

4.2. The need to protect pension scheme members from the volatility of investment returns, particularly in the run-up to and in retirement, has led to the widespread adoption of so-called lifestyle investment strategies. The key assumption underlying such strategies is that younger employees, whose funds are smaller and who thus have less to lose, and who also have a longer time to recover from any losses incurred, are better able to accept the vicissitudes of fluctuating markets than older employees and pensioners. As an aside, it is an over-simplification to assume that young investors are more prepared than their older counterparts to accept volatility of investment returns. Everyone, young or old, rich or poor, experienced or novice investor, is loss averse. The extent of an individual's loss aversion is due more to their psychological make-up than to their age, wealth, or understanding of the world of stock exchanges and investments. For the time being, however, we accept the premise underlying lifestyle investment strategies, that older members of pension schemes – those approaching retirement and those already retired – have more to lose and so need more protection from stock market volatility than their younger counterparts.

4.3. Lifestyle investing during the accumulation stage means moving from riskier to safer investments as retirement date approaches. A not-untypical default investment strategy, which is the one assumed in the example below, is to invest 80% of a contributor's fund in equity-type assets and 20% in bonds until 10 years from retirement, then move both existing investments and new contributions gradually to bonds so that, by retirement, the ratios are reversed: 20% in equities and 80% in bonds.

4.4. Post-retirement, there is wide variation in disposition of investments. The DC market is still immature and there are relatively few retirees. A high proportion of DC pension pots, particularly for employees of more modest means, are taken entirely in cash. The better-off generally have other resources and so can afford to invest a higher proportion of their retirement savings in equities. In the future world of auto-enrolment, their pension account will represent a high proportion of total net worth for people of limited means. The general advice for such people will be either to buy an annuity (implying 100% in bonds) or, if they opt for a drawdown product, to invest a high proportion in bonds and cash. In projecting possible retirement benefits for a new joiner below, a bond ratio of 80% and an equity ratio of 20% is assumed from retirement date onwards. In practice, retired DC members will probably be advised to increase the bond portion towards 100% at more advanced ages. That possibility is ignored in the example.

4.5. Other assumptions employed in estimating the pension under a lifestyle investment strategy for an employee who starts contributing at age 24 are as follows:

- Contribution 14% of earnings (6% from employee, 6% from employer, 2% from the state, as per the previous government's 'strawman' auto-enrolment proposals).
- Earnings remain unchanged throughout the employee's working life. This is broadly equivalent to assuming constant earnings in real terms, with similar 'real terms' adjustments to investment returns and pension.
- Retirement at age 68 (this is the proposed state retirement age for someone now aged 24).
- Employee withdraws a gratuity equal to 25% of fund at retirement, to a maximum of 1½ times earnings (for a joiner aged 24, the maximum of 1½ times earnings applies if the projected investment returns are achieved).
- The remaining balance in the account is drawn down gradually during the employee's retirement, to provide a level income to age 90, leaving a residual fund at that age equal to 10% of the account value at retirement date if the assumptions on investment return are realised. As noted earlier, the possibility of the beneficiary living beyond age 90 will be considered in Section 11. On death, the balance in the account is paid to the member's estate/ dependants.
- Average investment returns 1% a year on bonds, 5% a year on equities (implying a 4% equity risk premium). The proportions allocated to the two asset classes at various ages under the 'lifestyle' investment strategy are as set out above.
- Pre-retirement, expenses equate to a yield reduction of 0.5% a year (this is the proposed maximum charge under the previous government's strawman AE proposals).
- Post-retirement, expenses equate to a yield reduction of 1.5% a year. The higher assumed expense charge post-retirement reflects current market experience for drawdown products. Members need expert advice on their investment and drawdown options, not just at retirement but also at regular intervals thereafter. Such advice is costly and time-consuming.

*4.6.* On the above assumptions, the fund at retirement for a total contribution of 14% of earnings is 13.4 times earnings and the annual pension, after withdrawing a gratuity of 1½ times earnings, is 50.2% of earnings. This is paid until age 90, at which point the residual account value, equal to 10% of the fund at retirement, is 1.34 times earnings, enough for close to another three years' pension payments - if the pensioner lives that long. Graphically, the growth and decline of the member's account from date of joining to age 90 can be represented as follows:

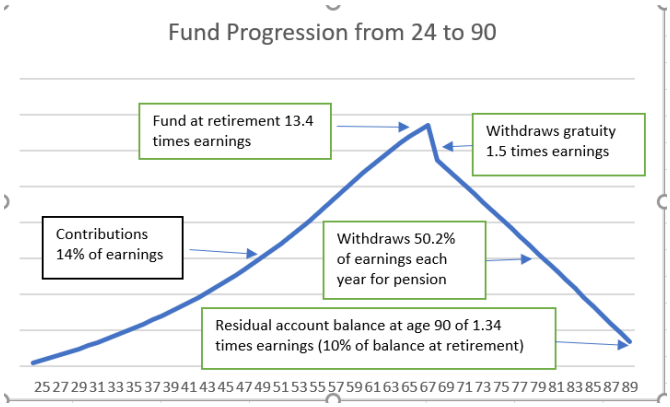


*Figure 8*

*4.7.* Another view of this graph, which provides some additional insight, is to compare fund values with contributions paid pre-retirement, and with fund value at retirement less amounts withdrawn from retirement onwards.

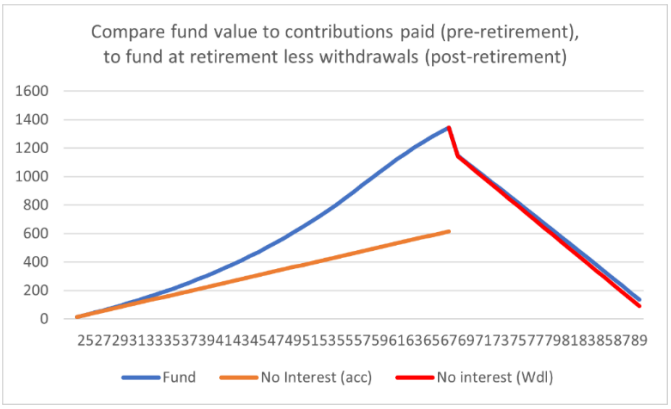


*Figure 9*

4.8. The difference between the blue and the brown lines on the left shows the impact of interest earnings pre-retirement, while the difference between the blue and the red lines on the right shows the impact of interest earnings post-retirement. The fact that the blue and red lines are so close together post retirement indicates that investment earnings add very little to post-retirement account values. That is clear from the following comparison of average investment returns pre- and post-retirement. In the period up to ten years before retirement the investment return (net of expenses) is 3.7% a year, calculated as follows:

| | |
|---|---|
| 5% return on 80% of fund invested in equities: | 4.0% (80% of 5%) |
| 1% return on 20% of fund invested in bonds: | 0.2% (20% of 1%) |
| Less: 0.5% a year in charges: | -0.5% |
| **Net return until 10 years pre-retirement:** | **3.7%** |

4.9. The net return after retirement is just 0.3% a year, derived as follows:

| | |
|---|---|
| 5% return on 20% of fund invested in equities: | 1.0% (20% of 5%) |
| 1% return on 80% of fund invested in bonds: | 0.8% (80% of 1%) |
| Less: 1.5% a year in charges: | -1.5% |
| **Net return post-retirement:** | **0.3%** |

## 5. Market values must serve investors, not be their masters

5.1. The main reason why DC scheme members are advised to sacrifice return by investing less in high-yielding equities and more in low-yielding bonds as they get older is to reduce the short-term risk of loss. The key proposal in this paper is that the trustees of the national AE scheme should use smoothed rather than market values for members' transactions with the scheme. This change in valuation approach eliminates short-term volatility of returns and allows members' funds to be invested in high-yielding equities for their entire membership of the scheme, both before and after retirement. It results in significantly higher benefits and has other implications, which are explored below.

5.2. It is fashionable nowadays to treat market values as sacrosanct. That was not always the case. In my early years in the actuarial profession –a long time ago! – it was not uncommon for pension scheme assets to be valued on a discounted cash flow basis. I am not advocating a return to those days: for one, actuaries had far too much discretion in how values were derived. I am proposing instead that the scheme's trustees adopt a formula-based approach to valuation, which allows them no discretion in how values are derived, and which also gives due recognition to market values. The proposed valuation approach is set out below, but first it is important to dispel the widely held view that market values should always reign supreme.

5.3. I am in good company in suggesting that market values should be our servants, not our masters. Warren Buffett imagines "Mr Market" as his partner in a private business. Every day, he offers either to buy out Warren's interest or sell him his interest in the business. At times, Mr Market is euphoric and will offer to buy Warren's interest at a very high price. At other times, he sees nothing but trouble ahead and offers to sell his interest at a very low price. He also has the endearing quality that he never takes offence if his offer is ignored.

5.4. Buffett's contempt for market values helps explain his earlier "Rule number one and Rule number 2" quote about not losing money. He does not interpret a transient fall in market values as losing money. Quite the opposite. He sees a fall in the market value of a good quality company as an opportunity to add to his holding. He has said many times that his ideal holding period for a good quality business is forever. My own experience with Renishaw, as recounted earlier, has imbued me with a similar jaundiced view of market values.

5.5. The stock market is the receptacle for the fears and hopes of investors at both ends of the fear/greed spectrum. At the fear end, falling share prices reflect the forebodings of forced sellers and those frightened into selling by prognostications of impending disaster. At the greed end, soaring prices reflect the hopes - and avarice - of investors who feel compelled to buy when markets are artificially inflated, either through genuine belief in bonanza profits to come, through peer pressure, or simply FOMO – Fear of Missing Out.

5.6. Market fluctuations should be of no concern to the long-term investor. Employees saving for retirement and those already retired and drawing a regular income from their account fall firmly into this category. Transient market values should largely be irrelevant to them.

5.7. Market values cannot be dismissed entirely, however. Despite their drawbacks, they are the best, oftentimes the only, available objective measure of value. We depart from them at our peril. If the trustees value the scheme's assets at more than the market says they are worth, there is a risk that members will contribute less and withdraw more. Conversely, if

they value them at less than market value, employees and employers might be tempted to take advantage of the 'special offer' by making higher contributions or deferring taking money from the fund. Since the AE scheme is a mutual endeavour, other members must pick up the tab for gains made by members playing the system. For these reasons, trustees and managers of funds which investors can join and leave at will must always price assets at market values, regardless of how insane market values have become - in either direction.

5.8. But Automatic Enrolment (AE) is not a normal fund. Under AE, employees and employers commit to contributing a specified percentage of earnings over many years – someone joining in their twenties could be contributing for 40 years or more and then drawing from their account for another 25 years or longer. Other than in special circumstances[3], savings remain in the fund until the member's retirement or death. Then, when it comes to drawing savings from the fund, withdrawals (other than the retirement gratuity) will also be spread over many years – possibly over two or three decades from retirement to death.

5.9. Thus, if the trustees sometimes value the scheme's assets at more than market value, sometimes at less, there will be swings and roundabouts. If they are valued below market value on a particular date, employees contributing to the fund at that date will do well while retiring employees taking a gratuity or employees already retired making regular pension withdrawals will do badly; conversely, if assets are valued at more than market value on a particular date, employees contributing to the fund at that date will do badly while members making withdrawals will do well. Over the many years of an employee's membership, first as a contributor, then as a retiree, periods of under-valuation and overvaluation relative to market values should even out – provided that members are prevented from 'playing the system' for their personal benefit.

5.10. A small number of straightforward and reasonable rules will achieve the twin objectives of ensuring the scheme's financial stability and preventing some members from 'playing the system' to gain unfair advantage over others:

- The most important rule is one prohibiting unscheduled withdrawals. The purpose is to prevent large-scale exits if asset values quoted by the trustees are significantly above market values. Employees (or their representatives) will only be allowed to withdraw money on death or at/in retirement, except in special circumstances as per footnote 4 below. Employees will be free to stop contributing to the scheme and to join another one if they wish but, in those circumstances, there will be no transfer of accrued savings: those will remain in the AE scheme and will continue to earn investment returns like other accounts, and will be paid out eventually, on or after retirement or on death, in accordance with the rules of the scheme.
- Employee and employer contributions will be a fixed percentage of earnings. This removes the risk of employees and/or employers contributing more if the trustees' valuation is below market value and less if assets are valued at more than the market's assessment of their worth.
- Employees will be obliged to take the full gratuity on retirement. They will not be given the option of leaving some or all of it in the fund for drawing down at a later date. Without this rule, a retiring employee could opt to take the gratuity if the trustees' value of the fund at retirement exceeded its market value but leave it until later if the

[3] For example, if government includes a provision in the legislation establishing AE which allows members to make withdrawals from their pension account to help meet the cost of their first home.

trustees' value was less than market value. A rule on these lines will not be seen as a significant imposition, since the vast majority of employees will want to take the full gratuity at retirement in any event, particularly if it is tax-free when it would be taxed as income if left in the scheme for drawing down at a later date.

- The rules will stipulate minimum and maximum yearly withdrawals in retirement. For example, the minimum annual withdrawal could be set at (say) 3% of account value. A requirement to make withdrawals of at least a specified amount each year will also meet the tax authorities' objective of preventing pension accounts being used to defer income tax (since withdrawals in retirement are taxed as income at the pensioner's marginal rate). The maximum yearly withdrawal could be set at (say) 8% for members under age 80. The imposition of a maximum has the added benefit of reducing the risk of pension accounts being exhausted prematurely. (Other provisions to prevent pension accounts being exhausted prematurely will be discussed in Section 11.) Retired employees' freedom to move between the upper and lower withdrawal limits will also be curtailed.

5.11. Rules on these lines will still give employees considerable flexibility on how much to withdraw each year, while allowing the trustees to depart from market values when setting the terms on which members transact with the scheme, without upsetting its financial equilibrium.

## 6. A formula for calculating smoothed returns

6.1. Having set the rules of the AE scheme so that the values at which members transact with the scheme can differ from market values without upsetting the scheme's financial equilibrium, the next challenge is to devise a valuation approach that smooths the humps and hollows of short-term changes in market values, while recognising their importance in the longer term.

6.2. A generalised approach that satisfies this objective is for the trustees to calculate a smoothed fund value each month as the sum of (a) and (b), where:

a) Equals X% of current market value.
b) Equals (100-X) % of last month's smoothed value, plus cash flow in the month (assumed to take place at the start of month) increased by one month's 'interest' at the assumed long-term rate of return.

6.3. The lower the value assigned to X, the lower the risk that monthly returns quoted to members will fall below zero even in adverse market conditions, but by the same token, the higher the risk that smoothed values could depart significantly from market values. These are the key trade-offs. Their implications will be explored in Section 9.

6.4. The extremely long duration of the liabilities – the average length of time between a contribution being paid and withdrawn will exceed 30 years, at least for the first few decades of the scheme's existence – and the strict rules preventing members from 'playing the system' mean that close adherence to market values will not be a constraint. Thus, it is desirable to choose a low value for X, especially having regard to the psychological importance of loss aversion, particularly among less financially sophisticated contributors, as discussed in Section 3. The vast bulk of the scheme's membership will consist of contributors who are not financially sophisticated.

6.5. The analysis below is based on X = 1.5%, i.e., the smoothing formula gives a 1.5% weighting to current market value and a 98.5% weighting to last month's smoothed value increased by the assumed long-term rate of return. This value of X was chosen on pragmatic grounds; it seemed to offer a good balance between faithfulness to market values and reducing the frequency of negative smoothed returns. As will be seen in Section 9, X=1% may be a better choice when the scheme goes live.

