ABSTRACT OF THE DISCUSSION
HELD BY THE FACULTY OF ACTUARIES

Mr N. D. V. Bodie, F.I.A. (introducing the Continuous Mortality Investigation Working Paper 32)**:** I first let you know that we would prefer not to discuss rates of mortality improvement, as we have insufficient appropriate data at this time. We have ten million years in the exposed to risk, but it is over a relatively short time span. The Continuous Mortality Investigation (CMI) insured investigations have smaller volumes of data, but they extend over a very long period of time. We also have a considerable heterogeneity of data, in that about 380 sets of data have been submitted, but only about 30 schemes have two successive valuations. We are looking for much more information to build up our data. I now comment on how the Self-Administered Pension Schemes (SAPS) tables might be used. First, they are the most up-to-date tables, and secondly, they have a significantly different shape to the existing '00' series and to the '92' series. Figures 42 through to 51 in Working Paper 32 (WP32) show comparisons of the rates. We are now beginning to see the largest pension schemes subdividing their data into low and high paid members, so that we are seeing different mortality assumptions for different categories of membership, partly arising from the earlier work which the Committee carried out. We now have additional tables which will allow Scheme Actuaries more choice in the assumptions which they adopt, even for the largest schemes, where an element of self-rating is always possible. Thirdly, for smaller schemes, which do not have a statistically credible experience, we are, by publishing three sets of tables: the 'All Lives', the 'Heavy' and the 'Light' mortality; giving Scheme Actuaries a choice. If the scheme which they are valuing does not have credible data, but is particularly biased towards blue collar or white collar workers, for example, we have tables which they may find helpful in valuing their scheme.

Mr A. T. Gaches, F.I.A.: [Mr Gaches presented the CMI SAPS graduation consultation paper (WP32) both at this meeting and at the Sessional Meeting held by the Institute of Actuaries on 28 January 2008. The two presentations were virtually the same, and what he said at the Institute appears in the abstract of that discussion on pages 208-218 of *B.A.J.* **14**, II.]

Mr J. Ellam, F.F.A. (presenting the future work to be carried out by the CMI SAPS Mortality Committee)**:** The SAPS Committee, when it started, thought that it was going to do a finite piece of work. Now there seems to be much work which it can do, but to do this requires more data.

   Mr Bodie said, in the introduction, that the data which we are receiving is not suitable for projecting future improvements, but it will be suitable, if we get more of it, to see some patterns of improvement from the past.

   The analysis to date has been done, broadly, on high annuities and low annuities; that simple split being a proxy for a socio-economic group. It may be a proxy for an industrial type of work or type of workers. The data are there to do an analysis by large industrial groups.

   The data cover calendar years 2000 to 2006. These are valuations which have been done over the period, probably up to mid 2007. However, these are data, effectively, up to 2006, clustered very heavily in the middle, so that we do not really have a long trend analysis which we can use for improvements.

   The data which are on the CMI website show improvements against the '92' series short cohort. It is not meant to suggest that the short cohort is the right answer. Similarly, the medium cohort is not necessarily the right answer either. At the time when this work was being done, there was very little difference between short cohort and medium cohort, or even long cohort, projections over the periods 2000 to 2006.

   Figure D.17 shows a reminder of the data which we have seen coming in, how it has peaked in 2002, a little less in 2003, and then tailing off. The left axis is actual to expected (A/E) against the PMA92 short cohort. This was work which was carried out prior to graduating the tables, producing the graduated tables which we have in WP32. The A/E is very heavy relative to

PMA92 for SAPS business: for all retirements; and for all amounts. The age bands are more or less horizontal, and they show that mortality at the younger ages is much heavier than that for life offices, and, at the older ages, is reverting to the level of life offices. In general, it looks quite a bit heavier. It also looks as if the cohort projection might have given the right kind of answer to date.

