Report to University and College Union
Input to the valuation as at 31 March 2017 of the Universities Superannuation Scheme

Introduction

The Universities Superannuation Scheme (USS) is a defined benefit scheme of longstanding which is open to both future accrual and to new entrants. It is sponsored on a "last man standing" basis by many employers of very strong aggregate covenant.

Preparation for the triennial valuation at 31 March 2017 is underway and UCU have asked us to provide some initial commentary on three issues:

- Expected future investment returns relative to CPI on different asset classes
- Setting a discount rate for a statutory valuation
- The concept of self-sufficiency and what this might mean for USS

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Expected future investment return relative to CPI

Our analysis is limited to the main asset classes. Our knowledge of the USS investment strategy is limited to public summary data. We expect that the USS investment team would be capable of producing a much more detailed analysis than ours, including analysis of their investments outside the main asset classes. We would welcome working with the investment team in developing the approach used.

A defined benefit scheme which has been open for a long time reaches a point at which there is a rough balance between the income from the assets and contributions and the outgo on benefits. The balance is sometimes not exact because for example benefit levels have been reduced or the benefits or contributions reflect changes in the membership. But in large measure such schemes have limited exposure to risk from asset market value volatility. Because there is a rough balance between income and outgo, the scheme has little need to either buy or sell assets, and what need there is to buy or sell is well spread over time.

A model suitable for the planning of an open scheme will then take asset income expectations as an input to the valuation assumptions. The funding regulations require the assets to be shown at market value. Putting these two things together, the expected return on assets is the rate of return which values the income on the asset at the asset's market value. This is called the "**internal rate of return**", a method which is common to all finance professions including actuaries, accountants, business managers, surveyors and economists.

The projection of income may be a best estimate or it may be prudent i.e. on the cautious side of best estimate. The internal rate of return method works for both purposes.

A model suitable for the planning of an open defined benefit scheme should have results which are sensitive to changes in asset income and insensitive to changes in asset market value. It is also important that the planning approach used places a consistent value on assets and liabilities and uses values which do not produce wildly fluctuating valuation results when there has been little change in long term expectations.

CPI and RPI

Before considering investment returns relative to CPI, it is helpful to first consider the relative merits of CPI and RPI. Compilation of a price index is an exceedingly complex task involving many judgements and compromises. Different parts of the index may be compiled using different mathematical techniques. The commentary below is necessarily simplified.

RPI is (mainly) based on an arithmetic mean of price increase data. CPI is (mainly) based on a geometric mean of price increase data.

Using an arithmetic mean introduces an upward bias into the index. If a price rises then falls back to its original level, an arithmetic mean wrongly records an increase overall. The use of arithmetic means introduces an upwards bias into the RPI estimated to be less than 0.1% per annum[1]. The geometric mean of CPI does not have this problem.

A geometric mean is always less than an arithmetic mean, and the more disparate the data, the greater the difference. This is illustrated in the table below:

Data	Arithmetic mean	Geometric mean
9, 10, 11	10	9.97
6, 10, 14	10	9.4
3, 10, 17	10	8.0
0, 10, 20	10	0 *

* The geometric mean of any set of numbers with a zero in it is zero, regardless of what the other numbers are.

Where price increase data shows little variation between samples, there will be little difference between the RPI and the CPI. Where price increase data shows wide variation between samples (as is the case for example for clothing price data), the difference between a geometric mean and an arithmetic mean is large, creating a noticeable difference between the CPI and the RPI.

If a geometric mean is to be used, it is important to collect data very carefully, because disparities in the data have a big effect on the outcome. Data disparities are especially marked in clothing price data, and the effect of this on a geometric mean accounts for most of the difference between the CPI and the RPI. In 2010, the Office for National Statistics amended the way it collected clothing price data in a way which *increased* the variability in the data it collected, and the difference between the CPI and the RPI got bigger.

The difference between the RPI and CPI is around 1% pa[2]. The major cause of the difference is the difficulty that the geometric mean of CPI has with widely variable data. Were the quality of data collection to be tightened up, the gap between the CPI and RPI would narrow, CPI would rise, and RPI would be largely unaffected. There is a risk here for the USS Trustee to note in the setting of assumptions.

In considering investment returns, RPI is much more useful than CPI for two reasons: RPI has a much longer history, and a market view of RPI expectations can be obtained from the gilts market.