6.6. The expected long-term return on the fund (in (b) of the above formula) will depend on the asset mix. Given the extremely long duration of the liabilities and the expected long-term outperformance of equities over bonds, it is appropriate to invest 100% in equity-type assets, while ensuring sufficient diversification in terms of exposure to different geographies, industries, investment themes, technologies, economic outlooks, etc. Furthermore, a high proportion of the assets can be in illiquid/ unquoted investments, for two reasons:

i. Positive cash flows are projected for the first three or four decades at least. The assurance of positive net cash flows, irrespective of market conditions, and the prohibitions on unscheduled withdrawals, mean that there will be no need to redeem assets at short notice to meet calls on the fund.
ii. The low weighting for current market value in the smoothing formula means that accurate up-to-date valuations of all the fund's assets are not as pressing as they

would be for a fund where values quoted to investors are marked to market on a daily or weekly basis.

In the circumstances, it should be possible to invest 30%, possibly more, in illiquid or unquoted assets.

6.7. In theory, illiquid and unquoted investments should deliver higher returns because investors are prepared to pay a premium for the easy marketability of large cap quoted securities, i.e., to accept a lower return for the easier marketability. There is considerable debate within the investment community however on whether higher returns from private equity, if they exist, percolate down to investors. Some experts claim that most if not all the higher returns are swallowed up in fees. Rather than venture into this debate, I decided to assume no additional return under this heading. All equities are assumed to earn the same ERP as that assumed in Section 4 above for the equity portion of a scheme run on 'lifestyle' lines.

6.8. Therefore, the assumed long-term return on the fund in (b) of the formula equals the prevailing risk-free return plus an estimate of the long-term equity risk premium. Earlier analysis indicated an ERP of the order of 4% a year, but it is proposed to err on the cautious side by assuming a lower ERP of 3% a year in the smoothing formula. Section 9 explores the implications of assuming a different ERP in the smoothing formula.

6.9. The operation of the smoothing formula is best explored through an example, as follows:

- Assume the AE scheme commenced at the start of 2020, with the first contributions being invested on 1st January 2020. Assume that net income (contributions by employees, employers, and the state, less pay-outs on death and retirement) increased from 10 on 1st January, to 20 on 1st February, 30 on 1st March, etc. This model of cash flow progression in the early months is not unreasonable, given the likely gradual roll-out of the scheme. Strong early growth in contribution income has advantages for smoothing, as will be seen later.
- There will be just one fund for all members, young and old, active and retired, cautious and adventurous. Everyone will be credited with the same 'interest rate' each month/quarter.
- Assume a risk-free return of 1% a year. Adding an assumed ERP of 3% results in a total assumed return in (b) of the formula of 4% a year (0.33% a month).
- For simplicity, charges for administering members' accounts and for managing the scheme's assets are ignored in the example. They will be considered in Section 10.
- Assume that changes in market values of the scheme's assets match changes in the FTSE All-Share Index in the first six months of 2020, with dividends reinvested (in sterling, ignoring currency movements). Thus, the fund's progress is as follows:

| **Month** | **Jan 20** | **Feb** | **Mar** | **Apr** | **May** | **Jun 20** |
|---|---|---|---|---|---|---|
| Net investment at start of month: | 10 | 20 | 30 | 40 | 50 | 60 |
| Investment Return (mark to market) | -3.3% | -8.9% | -15.1% | +4.9% | +3.4% | +1.5% |
| Market value at month end: | 9.67 | 27.04 | 48.44 | 92.79 | 147.68 | 210.87 |

6.10. The notional fund value on 30 June 2020 (210.87) was marginally ahead of the total amount invested (210), but the journey towards that satisfactory end result was fraught. Values fell in the first three months, especially in March, as concerns grew over the impact

of Covid-19. There followed a partial rebound in April, May and June. The market value of contributions invested on 1 January would have fallen more than 25% by the end of March, before recovering to be down 'just' 12.5% by end June. Monthly changes in market value ranged from a low of -15.1% in March to a high of +4.9% in April. The entire experience would have been quite unnerving for a neophyte investor. The vast majority of AE contributors will fall into this category.

6.11. Smoothed returns in accordance with the above smoothing formula over the same period are as follows:

| **Month** | **Jan 20** | **Feb 20** | **Mar 20** | **Apr 20** | **May 20** | **Jun 20** |
|---|---|---|---|---|---|---|
| Cash flow invested at start of month: | 10 | 20 | 30 | 40 | 50 | 60 |
| (a)Smoothed value at start of month | 10 | 30.03 | 60.08 | 100.10 | 150.32 | 210.78 |
| (b) Market value at end of month | 9.67 | 27.04 | 48.44 | 92.79 | 147.68 | 210.87 |
| (c)Smoothed value at end of month = 98.5% of (a) increased by 0.33% + 1.5% of (b): | 10.03 | 30.08 | 60.10 | 100.32 | 150.78 | 211.47 |
| Smoothed return = (c)/(a)-1: | 0.28% | 0.18% | 0.04% | 0.22% | 0.30% | 0.33% |
| Smoothed Value/Market Value: | 103.6% | 111.3% | 124.1% | 108.1% | 102.1% | 100.3% |

6.12. In contrast with the violent fluctuations in market values over the period, smoothed returns are a model of stability, ranging from a maximum of +0.33% in June to a minimum of +0.04% in March. The price to be paid for smooth returns in volatile markets is wide fluctuations in the ratio of smoothed value to market value. Fortuitously, smoothed and market values end up being very close in this example (ratio of smoothed to market is 100.3% at end June) but at end March the smoothed fund value was 124.1% of market value.

6.13. The fact that liabilities will not crystallise for decades into the future means that the shortfall of market values to smoothed values at end March is not a concern. There is plenty of time for the shortfall to be recovered, even in the absence of cash flows or a market upturn. This question will be explored in more detail in Section 12.

6.14. The incidence of cash flows has no impact on returns calculated by reference to market values, but their incidence does have an impact on smoothed returns. Taking the above example, and assuming a single cash flow of 100 at the start, and nothing thereafter, the calculations are as follows:

| **Month** | **Jan 20** | **Feb 20** | **Mar 20** | **Apr 20** | **May 20** | **Jun 20** |
|---|---|---|---|---|---|---|
| Cash flow invested at start of month: | 100 | 0 | 0 | 0 | 0 | 0 |
| (a)Smoothed value at start of month | 100 | 100.28 | 100.43 | 100.37 | 100.37 | 100.42 |
| (b) Market value at end of month | 96.75 | 88.15 | 74.86 | 78.55 | 81.23 | 82.49 |
| (c)Smoothed value at end of month = 98.5% of (a) increased by 0.33% + 1.5% of (b): | 100.28 | 100.43 | 100.37 | 100.37 | 100.42 | 100.48 |
| Smoothed return (c)/(a)-1: | 0.28% | 0.15% | -0.05% | 0.00% | 0.04% | 0.06% |
| Smoothed Value/Market Value: | 103.6% | 113.9% | 134.1% | 127.8% | 123.6% | 121.8% |

6.15. The smoothed returns from February on are lower than those shown in the previous table. This is because, unlike in the previous example, there is no new cash being invested

at lower prices in a falling market, with the benefits of the more favourable purchases being shared among all investors. This also explains the higher ratio of smoothed to market value after the first month.

6.16. Increasing cash flows (which are more or less a certainty in the early years, as AE is being rolled out) damp short-term changes in smoothed returns - in both directions. They also help reduce the divergence of smoothed values from market values. In the above example, the sharp growth in net inflows from month 1 (10) to month 6 (60) helps keep smoothed returns positive throughout, despite a market fall of more than 25% between the start of the year and end March. If market values had increased sharply over the period instead, the opposite would have happened: the strong cash flows would have caused smoothed returns to be lower than they would otherwise be. This feature of the proposed smoothing approach is attractive. It means that, in the early months and years of AE, quoted smoothed returns will be relatively stable, irrespective of external market conditions. As a consequence, new contributors, most of whom will have had no prior experience of investing, will receive a relatively pain-free introduction to the world of stocks and shares.

6.17. The relationship between cash flows and smoothed returns also has a darker side, which will be explored in Section 12.

## 7. Smoothed returns assuming favourable markets

7.1. The next two sections simulate the consequences of applying the smoothed approach to fund valuations over a 30-year period, on contrasting assumptions for the external financial/ economic environment. This section assumes generally favourable markets for the period; the next section assumes generally unfavourable markets.

7.2. For both scenarios, it is necessary to input assumed cash flows for the entire 30-year period. The same cash flows are assumed for both scenarios. At first sight, this seems wrong. Surely, the argument goes, assumed cash flows under the second scenario (i.e., generally unfavourable markets) should be lower than in the first, because employees are more likely to opt out of auto-enrolment if investment performance is poor. The opposing argument is that all equity-based savings products will deliver poor returns in adverse market conditions and the proposed smoothing approach will deliver better – less bad may be a more appropriate choice of words – outcomes than unsmoothed, market-based products in those conditions, so it could be argued that cash flows will actually be higher in unfavourable markets. The question of a possible interplay between investment returns and net cash flows will be considered further in Section 12.

7.3. The cash flow model for both the favourable and the unfavourable scenarios assumes net inflows starting at 10 in month 1, increasing to 20 in month 2, 30 in month 3, etc. until they reach 1200 in month 120; they are projected to stay at that level for the next 10 years and then, in the final 10 years of the 30-year projection, they are projected to start falling by 10 per month, reaching zero by month 360. Graphically, projected cash flows are as follows:

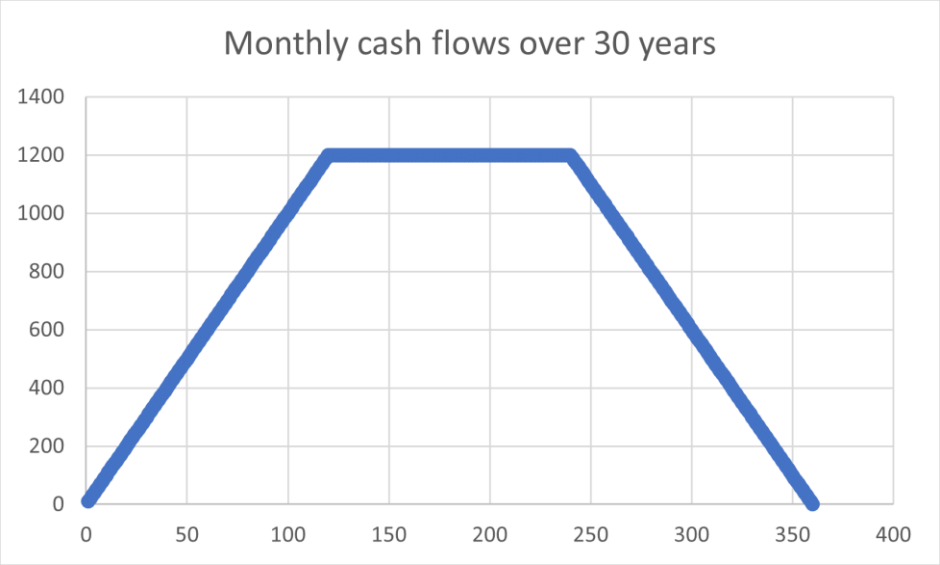


*Figure 10*

7.4. This model of projected cash flows assumes the gradual roll-out of auto-enrolment, first to larger employers, then to smaller ones. No attempt has been made to predict the pace at which contributions might increase in the early years, nor when they will start to stabilise before falling back towards zero as the scheme reaches maturity, but the general trapezoid shape is reasonable. It is also worth noting that cash flows for investment purposes will remain positive for many years after external cash flows (contribution income less benefit outgo and costs) have turned negative, because of dividends on existing investments. Section 12 includes a more scientific estimate of future cash flows.

7.5. The favourable market assumption is that the 30 years from the start of auto-enrolment are a repeat of the 30 years 1990 to 2019 in the UK (FTSE All-Share Index with dividends reinvested, no allowance for exchange rate movements, which are irrelevant for these purposes). Yearly returns for each of the 30 years are shown in the graph below.

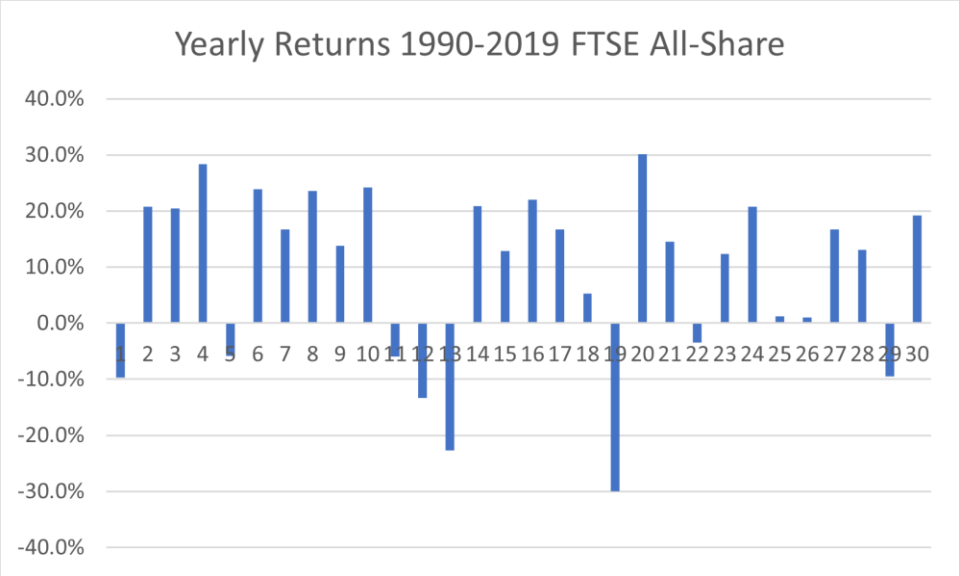


*Figure 11*

7.6. Yearly returns (January to December) range from a minimum of -29.9% in year 19 (a repeat of 2008) to a maximum of +30.1% in year 20 (a repeat of 2009). The longest sequence of negative returns is years 11 to 13 (a repeat of 2000 to 2002), when markets fall by 5.9%, 13.3% and 22.7% respectively, a cumulative fall of 36.9% - which extends to 42.6% by month 37. Falls of that severity over an extended period would have tried the nerves of even the bravest of investors, not to mind someone with no prior experience or knowledge of investing. They go a long way to explaining why previous government and industry efforts to coax workers to save for retirement through stock-exchange based products met with little success.

7.7. The graph of index movements over the 30 years is as follows:

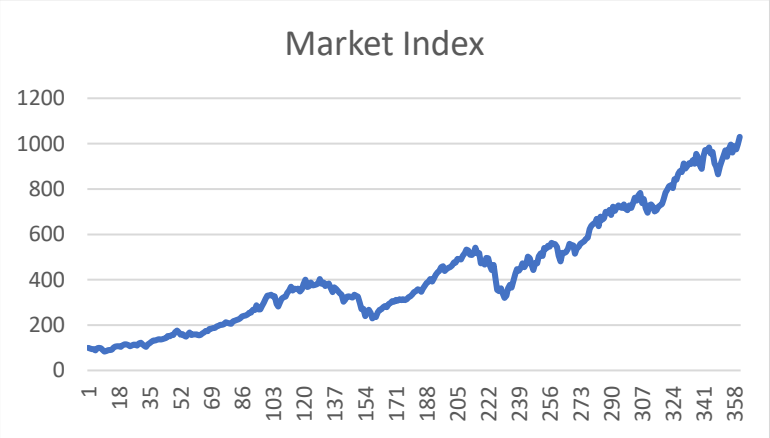


*Figure 12*

7.8. The average return over the entire 30-year period is 8.1%, so the committed long-term investor is well-rewarded – but at a heavy cost in the form of volatility of returns over shorter periods, where so-called shorter periods can extend over many years.

