Continuous Mortality Investigation

SAPS Mortality Committee

WORKING PAPER 35

The graduations of the CMI Self-Administered Pension Schemes 2000-2006 mortality experience

Final "S1" Series of Mortality Tables

Please note that in this version of Working Paper 35 minor corrections have been made to Charts C3 and C4, in Appendix C. These corrections affect the presentation of the graduation results only. The actual graduation results are unaffected. This version replaces the version that was published in October 2008.

February 2009

EXECUTIVE SUMMARY

CMI Working Paper 35 – "The graduations of the CMI Self-Administered Pension Schemes 2000-2006 mortality experience – Final "S1" Series of Mortality Tables" presents the first set of graduated tables based on the CMI SAPS dataset.

This paper follows the publication of CMI Working Paper 32, which consulted on draft graduated tables. The tables were widely publicised and feedback was encouraged.

This Working Paper provides a summary of points made in feedback and the CMI SAPS Mortality Committee's response to this feedback. A description of the methodology used to produce the graduations is outlined and the key statistics for each of the graduations are summarised.

The number of final graduated tables is unchanged from the number of draft tables. However, revisions have been made to the various aspects of the graduations including changes to the following:

- The naming convention;
- Which graduations extend back to younger ages;
- The thresholds for "Light" and "Heavy" tables;
- The methodologies used to extend the graduations to younger ages and to older ages;
- The methodology adopted to calculate exposed to risk; and
- Correcting for the discrepancy in the age definition between the data and that assumed in the software.

These tables have been approved by the Management Board for adoption by the Actuarial Profession. It should be noted that adoption implies that the Actuarial Profession is satisfied that the tables have been well-constructed and subjected to rigorous peer review, such that the Profession is happy for the tables to be published in its name. It does not carry any implication that the tables are appropriate as a standard for any particular purpose and **it is the responsibility of any actuary or other person using a base table to ensure that it is appropriate for the particular purpose to which it is put.**

Key features of the tables include:

- The graduated tables are based on the various types of data submitted:
  - The "Ill-health" tables are based on data where pensioners were specified to have retired (before their normal retirement date) as a result of ill-health;
  - The "Normal Health" tables are based on data where pensioners were specified to have retired other than as a result of ill-health;
  - The "All pensioner (excluding dependants)" tables are based not only on the data in the previous two categories, but also on schemes where data contributors were unable to differentiate between normal and ill-health retirement; and
  - The "Dependants" tables are based on data where the beneficiary is not the ex-employee, but their spouse (or other dependant).
- Note that some schemes submit data with no separation between "pensioner" and "dependants"; this has not been used in these graduations.
- Separate tables have been produced for males and females in most cases. The exception is "Dependants", where only the female data have been graduated.
- In all cases, tables have been graduated on an "amounts" basis, meaning that greater weight is given to those with larger benefits. In addition, the data have been graduated on a "lives" basis for "All pensioner (excluding dependants)" and "Dependants" tables.

- In several cases, "Light" and "Heavy" tables have been produced. These are graduations of subsets of the data where the benefit amount exceeds a specified amount (for the Light tables) or is lower than a specified amount (for the Heavy tables). These graduations are intended to indicate variability; pension amount is necessarily an inexact proxy for the determinants of mortality and these tables should not be used without due consideration of their appropriateness.
- In all cases the tables cover ages 16 to 120 (inclusive) however the data that has been graduated spans a much narrower age range, reflecting where there is credible data. This varies between the tables, for example the Normal Health tables are based on data from ages 60 to 95 whereas the Ill-health tables are based on data from age 35 to age 95. Outside these ages, there was too little data to derive graduations and arbitrary approaches have been adopted. Indeed at the older ages, there is little data even at a UK population level.

Graduated rates of q_x and μ_x are given. The age definition applicable to the rates is age exact.

The value of q_x applies, on average, to a life attaining age x around 1 September 2002 and gives the probability of death before attainment of age x+1 around 31 August 2003. The Committee considers it appropriate that all rates are deemed to relate to the year starting 1 September 2002.