For the purpose of this note, we will assume a best estimate difference between RPI and CPI of 1.1% pa.

[1] Consumer Prices in the UK, Mark M Courtney, Social Science Research Network, 6 November 2014 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2520056
[2] Estimated at 1.3% by OBR Economic and Fiscal Outlook November 2016

[In the 2014 valuation assumptions, it was assumed that the difference between RPI and CPI was 0.8% pa. Because RPI is set first by inference from market data, a reduced RPI – CPI gap increases the CPI assumption. We assume that the RPI – CPI gap of 0.8% is a prudent assumption for valuing future benefit outgo for SFO purposes. As prudence in the basis will be introduced by reducing the discount rate, it is cleaner to consider returns relative to CPI as relative to a best estimate of CPI.]

We now move on from the RPI/CPI discussion to a discussion on investment returns relative to CPI.

The principle is to construct a best estimate internal rate of return for each investment.

UK equities

Following on from our earlier comments, we would assess an internal rate of return on equities by combining the dividend income currently produced by an equity holding, an assumption for future RPI inflation, the rate at which we expect these dividends to grow in the future in excess of RPI inflation, and an allowance for the expenses associated with investing in this asset class.

UK equities	31 October 2016	31 March 2014
Dividend yield	3.52%	3.41%
RPI	3.60%	3.45%
Real growth relative to RPI	1.00%	1.00%
Expenses	(0.20%)	(0.20%)
Overall return	8.30%[3]	8.00%
Real return relative to CPI	5.60%	5.50%

As a simple approach for the purposes of this paper, we have used an RPI assumption at the last valuation date of 31 March 2014 as an average of the valuation assumption of 3.4% rising to 3.5% over 20 years i.e. 3.45% pa.

We have then used an assumption for RPI at 31 October 2016 as the 2014 assumption adjusted for the change in gilt market implied RPI over the period, which gives 3.6% pa.

Post World War II, real dividend growth over RPI has been in the region of 1.3% - 1.4% pa. (This assessment has been done using RPI due to its longer history.)

[3] The return on a perpetuity is obtained by compounding next year's dividend income (so last year's rate of income is increased by a year's growth) with the income growth rate, less expenses, as follows:
(1 + 0.0352 x 1.036 x 1.01) x 1.036 x 1.01 x 0.998 – 1 = 8.3% pa

Overseas equities

An internal rate of return on overseas equities can be assessed in the same way but there is the additional factor of the long run rate of change in the exchange rate.

The return in sterling on US equities as an example comprises:

- US dividend yield
- US inflation
- real dividend growth relative to US inflation, and
- changes in the $/£ exchange rate.

If we make an assumption that the long run change in the exchange rate reflects relative inflation between the US and the UK, then the return in sterling on US equities comprises:

- US dividend yield
- US inflation
- real dividend growth relative to US inflation, and
- UK inflation minus US inflation

US inflation cancels out to give us the simple model for the sterling return on US equities comprising:

- US dividend yield
- real dividend growth relative to US inflation
- UK inflation

In the short term, exchange rates fluctuate for many reasons and can fluctuate materially, for example since the EU referendum. It is a weakness of the approach set out above that an opinion is not given about whether the present position of the exchange rate is temporarily out of line. This is an issue on which the USS investment team might have some thoughts.

Using this approach, the internal rate of return on a basket of overseas equities can be built up as follows:

Overseas equities	31 October 2016	31 March 2014
Dividend yield exc UK	2.40%	2.30%
RPI	3.60%	3.45%
Real growth	1.00%	1.00%
Expenses	(0.20%)	(0.20%)
Overall return	7.00%	6.80%
Real return relative to CPI	4.40%	4.30%

For US equities, post World War II real dividend growth over US inflation has been in the region of 1.2% - 1.3% pa.

Property

Property	31 October 2016	31 March 2014
Rental yield	4.50%	5.60%
RPI	3.60%	3.45%
Real growth relative to RPI	0.00%	0.00%
Expenses	(1.00%)	(1.00%)
Overall return	7.30%	8.30%
Real return relative to CPI	4.70%	5.90%

The rental yield on USS's property portfolio has been estimated from the USS accounts by dividing the net rental income in Note 8 by the property market value in Note 9, excluding the pooled property funds. It is assumed that income on the pooled property funds is not included in the net rental income. The rental yields obtained appear plausible relative to market data.