7.9. Allowing for cash flows as set out at the start of this section and applying the smoothing formula developed in Section 6 (formula assumes a bond yield 1% and an ERP of 3%, and gives a 1.5% weighting to current market value), the progression of market and smoothed returns is as follows:

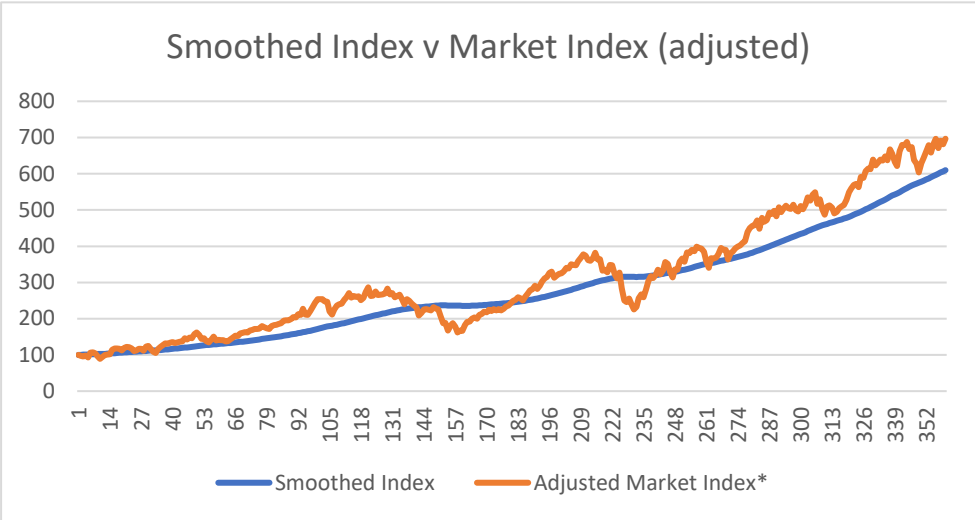


*Figure 13*

*The adjusted market index is defined as the smoothed index (derived by linking successive monthly smoothed returns) multiplied by each month's ratio of market value to smoothed value.

7.10. The shape of the adjusted market index differs from that shown earlier because it allows for the incidence of cash flows. The earlier index effectively assumed a single investment at the start.

7.11. Yearly smoothed returns (January to December) range from a low of +0.6% (year 14) to a high of +10.9% (year 9), in sharp contrast to a low of -29.9% and a high of +30.1% for market-based returns, as quoted above. Most importantly, given what we know about loss aversion, the smoothed return is positive in each of the 30 years of the simulation (while noting that all returns are before charges).

7.12. The contrast between smoothed and unsmoothed returns is seen even more starkly in the histograms of monthly returns.

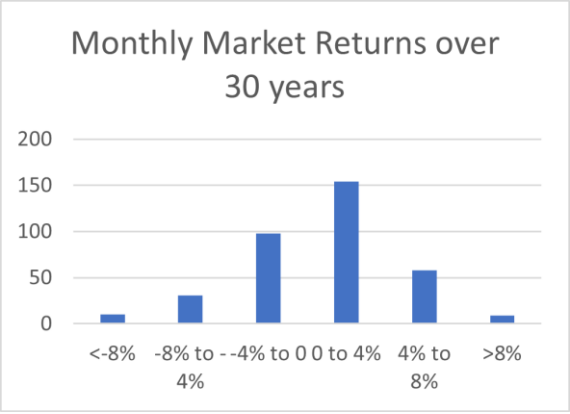


*Figure 14*

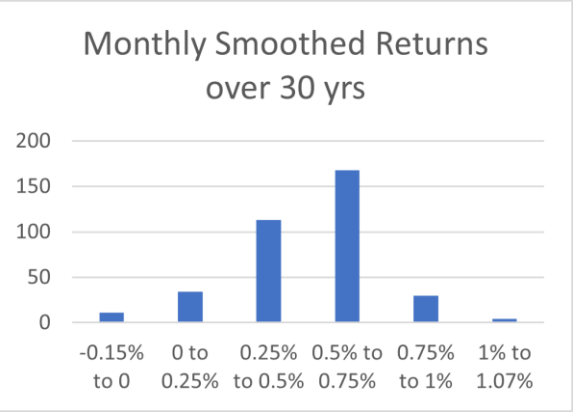


*Figure 15*

7.13. On ten occasions (out of 360) market values fall by more than 8% in a month, the worst being a fall of 13.2%. They fall more frequently than one month in every three (139 months out of 360). In contrast, monthly smoothed returns are negative on only 11 occasions, the worst being a fall of less than 0.2%.

7.14. The ratio of smoothed value to market value ranges from a low of 67.6% (month 99, a repeat of March 1998, when the dotcom boom was in full spate) to a high of 145.6% in month 157 (a repeat of January 2003, towards to end of the hangover from the dotcom bust).

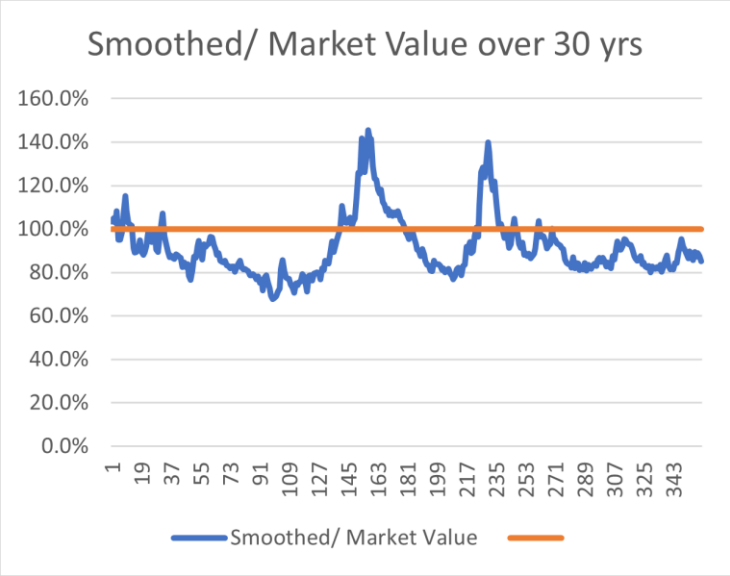


*Figure 16*

7.15. The stability of the smoothed approach is most at risk when the ratio of smoothed to market value is significantly above 100%. At such times new contributors are being asked to pay more than the market value of the underlying assets to buy into the fund, while members withdrawing are being paid more than the 'true' value of their interest (but noting earlier reservations on whether market values can be classified as 'true').

7.16. Such concerns are overblown. Take for example the situation in month 157 of the simulation, when smoothed value equates to 145.6% of market value. At that point in the simulation, it is reasonable to ask: *"Will members be prepared to keep contributing, knowing they are paying so much over the odds to buy into the fund?"*

7.17. Counterintuitively, the answer is almost certainly *"Yes"*. A contributor at that date is looking at a smoothed return (before charges – to be discussed in Section 10) of 5.4% over the previous two years. At the same date, a different investor, one fully exposed to the vagaries of the market, is looking at a negative return of minus 39.2% (again before charges) over the same two-year period. The contributor to the smoothed fund is thanking their lucky stars that they did not opt for a market-based product and, while they may have some concerns that the smoothed return will be held back in future by the need to bring the 145.7% back to 100% at some future date, the strong likelihood is that they will be more than happy to stay the course, in the belief that the return to 100% will not prove too painful.

7.18. As it happens, in this scenario the 145.6% ratio of smoothed value to market value is back below 110% in less than a year and is below 100% in two years. The smoothed return

is 0.9% in the next 12 months and 3.7% in the following 12 months (again, before charges), so the experience of getting the ratio back to 100% has not proven particularly painful.

7.19. The graph in Figure 16 shows a second peak in the ratio of smoothed value to market value at month 230 (a repeat of February 2009, which marked the nadir of the Global Financial Crisis, at least as it manifested itself in UK share prices). In this case, the smoothed return over the previous 12 months is +2.7% while the market return is a negative 33%, so once again the contributor whose return is smoothed is pleased with their decision. In this case, the ratio of smoothed value to market value is back below 100% in just 9 months (a repeat of November 2009).

7.20. Of course, there will be occasions, hypothetical or real, where the experience of getting the ratio back to 100% proves far more painful, but the extremely long duration of the liabilities – an average remaining duration well in excess of 25 years for the majority of members for at least the first 20 or 30 years of the scheme's existence, supplemented by a prohibition on members leaving and withdrawing their accumulated funds - means that the trustees can always adhere to the smoothing formula set out above. A hypothetical scenario where the experience of getting the ratio back below 100% proves more painful will be explored in the adverse scenario, modelled in Section 8, and will be discussed again in Section 12.

7.21. Paradoxically, the smoothed approach could face challenges of a different nature when the ratio of smoothed to market value is exceptionally low. In month 99 of the above simulation (a repeat of March 1998), the ratio of smoothed value to market value is 67.6%. This means that contributors are buying into the scheme at a discount of almost a third to the going market value of the scheme's assets; however, there is a possibility they will look instead at what they could have earned if they had been fully exposed to the market. Market values increased by 36.5% in the immediately preceding twelve months and by 18.7% in the twelve months before that, yet contributors to the smoothed fund would 'only' have been credited with returns of 10.7% in the most recent twelve months and 8.5% in the previous twelve months (all returns before charges).

7.22. Over time, scheme members will gain a good understanding of how the smoothing formula works, its advantages in bad times and its disadvantages in good times, so neither good nor bad times should be a cause for concern. Thanks to loss aversion, contributors will be much happier with a stable return that delivers much the same average return as the unsmoothed return over the long-term, but with far fewer low points as well as fewer high points.

## 8. Smoothed returns assuming unfavourable markets

8.1. A recent report by Deutsche Bank Research, titled "Long-Term Asset Return Study", states that the forty years from 1980 to 2020 *"saw the best combined asset growth of any era in history, with equity and bond returns very strong across the board*." In the circumstances, the results in the previous section, which showed positive smoothed calendar year returns every single year in a simulated repeat of the UK stock market between 1990 to 2019, are not surprising[4].

8.2. The Deutsche Bank report concludes that the world is now on the cusp of a very different era, what it terms the *"Age of Disorder"*. Quoting directly from the report, the *"Age of Disorder"* will be marked by at least eight themes:

1) Deteriorating US/China relations and the reversal of unfettered globalisation (the report was written before the US Presidential Election, while Donald Trump was still President).
2) A make-or-break decade for Europe, with muddle-through less likely following the economic shock of Covid-19.
3) Even higher debt and MMT/helicopter money becoming mainstream.
4) Inflation or deflation? As a minimum, it is unlikely it will calibrate as easily as we saw over the last few decades.
5) Inequality worsening before a backlash and reversal takes place.
6) The intergenerational divide also widening before Millennials and younger voters soon start having the numbers to win elections and, in turn, reverse decades of policy.
7) Linked to the above, the climate debate will build, with more voters sympathetic and thus creating disorder to the current world order.
8) We're in the midst of a technology revolution with astonishing equity valuations reflecting expectations for a serious disruption to the status quo. Revolution or Bubble? Also, if WFH becomes more permanent, it will cause major changes to societies and economies. Big cities were huge winners in the previous era, and this could now reverse.

8.3. The Japanese experience in the 30 years starting from 1990 is my attempt at modelling how a scenario such as that painted above might manifest itself. This scenario is represented graphically as follows:

[4] Although historic 12-month smoothed returns would have been negative between April and September 2003. (All figures before charges)

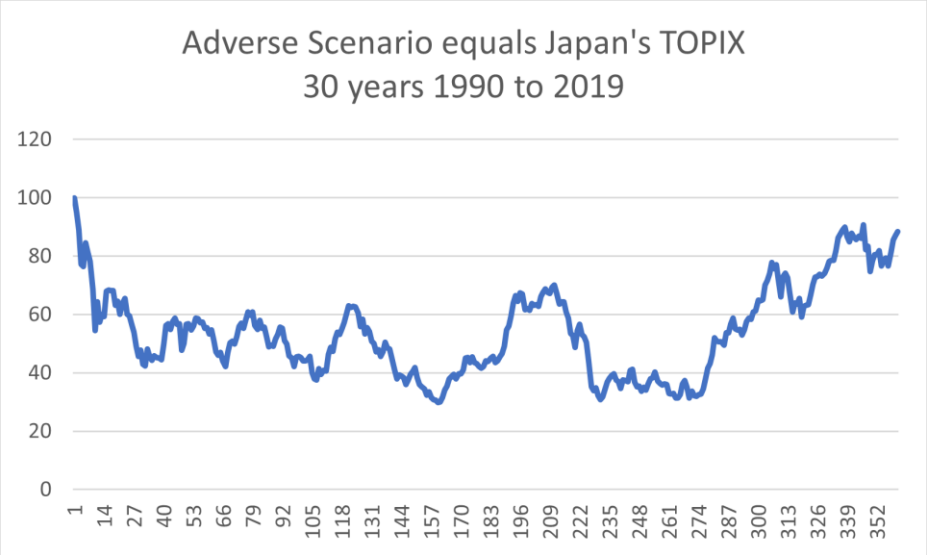


*Figure 17*

8.4. The first real-world event on which the *"Age of Disorder"* adverse scenario is modelled is the collapse of the Japanese stock market in the early 1990's. The TOPIX index fell 40% in 1990 and a further 25% over the following two years, so that, after three years, market values were just 45% of their starting levels. Japan's precipitous fall in the early 1990's can be explained in part by overvaluation at end 1989: the market had risen by over two-thirds in the previous two years. While there is undoubtably an asset bubble at present in certain stocks and sectors (I make no secret of my conviction that Tesla's current share price, at more than $700 as I write, is over seven times its true worth), any possible overvaluation at the level of the total market is nowhere near that of the Japanese stock and property markets at the end of 1989, so any fall is unlikely to be as severe as that experienced in Japan in the early 1990's. (My comments on the possibility of the overall market or individual stocks being overvalued, and the extent of any possible overvaluation, must be read in the light of the earlier observation that it is foolhardy to try to predict the market's future direction. The purpose of the exercise, however, is to postulate what an adverse scenario might look like. It is reasonable to hypothesise that a fall of 55% over three years qualifies as "adverse".)

8.5. Continuing with the Japanese analogy, the adverse scenario assumes that markets remain depressed until year nine. Japan's troubles in the 1990's and later were compounded by policymakers' failure to deal with zombie banks and corporates, many of which were kept on life support when it would have been far better to have let them die. It is unlikely that authorities in other countries will repeat that mistake, or at least not to the same extent, so this assumption could be seen as extremely cautious.

8.6. The third phase in the adverse scenario, still modelled on Japan's experience since 1990, is the dotcom boom at the end of the last millennium (year 10 of the projection) followed by the bust at the start of this millennium (years 11, 12 and 13). The Japanese market rose 60% in 1999, then fell back even more sharply, so that by end 2002 it was 20% below its level of four years earlier. It rose almost 40% over the next two years (years 14 and 15), yet by end 2004 it was only back to its end-1992 level, twelve years previously, still 56% down on its starting point in 1990.

8.7. The final fifteen years from 2005 to 2019 saw the market rise sharply in 2005 and 2006, then fall back to less than 80% of its 2004 level, or 35% of its starting level, by end 2008 before following a generally upward trajectory in later years, reaching 88% of its initial level by end 2019.

8.8. Whilst massive overvaluation of the Japanese stock and property markets at the end of 1989 and the authorities' subsequent failure to deal with the fall-out are the main contributors to that market's poor performance over the subsequent 30 years, it can also be explained in part by Japanese businesses' collective failure to compete effectively with the likes of Microsoft, Apple, Amazon, Google and Facebook. One of the key criteria in deciding an investment strategy for the AE scheme will be to minimise the risk of missing out on new areas of opportunity, in either quoted or unquoted sectors of the market and across geographies, so this should not be a serious risk.