If we then look at normal retirements, as shown in Figure D.18, as opposed to early retirements, ill-health retirements or any other type of retirement, we can see that, for the younger ages, we are getting a significant improvement, albeit that there are not much data in 2006, against short cohort improvements. So, there is plenty of scope to see from these data where improvements might have been. However, there are not enough to see where changes are going yet.

Finally, Figure D.19 shows the number of deaths over the period 2000 to 2006 by industrial category. Some of these industrial categories could well be big enough to justify a graduation on their own, or an analysis on their own. That is the intention of the SAPS group this year, to look at the variations between classifications, or even, maybe, for some of these actually within classifications because 'Industrials' could cover a multitude of companies and 'Consumer Goods' similarly. So, there may well be scope to look within these and to produce results, maybe not graduations, for each of several different classifications.

[n.b. Figures D.17, D.18 and D.19 appear in the discussion on this subject held by the Institute of Actuaries.]

Professor A. D. Wilkie, C.B.E., F.F.A., F.I.A. (opening the discussion)**:** One of the questions asked was, basically: "Do you want lots of tables?" There is no harm in publishing many tables.

I have a technical point on which it would be helpful to have clarification. For the low ages ill-health pensioners, the minimum value of μ_x was at about age 41 for males and at about age 42 for females. Below those ages you had used something. Was it actually the minimum value if you discovered it exactly, or was it μ_{41} or μ_{42} exactly? That would not be very far away. It is just useful to know which.

Concerning young ages, I would not have thought that there was any difficulty going down to age 17 rather than to age 20. Quite a lot of past CMI tables did go down to age 17, and, conceivably, there could be an ill-health pensioner or widow of that age. Figure D.17 shows improvements on the normal retirements at young retired ages. It would be interesting to see the same graphs for ill-health retirements.

What would be interesting to look at is the proportions of normal and ill-health retirements. If the ill-health retirements have gone up substantially in the most recent years, then this might be accounted for, possibly, because there are different schemes coming in. That is the sort of situation at which one might want to look. It is important, also, to look at the aggregate mortality. It should not have changed too much, but it could be that the super fit people stay on working and the slightly tired people retire early.

Mr M. A. Potter, F.I.A.: I was interested in the extension to higher ages. I have heard that, for mortality studies for pension schemes, it is better to have a good fit where the bulk of your data lies, which is expected to be between ages 60 and 80, whereas, in reality, when we are interested in the expectation of life and in annuities, the age range 85 to 95 is of more interest.

My question for the panel is a few comments on the level of data which they found in the 85 to 95 age range, with, perhaps, some comments on what might have been the state of the development of occupational pension schemes when those people were active members.

It was pleasing to note, as an actuary with clients with pension schemes, that the mortality tables which you have drawn up for us are heavier than the '00' tables. I wonder whether you have any insights for us on why that might be the case?

Mr Gaches: I comment first on the amount of data at ages 85 to 95. There are two things to which I would point. The first is that, if you are really interested in the amount of data, then the CMI Working Paper 31 should provide some information on that. The other thing which may

be quite helpful to look at are Figures 21 onwards in WP32, the ones which have the 2.5 and 97.5 percentiles. Broadly, if the percentiles are very close together, then we are fairly sure what the data are saying. If they remain fairly close together over the range up to age 95, which they do, which is why we were happy to graduate up to that age, that means that we are fairly confident that we have enough data to be telling us what is happening. If they are wider apart, then it means that we have to select from a slightly wider range than the data would support.

In terms of why the SAPS tables may be observed to be heavier than the '00' series tables, I think that the reason why the mortality rates in the tables are heavier comes back to the data. In earlier working papers we have seen this effect in the data throughout. There have been a number of suggestions, the key one being that it is probably a different kind of population underlying the data.

The pensioners' tables from the '00' series may contain more smaller schemes and they may contain more higher earners, although the average amount of pension may or may not support that.

The Junior Vice-President (Mr R. S. Bowie, F.F.A.): What most pension Scheme Actuaries do with mortality tables is that they apply an interest rate on them, discount them, and come up with a value. I was not able to tell the extent to which some of these tables, once you apply a discount rate on them, actually give you much difference in the value.