Corporate bonds

A corporate bond return can be assessed directly from bond indices.

Corporate bonds	31 October 2016	31 March 2014
Yield (over 15 year non-gilts)	3.04%[4]	4.60%
Risk of downgrade	(0.10%)	(0.10%)
Expenses	(0.10%)	(0.10%)
Overall return	2.80%	4.40%
Real return relative to CPI	0.30%	2.00%

Fixed interest gilts

Similarly, a gilt return can be assessed using an appropriate index. (In reality, we believe the valuation will be undertaken using a term dependent discount rate but we are presenting a simplified approach here).

Fixed interest gilts	31 October 2016	31 March 2014
Yield (BoE 20 years)	1.94%	3.61%
Expenses	(0.10%)	(0.10%)
Overall return	1.80%	3.50%
Real return relative to CPI	(0.70%)	1.10%

[4] Iboxx over 15 year non-gilts

Index linked gilts

The expected return on index linked gilts will not be the same as on fixed interest gilts as the gilt market implied inflation is adjusted by the inflation risk premium. (Again, in reality, we believe the valuation will be undertaken using a term dependent discount rate but we are presenting a simplified approach here).

Index linked gilts	31 October 2016	31 March 2014
Real yield (BoE 20 years)	-1.75%	-0.01%
RPI	3.60%	3.45%
Expenses	(0.10%)	(0.10%)
Overall return	1.70%	3.30%
Real return relative to CPI	(0.80%)	1.00%

Discount rate

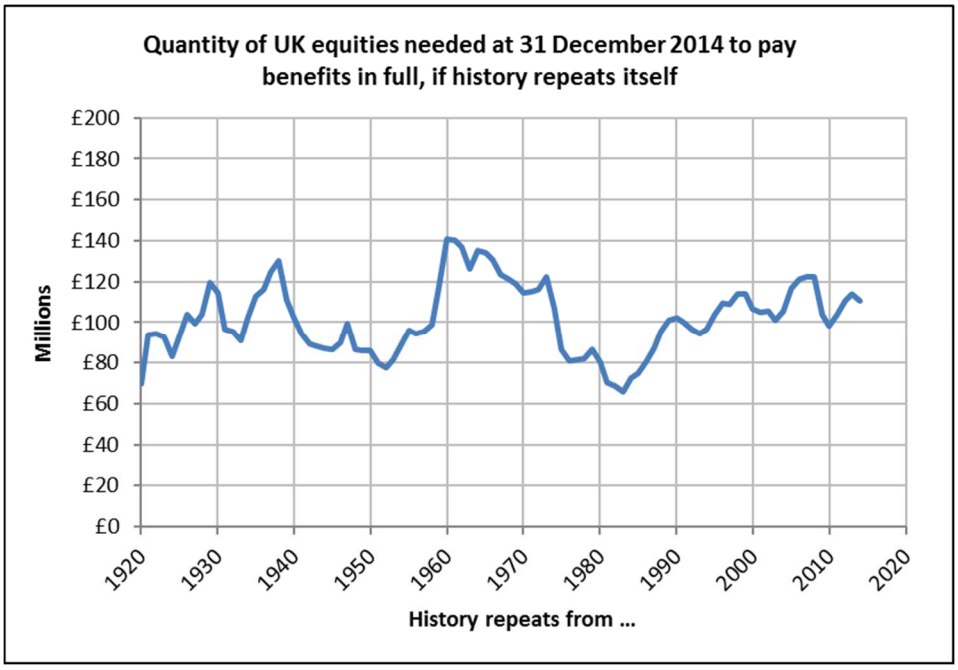
To derive a prudent discount rate for scheme funding purposes, we would start with the above best estimate investment returns and take a prudent margin against the risk of the actual returns being lower than the best estimate. The prudent return for the whole scheme is the average of the returns per asset class, weighted by the scheme's asset allocation.

The level of prudence needed can only be assessed subjectively. Given the strong covenant, there should not be a need for large margins for prudence and we would ask that the Trustee provide clear indications of the margins allowed and their rationale for setting these. Excessive caution in the either or both of the funding and investment plans could drive contributions above what the employers are willing to pay.

One approach to setting a margin for prudence if all the assets were invested in equities would be to consider past variability in the cost of providing pensions from a portfolio wholly invested in UK equities.