The force of mortality, μ_x, applies approximately six months later than the rates of mortality, q_x, i.e. around 1 March 2003.

The Committee has published CMI Working Paper 34 – "Methodology and assumptions used for CMI Self-Administered Pension Schemes mortality experience analyses" alongside this Working Paper. This paper provides information about the methodology and assumptions underlying the results production process for individual and 'All Schemes' analyses, including data validation and results checking. Working Paper 34 also outlines the changes that have been made to the dataset used for the graduations since the draft graduations were produced.

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1. Introduction

In 2007 the CMI Self-Administered Pension Scheme (SAPS) Mortality Committee started work on the graduation of a new set of mortality tables, to be based on the SAPS 2000-2006 experience, based on data received by 30 June 2007. The members of the Committee during the graduation process, for all or part of the time, have been Brian Wilson (Chairman), Nigel Bodie, Andrew Gaches, Jonathan Lawlor, Richard Campbell, and Deborah Cooper. Valuable assistance has been given by John Ellam who had been a member of the CMI working party that had produced the "00" Series of tables.

Draft graduated tables were exposed to the UK Actuarial Profession in Working Paper 32. These were widely publicised, for example via the Profession's e-bulletins, and presentations on the draft tables have been given to a number of seminars, including sessional meetings of both the Institute of Actuaries and the Faculty of Actuaries. Working Paper 32 set out a series of questions on which feedback was requested.

The Committee would like to thank all respondents for the valuable comments made. Sections 2 and 3 of this Working Paper contain a summary of the feedback received together with the actions taken by the Committee as a result of the feedback.

The structure of the remainder of this paper is as follows:

- A summary of the dataset used in the final graduations is contained in section 4.
- Section 5 lists the final tables that have been produced.
- The methodology used to produce the graduations is described in section 6. The approaches at younger and older ages, where data volumes are limited, are also described.
- Summary statistics for each of the graduations are contained in section 7.
- The final graduated tables are described in section 8, with the mortality rates themselves contained in Appendix A.
- Appendix B contains comparative graphs between some of the graduated tables.
- Appendix C contains graphs comparing the graduated and crude values of μ_x, whilst annuity and expectation of life values are contained in Appendix D.
- Finally, Appendix E illustrates the impact of the change to the pension amount bands for the "Light" and "Heavy" tables between the draft graduations and these final graduations.

A separate paper (Working Paper 34) contains greater detail on technical issues that the Committee has considered and how the final dataset for use in the graduations was arrived at.

The tables have been approved by the Management Board for adoption by the Actuarial Profession. It should be noted that adoption implies that the Actuarial Profession is satisfied that the tables have been well-constructed and subjected to rigorous peer review, such that the Profession is happy for the tables to be published in its name. It does not carry any implication that the tables are appropriate as a standard for any particular purpose and **it is the responsibility of any actuary or other person using a base table to ensure that it is appropriate for the particular purpose to which it is put.**

The Committee draws particular attention to the arbitrary nature of the graduations at younger and older ages, where the data is very limited.

The tables will be included in the next release of the CMI Tables Program (STP). In due course a CMI Report containing the final “S1” Series tables may be published. At the present time no decision on this has been taken. If this Report is published it will take account of comments received, up to the time of drafting, should any further explanation or clarification be required, but there will be no changes to the graduated rates contained in this paper.

Comments and feedback on this Working Paper and the graduations should be sent to:

Simon Spencer, CMI, Cheapside House, 138 Cheapside, London, EC2V 6BW
Email: self-admin@cmib.org.uk

2. Feedback to Working Paper 32: Responses to specific questions

2.1 Introduction

Working Paper 32, containing the draft graduations, was published as a consultation document and contained a number of specific questions for feedback.

Sixteen responses were received from a variety of individuals and organisations, including many of the larger pension consultancies and some insurance companies.

In addition to the written responses that were received, the tables were also discussed at two Sessional Meetings, held by the Institute of Actuaries on 28 January 2008 and by the Faculty of Actuaries on 5 February 2008. At both meetings a "show of hands" was taken on some of the questions to gauge the views of the meetings as a whole. These are referred to under the relevant question below.