It was not easy to tell from the figures, but one of the things which you can do with the tables is to say: "I will take 90% of the rates in a table. If my particular scheme is not an exact match for this, but it is broadly the right shape, then I will take 90% or 110% of it." I wonder to what extent some of these tables should be pretty closely arrived at just by taking a proportion of one of the other tables.

Mr Bodie: Certainly, in terms of the difference between 'Heavy' and 'Light', we are looking, as Mr Gaches said, at 2½ years' difference in the expectation of life, which will translate into annuity values of 7% or 8% difference. That would be distinctly noticeable if the 'Heavy' tables would be more appropriate, and we also find that the tables, generally, are also heavier than the existing standard tables.

In terms of taking a percentage of another table, it would be helpful if that were the case. We did start off looking at this, to see whether there was some way of parameterising the tables, such that you could simply adjust a parameter and say that this was suitable for 'Heavy', 'Light', etc. Unfortunately, it does not work. We find that, once you reach ages 90 to 95 the tables have tended to converge, although not completely, whereas, at age 60 they are very far apart. One of the figures in CMI Working Paper 31 shows that, for people aged 65, the people in the highest band of pension exhibit half the rate of mortality of the people in the lowest band. So, while there is a very substantial difference at the younger ages, the tables tend to come together at the older ages, suggesting that there are elements of luck and genetics in how long you survive beyond a certain point.

Scheme Actuaries are going to have to make their minds up as to which tables they may bring to the attention of the trustees as being appropriate for their schemes.

I now make a comment on the naming convention of the tables. Dr Pryor, who is on the Board of Actuarial Standards, said, in the discussion about these tables which was held at the Institute last week, that the public perception is that, if you publish a set of tables in 2008 which are labelled '03', then they are five years out of date, and, in the past, people have said: "How can it take the Actuarial Profession so long to produce something which is so out of date?" The tables are not out of date, as we know. The suggestion was made that, perhaps, we could call them something not time related, such as Series 1 or Series 2, as we go through the various publications.

Professor Wilkie: There is a danger the other way round, in that the PA(90) tables were based on data from 1967 to 1970, but then were forecast to 1990. They gave the impression that they

were up-to-date in 1990, by which time they had been totally overtaken by events. So, do not call them 2020 tables. That would be wrong.

Mr Bodie: I now consider some of the questions for feedback. The first is whether anyone would be opposed to the publication of ill-health retirement tables.

[On a show of hands, there was a positive demand for ill-health retirement tables.]

The next is whether we require sets both of all and of normal retirement tables.

[On a show of hands, there was positive support for a wide range of tables.]

Most of the tables in WP32 are for amounts, with very few for lives. Is anyone anxious that we should have more lives tables?

[On a show of hands, the majority was not in favour of extending the number of lives tables.]

The Junior Vice-President (Mr R. S. Bowie, F.F.A.): What is the advantage of having more lives tables?

Dr G. T. Smith: The lives tables are based on the raw experience. However, the amounts tables are effectively the lives experience weighted by the pension amounts. Since we have two separate amounts tables (tentatively called 'Heavy' and 'Light'), and the split between them is based on pension amount, is there an inconsistency or some element of double counting in the amounts weightings applied to these two sub-experiences, since the discriminating factor between them is also pension amount?

Is there any difference between a 'Light' lives table and a 'Light' amounts table, since it is only a quarter of the total experience anyway, and the effect of the weighting is presumably pretty small in a smaller population?

Mr Gaches: There is not very much difference. When we were doing the analysis, one of the things which we looked at was how much variation there was within the subdivisions by amount bands, and where we found that there was a lot of variation, or that the variation was not what we expected, we split the band down further. That is the reason why we went from having four bands in some of the much older working papers to five bands, because there were some apparent inconsistencies. Once we split it out, things made much more sense.