Variability of cost of providing for pensions from investment in UK equities

We have investigated the variability of cost of providing for pension cash flows from investment in UK equities. A specimen set of pension cash flows has been valued using the actual real return achieved on UK equities as the discount rate for each 1 year time period. Returns for pre-1997 have been adjusted down to make allowance for tax on dividends.



The benefit cash flows were scaled to produce a median valuation of £100m. The values range from £65m to £140m. The actual numbers here are not important in themselves it is their relationship that matters. This tells us that benefit cash flows could have been met by UK equity assets of at least £65m or at most £140m over this last century. In broad terms, the amount needed varies by plus or minus 40%.

The sensitivity analysis in the 2014 valuation report shows a £1.9bn change of technical provisions for a 0.25% change of discount rate. £1.9bn is 4.1% of £46.9bn technical provisions. At this sensitivity to the discount rate, it would require a 2.1% reduction to the discount rate to increase the value of benefits by 40%.

So, a discount rate which is 2.1% lower than the best estimate return on UK equities has sufficient prudent margin in it to cover the effect of ***all*** historic variability in UK equity returns on the provision for the payment of benefits.

In the first instance, we have calculated a prudent discount rate using a real dividend growth assumption of nil (relative to RPI). This means reducing returns by 1% per annum. This is the same assumption as used by First Actuarial in our work on the 2014 valuation. It seems very prudent to assume nil real dividend growth. In effect, it is assuming insufficient growth in the world economy to support any increase in real dividends.

Reducing the discount rate by 1% from the median discount rate creates sufficient margin to cover 77% of outcomes in the chart above. We note that the USS team indicated a 60th or 70th percentile outcome as an example of a prudent estimate in its document "Proposed Approach to the Methodology for the 2017 Actuarial Valuation". Granted the indication is merely an example, and not a formally agreed target, nevertheless it seems worth mentioning the level of prudence in a 1% reduction.

Prudent investment returns by asset class

Working as before to derive the investment returns but using a nil real income growth assumption on equities and -1% real growth on property (i.e. a 1% margin against best estimate), the following prudent investment returns are obtained:

Prudent investment returns	31 October 2016	31 March 2014
UK equities	7.2%	6.9%
Overseas equities	6.0%	5.7%
Corporates	2.8%	4.4%
Gilts	1.8%	3.5%
Property	6.2%	7.2%

Asset allocation

We have considered the strategic asset allocation and the reference portfolio rather than the actual asset allocation because the actual allocation may include short term tactical deviations from the benchmark which are not expected to be permanent.

The assets which do not naturally fall into the main investment classes (typically those called "alternatives") have been given an expected return which is a 50:50 mix of equities and corporates.

We expect that the USS investment team would be capable of producing a more detailed analysis than ours, including analysis of the investments outside the main asset classes.

Asset allocation 31 March 2016 Description in accounts	Classified as:	Allocation
UK equities	UK equities	15.6%
Equities: Europe, N America, Pacific inc Japan, Emerging markets	Overseas equities	46.9%
Non-government and emerging market debt	Corporates	10.0%
LDI and cash	Gilts	20.0%
Property	Property	7.5%
Total portfolio		100.0%

Asset allocation 31 March 2014 Description in accounts	Classified as:	Allocation
UK equities	UK equities	15.6%
Equities: Europe, N America, Pacific inc Japan, Emerging markets	Overseas equities	31.2%
Investment grade credit and emerging market debt	Corporates	5.5%
Global government, liability hedging, cash	Gilts	21.7%
Property	Property	6.6%
Alternatives: private capital, infrastructure, absolute return	50% equities 50% corporates	19.4%
Total portfolio		100.0%

Discount rate

We can then calculate prudent discount rates by combining the prudent returns per asset class with the asset allocations. The markets examined are UK and overseas equities, corporate bonds, gilts and property. A constant margin of 1% relative to best estimate has been taken at both dates on equities and property.

Prudent discount rate	31 Mar 2016 Allocation	31 Oct 2016 Prudent return	31 Mar 2014 Allocation	31 Mar 2014 Prudent return
UK equities	15.6%	7.2%	15.6%	6.9%
Overseas equities	46.9%	6.0%	31.2%	5.7%
Corporates	10.0%	2.8%	5.5%	4.4%
Gilts	20.0%	1.8%	21.7%	3.5%
Property	7.5%	6.2%	6.6%	7.2%
Alternatives	0.0%	4.6%	19.4%	5.3%
Whole portfolio	**100.0%**	**5.0%**	**100.0%**	**5.3%**

Based on prudent expected returns as at 31 October 2016 and the asset allocation as at 31 March 2016, both of which would be updated to 31 March 2017 when the time comes, the discount rate would reduce by 0.3% to allow for the changes in market conditions and asset allocation over the period.