The Committee believes it can reasonably consider the feedback to be representative of the views of a wide spectrum of the UK Actuarial Profession.

The Committee has considered all the comments received, together with points made in discussion at the meetings, and whether – and how – these should be reflected in the final tables that are contained in this Working Paper.

Within this paper the Committee seeks to summarise points made in feedback and its reaction to these points. Many of the responses received (and points discussed at the meetings) covered the specific questions and these are considered below. We have also included in this section comments that were not made in response to a specific question, but where the Committee felt that the response addressed similar areas. Other items of feedback that did not easily relate to a specific question are considered in section 3.

We would like to express our thanks to all those individual actuaries and organisations who took the time to respond to Working Paper 32. We did not state in that Working Paper that we would publish a list of respondents, so we have not named them in this paper.

In this section and section 3 we have used quotations from responses to illustrate the views expressed. These are shown in italics to distinguish them from the views of the Committee. Note that in some cases we have slightly altered the exact words to try to ensure the context of the comments is clear, when separated from other parts of that response; we hope that as a result we have not distorted the views of respondents. Given the large volume of feedback received, we hope also that respondents will understand if all their individual points are not specifically addressed in this paper.

2.2 Table names

The naming convention was outlined in Working Paper 32 and the complete set of proposed table names was provided. Key points that were highlighted in the Working Paper were:

- Prefacing each table with "S" to differentiate the tables from those derived using life office mortality data.
- Referring to the year 2003 in the name of each table to reflect the "weighted average" year to which the data relates.
- Use of "Light" and "Heavy" as descriptors for the tables representing subsets of the population that have pension amounts in excess of a specified fixed amount and lower than a specified fixed amount (and exhibit lighter and heavier mortality), respectively.

Two specific questions requested feedback on the naming convention proposed in Working Paper 32: question 9 requested feedback on the names in general, whilst question 1 asked more specifically about the names for the "Light" and "Heavy" tables, with the Paper noting the possible confusion with a "Lives" table when "Light" was abbreviated to "L".

Q9: Feedback on the suggested table names

A number of responses commented that they were happy with the proposed approach and gave no further reasons. However there were two particular areas of the naming convention that did generate discussion.

Reference to "03" in the table names
The draft tables followed the naming convention of recent CMI insured mortality tables by referring to the central year of the data, in this case taken to be 2003.

A comment was made at the Institute meeting about the importance "*that, as well as being up to date, the mortality rates are seen to be up to date*" and suggested that referring to 2003 in the table names would give "*a misleading impression as to how up to date the rates are*". The speaker went on to suggest that it would be preferable to refer to the year of publication in the name, i.e. "08".

Given this public statement, this issue generated considerable debate. Several responses echoed the view that the tables should not be labelled "03", for example:

- "*In our experience the end users of these tables, pension scheme trustees and sponsors, wish to have confidence that the tables being adopted are the latest available.*"
- *avoid the presentational risk of the tables appearing out of date even when they are first issued…*"

Another comment that supported not referring to 2003 in the table names was "*Those who use the tables will, if they are competent, know to which dates the rates apply; it does not need to be in the name.*"

However, others felt it was important that the table names referred to the year to which the data relates:

- "*'03' should be retained as it is essential that actuaries know the central year of the dataset and hence from which year to use any level of improvement factor.*"
- "*We think it is important though that the naming convention makes it clear that the data relates to 2003 as this reminds users and consumers to consider what, if any, allowance for improvements since 2003 it would be appropriate to make.*"
- "*The format of the suggested table names is consistent with previous CMI graduations, and to that extent the names are appropriate.*"

The suggestion at the Institute meeting that the table names refer to "08" appeared to attract little support. One speaker at that meeting suggested it could be misleading for users in knowing which year to project forward from, particularly "*…all the other actuaries out there who have not had the benefit of this discussion.*"

A number of responses received also made comments to this effect:

- "*…under no circumstances should '08' be used simply because it is the year of publication: this is bound to backfire with someone somewhere assuming that the tables are current to 2008 and allowing for future mortality improvements only from there.*"

- "*…this approach would not be consistent with the naming of other CMI tables and so could create some confusion especially when considering the start date for allowing for future improvements.*"

A number of responses suggested that the tables should not refer to a year at all, but should use a generic name, such as "SAPS1", "SAPS2", etc or "S1", "S2", etc. The comments provided in support of this approach explained that it was preferable as it would avoid the issues arising from referring to the date to which the data applies or the date of publication, which are summarized above.