So, there would not be much difference between a 'Light' lives table and a 'Light' amounts table. Are we double counting? I do not think that we are coming up with answers which are wrong, but there is not a lot of difference between the two.

Mr Bodie: There has been a suggestion that, if we took, for example, the top band and put in the top 12.5% rather than the top 25%, we would end up with expectations of life which are close to the existing standard tables. Also, if we were to move to a different banding at the lower end, say take the bottom 50% instead of 75%, some users may prefer to be able to interpolate between the two tables rather than have just two tables which encompass 100% of the data. What do you think?

[After a show of hands, there were no strong views shown on whether or not there should be a wider spread of the bands.]

Professor Wilkie: It is worth investigating. I would be inclined to look at the bottom 20, then the next 20 and the next 20. You may have done some of that in the first place. Another approach would be the generalised linear model approach. That would be a more elaborate investigation, but that is worth doing sometimes.

Mr Bodie: Certainly, when we were looking at the data we started off with males, the bottom 50%, but we did find that there were distinctly different characteristics for about the bottom 30 and the next 20. There was a noticeable difference in shape when we started delving deeper into the data. There are different sub-divisions.

[After a show of hands, there seemed to be a variety of views as to whether there should be a wider spread of the bands of mortality.]

Therefore, I think that the Committee will take the line of least resistance, and not change what is now in place.

It is possible to extend the tables to younger ages, say to 20 or to 17. Would you like the Committee to extend the normal table down to a low age, even though we would be actually using rates which could not possibly have any justification, because there cannot be any *normal* retirements below age 50?

[After a show of hands, there was a balance of views between extending, even where there are no data, and leaving the tables as drafted.]

Now, let us consider the oldest ages, and whether we should extend the tables further upwards. Would you like to have a bigger spread into more advanced ages?

[After a show of hands, there was a balance of views.]

Mr C. J. Morton: The Committee has already asked for alternative names for the two sets of tables to replace the proposed names of 'Light' and 'Heavy'. The normal social class structure has three groups: working class, upper class and middle class. Do the data not suggest a middle class, or were there other reasons for only choosing two classes?

Mr Bodie: When we looked, in Working Paper 31, at the figures of the A/E against the standard table, we found that the three bands which we put together into the 'Heavy' group were all noticeably above 100% A/E, and that they tended to follow pretty much the same pattern, heading down from values of 160%/170% A/E at ages 60 to 65 to about 120% at age 95.

For the two highest paid bands, the lightest mortality, they started around 60% to 70%, and gradually went upwards. There was a very clear distinction between the three heaviest groups and the two lightest groups. You can almost draw a line between them, and they were almost a mirror image. That is why we picked these particular groupings. They appeared to have similar characteristics between themselves, and very different characteristics against the other one. We would certainly be prepared to look at a wider spread of those. My own view is that it leaves that gap in the middle which is not appropriate. I am not sure that we want a third set of tables, as we have 'All', which is not too bad a fit between all of them. So, there was a reason why we subdivided the data in the way in which we did.

Mr A. J. Rae, F.F.A.: The amount is a proxy to a socio-economic group. Given that quite a lot of rich people have lots of smaller pensions, I suspect that, as you get down to the lower pension amounts, you may be having more of a mix between different socio-economic groups, whereas when you get higher pensions, you are fairly certain that they are people in the higher groups.

Mr Bodie: We certainly believe that that is the case for females. The amount of pension is a very poor proxy for socio-economic groups there. At least for the males it works on the amount of pension. However, we are now asking schemes to submit postcodes to us when they send us data. We will be trying to address that question in future. We also have a slight issue as to whether we use the whole postcode and get very granular results, or whether we use the first part of it and get rather more broad-ranging results. The experience which I have seen of using a much broader ranging, rather smoothed, approach is that you tend to lose all regional differentiation in that way. A more granular approach probably is better.

The Junior Vice-President (Mr R. S. Bowie, F.F.A.): Given the lead time, and that you have sufficient data to be able to do things, for what are these tables to be used?