8.9. Therefore, it can be argued that the Japanese stock market experience in the 30 years 1990 to 2019 is an overly cautious interpretation of what the *"Age of Disorder"* could imply in terms of overall returns for the AE scheme. Nevertheless, it will be taken as the model for the adverse scenario in order to test the robustness of the proposed smoothing approach.

8.10. The calculation of smoothed returns requires projected cash flows for each month of the 30-year period. I have assumed exactly the same net inflows (contributions less claims) as in the favourable scenario, i.e., growing for the first ten years, then levelling out for the next ten years, before moving gradually back towards zero net inflows/ outflows at the end of thirty years. As mentioned earlier, it can be argued that cash flows should be lower in the adverse scenario, but the counterargument is that, in an adverse scenario, smoothed returns will be significantly higher than unsmoothed returns for investments where returns are marked to market. Therefore, it is reasonable to assume the same shape of cash flows in the favourable and unfavourable scenarios. Of course, contribution income may be lower in absolute terms in the adverse scenario because economic activity may be lower, but the overall shape is what matters.

8.11. Assuming cash flows in years 1 to 30 the same as those assumed in Section 7, and applying the smoothing formula from Section 6 (assuming a bond yield of 1% throughout, assumed ERP 3%, 1.5% weighting to current market value), the progression of market and smoothed indices over the 30-year projection period is as follows:

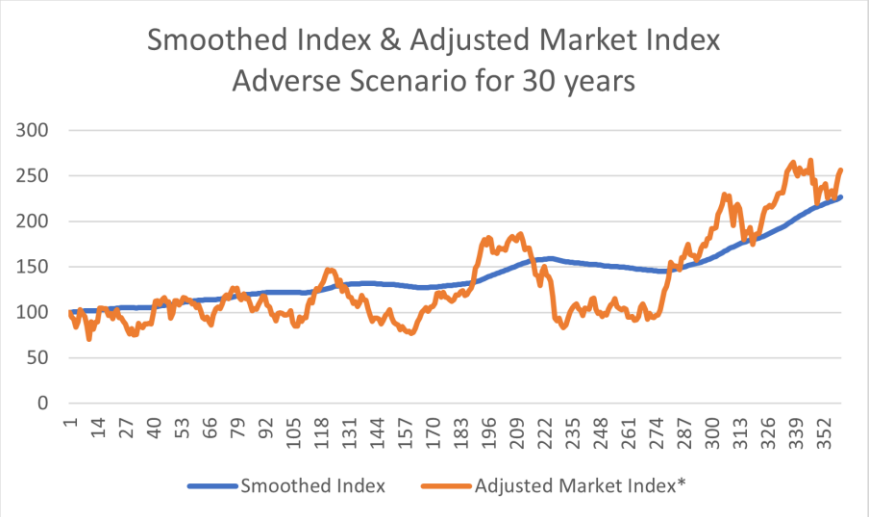


*Figure 18*

8.12. The adjusted market index as shown above has a completely different shape to the market index shown in Figure 17. The adjusted market index in Figure 18 follows a broadly flat trajectory for the first 23 years, before increasing in the last few years. The market index charted in the previous graph falls sharply at the start and remains depressed, never recovering to its starting level. The reason for the difference is that the one in Figure 18 allows for low cash flows in the early years, when market falls are greatest, and higher cash flows in later years, when markets have already fallen sharply. Higher positive cash flows in depressed market conditions boost overall returns (provided of course that markets eventually recover). The index shown in Figure 17 assumes a single investment in January 1990, worth just 82% of its starting value 30 years later.

8.13. The four worst years in terms of market returns for a fund invested in assets that follow the same trajectory as the Japanese market between 1990 and 2019 are repeats of 2008 (-41%), 1990 (-40%), 2000 (-25%) and 1992 (-24%). The four worst years for smoothed returns are repeats of 2009 (-2.7%), 2011 (-1.9%), 2010 (-1.8%) and 2012 (-1.8%). The contrast between the worst smoothed and the worst unsmoothed returns demonstrates the virtues of smoothing.

8.14. Nevertheless, the fact that the worst smoothed returns occur in four successive years 2009 to 2012 is a cause for concern, particularly as the market index rises by 21% in the last of these (2012) and rises again, by 54% in the following year, 2013 (when the smoothed return is +4.4%). Whilst contributors will undoubtedly be unhappy that the returns credited to their accounts in those years lag what they would have earned if they had been fully exposed to the market, this is part of the cost of eliminating sharp reductions in account values. The lesson from behavioural economics is that it is a price contributors will be happy to pay.

8.15. The story is similar to Section 7 for monthly movements in market returns and smoothed returns.

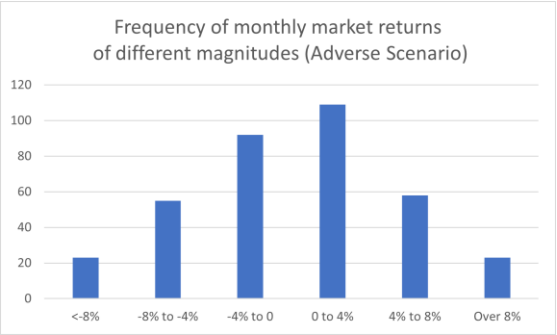


*Figure 19*

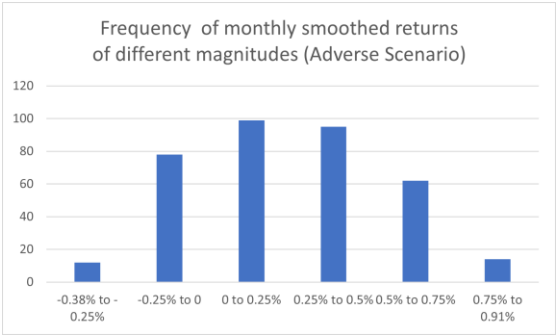


*Figure 20*

8.16. Monthly changes in market value range from a low of -20.4% to a high of +18.2%. Monthly smoothed returns range from a low of -0.4% to a high of +0.9%. On 12 occasions over the 30 years market values fall by more than 20% in a month. (All returns are before charges).

8.17. The next chart shows the ratio of smoothed value to market value over the 30-year projection period.

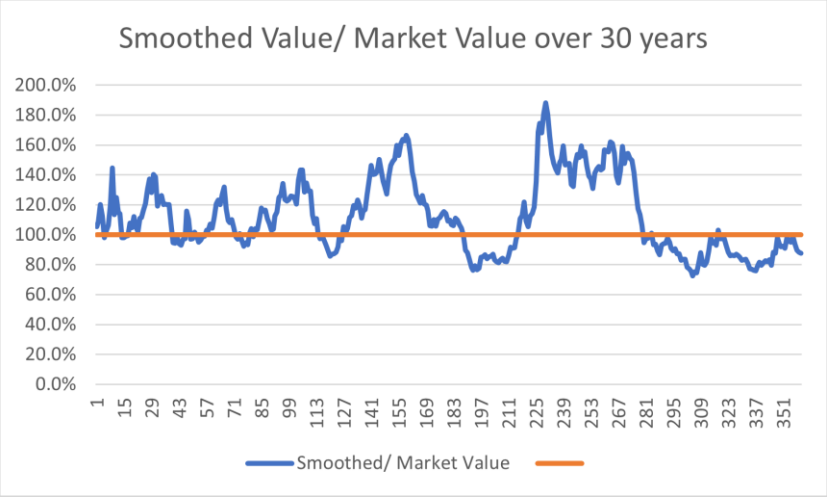


*Figure 21*

8.18. For the adverse scenario, smoothed values exceed market values for most of the projection period – in 215 out of 360 months. For the favourable scenario of Section 7, smoothed values exceed market values in only 61 out of 360 months. The greatest excess of smoothed over market value in the adverse scenario is at month 230 (a repeat of February 2009), when the ratio hits a peak of 188.1%; however, it is back below 100% by month 280 (April 2013). Since contributors are not allowed to cash their investments or move them out of the AE scheme other than on death or retirement, the possibility that smoothed values could exceed market values for prolonged periods is not a major concern. The question of whether, and if so when, a persistent excess of smoothed value over market value could or should become a concern for trustees and regulators charged with overseeing the scheme's solvency will be discussed in Section 12.

8.19. The contrast between long-term smoothed and unsmoothed returns in the adverse scenario is striking. Exactly half the time between year 10 and year 30 (120 months out of 240) the historic 10-year *unsmoothed* return is negative, yet the historic 10-year *smoothed* return never falls below +10%. The reason is that the sharpest falls in market values occur near the start of the 30-year projection period. The outcome would be different if the sharpest falls were to occur near the end of the projection period. A range of even more adverse hypothetical scenarios than that considered above, including scenarios where market values fall towards the end rather than close to the start of the projection period, will be discussed in Section 12.

## 9. Sensitivity of results to chosen parameters

9.1. This section explores the sensitivity of smoothing results to the chosen parameters for:

(i) Weighting given to current market value in the smoothing formula.

(ii) Equity Risk Premium assumed in the smoothing formula.

**(i) Weighting given to current market value**

9.2. As noted in Section 6, a trade-off is expected between delivering smooth investment returns to scheme members and adhering reasonably closely to market values: the more stable the returns quoted to contributors, the greater the likelihood that smoothed values will depart significantly from market values.

9.3. It is not that straightforward, however. The chart below shows the progress of smoothed and adjusted market indices for the favourable scenario on two bases: one giving a 1.5% weighting to current market value (as per Section 7 above), the other giving it a 1% weighting.

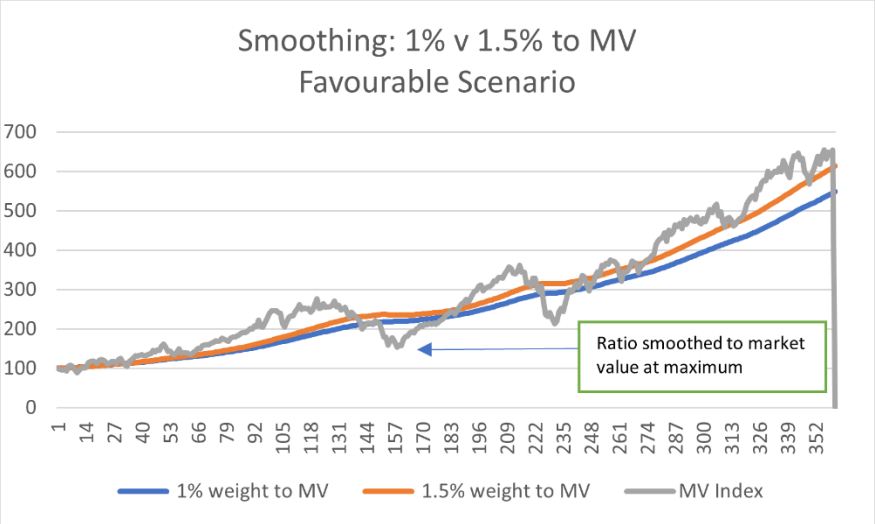


*Figure 22*

9.4. The ratio of smoothed to market value is highest in month 157 (a repeat of January 2003) for both, but the smoothed value when current market value gets a 1.5% weighting is higher at that point than the smoothed value when current market value gets a 1% weighting. This is not what we would have expected *a priori*. The reason for the surprising result is that, at that date, the smoothed value with a 1.5% weighting for current market value still retains a strong 'memory' of the returns achieved before the dotcom bust. The vividness of that memory outweighs the importance of the more recent market falls and so causes smoothed value with a 1.5% weighting for current market value to be higher than the smoothed value with a 1% weighting for current market value.

9.5. While there is little difference between the two parameters for weighting given to current market value in terms of long-term fidelity to market values, there is a significant difference between them in terms of smoothed returns. The graph below shows the differences in the distributions of smoothed returns, depending on whether market values get a 1.5% or 1% weighting in the smoothing calculation.

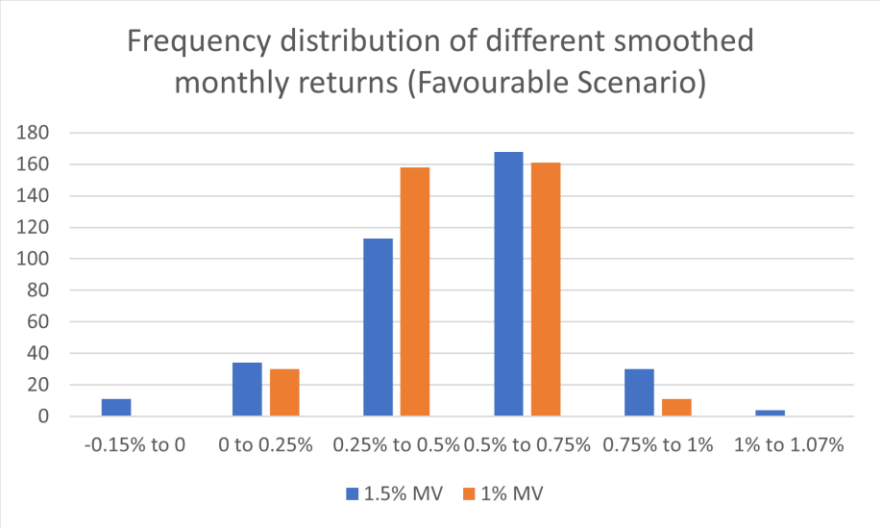


*Figure 23*

9.6. The chart shows that, when market values get a 1% weighting in the calculation of smoothed returns, there is not a single month in the entire 30-year period when the smoothed return is negative, compared with negative smoothed returns on 11 occasions when current market value gets a 1.5% weighting in the smoothing formula. The lowest smoothed return when current market value gets a 1% weighting is 0.03%, the second-lowest 0.05%, implying that there would be just one month in the entire 30-year period in the 'favourable' scenario when the smoothed return net of charges would be negative, assuming charges at 0.5% a year, equivalent to 0.04% a month. Charges are discussed in Section 10.

9.7. Given what was written earlier about the psychological importance of loss aversion, this indicates a preference for giving current market value a 1% rather than a 1.5% weighting in the smoothing formula – provided that the 'favourable' experience of the last 30 years is repeated in future.

9.8. Turning now to the unfavourable scenario of Section 8, the graph of adjusted market index (defined as earlier) and smoothed indices assuming a 1.5% or 1% weighting for current market value in the smoothing formula is as follows:

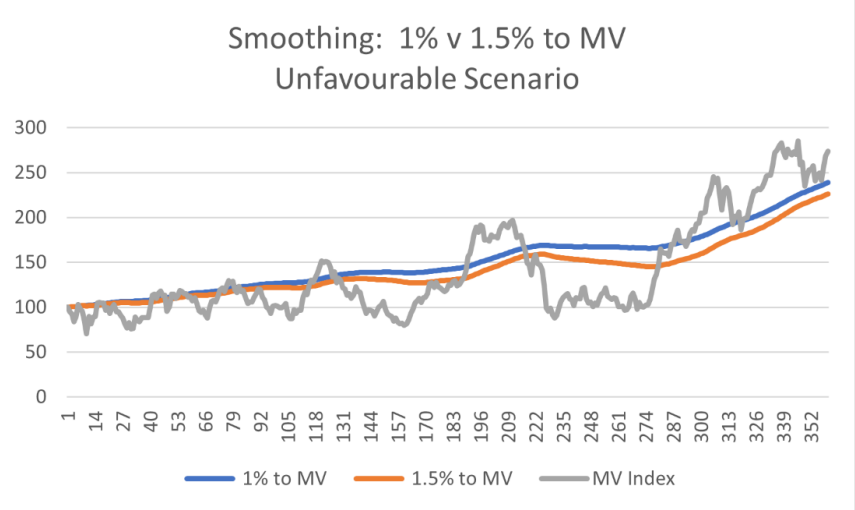


*Figure 24*

9.9. Smoothed fund values are higher than market values in 225 months out of 360 when the smoothing formula gives a 1% weighting to current market value and in 215 months out of 360 when the formula gives a 1.5% weighting to current market value.