A comment made at the Faculty meeting quite helpfully summarised that the overall decision depends "*whether you name them to suit the actuaries or name them to suit the outside world*".

Committee's response
The Committee accepted the arguments that the use of "03" could be misconstrued by non-actuaries. Furthermore, although 2003 is the year of the mid-point of the graduations, the start of the weighted middle year falls in 2002 (see section 8 for more details).

However the Committee felt that to include the year of publication also held dangers. Consequently it decided not to include a reference to a year in the table names and instead label the first set of graduations as "SAPS Series 1", abbreviated to "S1" in the table names.

Dependants tables
The other aspect of the naming convention that generated debate was the approach used to name the widows' tables.

In particular, a couple of responses commented that the proposed table names for dependants (e.g. SWA03) were inconsistent with the other table names since there was no reference to gender. It was noted that this is not problematic for the current graduations as only female dependants were included, but this may not be the case in the future. It was suggested that the table names included a reference to gender, in the same way as for all the other proposed tables.

Another response raised the question whether the term "widows" should be referred to in the table names and suggested that perhaps "dependants" or "spouses" would be more appropriate.

Committee's response
The Committee decided to:

- Replace the "W" in the "Dependants" tables with a "D"; and
- Include a gender indicator in the "Dependants" tables.

These changes have the effect of increasing the consistency with the other table names.

Q1: Feedback on alternative names or abbreviations to use for Light and Heavy tables

Many responses agreed that the use of "Light" and "Heavy was appropriate. However, a number of these responses considered that there may be confusion with "Lives" tables if "Light" was abbreviated to "L". Several suggested abbreviations were provided that may prevent confusion:

"Lt" and "Hv"
"[L]" and "[H]" and appending to the end of the table name
"LR" and "HR", representing "Light Rates" and "Heavy Rates"
"Lo" and "Hi", representing "Low" and "High" rates

One response suggested re-positioning the "L" and "H" to after the "L" and "A" abbreviations for "Lives" and "Amounts", for consistency with other CMI tables; also suggesting that "C" should then also be used for the combined tables, based on all data.

A few responses suggested that "Top" and "Bottom" could be used as alternatives, reflecting the fact that the "*tables are derived from members with the largest and smallest pensions*". Another suggested that "Top" and "Bottom" may be more appropriate since "*The use of Light and Heavy applies a judgement to the data that those with higher pensions will have lighter mortality, whereas top and bottom are a factual statement about the data*".

Another response mentioned that it would be preferable for the names to refer to the level of the pension income in the table name so making "*clear that the tables relate to 'High pension income' and 'Low pension income'*" This respondent also commented that the CMI should remind users that "*the thresholds relate to amounts at a specific point in time*".

A number of responses commented that it would be preferable for the table names to be succinct, intuitive and unambiguous.

Committee's response
The Committee agreed that it was preferable that the table names were succinct and therefore would not need to be shortened by users. Although it does not consider the abbreviations of "Light" and "Heavy" to "L" and "H" to be ideal, the Committee decided to retain these in the absence of a clearly-preferable alternative. However to reduce the scope for confusion it has appended these labels to the end of the table name, following an underscore, e.g. S1PMA_L.

2.3 Graduation by pension amount

Graduations of the data split by amounts of pension were proposed in Working Paper 32. The paper explained that approximately 25% of the data with the highest pension amounts was aggregated to produce the "Light" graduations and the remaining 75% of the data was used for the "Heavy" graduations.

The possibility of basing the "Light" tables on the top 12.5% of pension amounts rather than the top 25% was raised and feedback was sought about this alternative:

Q2: Feedback is requested as to whether [the "Light" tables should be based on the top 12.5% of pension amounts] and a further round of consultation embarked on.