Self sufficiency

The financial assumptions for a self-sufficiency-in-gilts valuation are derived from gilt yields. We have already indicated the expected returns on gilts.

Fixed interest gilts	31 October 2016	31 March 2014
Overall return	1.8%	3.5%
Real return relative to CPI	(0.7%)	1.1%

Index linked gilts	31 October 2016	31 March 2014
Overall return	1.7%	3.3%
Real return relative to CPI	(0.8%)	1.0%

In reality, we believe the valuation will be undertaken using a term dependent discount rate but we are presenting a simplified approach here.

There are some residual issues. Term dependent yield data is readily available from the Bank of England for terms up to 25 years. For terms beyond 25 years an assumption needs to be made.

It is also very important to consider the heightened longevity risk on a gilts based self sufficiency basis. The real yield on index linked gilts is very negative, at about -1.7% on 31 October 2016, relative to RPI. This equates to a negative real yield of about -0.8% relative to CPI, the measure of inflation used to increase USS pensions. When the discount rate for valuing pensions is less than the rate of annual increase to the pensions, the pension payments furthest into the future have the highest present value. The payments at a pensioner's end of life are more expensive to provide for now than the payments just after retirement. Decreasing the investment risk and return increases the longevity risk. The importance of the mortality assumptions is increased. Any prudence already in the mortality assumptions is then magnified and this issue needs specific consideration.

The purposes of a self sufficiency valuation

Our starting point is the strength of the employers' covenant, the unique multi-employer construction of the USS and the performance of the scheme over time.

The Trustee defines the reliance on the covenant as the difference between the self-sufficiency-in-gilts amount and the technical provisions. The Trustee requires this amount to be less than the value of available additional contributions.

We believe it would be helpful for the Trustee to reconsider the relevance of an assessment of funding assuming the scheme is self sufficient (that is able to continue for the long term future without seeking additional contributions from employers) assuming it is wholly invested in gilts.

Test 1 - Reliance on covenant

In our paper of November 2014, we devoted a section to an analysis of Test 1.

Test 1 is structured to worsen with time as there is turnover from the final salary to CRB sections

We noted in November 2014 that the difference between technical provisions and self-sufficiency would widen as there is turnover from the final salary to the CRB sections. However, the subsequent decision to terminate accrual in the final salary section and to terminate the link to final salary has the effect of reducing technical provisions on the date of change and widening the gap between technical provisions and self-sufficiency.

What was the reaction of the Trustee to this? It would be helpful to hear whether this problem was discussed. One reaction could have been that the opening amount for Test 1 should be the self-sufficiency-in-gilts liability less the value of leavers' benefits on the technical provisions basis, as we suggested. An alternative would be to decide on some other target for the "self sufficiency minus technical provisions" amount", such as the original amount when the salary link was still in place.

Hopefully the widened gap between technical provisions and self-sufficiency created by closure of the final salary section was not taken as an indication of a heightened expectation of risk: a reduction in the value of accrued benefits and of future accruals reduces liability. A clear understanding of the Trustee approach here would be very helpful.

Indexation of the reliance on covenant amount by CPI

The ability of the assets to provide for the benefits can be expected to grow in line with economic growth in the world economy. On the liability side, the benefits accrue as a proportion of salary and the liabilities will grow in proportion to salaries. In turn, salaries will grow as supported by economic growth. (Salary growth in higher education may be higher or lower than is supported on average in the larger economy, however, and salary growth in higher education has been modelled alongside other assumptions.)

Our view is that the target "reliance on covenant" amount should be increased annually at a rate reflecting expected economic growth. The assumption for expected economic growth should be mutually consistent with the expected return on equity assets and with an assumption for general salary growth.

Indexation of the reliance of covenant amount by price inflation (however measured) needs to be reconsidered in the context of real economic growth over time. By inflating for prices only, the state of the economy in 2014 is preserved in the target and no allowance is made for the benefit of economic growth in the following years, growth which will increase the returns on the assets and the size of the benefits.