9.10. As was the case for the favourable scenario, monthly smoothed returns have a tighter distribution when current market value is given a 1% rather than 1.5% weighting in the smoothing formula, as the following table shows:

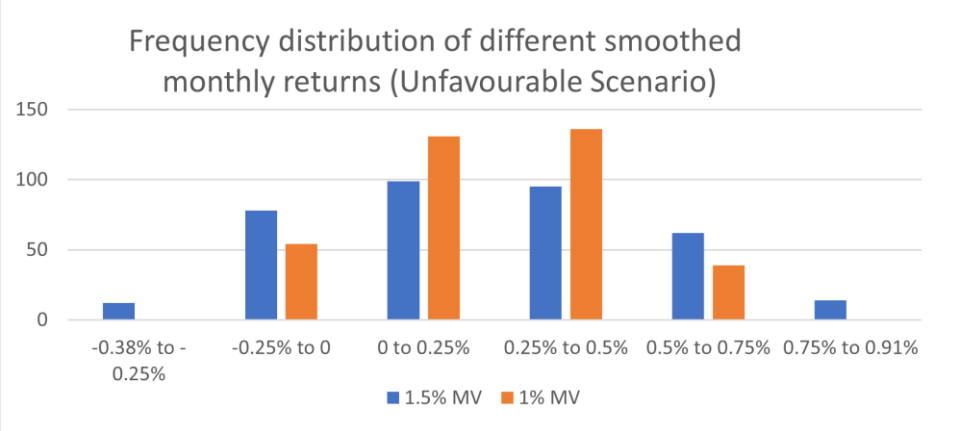


*Figure 25*

9.11. Smoothed monthly returns are less than -0.25% on twelve occasions (out of 360) when market value gets a 1.5% weighting in the smoothing formula. The lowest smoothed return is -0.15% when current market value gets a 1% weighting in the smoothing formula. It is worth emphasising again that these returns are before charges.

9.12. The tentative conclusion, for both favourable and unfavourable scenarios, is that there is a strong argument for giving current market value a weighting of 1% rather than 1.5% in the smoothing formula. It should be borne in mind however that both the favourable and unfavourable scenarios assume that the scheme's assets will be invested entirely in a single stock exchange (the UK for the favourable scenario, Japan for the unfavourable scenario). In reality, they will be spread across a large number of stock exchanges spanning the globe and a portion may also be in real estate and unquoted investments, such as private equity, infrastructure, etc. The wider range of assets should reduce the volatility of returns and make it more likely that monthly smoothed returns will remain positive throughout if current market value gets a weighting higher than 1% in the smoothing formula.

**(ii) Equity Risk Premium assumed in the smoothing formula**

9.13. The smoothing formula for both the favourable and unfavourable scenarios in Sections 7 and 8 above assumed an equity risk premium (ERP) of 3% a year, for a total assumed return of 4% a year. The graphs below show the impact on smoothed returns of assuming an ERP of 2% a year in the smoothing formula.

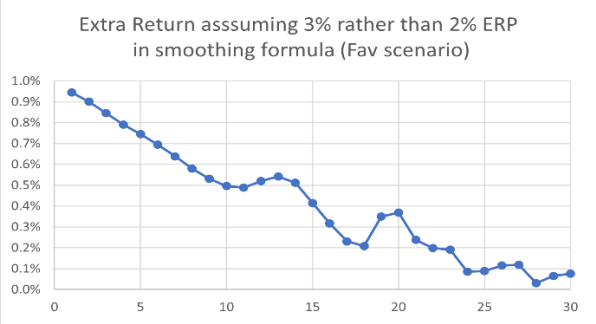


*Figure 26*

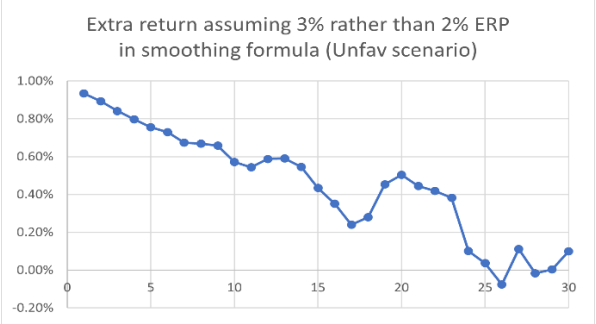


*Figure 27*

9.14. In both the favourable and unfavourable scenarios, the smoothed return in year 1 when the smoothing formula assumes a 3% ERP is almost 1% higher than when it assumes a 2% ERP. This is as expected, since the return assumed in the smoothing formula is all-important in month 1. Market returns take on greater importance in later months and years. Therefore, the difference between the two smoothed returns reduces over time until, by year 30, the difference is close to zero. By that stage, the smoothed returns are almost identical, irrespective of whether the smoothing formula assumes an ERP of 2% or 3%. In other words, the ERP assumed in the smoothing formula is irrelevant in the very long-term.

9.15. In the favourable scenario of Section 7, smoothed values assuming a 3% ERP exceed market values less than 20% of the time. In the unfavourable scenario of Section 8, they exceeds market values 60% of the time. The ideal is for smoothed values to exceed market values approximately 50% of the time and to be below market values for the other 50% of the time, but we don't know if the future will look more like the favourable or the unfavourable scenario. A personal belief, which chimes with many experts' views, is that, while the next 30 years are unlikely to be as favourable as the 'favourable' scenario of Section 7, they will probably be closer to it than to the 'unfavourable' scenario of Section 8. Therefore, if an ERP of 3% is assumed in the smoothing formula, the smoothed index is unlikely to exceed the adjusted market index more frequently than (say) double the 20% frequency derived for the last 30 years. That is still significantly less than 50%.

9.16. Finally, one important short-term consequence of assuming a 3% rather than a 2% ERP in the smoothing formula is that the smoothed return in the first year after the scheme's launch will be almost 1% higher. This could be important in persuading new contributors to join but can only be justified if the trustees and their advisers believe firmly that the higher figure is closer to the ERP that will actually be realised in the long-term, while still erring on the side of caution.

## 10. Projected benefits and charges under smoothed approach

10.1. This section estimates retirement benefits and charges under the smoothed approach, on assumptions consistent with those used to estimate retirement benefits under a 'lifestyle' investment strategy, as derived in Section 4.

**Investment return**

10.2. The key investment assumption in Section 4 was that, for a default fund employing a 'lifestyle' investment strategy, 80% of contributors' funds are invested in equity-type assets until 10 years before retirement, with the equity content reducing each subsequent year so that, by retirement, just 20% is in equities and the other 80% in bonds, reversing the asset mix of ten years previously. The equity/bond mix is assumed to stay at 20/80 throughout the member's retirement.

10.3. The UK's NEST (National Employment Savings Trust) achieves a 'lifestyle' risk reduction objective pre-retirement by having separate funds for each scheduled retirement date, so someone scheduled to retire in (say) 2032 will be invested in a fund with a slightly riskier asset mix than someone scheduled to retire in 2028. NEST operates 46 different retirement date funds, each with its own asset mix and performance profile.

10.4. The main reason for shifting to bonds in the run-in to retirement is to reduce the volatility of returns for contributors. It is worth noting, however, that moving part of the fund from equities to bonds or cash only reduces volatility; it does not eliminate it. Revisiting the equity experience of the first three months of 2020, quoted in Section 6, a fund invested 80% in bonds (assumed to generate a zero return – a generous assumption in current market conditions –with zero volatility) and 20% in equities would still have suffered a loss of 0.7% in January 2020, a further loss of 1.8% in February and a bigger loss again of 3.0% in March. These losses are only 20% of the losses that would have been incurred by a fund invested entirely in equities in those months, but they would have been painful nonetheless.

10.5. Sections 6 to 9 showed that it is possible to invest 100% in equities and yet quote returns to contributors considerably less volatile than the (marked to market) returns on a fund invested 80% in bonds, 20% in equities. This is achieved by smoothing returns in accordance with the formula in Section 6. Continuing with the same example of performance in the first three months of 2020, a smoothed fund that started in January 2020 and invested 100% in equities would have quoted positive returns to contributors of +0.28%, +0.18% and +0.04% in January, February and March respectively (all figures before charges).

10.6. Given these encouraging results, the conclusion is that a fund invested entirely in equities, with returns smoothed as per the formula of Section 6, is suitable for investors of all ages, active and retired, and all risk appetites. Therefore, it is assumed that, under the smoothed approach, 100% of members' funds will be invested in equity-type assets for the entire period of their membership, before and after retirement. As a consequence, there will be no need to have separate funds for different ages, different membership categories, or different risk classifications. Everyone will get the same return each month. This simplifies the investment message considerably.

10.7. Also, while funds run on conventional lines with investments marked-to-market must quote returns weekly, or even daily, the stability of quoted returns on a smoothed

fund means that it may be possible to publish them even less frequently than monthly, say quarterly, e.g. the smoothed return (before charges) for the first quarter of 2020 could be quoted at 0.5% (derived from monthly smoothed returns of 0.28%, 0.18% and 0.04%), despite monthly market returns in the period ranging from a high of -3.3% to a low of -15.1% (again, before charges).

10.8. The stability of smoothed returns also means that there is not the same need for a predictable, consistent time-lag between when contributions are deducted from members' and employers' accounts and when they are transferred to the investment managers as there is for a scheme where returns depend on prevailing market values when funds are invested. The requirement for a predictable, consistent time-lag between when contributions are deducted and when they are invested could pose problems when automatic enrolment is rolled out to a variety of employers, large and small, with varying payroll and banking arrangements. This problem disappears for a smoothed fund.

**Expenses and Charges**

10.9. This above discussion shows why it should be easier and cheaper to administer and manage the investments of a scheme run on the proposed lines than one run on more conventional lines.

10.10. The previous government proposed a maximum charge for administration and investment management of 0.5% a year for auto-enrolment pension schemes, which must cover providers' fixed overheads as well as allowing them to run a selection of unitised accounts for members, each of which has to be priced daily or weekly, with units being added to or deducted from accounts as members join, leave, or switch funds, either with the same provider or on moving to another provider, as well as generating a profit for the provider.

10.11. The more straightforward administration and investment management arrangements under the proposed scheme will result in substantial cost reductions. There will be just one central investment account, on which a smoothed return will be declared each month, or more likely each quarter. This return will be applied to members' accounts like an 'interest rate' on a bank, post office or credit union account.

10.12. Charges at 0.5% a year on members' account balances are projected to grow ten-fold between years 1 and 3 and to triple between years 3 and 6. In the early years, charges against members' accounts will be less than the costs of administration and investment management, but their high growth rate means that the trustees should have little difficulty borrowing on attractive terms to cover the shortfall, which they should have easily repaid by year 20. By that stage, the scheme's assets are projected to have grown to almost €35 billion (see Appendix 1). Assuming a passive investment strategy (discussed in Section 13), the costs of investment management at that time are unlikely to exceed 0.1%, while administration costs will probably be considerably less than 0.2% of assets under management, bringing total expected costs to 0.3% a year or less, implying a surplus under this heading of 0.2% a year or more. It is proposed to transfer the surplus to a buffer account, which will be used to strengthen the scheme's defences. The buffer account will be discussed in Section 12.

10.13. The calculations in Section 4 assumed that, while charges for investment management and administration under the 'lifestyle' approach will be held at 0.5% a year pre-retirement, they will increase to 1.5% post-retirement. This is in recognition of the

move from a group to an individual arrangement and the additional advisory costs to be incurred at and after retirement by holders of Approved Retirement Funds (ARF's). The post-retirement charges assumed in Section 4 reflect prevailing charges for such products, which market intelligence suggests are, on average, at least equal to, possibly higher than, the 1.5% per annum assumed in that section for medium-sized ARF's.

10.14. There will be no corresponding need for advice at or after retirement under the proposed smoothing approach. Members will be obliged to take a gratuity on retirement equal to the lower of 25% of account value and 1½ times earnings. They will not have the option of leaving some or all of it in their pension account to claim at a later date. Neither will they have any choice on the disposition of their investments: the asset mix post-retirement will be exactly the same as pre-retirement.

10.15. A key decision facing retired scheme members, both now and in the future, is how much to withdraw from their pension account each year in order to minimise the risk of outliving their savings. Financial advisers cannot add much to members' own deliberations under this heading, since no-one knows how long an individual retiree will live. Percentage probabilities and average life expectancies are of no use when it comes to individuals: at any future date, they will be either alive or dead.

10.16. The decision on how much to withdraw each year also depends on current and likely future income and outgo, e.g., if the pensioner decides to work part-time, if they have a partner or dependents, if they want to leave something for the next generation when they die, etc. The financial adviser cannot add much to the beneficiary's (and their family's) own thinking under these headings. Therefore, the estimate of retirement benefits under a smoothed approach assumes the same 0.5% annual charge post-retirement as pre-retirement.

**Estimated Pension under smoothed approach**

10.17. Under a smoothed approach, with 100% invested in equities throughout and charges of 0.5% a year before and after retirement, a combined contribution rate of 7% (3% employee, 3% employer, 1% state) produces higher benefits than those provided under the 'lifestyle' approach per Section 4 above, for a combined contribution of 14%. The comparison of the two approaches for a 24-year-old joiner retiring at age 68 is as follows:

| | **'Lifestyle' Approach** | **Smoothed Approach** |
|---|---|---|
| Total contribution (ratios 3:3:1 for employee, employer, and state) | 14% of earnings | 7% of earnings |
| Gratuity on retirement at age 68 | 1½ times earnings | 1½ times earnings |
| Yearly Pension from 68 to 90: | 50.2% of earnings | 53.8% of earnings |
| Residual Fund at age 90: | 1.34 times earnings | 0.94 times earnings |

10.18. The graphical representation of the growth and decline of the account balance under the smoothed approach is as follows:

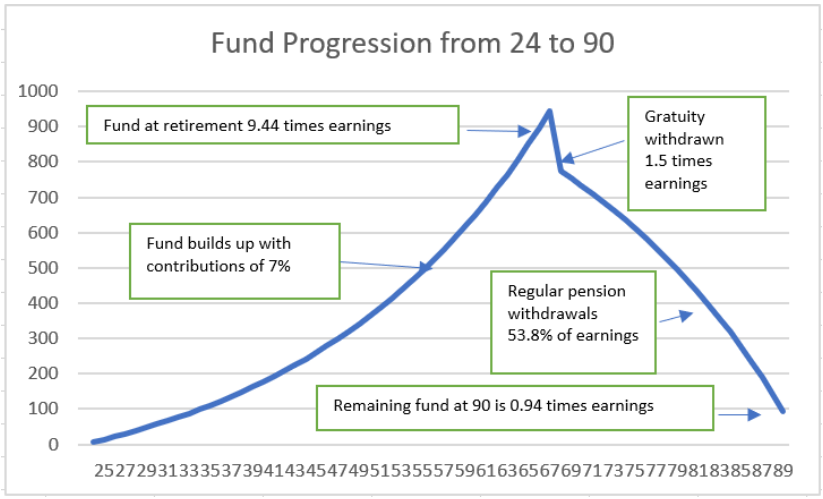


*Figure 28*

10.19. Another view of this graph, which provides additional insights, is to compare fund values with contributions paid up to retirement, and with fund value at retirement less amounts withdrawn from retirement onwards.