An informal vote at the Faculty meeting indicated that the majority of the audience was happy with the draft "Light" and "Heavy" graduations. However, the corresponding vote at the Institute meeting supported the proposal to revise the "Light" graduations and base them on the top 12.5% of pension amounts. The majority of written responses received also supported this proposal.

A number of respondents suggested that it would be useful if intermediate tables could also be provided to reflect the experience of the dataset with pension amounts between the "Light" and "Heavy" thresholds. However one response expressed the counter-argument that we "*…should have a limited number of tables which cover as wide a range as possible,….if you have a wider range you can always interpolate in some way.*"

Several responses commented that it was difficult for them to say whether the proposed alternative for the "Light" graduations was appropriate or not since it depends whether the alternative shows "*…a statistically significant material change in the shape of the curve rather than just shifting the table up or down…*"

Another response noted that these are not the only proportions that could be considered and that "*…it it also possible to graduate for the top 15%, the top 20%, etc…*". The suggestion that was made was for the groupings to be determined by the data and that groupings should be chosen "*that give mortality tables which are demonstrably different both in terms of statistically significant differences in the shape of the mortality curve, and financially significant in terms of giving rise to materially different annuity values.*"

One comment raised concerns that the sensitivity to pension amount may suggest heterogeneity in the underlying data. As a result of this it was suggested that caution should be exercised when considering graduating "*…an 'ultra light' version to reflect the experience of the lives with very high pension amounts.*"

Several respondents proposed that if the approach used for the "Light" graduations was amended it may also be useful to amend the approach for the "Heavy" graduations. The two suggestions that were made were that the "Heavy" graduations be based on:

- "*…the lowest pensions rather than the balance of those not included in the "Light" tables.*"
- "*…the bottom 12.5% of pension amounts.*"

General requests made regarding the "Light" and "Heavy" graduations were:

- That "*the experience for each of the individual pension bands and aggregate data are compared against the relevant "Light", "Heavy" and "All" graduated tables*".
- That "*an indication of how to interpolate between Light and Heavy for the five bands which the authors originally analysed*" be provided.
- "*It would be fraught with danger to simply apply without adjustment either the 'light' or 'heavy' tables to lives with pension amounts greater than or less than whatever the threshold number is. This is clear from Working Paper 9 where 'general industry' schemes and 'local authority' schemes have the same average pension amount but markedly different mortality characteristics and where 'cyclical services' and 'information technology' have markedly different average pension amounts but very similar mortality characteristics. The SAPS Committee should do what it can to warn against the potential pitfalls.*"

In addition, one respondent expressed concern "*…that the pension bands set at the start of the investigation period in calendar year 2000 may not be relevant to today's pensioner population. We would welcome the CMI's view on whether the thresholds should be indexed and how this might be done.*"

Finally, no response suggested that further consultation would be necessary if the Committee decided to change their approach in response to the feedback received.

Committee's response

The proposal to base the "Light" graduations on the top 12.5% of pension amounts was favoured overall so the Committee agreed that they would revise the "Light" graduations. The Committee also agreed that it would investigate alternative thresholds for the "Heavy" graduations since a reasonable number of responses suggested that this would be desirable.

The Committee investigated the experience of the individual pension bands and groupings of various individual pension bands. In particular, it compared each of the experiences to confirm which were significantly different. It concluded that the thresholds shown in Table 2.1 would be used. This table also shows the amount of exposure within each band, expressed as a percentage of the total exposure within that category.

Table 2.1 – Thresholds for light and heavy graduations in final tables and an indication of the volume of exposed to risk data within each band.

Pension amount band	**Pensioner Type**	**Males**			**Females**		
		Threshold (p.a.)	**% of relevant data**		**Threshold (p.a.)**	**% of relevant data**	
			Lives	**Amounts**		**Lives**	**Amounts**
Light	Pensioners	>£13,000	13%	43%	>£4,750	16%	49%
Light	Dependants	-	-	-	>£4,750	15%	49%
Heavy	Pensioners	<£1,500	20%	2%	<£750	25%	4%
Heavy	Dependants	-	-	-	<£1,500	46%	14%

For comparative purposes, the corresponding figures based on the thresholds in the draft tables in Working Paper 32 are shown in Table 2.2. Note that the volumes of data in both Table 2.1 and Table 2.2 relate to the dataset used in the final graduations presented in this paper.