Willingness to contribute and the ability to contribute

The USS paper on the Proposed Approach to the Methodology for the 2017 Actuarial Valuation helpfully distinguishes between the employers' ability to contribute and the employers' willingness to contribute. We acknowledge this distinction made in the USS paper and we are aware that these and other factors will be considered in regards to the tests as part of the negotiations covering the valuation for 2017.

Unreliability of the reliance on covenant amount

The reliance on covenant amount is the variable difference between two large numbers. Its status should be no more than an indicator of a need for opening a discussion, as befits an unreliable number which is the difference between two large numbers. It should not be a direct driver of either the technical provisions discount rate or a force for change of the investment strategy.

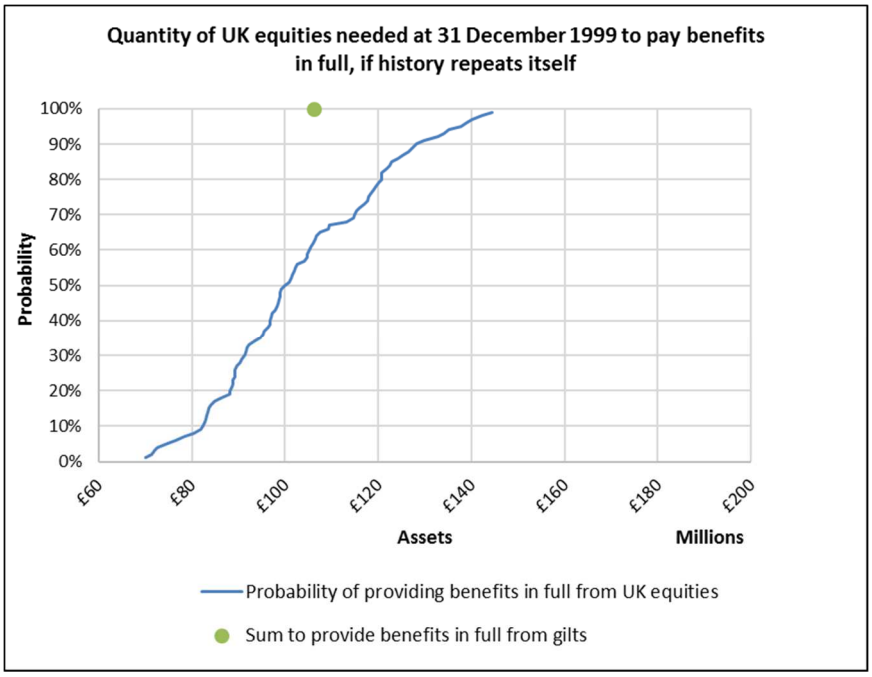
Each of these comments on Test 1 is more important than the detail of the assumptions for the self-sufficiency-in-gilts calculation which is an input to Test 1.

Self sufficiency and the planning of a continuing scheme

A continuing scheme with continuing employers is free to invest how it likes. There is no need to constrain considerations of self-sufficiency to gilts only. What does a self sufficiency in other kinds of investment, such as equities and property, a diversified balanced portfolio look like? How does it inform the choice of a prudent discount rate?

Self sufficiency in gilts and UK equities, 31 December 1999

This chart repeats the investigation of what it would cost to provide a sample set of pension payments when discounted using actual real returns on UK equities. It uses data to 31 December 1999 only. The results are charted differently. They are placed in a numerical order to enable the reading off of the proportion of results below a particular value. We have also shown the value of the cash flows when discounted using the real gilt yield at the time.