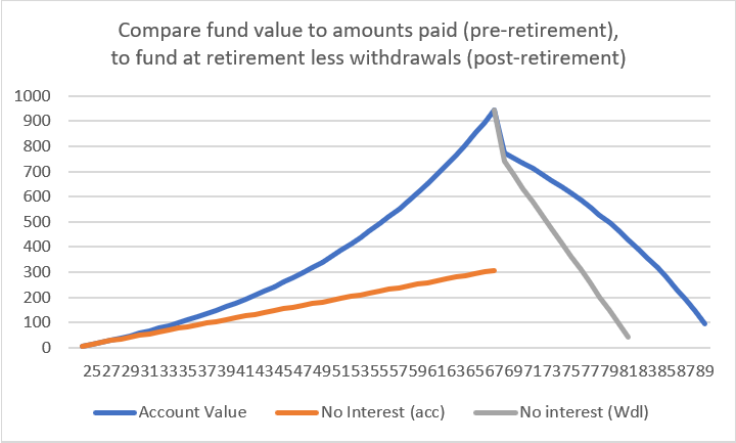


*Figure 29*

10.20. The difference between the blue line and the brown line on the left shows the impact of interest earnings during the accumulation phase, while the difference between the blue and the grey lines on the right shows the importance of interest earnings post-retirement. The large gap between the two sets of lines shows the importance of investment earnings, both pre- and post-retirement.

10.21. The assumed return on the fund for the entire period from date of joining to death is 4.5% a year, on average, made up as follows:

| | |
|---|---|
| 5% return on 100% of fund in equities: | 5.0% |
| Less: -0.5% a year in charges: | -0.5% |
| **Net average return for each year of the employee's membership:** | **4.5%** |

10.22. This compares with a net yearly return under a lifestyle approach (as calculated in Section 4 above) of 3.7% until 10 years pre-retirement, reducing to 1.3% by retirement date, then falling another 1% (due to higher charges post-retirement) to 0.3% post-retirement.

10.23. The effect of the difference in net returns between the lifestyle and smoothed approaches can be seen in the contrast between figures 9 and 29:

**Lifestyle approach**

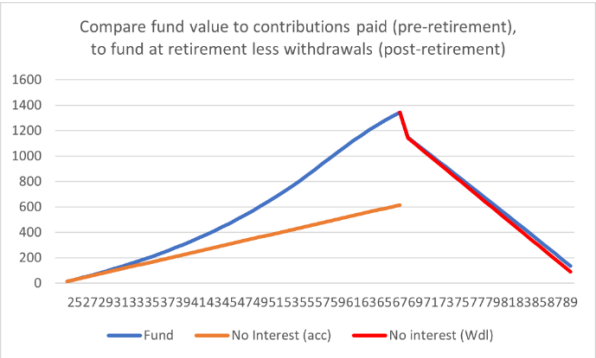


*Figure 9*

**Smoothed approach**

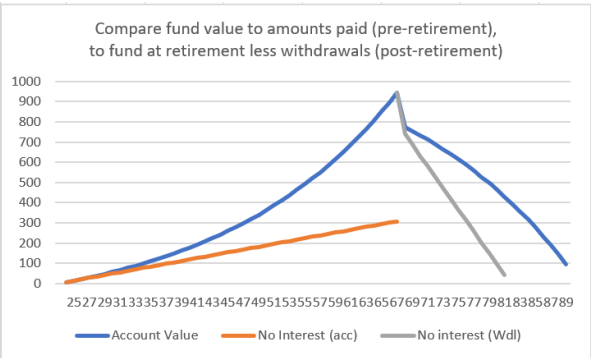


*Figure 29*

10.24. The difference between the two graphs is most pronounced in the years after retirement (right-hand side of each graph). Under the lifestyle approach, the gap between the two lines on the right is almost invisible; under the smoothed approach, there is a big - and growing – gap between them. This is because the net investment return post-retirement for the 'lifestyle' graph is just 0.3% a year on average, while it is 4.5% a year on average for the 'smoothed' graph. The difference in the shapes of the two graphs in the years immediately before retirement is also worth noting. Under the 'lifestyle' approach, the graph flattens in the run-up to retirement, because of the impact of de-risking while under the 'smoothing' approach, fund values continue to grow strongly, a consequence of not 'taking the foot off the gas' when the fund is at its maximum earning power.

## 11. Addressing the challenge of longevity

11.1. This section sets out an approach to addressing the risk of retired scheme members outliving their savings. However, in order to keep the primary focus on smoothed investment returns, what follows is a high-level summary. The details are in Appendix 2.

11.2. On reaching age 75, retired scheme members will be given the option of moving some or all of their pension savings to a "Lifetime Income Account" (LIA) account, which will earn a lower rate of return, estimated at 2.45% a year less than the return credited to 'normal' pension accounts. Amounts deducted will be transferred to a separate pooled account, the "Longevity Protection Fund" (LPF).

11.3. In return for accepting a lower rate of return, beneficiaries can withdraw the entire balance in the account over the fifteen years between ages 75 and 90, leaving a zero balance in the account by the time they reach age 90. If they survive beyond age 90, they will continue to receive an income, which now comes from the pooled LPF account, equal to what they would have received if they were still withdrawing one-fifteenth of the account balance each year.

11.4. For example, suppose that, on attaining age 75, a member opts to transfer €150,000 of their pension savings to the Lifetime Income Account (LIA). This is converted into 15 subaccounts, each with a starting value of €10,000. Suppose too that the smoothed rate of return on the 'main' pension account is 4.5%, which is the expected long-term smoothed return on the assumptions in Section 10. Therefore, the return each year on the LIA account is 2.05% (4.5% less 2.45%).

11.5. The member withdraws a subaccount each year. At the end of the first year, after withdrawing the first subaccount, there are 14 subaccounts left, each worth €10,205 (i.e., including one year's interest at 2.05%). At the end of the second year, there are 13 remaining subaccounts, each worth €10,414, etc. After 14 years, there is just one subaccount left, worth €13,286 after the addition of 14 years' 'interest' at 2.05% a year to the starting €10,000 in the subaccount. This last subaccount is claimed in the year between ages 89 and 90.

11.6. Then starting from the member's 90th birthday, the trustees will pay the beneficiary the equivalent of another subaccount, plus interest, each year for the rest of their life. Payments from age 90 onwards will come from the LPF.

11.7. On death before age 90, the balance in the subaccounts is paid to the member's estate. In the above example, if the member dies at the end of the second year, the 13 remaining subaccounts, worth 13*€10,414 = €135,382, will be paid to their estate or dependants.

## 12. Ensuring the scheme's durability and solvency

12.1. Sebastian Mallady, in his excellent biography of Alan Greenspan ("The Man who Knew") recounts an exchange between the former Chair of the Federal Reserve and a journalist, on the subject of bank capital ratios:

> *"Mr Greenspan, do you have a figure in mind for what the appropriate capital ratio should be at this time?",* the journalist inquired.
>
> *"Yes, I do, but that's irrelevant because it depends on the individual bank,"* Greenspan replied. *"It depends on the type of liabilities it has. For example, a bank which has nothing but certificates of deposit that mature in ten years can do with a lot less capital than one which has borrowed overnight money."*

12.2. Like Greenspan's hypothetical bank, the extremely long duration of the AE scheme's liabilities creates a robust bulwark against insolvency. To illustrate, consider a single contribution by a 35-year-old at the very start of the adverse 30-year scenario of Section 8. Excluding the possibility of death or ill-health retirement (which are considered below), the earliest date on which the liability created by this contribution falls due is 33 years later (assuming the state retirement age has increased to 68 by then). Even then, it only falls due in instalments: 25% at retirement; the other 75% over the member's remaining lifetime. Insolvency results if the market value of the assets is, or is projected to be, consistently below smoothed values when liabilities fall due.

12.3. In the adverse scenario of Section 8 (a repeat of the Japanese experience from the start of 1990), market values fall almost 55% in the first three years. Allowing for fund charges at 0.5% a year, the market value of a single contribution at the start falls to 44.7% of the amount invested by the end of the third year and never fully recovers, even after 30 years, as illustrated below:

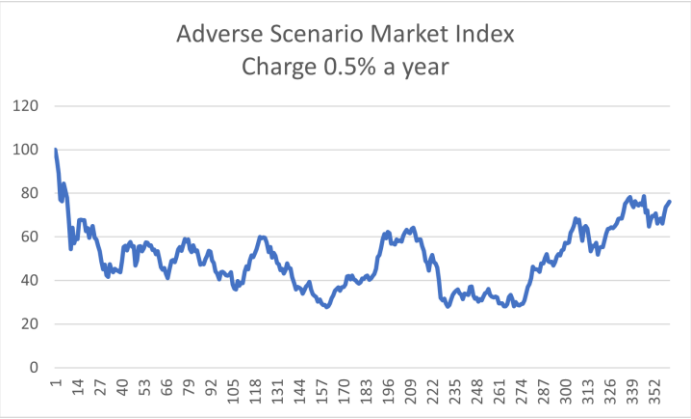


*Figure 17*

12.4. After 25 years, the original investment is still worth less than 60% of the amount contributed, having fallen earlier to below 30%. Despite these setbacks, the smoothed value, calculated in accordance with the formula of Section 6 and ignoring any contributions after month 1, briefly touches 100% of market value in year 17, before another precipitous fall (a simulated repeat of the Global Financial Crisis of 2007/08) causes the ratio to spike again. The smoothed value falls more securely below 100% of market value towards the end of year 25, eight years before the first instalment of the liability falls due, and stays within 20% of market value, in either direction, from then to the end of the projection

period. Solvency is secured with more than eight years to spare, even in this adverse scenario.

12.5. Allowing for claims (deaths and ill-health retirements), estimated conservatively at 0.5% a year, which are paid at smoothed values rather than market values, the ratio of smoothed to market value, having exceeded 100% for the entire period (with consequent losses for continuing members who have to foot the bill for the higher smoothed values paid to exiting colleagues), drops below 100% near the start of year 26 and stays within 20% of market value in either direction from then to the end of the projection period.

12.6. Admittedly, the journey from the start to the end of year 25 is far from a picnic: smoothed returns are negative in 21 of the 25 years (22 of 25 allowing for exits), the worst being a smoothed return of minus 5.1% in year 3. Nevertheless, the alternative is even more painful: market values fall 40% in year 1 and 24% in year 3. On the smoothed journey, the pain is more prolonged but less acute. The member also has the consolation of knowing that, if they die or are forced to retire prematurely through ill-health, they (or their estate) will receive the smoothed account value. Smoothing cannot undo the wreck caused by the collapse in market values, but it does make the pain more bearable.

12.7. Of course, it would be wrong to conclude from simulating just one adverse scenario that the smoothing approach works in all conceivable future market conditions and for all conceivable patterns of cash flows for investment or disinvestment in future. Before moving on to consider other possible scenarios however, it is important to recognise that the Japanese experience in the years and decades from the start of 1990 was more extreme than almost any negative real-world scenario that could be envisaged. For a start, the Japanese stock and property markets were ridiculously overvalued at the end of 1989:

- The Imperial Palace in Tokyo was supposedly worth as much as the entire state of California.[5]
- The total Japanese property stock was valued at more than four times that of the US.
- Nippon Telephone and Telegraph floated in 1987 at a Price Earnings Ratio of 250. Utilities generally trade on low double-digit P/E ratios at best.
- At end 1991, bank shares traded at an average P/E of c60, and that was after the market had already fallen sharply. To make matters worse, a portion of bank earnings consisted of unrealised gains on property holdings. We know what happened to them.

12.8. The biggest risk to the durability of the smoothing approach is not a sudden collapse in asset values, which, as we have seen, it deals with very effectively. The fact that contributors cannot head for the exit when prices fall is an added bonus. It happens too often in the real world, generally to investors' detriment: private investors have an unfortunate proclivity to buy high and sell low. What causes problems for the smoothing approach is a long period of stasis, where values slide along the bottom. That is what happened in Japan. After its collapse in the early 1990's, the Japanese market remained depressed for years, even decades. In mid-2012, the TOPIX Index, allowing for reinvestment of dividends, was just 31.5% of its starting level on 1 January 1990, over twenty-two years previously.

12.9. The Japanese downturn was prolonged by numerous policy mistakes. Policymakers in the West learned from those mistakes when the Global Financial Crisis struck in 2007-08,

[5] This, and other statistics quoted here, come from "The Bubble Economy" by Christopher Wood.

thereby avoiding a similar long-drawn-out stagnation. Whether stagnation was just deferred rather than avoided is another question. The adverse scenario of Section 8 effectively assumes that it was just deferred and that a repeat of Japan's mistakes of the 1990's will soon afflict world-wide stock markets.

12.10. Nevertheless, the trustees must be able to demonstrate the scheme's durability and solvency in all plausibly conceivable circumstances to the Central Bank of Ireland domestically and to EIOPA (European Insurance and Occupational Pensions Authority) at EU level.

12.11. Before considering the circumstances that could threaten the scheme's durability and ultimately its solvency, and what can be done to avoid insolvency in even the most difficult circumstances, it is important to consider again the central importance of the long duration of the scheme's liabilities, as demonstrated at the start of this section by the exchange between Alan Greenspan and a reporter. Insolvency is impossible when positive cash flows are projected for the foreseeable future, not just in the narrow sense of not running out of cash, which is obvious, but also in the broader sense that positive cash flows always bring the ratio of smoothed value to market value back to 100% at some stage. That was clear from the earlier exploration of the adverse scenario of section 8, both for a single contribution at the start and for ongoing cash flows. In the adverse scenario, market values fall 55% in the first three years and never fully recover, yet the smoothed value for a single contribution at the start is in line with market value before the liability matures. For monthly cash flows, smoothed values fall below market values at a dozen month-ends in the first four years alone.

12.12. This leads to consideration of the extent to which positive cash flows are assured in future. Simulations of this nature normally assume a strong correlation between market values and investor cash flows: a fall in market values causes scheme members to contribute less and withdraw more. The proposed scheme is different. Firstly, the rules will prohibit unscheduled withdrawals. Secondly, members will have a strong incentive to keep contributing even if markets turn sour: for every €100 they contribute, their pension account grows by €233 (€100 from the employer and €33 from the state, on top of their own €100). Contributors are unlikely to turn down an offer this generous. The fact that smoothed values can increase even if market values fall (see earlier example of a positive smoothed return in the first quarter of 2020, when market values fell 25%) is another relevant consideration. Members are unlikely to move to another provider if that provider's fund is delivering negative returns when they are getting a positive return under the national AE scheme.

12.13. Appendix 1 sets out long-term (60-year) projections of contribution income and claims outgo, together with underlying assumptions for employee numbers and participation rates, average remuneration levels, claim rates, etc. The projections show positive cash flows for the first 50 years. While projections extending this far into the future are highly speculative, Appendix 1 probably underestimates inflows and overestimates outflows. For example, no allowance is made for the possibility of existing DC and DB schemes terminating, or at least closing to new entrants, and their members joining the AE scheme instead. That is a distinct possibility. Neither does it allow for the possibility of self-employed workers joining the scheme at some future date. Projected claims may also be overstated. The assumption in Appendix 1, that claims by year 50 will equate to 1.35% of the total fund, is that (say) 20% of the fund at that time will be allocated

to retired members and that their average withdrawal will be 6.75% a year. Both estimates are probably overstatements (recognising however that gratuities to new retirees could account for a significant proportion of outgo to retired/ retiring employees at that time and will boost the ratio). Positive cash flows extending so far into the future increase the chances of the scheme remaining solvent for the entire period, irrespective of investment returns.