Table 2.2 – Thresholds for light and heavy graduations in draft tables and an indication of the volume of exposed to risk data within each band.

Pension amount band	**Pensioner Type**	**Males**			**Females**		
		Threshold (p.a.)	**% of relevant data**		**Threshold (p.a.)**	**% of relevant data**	
			Lives	**Amounts**		**Lives**	**Amounts**
Light	Pensioners	>£8,500	25%	62%	>£3,000	30%	68%
Light	Dependants	-	-	-	>£3,000	28%	66%
Heavy	Pensioners	<£8,500	75%	38%	<£3,000	70%	32%
Heavy	Dependants	-	-	-	<£3,000	72%	34%

The new thresholds were chosen such that sufficient data was included in the dataset and so that the experience was significantly different from other groupings. A comparison of the mortality using the pension bands from the draft graduations with the revised pension bands is contained in Appendix E.

With regard to the comment on indexation, the Committee acknowledges this concern but feels that further refinements would represent spurious accuracy, given that the "Light" and "Heavy" graduations are intended to indicate variability and not expected to be used blindly. In particular pension amount is necessarily an inexact proxy for the underlying determinants of mortality. In this regard the Committee is happy to endorse the comments that these tables should not be used without due consideration of their appropriateness.

2.4 The range of tables

Working Paper 32 included 20 proposed graduations, significantly fewer tables than the 40 tables that had been considered in preliminary informal consultations. However, the paper commented that this may still be too many tables and suggested which tables might reasonably be dropped. Feedback was requested on whether certain tables were unnecessary:

Q3: Feedback on the retention of "Light" and "Heavy" graduations for both "All Pensioner" and "Normal Health Retirees" and, more generally, on which tables should be dropped if the number of proposed tables is thought to be too high.

Retention of "Light" and "Heavy" graduations for "All" and "Normal Health" pensioners
During the sessional meetings the audience were asked to raise their hand if they were in favour of retaining the "Light" and "Heavy" graduations for both "All" and "Normal Health" pensioners. The Institute meeting indicated that approximately half of the audience were in favour of this. The other half of the audience thought that it would be sufficient for "Light" and "Heavy" graduations to be provided for either "All" or "Normal Health" pensioners only. The Faculty meeting indicated a clear majority for retaining these graduations.

All the written responses on this topic favoured the retention of "Light" and "Heavy" tables for both subsets of data. The reasons given included:

- "*As the impact of ill-health could vary between different pension schemes, we believe it is essential that Light and Heavy graduations are produced for Normal Health Retirees so an explicit adjustment can be made to allow for Ill-health retirees if necessary.*"
- "*…we can envisage situations where actuaries will want to have light/heavy distinction for "All Pensioners", for example where the data is not segregated by health status.*"
- "*We believe the "Light" and "Heavy" variants of the tables provide significant value to the user and are likely to be used widely.*"

Range of proposed tables in general
During the sessional meetings the audience were asked to raise their hand if they thought that graduations should be provided for "Ill-health" pensioners. At both meetings the audience was strongly in favour of this.

At the Faculty meeting the audience were asked whether they thought the range of "Lives" graduations was sufficient. This indicated that the majority agreed the range was sufficient.