Mr Gaches: It depends on the scheme with which I am dealing. For small schemes, what has happened in terms of mortality tells me something useful about why the funding position has moved to what it is now. It does not tell me anything about the future. For middle to large sized schemes, the total number of deaths might tell me something about the overall level of

mortality, but it does not tell me anything about the shape of the mortality, whether it is particularly high at younger ages or higher ages. For larger schemes, it tells me something about the shape as well.

I have a mix of options which I take for looking at schemes' data.

The Junior Vice-President (Mr R. S. Bowie, F.F.A.): So, for those small schemes, or the medium schemes, where there are probably not enough data in the scheme to do anything really fantastic, what are you looking for? Are you looking for some information about the kind of people who went into that particular table, because geographically, by industry, or by whatever else, they seemed to be a good match for the scheme which you have, but which does not have enough data to match something?

We have heard a little about labelling. We have not heard much about any descriptors which the CMI might issue with these tables, which might be helpful when an actuary is looking at the right table, and says: "I have not enough data in my scheme to get a very good fit, but this appears to be a set of tables for a group of people who have an average pension of £10,000 a year, and are predominantly from an industrial background'', or whatever else. Is part of the plan to give people those descriptors?

Mr Gaches: When I use a table I need to be able to correlate the risk factors which I can observe for the scheme, and, ideally, measure, rather than have a rough feel for some kind of measures in the data or in the tables to which I am comparing it, the wider data or tables. What we have sought to do so far, based on the data which we have, is to break things down in a way which seems sensible.

If there are ways in which people want data broken down, then we would be very keen to know how they want it to be done. If we are able to break the existing data down in that way, we can do so. If we are not able to break down the existing data in that way, then we can consider obtaining data which can be broken down in that way in the future.

The postcode is one example of that, where, clearly, there is a large number of people who are in favour either of looking at geography or at the more granular detail with some kind of mapping, to group together similar small areas.

Professor Wilkie: We know from population studies, mainly, that there are moderate regional differences throughout Britain.

In the book Carstairs & Morris (1991), reference was made to affluent areas and deprived areas, which were based on census enumeration districts rather than on postcodes. You can use the granular postcode approach to produce a whole range of more deprived and more affluent areas. However, different companies would have a wide mixture. Very few pension schemes have all their members from affluent areas, and very few would have all their members from deprived areas, who, if they are sufficiently deprived, are likely to be unemployed anyway, and not, perhaps, in pension schemes. That is one of the problems of the areas of severe deprivation.

Nevertheless, there are regional differences and there are industrial differences. I would have thought that certain industries, heavy industries, which are coal, steel, and similar industries, are declining, but there are plenty of pensioners around. My guess would be that they have poor mortality. A local authority will have a mixture of clerical and also everyday workers. The teachers' scheme (which is not in this investigation, since it is a national one) has pretty much all teachers, and so they probably have relatively good mortality.

There is no reason why actuaries should not tailor their consideration of what the right mortality is to use for a particular valuation or estimate on their assessment of the characteristics of the scheme, and it is subjective as to whether it is a national scheme, which would have enough data, or a fairly small local scheme with a regional locality. You would know something about the general social class of the staff in it. It certainly helps you to know more about the differentials. If one has only the PMA00 tables, there is not much choice for actuaries to use, but those tables.

I carried out a small investigation last year for some companies from the west of Scotland.

They were small companies, but, if we put them together, we had aggregate data which appeared to be enough. Their main point was that they knew that the west of Scotland had poor mortality. Presumably their schemes had also. However, actuaries were still advising them to use standard U.K. mortality. I was able to show that the mortality was not very bad, but was not as good as the '00' series tables. It might well have been much the same as the tables which we are considering here. That is simply because the '00' series tables are from a select group of those group pension schemes still insured by life offices.