12.14. Nevertheless, cash flows must eventually turn negative. Negative cash flows are projected from year 51. Net negative cash flows in the final ten years, between years 51 and 60, are projected at €6.5 billion (compared to a projected fund value of €335 billion at the end of year 60 on deterministic growth assumptions).

12.15. Two thousand Monte Carlo simulations of possible future investment experience were completed for the 60 years, based on the (deterministic) cash flows in Appendix 1 and the Wilkie model of stochastic investment returns (see Appendix 4 for a high-level description of the Wilkie model). All 2,000 simulations showed the scheme staying solvent for the full 60 years, in the narrow sense that, even in the worst scenarios, fund values were positive throughout and the smoothing formula could be applied to calculate smoothed returns at all times.

12.16. Having seen no 'failures' at the crudely defined level of not running out of cash, we then searched for simulations where smoothed returns were negative for the final eight years or longer. Just two out of 2,000 simulations satisfied this criterion. The likelihood is that, if the projections were extended beyond year 60, both these simulations would eventually cause the scheme to run out of cash and become insolvent.

12.17. Before considering the actions required to forestall the adverse outcomes envisaged in these two simulations, it is worth considering the plausibility or otherwise of the underlying investment trajectories:

a) In one of the two simulations, the index of market values (with dividends reinvested) falls 55% in the last 11 years. The average return on cash flows over the entire 60-year period is negative, compared with an expected return of around 5% a year according to the model.
b) In the second simulation, the index of markets value falls 75% in the last 13 years, i.e., its final value is just 25% of its level 13 years previously. The average return on cash flows over the entire 60 years is equivalent to 1.9% a year.

In both simulations, the severe adverse outcomes can be explained in large part by the absence of mean reversion in the dividend component of the Wilkie model. Market collapses of such severity, and extending over such prolonged periods, are difficult if not impossible to reconcile to any plausible real-world economic scenarios.

12.18. Seeing that only two out of 2,000 random simulations of future experience show the scheme facing the possibility (not the certainty) of insolvency at some point after it has been in existence for 60 years, and that even those two simulations are a consequence of highly implausible financial trajectories, it is tempting to conclude that the scheme will remain solvent in all reasonably foreseeable future circumstances. That would be wrong. Negative cash flows will pose a new set of challenges for the smoothing approach and will require new solutions.

12.19. We saw in Section 6.16 that strong positive cash flows in the scheme's early years are a source of stability in the smoothing calculations. They have the doubly beneficial

impact of (i) damping short-term changes in smoothed returns - in both directions - and (ii) reducing the divergence of smoothed values from market values. These two effects were evident in the hypothetical example of a scheme starting on 1 January 2020. Market values fell by more than 25% in the first three months, yet strong cash flows meant that smoothed returns were positive throughout. Also, the ratio of smoothed to market value, having risen to more than 125% by the end of March 2020, was back to 100% by the end of June.

12.20. The opposite is true when cash flows turn negative. Strong negative cash flows relative to existing funds are a source of *instability*. They tend to push smoothed values away from market values, in both directions, i.e., causing the excess of market value over smoothed value to increase when smoothed values are less than market values, and the excess of smoothed value over market value to increase when smoothed values exceed market values. Persistent excesses of market values over smoothed values when cash flows are negative is a nice problem to have and can be resolved easily by awarding ex-gratia interest credits to scheme members, or reducing the 0.5% annual management charge, but if smoothed values are above market values for an extended period when cash flows are negative, the obligation to pay more than can be realised in the market to members leaving exacerbates the shortfall and could eventually draw the scheme into an insolvency vortex. Capital will be needed to address that risk.

12.21. The required capital will come from margins in management charges. As noted in Section 10, the annual costs of scheme administration and investment management are expected to equate to 0.3% of scheme assets (or less) by year 20. The other 0.2% a year (possibly more) of the 0.5% annual management charge will be transferred to a buffer account - "the Estate" in with-profits parlance. Assuming transfers of 0.2% a year to the Estate from year 20 onwards, and interest at 2% a year (the assets in the Estate will be invested more conservatively than the scheme's assets, so a lower rate of return is assumed), the Estate is projected to have grown to €8 billion by the time cash flows turn negative at the end of year 50 and to €15.6 billion by the end of year 60, assuming no prior calls on it. This equates to 4.7% of scheme assets at that date.

12.22. It is impossible to predict at this remove what the calls on the Estate might be fifty years from now, when cash flows are projected to turn negative. One possible use might be to pay any excess of smoothed values over market values for net exits from the Estate rather than from scheme assets, thereby eliminating the risk of the scheme being drawn into an insolvency vortex as described above, since any excess payments over market values to members leaving will not exacerbate the shortfall of market values from smoothed values for remaining scheme members. Approximate calculations indicate that the Estate will be easily able to meet any such costs. For example, even in the two 'near failure' simulations noted above, where smoothed returns are negative for the last eight years of the projections (at least) and smoothed values exceed market values for the entire period during which cash flows are negative, the Estate is projected to be more than sufficient to cover shortfalls of market values from smoothed values for net exits in those years. In one of the two simulations, the transfers to the main scheme up to year 60 represent 12% of the Estate; in the other they represent 37% of the Estate.

12.23. As an additional safeguard, the legislation establishing the scheme should empower the trustees to increase the annual management charge above 0.5% if projections ever indicate that additional capital may be required to deal with contingencies. This is a power which the trustees will only be allowed to exercise in the most extreme circumstances, and

only with the permission of the regulator. It is far more likely that, in the long-term, the trustees will be rebating a portion of the 0.5% annual management fee back to scheme members.

12.24. The conclusion from the above is that the proposed AE scheme will be able to satisfy the most demanding standards for solvency and durability. The scheme's financial strength will derive primarily from strictly enforced, yet eminently reasonable, rules on timings and levels of contributions and withdrawals, with the additional safeguard of a buffer account, an "Estate", which will only be required when cash flows turn negative (estimated to occur approximately 50 years after the scheme's commencement date). The Estate will be funded from management fees in excess of the costs of administration and investment management, starting from around year 20.

12.25. However, even though the scheme will be able to satisfy extremely onerous solvency requirements, it is unlikely that existing Solvency II regulations will be able to accommodate it. Changes will be needed to the text of the regulations, both at EU level and domestically. Given that the prize for overcoming this technical hurdle is vastly superior outcomes for contributors, it should not prove an insuperable obstacle. A further incentive at EU level is that the scheme as proposed could serve as a template for similar schemes in other EU member states in future.

## 13. Conclusion

13.1. The three key elements of the proposed new approach to automatic enrolment are:

(i) 100% investment in equities, before and after retirement.

(ii) Employees remain as members of the scheme after retirement.

(iii) The risks and rewards of equity investment are shared across generations by crediting investment returns to members by reference to smoothed values rather than market values.

The value for money of a scheme structured on these lines is more than twice that of one structured on more conventional lines, which adopts a 'lifestyle' approach to asset allocation. A combined contribution of 7% of earnings (3% employee, 3% employer, 1% state) under the proposed approach delivers a higher pension than that earned by a combined contribution of 14% under a scheme that adopts a 'lifestyle' approach to asset allocation.

13.2. The above result assumes an Equity Risk Premium (ERP) of 4% a year. Even at a lower ERP, the proposed approach delivers much superior returns. If the average realised ERP is 3% a year instead of 4%, the required contribution rate for the same pension as that produced by a 14% contribution under a 'lifestyle' approach to asset allocation increases by just 1%, from 7% to 8%.

13.3. Keeping employees in the scheme after retirement and allowing them to draw a retirement income from their pension account means that they continue to enjoy the benefits of lower charges for administration and asset management that the trustees have negotiated for scheme members. Under the current pension regime, they must leave the scheme on retirement, which forces them to pay more for these services. Furthermore, having separate 'products' for pre- and post-retirement creates an artificial cliff edge at retirement. A new retiree has to cash out of the pre-retirement product and replace it with a new post-retirement one. They must also pay – directly or indirectly (through commission) – for bespoke advice on which post-retirement product to choose and where to invest during their retirement years. The paper estimates that this change alone will result in a saving equivalent to an extra investment of return of 1% a year. Given that a new retiree can expect to live for another 20 to 30 years on average, and that the accumulated account value reaches a maximum at retirement, the savings under this heading are significant.

13.4. The proposal that members' financial transactions with the scheme take place at smoothed values rather than market values is probably seen as radical yet it is eminently logical and reasonable. Why should market prices, which are determined by reference to transactions between marginal buyers and marginal sellers, loom so large for members of a scheme which can look forward to positive cash flows for the next 50 years, probably longer? As stated in the heading to Section 5, market values should serve investors, not be their masters. This single change transforms our attitude to equity investment. Gone are the occasionally violent, gut-wrenching falls in market values, to be replaced by gentle upwards or sideways movements, as evidenced by the contrast between Figures 14 and 30 (for the 'favourable' scenario of Section 7, which gives market values a 1% weighting in the smoothing calculation):

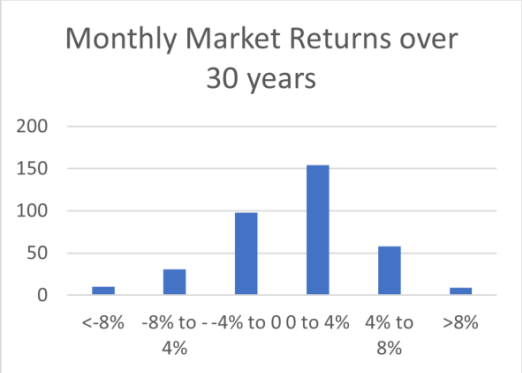


Figure 14

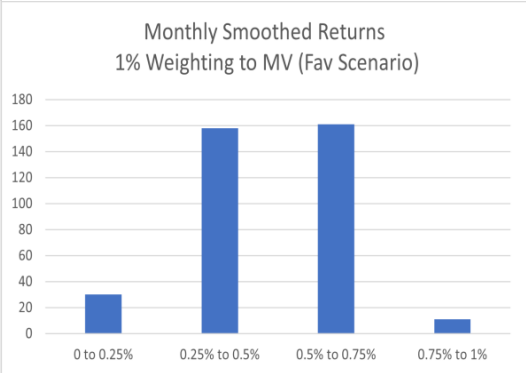


Figure 30

13.5. Over a 30-year period, the range between lowest and highest monthly returns reduces from 24.5% (-13.2% to +11.3%) when returns are determined by changes in market values to just 0.84% (+0.03% to +0.87%) when they are calculated by changes in smoothed values. Most importantly, smoothed returns are positive in each of the 360 months. Even in the 'adverse' scenario of Section 8, where market values fall 55% in the scheme's first three years, the lowest monthly smoothed return over a 30-year period is -0.15%. The stability of smoothed returns means that scheme members can enjoy the higher expected returns from 100% investment in equities for their entire lifetime, including all through their retirement.

13.6. The integrity of the smoothed approach is ensured by rules minimising the opportunities for some members to exploit differences between smoothed values and market values for their personal benefit, to the detriment of others. The most important rule is a prohibition on unscheduled withdrawals, including a prohibition on exiting members transferring their accrued account balances when moving to a new scheme. Employees will also be obliged to take their full gratuity entitlement on retirement rather than leave it in the scheme, to withdraw at a later stage. There will be upper and lower limits on amounts of regular withdrawals in retirement, suggested at 8% (for ages under 80) and 3% respectively. The rules are straightforward and reasonable, and still give employees considerable discretion on how much to withdraw by way of 'pension'.

13.7. Detailed consideration of investment strategy, including ethical aspects, is beyond the scope of this paper. The high-level objective will be to earn a long-term return of the prevailing risk-free rate plus the equity risk premium on all the scheme's assets, without exception, while paying due regard to the need for diversity and long-term risk mitigation in terms of exposures to various geographies, technologies, investment themes, economic outcomes. The simplest approach to meeting this objective, which has considerable merit, is to invest entirely in a passive world equity fund, the cost of which is unlikely to exceed 0.1% of assets under management. An investment strategy on these lines will also help the scheme cope with an uptick in inflation, which some experts consider a strong possibility in future.

13.8. Section 12 showed that the scheme will be able to meet stringent solvency standards. Two thousand Monte Carlo simulations of possible future experience were completed over a 60-year period, the last 10 of which have negative cash flows. All 2,000 showed the scheme remaining solvent for the entire period. In two of them, the scheme was likely to run out of cash sometime after year 60; however, the simulated investment returns giving rise to these two adverse outcomes were highly implausible:

(i) In one, the index of market values (with dividends reinvested) falls 55% in the last 11 years of the projection. The average return on cash flows for this simulation over the entire 60-year period is negative, compared with an expected return of around 5% a year according to the model.

(ii) In the other, market values fall 75% in the last 13 years of the simulation, to just 25% of their level at the start of the period.

13.9. Nevertheless, the scheme will face new challenges when cash flows turn negative, projected from sometime after year 50. It is proposed to establish a buffer account – an Estate in with-profits parlance – to address those challenges. The Estate will be funded from margins in the 0.5% annual management fee, which are estimated at 0.2% per annum from year 20 onwards. By year 50, the Estate is projected to have grown to over 3% of assets under management and to close to 5% by year 60. Approximate calculations indicate that the Estate should be comfortably able to meet the cost of smoothed payments in excess of market values for net exits from when cash flows turn negative. As an additional safeguard, the rules should authorise the trustees to increase the management fee beyond 0.5% in extreme circumstance, but only with the approval of the regulator. A far more likely long-term outcome is that the trustees will be rebating a portion of the 0.5% annual management fee back to scheme members.

13.10. The scheme's unique nature means that it is unlikely to be possible to accommodate it within the EU's Solvency II regime as currently documented. Changes will be required to the text of the regulations, while ensuring no dilution of the underlying principles. Given that the reward for overcoming this technical hurdle is vastly superior outcomes for contributors, which could be enjoyed in due course by members of automatic enrolment schemes in other EU member states, it should not prove an insuperable obstacle.

13.11. Finally, this paper has been in gestation, in one form or another, for more than three years. Numerous friends and colleagues have helped along the way, encouraging, advising, providing information. I would like to thank two people in particular, who have been of great assistance throughout the entire period, particularly over recent months. My son Bryan advised on investment aspects and supplied whatever information I needed on historic performance for various markets. Brian Woods, who collaborated with me on my first paper, over 43 years ago, was of great assistance this time also, particularly on the stochastic simulations. More important than his technical input, however, was his wise counsel on all aspects of the paper.

## Appendix 1
## Projected Contribution Income, Claims Outgo, Fund size Years 1 to 60

| Year | Total Contributions (Employee, Employer, State) | Claims (Deaths and Retirements) | Net Income (Contributions less Claims) | Fund at year end |
|---|---|---|---|---|
| | /millions | /millions | /millions | /millions |
| 1 | 308 | 0 | 308 | 312 |
| 2 | 604 | 1 | 603 | 941 |
| 3 | 802 | 3 | 799 | 1,799 |
| 4 | 936 | 6 | 930 | 2,834 |
| 5 | 1,031 | 11 | 1,020 | 4,010 |
| 6 | 1,099 | 17 | 1,082 | 5,308 |
| 7 | 1,152 | 25 | 1,127 | 6,715 |
| 8 | 1,195 | 34 | 1,161 | 8,225 |
| 9 | 1,231 | 45 | 1,186 | 9,834 |
| 10 | 1,263 | 57 | 1,206 | 11,543 |
| 11 | 1,293 | 71 | 1,222 | 13,351 |
| 12 | 1,322 | 87 | 1,235 | 15,261 |
| 13 | 1,350 | 105 | 1,245 | 17,274 |
| 14 | 1,378 | 124 | 1,254 | 19,395 |
| 15 | 1,406 | 146 | 1,260 | 21,626 |
| 20 | 1,551 | 284 | 1,267 | 34,569 |
| 25 | 1,710 | 480 | 1,229 | 50,896 |
| 30 | 1,884 | 745 | 1,139 | 71,242 |
| 35 | 2,077 | 1,090 | 987 | 96,366 |
| 40 | 2,289 | 1,530 | 760 | 127,166 |
| 45 | 2,523 | 2,079 | 444 | 164,709 |
| 50 | 2,781 | 2,759 | 22 | 210,258 |
| 55 | 3,065 | 3,592 | - 527 | 265,309 |
| 60 | 3,378 | 4,605 | - 1,227 | 331,631 |

**Key assumptions:**
400,000 eligible employees at the start, growing to 500,000 after 50 years. Participation rate 27% in year 1, increasing to over 90% by year 7. Average earnings €40,000 a year (excluding earnings in excess of upper limit), inflating at 1.5% a year. Total contributions 7% a year (3% employee, 3% employer, 1% state). Assumed fund growth rate 4.9% a year (net of charges). Assumed claims 0.14% of accumulated fund in year 1, increasing to 0.55% in year 10 and 1.35% by year 50.