The written responses that mentioned the number of tables were in agreement that all the proposed tables should be retained. Quite a few responses felt strongly about this due to the variety of experience for different pension schemes:

- "*We do not consider that there are any big disadvantages in having a large choice of tables available. In many ways we think this would be advantageous, especially where the tables reflect populations with different characteristics.*"
- "*We particularly welcome the publication of a variety of tables. This concurs with our experience that different pension schemes can exhibit markedly different levels and patterns of mortality owing to the different characteristics of the membership.*"

A number of respondents mentioned specifically that the option to choose tables was desirable:

- "*…it is better to have the choice to not use a table than not to have the choice not to use it!*"
- "*A core competency of individual actuaries advising on longevity assumptions must be the ability to consider the range of possible tables available to the scheme and identify a subset of these tables which it would be appropriate to consider using, having taken into account the circumstances of the scheme and the data available. To have a broad range of published tables at their disposal can surely only be of benefit to such actuaries in this respect.*"

One response, however, mentioned a downside to having so much choice:

- "*Previously we had essentially one table to choose from so it was justifiable to use that standard table without adjustment (in the absence of any concrete knowledge). Now we have several tables – how does one choose between them?*"

A number of responses commented that it was important that tables were retained for all subsets of the data that showed significant differences in the experience:

- "*If tables have a different shape then we favour retaining the differently-shaped tables.*"
- "*We believe any tables which are demonstrably different… should be retained.*"
- "*We would encourage the CMI to retain any tables which exhibit significant differences in the mortality beyond those which can be accounted for via the use of a simple scaling factor.*"

One response mentioned that "*Given today's computer power we do not think that the number of tables proposed is too high.*"

A few responses requested additional tables:

- "Normal Health" pensioners on a "Lives" basis as well as "Amounts".
- Graduations of the five individual pension bands for males and four individual pension bands for females for "All" and "Normal Health" pensioners.
- Graduations of the bottom two pension bands combined and separate graduations of the top two pension bands for "Dependants".
- A male dependants table. This respondent commented "*…we understand that the data volumes in the SAPS investigation are sufficient for a table of widowers' mortality to be graduated or, as a minimum, confirmation of which other table the widower mortality is insignificantly different from.*"
- A "combined" table, which we interpreted to mean the data that is not split between "Normal Health" and "Ill-health".

There were a few suggestions about which tables could be dropped if the number of tables was considered too many:

- "*Given the similarity between the "Lives" and "Amounts" tables for "All" pensioners one of these could be dropped.*"
- "*We observe that the experience for female dependants appears very similar to that for all female pensioners. If there is a desire to reduce the number of graduations we think the "Dependants" graduations could be removed with little loss of value to the user.*"
- "*We would prefer that graduated tables for "All Pensioners" be provided for both "Light" and "Heavy" graduations as the vast majority of the data (especially for males) are covered by this group…. Therefore, if the Committee were minded to drop one of these tables we would suggest that the "Normal Health Retirees" split by "Heavy" and "Light" be dropped.*"

Committee's response

The Committee agreed that it would be better to give users the choice to select the tables they wish to use than to make the decision for them. This was supported by the responses received which indicated that there was sufficient support for retaining all the proposed tables. In particular, "Light" and "Heavy" graduations would be provided for both "Normal Health" and "All" pensioners.

The Committee did not feel that there was a sufficiently strong view that additional tables to those proposed should be graduated.

2.5 Extension of tables to younger ages

Due to sparse data for all of the pensioner types at younger ages, arbitrary extensions back to age 20 were proposed for all of the tables, with the exception of the "All" pensioner tables. Feedback was requested on a number of aspects about the extensions to younger ages; the Committee's responses to these questions are considered together at the end of this section.

Q4: The question of which graduations to continue down to a lower age of, say 20, is one on which the Committee would particularly value feedback.

The majority of responses expressed the desire for all the tables to be extended back to younger ages. A couple of those in favour recognised that there are "*technical difficulties in doing so*" but considered the benefits from doing so made it worthwhile.

The predominant reason given for extending all the tables back to younger ages was that it would ensure consistency in the rates used for the younger ages by different actuaries. A number of responses expressed concern that if extensions to younger ages were not provided then "*different actuaries may then extend the tables in different ways*". One respondent commented that "*users will construct their own arbitrary extensions and it would be helpful if there were standard (if still arbitrary) extensions.*"

In addition to the inconsistencies that may arise, one respondent commented on the possibility of "*communication issues when explaining what assumptions have been used in reports, correspondence etc*" and another suggested that tables that were not extended may be little used.