Therefore, an investigation into regional variations into the granular postcode, and using, as was mentioned, the generalised linear models to look at amounts, postcodes, and suchlike, is a useful exercise. It helps actuaries to make up their minds what to do. Even if there are far too many tables produced for everybody to use, or they look too complicated to use, you know which way to go.

<div align="center">REFERENCE</div>

CARSTAIRS, V. & MORRIS, R. (1991). *Deprivation and health in Scotland.* Aberdeen University Press.

Mr Potter: Following on from Professor Wilkie's comments, I advise a couple of schemes which are in the industrial sector in western Scotland. I suspect that the 'Heavy' table, being based on the 75% heaviest experience, is not going to be acceptable, and they are going to insist on me doing some work to find out the 25% worst, if not the 10% worst, for some of their workforces.

Mr S. J. Richards, F.F.A.: The subject of pension size versus postcode is addressed in a paper to be presented to the Institute sessional meeting in February 2008 (Richards, 2008), which covers the ways of allowing for socio-economic variations in pension schemes and life office portfolios.

Concerning regional variations in mortality, in all the work which I have done, regional variation is predominantly a variation in socio-economic groups. Most recently, I took a large portfolio of about 350,000 annuitants from a U.K. insurer which has a very good U.K. wide coverage, but there was no statistically significant regional variations whatsoever after allowing for postcode-driven lifestyle groups, i.e. using the full two-part postcode.

I would, therefore, caution against doing anything on a regional basis, as just using part of the postcode is very likely to mislead.

<div align="center">REFERENCE</div>

RICHARDS, S.J. (2008). Applying survival models to pensioner mortality data. *British Actuarial Journal*, **14**, 257-326.

Mr C. Taylor, F.I.A.: It is important to understand as best as possible the correlation between the different influences on mortality: male or female, age, location, wealth, lifestyle, etc. How much does postcode pick up on wealth and lifestyle effects, for example — if a lot, then we may not need to look any further.

Mr Richards: This is somewhat anticipating the paper Richards (2008), but there appears to be an independent effect of both pension size and postcode. The models which I have fitted suggest, in some circumstances, that the postcode is a slightly better proxy for social class than pension size. However, a combination of both pension size and postcode together was almost always better than either one of them on its own. You need to do postcode-based modelling and amounts-based modelling together.

Mr Bodie (closing the discussion)**:** In summary, we need to go back to the genesis of the SAPS Committee. We were brought into being because people found that the existing standard tables did not fit the experience of large pension schemes. We are now producing tables, which will be

more appropriate for general application, although this is not to say that the existing standards are incorrect for the populations from which they are drawn. I know, from some work carried out on the financial services sector, that the '92' series, for example, was by no means a bad fit for that particular grouping. On the other hand, there were a number of other schemes where we found that the '92' series, particularly, and the '00' series, to some extent, were the wrong shape.

We have tables here which will be useful to Scheme Actuaries in valuing their liabilities, because we are sampling from a different population. We have only to look at the relative volumes of male and female data to see that the CMI's data are relatively thin in female data. We have eight times the female data and four times the male data. There are very distinct different populations here, which will be useful to Scheme Actuaries.

Whether 24 tables are useful to Scheme Actuaries is still slightly open to doubt. I am concerned that they will say: "I do not know which to use. Therefore I will use what I did last time."

I take Professor Wilkie's point that there is no harm in publishing many tables, particularly as we have already done the graduations for them. We are minded to keep that going.

We will look at the question of extensions to other ages. We will also see whether we can come up with a better name for the tables. It looks as though we may have to do one more consultation on different banding effects.

The Junior Vice-President (Mr R. S. Bowie, F.F.A.): It is a characteristic of actuaries that they always want to see the glass half empty rather than half full. There is a risk that we can all see much more that the group could do, but Figure D.1 [in Mr Gaches' presentation] showed the amount of data which the group collected compared with that which, for decades, we seemed to be personally happy to work off, even though it was a tiny amount of data from a completely different population. That is a measure of how valuable this work is, and how much interest there is in this work. So, I offer my thanks, on your behalf, to the presenters.