## Appendix 2: Detailed Proposals for Longevity Protection

A2.1 Longevity is a challenge for both DB (Defined Benefit) and DC pension schemes, but the nature of the challenge differs. For DB, the cost of paying a pension for decades to the occasional centenarian is balanced by cost savings on pensioners who die prematurely. Actuaries can estimate average costs based on life expectancies. For DC pensions, averages are irrelevant. An individual pensioner could die within the year or could live for another forty years. On early death, there is a windfall for the member's dependents or estate, not for other members of the scheme. If the pensioner survives to extreme old age, they could be forced to live their final years in penury, having spent their nest-egg. There is no balancing between the two.

A2.2 A DC pensioner could buy an annuity to cover the risk of living too long, but the cost is generally seen as unacceptably high. For example, the annuity rate on offer from a leading life assurance company at present for a 70-year-old male is €42.50 a year for every €1,000 invested. If the pensioner lives to 100, the implied interest rate is just 1.7% a year. If they die after five years, almost 80% of their investment is lost. They need to live 23 years – well into their 90's – to get their money back. Deferred annuities, which pay out from an advanced age, are cheaper but they too are perceived as being too expensive for the protection they afford.

A2.3 The paper proposes a new approach to protecting DC pensioners from the risk of outliving their savings. From age 75, retired scheme members will be given the option of taking a lower 'interest rate' on all or a portion of their pension account, with the amount deducted being transferred to a central 'Longevity Protection Fund' (LPF) administered by the Trustees. The trade-off for the lower interest rate is that pensioners will be allowed to spend their entire pension pot over the next 15 years, secure in the knowledge that, if they survive longer than 15 years, i.e., past age 90, the trustees will use the interest deductions over the previous 15 years to pay them an income for the rest of their life, irrespective of how long they live.

A2.4 The key drivers for the cost of this benefit to the trustees are (i) the proportion of 75-year olds who die before age 90; and (ii) average life expectancy for those who live past 90. Any estimate of the likely cost must allow for the possibility that pensioners who opt for longevity protection will have better than average prospects of living to extreme old age. It must also recognise that it will probably be at least 20 years from now before the option is taken up for the first time (this estimate assumes that anyone now over 55 is unlikely to have a significant AE pension account by the time they reach age 75). Therefore, there will be at least another 20 years' medical advances and consequent improvements in life expectancy before the first pensioners opt for longevity protection, and a further 15 years of mortality improvements before the first 90-year olds start receiving an income from the LPF.

A2.5 The cost estimate assumes that 538 out of every 1,000 pensioners reaching age 75 will survive to age 90. This compares with 261 in every 1,000 75-year-old males and 387 in every 1,000 75-year-old females still alive at age 90 per Irish Life Table No 17. As an aside, the same charges are proposed for males and females, despite their different life expectancies. This could be seen as unfair to male pensioners, but self-selection at age 75 should mitigate the impact of gender on mortality rates. Also, social class is more significant than gender in determining future life expectancy. There would be obvious difficulties in differentiating by social class. It is further assumed that 227 of every 1,000 90-year olds will live to become centenarians. The corresponding proportions under Irish Life Table 17 are 61 out of every 1,000 (males), 70 out of every 1,000 (females). Thus, the cost estimate allows for considerable self-selection by 75-year olds and considerable improvements in life expectancy at extreme old ages.

A2.6 Estimates of this nature are prone to error, so the trustees must have the power to vary the interest deduction to meet the cost of longevity protection as experience unfolds. Any such powers will of course be strictly regulated and will also be subject to regular independent actuarial review and certification.

A2.7 More details on how the longevity protection will work in practice are as follows:

- On reaching age 75, pensioners may, if they wish, transfer some or all of their pension account to a separate account, a "Lifetime Income Account" (LIA). It is an option, not an obligation.
- The LIA will operate on the same smoothing principles as the main scheme account, except that the trustees will make an additional deduction from the member's LIA account, which will be transferred to a separate pooled account, the "Longevity Protection Fund" (LPF). The required deduction is estimated at 2.45% a year of the smoothed account value. This estimate is based on the mortality assumptions outlined above.
- Therefore, each year's quoted return on the LIA account will be 2.45% less than the quoted return on the main pension account. Assuming an average quoted return on the main pension account of 4.5% per annum (See Section 10), the average quoted return on the Lifetime Income Account will be 2.05% a year.
- The member's LIA account will be divided initially into 15 identical sub-accounts, one for each year from 75 and 90. The member will be allowed to cash one of the accounts, plus accrued interest, each year. There is no obligation to cash the entire account earmarked for a particular year. This possibility has been ignored in the calculations. Allowing for the possibility of members not claiming a portion of each year's subaccount will improve the Longevity Protection Fund's finances, since the additional 2.45% will still be charged on any unclaimed balances in the subaccounts and transferred to the LPF.
- Thus, it is assumed that, after 15 years (i.e., when the member reaches age 90), all 15 sub-accounts will have been claimed, leaving a zero balance in the LIA. From that date on, the trustees will credit the member with another sub-account each year, identical to the 15 claimed between ages 75 and 90, together with another year's interest, for the rest of their life. The money will be taken from the LPF. This means that pensioners who opt for the Lifetime Income Account are guaranteed an income each year from age 75 to date of death equal to one-fifteenth of their account balance at age 75, plus interest to date of payment.
- On death between age 75 and 90, any remaining balances in the LIA sub-accounts (plus interest) will be paid to the member's dependents or estate.

A2.8 The schedule in Appendix 3 illustrates the operation of the Longevity Protection Fund (LPF) and the Lifetime Income Account (LIA). It tracks the progress of the Lifetime Income Account at the individual level and of the Longevity Protection Fund at global level for 1,000 pensioners joining the LPF at age 75, who experience the mortality shown in Column 5 of the table. The example assumes a constant 4.5% a year credited to the smoothed fund (the expected net return derived in Section 10), of which 2.05% is credited to Lifetime Income Accounts and 2.45% to the Longevity Protection Fund.

A2.9 Each subaccount is projected to grow from 10 at the start to 13.29 (i.e., 10 increased by 2.05% a year for 14 years) by the end of year 14, while the number of subaccounts per member reduces by one each year as an account is cashed to provide an income. The total account balance of 150 per pensioner at the start (15 subaccounts of 10 each), as shown in Column 4, falls to just one subaccount worth 13.29 at the end of year 14, and to zero from year 15 on. Pension payments from

year 16 (13.42 in year 16, increasing to 19.34 in year 33) are paid from the Longevity Protection Fund.

A2.10 The balance in the LPF for a single cohort of 75-year-old joiners is shown in Column 7. Its growth and decline for that cohort is represented graphically as follows:

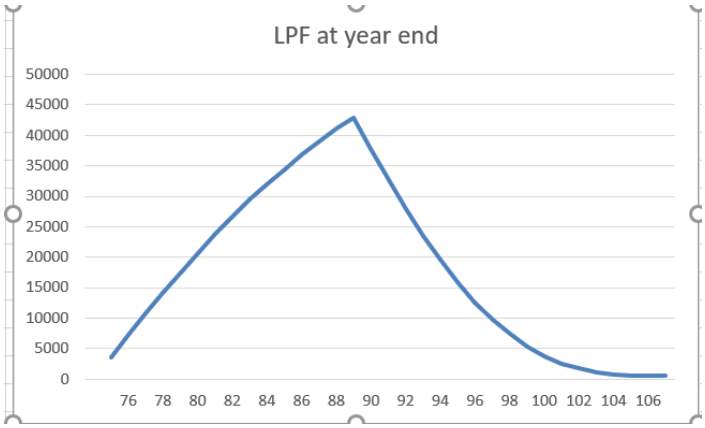


*Figure 31*

A2.11 The LPF grows between ages 75 and 90 as interest plus charges of 2.45% a year on members' pension accounts are credited. It starts to decline from age 90 as pensions start to be paid to beneficiaries who survive past age 90.

A2.12 The net result is that even pensioners who live to extreme old age – 2 of the 1,000 who opened Lifetime Income Accounts at 75 are assumed to be still alive and receiving benefit at age 107 – have the peace of mind of knowing that they will never exhaust their savings. The two hypothetical survivors to age 107 will have been receiving longevity benefits for 17 years.

A2.13 Psychologists say that normal people (not actuaries, of course!), when faced with a range of possible outcomes, tend to focus on the ends of the distribution and to ignore points in between. In this case, the payoffs (from a financial perspective at least) are good at both ends of the distribution:

- At one end, if a pensioner dies shortly after joining the Longevity Protection Fund, they will have lost very little: the full account balance is paid on death, so the only cost is the extra 2.45% annual charge for the short period from age 75 to date of death.
- At the other end, if the pensioner survives to age 100, they will have received a 'free' sub-account each year for the final ten years of their life, having cashed the last of their fifteen subaccounts in their 90$^{th}$ year.

The losers are the people in the middle, mainly pensioners who die between (say) 80 and 90. They will have had 2.45% deducted from the interest credited to their account each year, and transferred to the LPF, but they will get nothing in return, other than peace of mind.

## Appendix 3: Lifetime Income Fund and Longevity Protection Fund

| Progress of Longevity Protection Fund to age 107 for 1,000 pensioners joining at age 75. Each starting account value is 150 (15 sub-accounts of 10) | | | | | | |
|---|---|---|---|---|---|---|
| | | Per Contributor (150 starting balance) | | Total for all contributors (1,000 starters at 75) | | |
| Year | Age at start of year | Amount withdrawn | Account balance at year end | Survivors at year end | Additions to (+), Payments from (-) LPF | LPF at year end |
| 0 | | | 150.00 | 1000 | | |
| 1 | 75 | 10.10 | 142.87 | 992 | 3,573 | 3,653 |
| 2 | 76 | 10.31 | 135.38 | 980 | 3,361 | 7,253 |
| 3 | 77 | 10.52 | 127.53 | 963 | 3,129 | 10,778 |
| 4 | 78 | 10.74 | 119.30 | 942 | 2,879 | 14,206 |
| 5 | 79 | 10.96 | 110.68 | 916 | 2,617 | 17,520 |
| 6 | 80 | 11.18 | 101.65 | 888 | 2,346 | 20,706 |
| 7 | 81 | 11.41 | 92.21 | 856 | 2,070 | 23,755 |
| 8 | 82 | 11.64 | 82.34 | 823 | 1,795 | 26,658 |
| 9 | 83 | 11.88 | 72.02 | 787 | 1,522 | 29,413 |
| 10 | 84 | 12.13 | 61.25 | 750 | 1,254 | 32,019 |
| 11 | 85 | 12.37 | 50.00 | 710 | 995 | 34,476 |
| 12 | 86 | 12.63 | 38.27 | 669 | 745 | 36,790 |
| 13 | 87 | 12.89 | 26.04 | 626 | 510 | 38,966 |
| 14 | 88 | 13.15 | 13.29 | 583 | 291 | 41,017 |
| 15 | 89 | 13.42 | - | 538 | 91 | 42,956 |
| 16 | 90 | 13.70 | - | 493 | - 7,057 | 37,676 |
| 17 | 91 | 13.98 | - | 447 | - 6,566 | 32,659 |
| 18 | 92 | 14.26 | - | 402 | - 6,051 | 27,943 |
| 19 | 93 | 14.56 | - | 357 | - 5,520 | 23,557 |
| 20 | 94 | 14.85 | - | 314 | - 4,980 | 19,526 |
| 21 | 95 | 15.16 | - | 271 | - 4,430 | 15,876 |
| 22 | 96 | 15.47 | - | 231 | - 3,879 | 12,625 |
| 23 | 97 | 15.79 | - | 192 | - 3,335 | 9,784 |
| 24 | 98 | 16.11 | - | 156 | - 2,799 | 7,363 |
| 25 | 99 | 16.44 | - | 122 | - 2,281 | 5,363 |
| 26 | 100 | 16.78 | - | 92 | - 1,791 | 3,773 |
| 27 | 101 | 17.12 | - | 65 | - 1,340 | 2,573 |
| 28 | 102 | 17.47 | - | 44 | - 948 | 1,720 |
| 29 | 103 | 17.83 | - | 27 | - 629 | 1,155 |
| 30 | 104 | 18.20 | - | 16 | - 387 | 812 |
| 31 | 105 | 18.57 | - | 8 | - 218 | 625 |
| 32 | 106 | 18.95 | - | 4 | - 109 | 542 |
| 33 | 107 | 19.34 | - | 2 | - 53 | 512 |

# Appendix 4

## High-Level Description of the Wilkie Stochastic Simulation Model

A4.1 For the purpose of testing the robustness of the proposals in different investment conditions, 2,000 simulations of possible future scenarios were performed using a plausible stochastic model of equity markets. The model used was not precisely calibrated to historic or current data and it is not claimed that it would be suitable for determining regulatory reserves, for example. Nonetheless it is believed that it is appropriate for present purposes.

A4.2 It is constructed along the lines of the original Wilkie model, which was one of the pioneers in this area and was used for many years by actuaries. It is still used for getting a "feel" for the impact of stochastic movements in future asset prices.

A4.3 A simplification was taken compared to the original in that the prime driver of the Wilkie model was the rate of inflation. For present purposes this is an unnecessary complication but in any event one of the criticisms of the original Wilkie paper in 1986 was that it was too focused on the role of inflation. In the simplified model used in this paper there are two stochastic drivers:

- The prime driver is the rate of increase in the level of dividends. This was chosen to have a lognormal distribution with mean 2.5% and standard deviation 7.5%. The respective figures in the original model were mean 5% and standard deviation 7.5%. Note in particular that there is no mean reversion in this driver.
- The secondary driver is the dividend yield. It was chosen to begin with a lognormal distribution with mean Ln(2.5%) and standard deviation 17.5%. The original used Ln(4%) and 17.5%. However, for this secondary driver Wilkie did incorporate a mean reversion parameter. This makes intuitive sense as the pricing of equities in terms of dividend yield cannot wander off with complete randomness. In particular, it cannot approach 0 too closely. The model adopted for the paper also used a mean reversion in this secondary driver. The mean reversion parameter was calibrated as follows.
  The existence of a mean reversion in the secondary driver will show through in the long-term volatility being less than the short-term volatility. More precisely, in a completely random walk the variance of the log of, say, 10-year returns would tend in the long term to be 10 times the variance of single year log returns. In practice, we see ratios less than that. For the US market between 1926 and 2017 the variance of the log of 10-year returns was 6.1 times the log of the variance of yearly returns. For the UK market between 1900 and 2017 the corresponding multiple was 8.1. The reversion parameter was calibrated to give an average figure of 7.4. The distribution of the natural logarithm of the yield each year is then a weighting of its last value and its long term assumed value of Ln(2.5%).