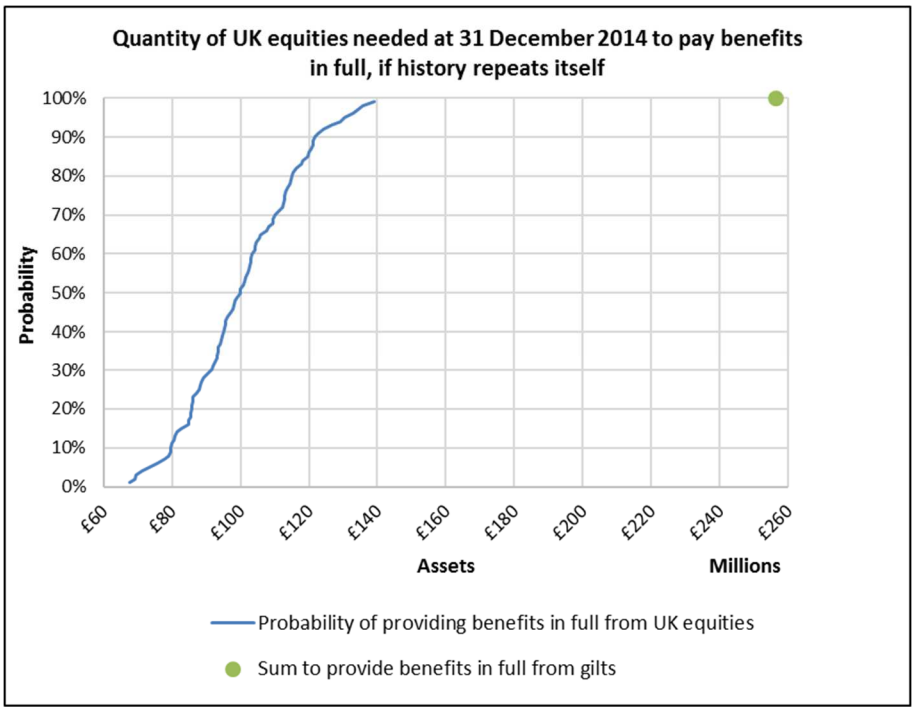
Observations from this chart include:

- The amount to be self sufficient in gilts (£106m) is less than the amount to be self-sufficient in UK equities (£145m).

- Having sufficient funds to be self-sufficient in gilts does not mean that the scheme is safe if it is invested in something else, such as UK equities. 38% of the outcomes while invested in UK equities require more than £106m. To be self sufficient, you need to have sufficient assets to be self sufficient **and** be invested in the chosen assets.

For the purposes of planning a continuing scheme, we conclude that it is more important to investigate what self-sufficiency in the actual assets looks like than to look only at self-sufficiency-in-gilts. To do so will help the planning of the scheme within the employers' willingness to contribute. To have relied on the self-sufficiency-in-gilts calculation in 1999 would have overlooked a material risk to managing the scheme within the employers' willingness to contribute.

Self sufficiency in gilts and UK equities, 31 December 2014



This chart restates the investigation of what it would cost to provide pension payments when discounted using actual real returns on UK equities, using data to 31 December 2014. We have also shown the value of the cash flows when discounted using the real gilt yield at the time. We have had to extend the horizontal axis to fit on the gilt yield value.

Observations from this chart include:

- The amount to be self-sufficient-in-gilts (£256m) is way in excess of the amount to be self-sufficient-in-UK equities (£140m). A scheme can be invested in UK equities and expect to be self-sufficient for much less than £256m.
- The self-sufficiency-in-gilts amount does not indicate the risk involved in investing in UK equities.
- Gilt yields have fallen since 31 December 2014. Including more recent data would widen the disparity.

Again, for the purposes of planning a continuing scheme, we conclude that it is more important to investigate what self-sufficiency in the actual assets looks like than to look only at self-sufficiency-in-gilts. To do so will help the planning of the scheme within the employers' willingness to contribute. To have relied on the self-sufficiency-in-gilts calculation in 2014 would have overstated the likely cost of the continuing scheme and given an inappropriately pessimistic view of the likelihood of keeping within the employers' willingness to contribute.

Prudent planning

A discount rate for self-sufficiency in UK equities could be a 2.1% margin against best estimate returns on UK equities, which is 6.1% pa. (1.083 / 1.021 - 1 = 6.1%).

The weighted average best estimate expected return for UK and overseas equities is 7.4%. A 2.1% margin against the best estimate return gives 5.1% pa, which is very close to the discount rate used in 2014 and the discount rates as at 31 March 2014 and 31 October 2016 derived in this report.

Of course, future events may be more extreme than observed in the past. And it is something of a misuse of data to apply the UK equity prudent margin to overseas equities. Nevertheless we hope that the large prudence contained in a discount rate of this order is demonstrated.

Given the very good covenant of the employers sponsoring the USS, and the intention to continue to invest a large proportion of the investments in “growth” assets, it seems highly appropriate to pay attention to self-sufficiency while invested in a balanced portfolio and to be aware of the size of margin required to give good protection against underperformance of the growth assets.

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6 December 2016