A few responses commented on the approaches used to extend back to younger ages:

- "*If tables are to continue below 50 then apart from the Ill-health tables, we would suggest merging in with standard assured lives tables if data is otherwise unreliable.*"
- "*Given that the normal health data may be contaminated with ill-health retirements at ages up to 65, we can see good grounds for graduating the Normal Health tables between ages 65 and 95 and then extending down to age 20 (or lower) on the assumption that lives below age 65 would also be in good health.*"
- Commenting on the approach used to blend the "Normal Health" pensioner graduations into the "00" Series assured lives values, one respondent expressed "*…slight unease at the proposal of using assured lives data [for pensions in deferment] but take some comfort from the value of benefits for deferred pensioners not being highly sensitive to the mortality assumption in deferment.*"
- "*I also think it is worth trying to get the extension to young and old ages by adjusting the parameters, so as to keep one formula throughout…*"

A few responses were of the view that not all tables should be extended back to younger ages, some of the reasons for this include:

- "*The mortality rates below age 50 are of very little economic significance to us and we would not want to see the rates at higher ages… distorted unnecessarily to fit the crude rates at younger ages.*"
- "*…the difficulties highlighted by the CMI with extending the all pensioner tables below age 50…*"
- "*…it is inappropriate to arbitrarily continue the Normal Health pensioner table down below age 50. In particular if this table is being applied to ages below 50 then by definition those individuals will not be normal health retirees.*"

Although all responses agreed that the "Dependants" graduations should be extended back to younger ages, there were inconsistencies as to which other graduations should be extended:

- "Ill-health" pensioner graduations – most responses requested that these be extended.
- "Normal Health" pensioner graduations – one response, quoted above, considered it inappropriate to extend these graduations.
- "All" pensioner graduations – this will be covered in detail in question 5.

Finally, one response mentioned the importance of drawing attention to the fact that where tables have been extended to younger ages the "*…values so obtained are either based on limited scheme data (widows and ill-health retirements) or indeed not based on scheme data at all (normal retirements).*"

Q5: The Committee would value feedback on whether the "All Pensioner" table should stop at a lowest age of 50

For this question the responses were split but with a slight majority in favour of the "All" pensioner table being extended back to younger ages. One of the reasons given by a number of respondents to support this view is consistency, as for question 4.

Another reason given in a couple of responses was that in cases where it is not possible to differentiate between "Ill-health" and "Normal Health" pensioners it would be preferable to use a single table and the "All" pensioner table would be likely to be used. On this basis "*there would be no good grounds for stopping the All Pensioner table at age 50. Rather it should be extended to age 20 (or lower).*"

Arguments against the extension that were provided in some responses included:

- "*There are other choices if practitioners need rates for younger lives.*"
- "*…no clearly appropriate methods for extending the tables down below age 50 appear to have been identified.*"

Working Paper 32 discussed the possibility of blending the "Ill-health" and "All" pensioner graduations, which would result in a discontinuity at some age, to provide a single table that could be applied to pensioners of any age. A couple of responses commented unfavourably on this approach:

- "*We would prefer the table produced to reflect the observed data between ages 50 and 60 and to be smooth at age 50….rather than producing a table with a discontinuity.*"
- "*Although in theory the mortality rates for the "All Pensioner" group would move towards the "Ill-health Retirees" below age 50, in practice extending this table using this approach would not be helpful if users also wished to use this table for pre-retirement mortality rates in deferment. As referred to within the Working Paper, there would also be the problem of the lack of continuity at this age of using this approach.*"

Q6: For tables that are extended downwards, would a starting age of 16 or 17 be preferable to 20?

Approximately half of the responses indicated that they had no strong views, with a couple highlighting that "*…it is of no financial significance either way.*"

The other half that expressed a view were in favour of a starting age below 20. Comments made supporting this view include:

- "*…consistency across all tables including life office tables and over time is paramount.*"

- "*If the table is to be extended downwards beyond the extent of the available data then it is important that it is extended down to the youngest age for which that table might be needed.*"
- "*Although they would rarely be required it may occasionally prove useful.*"

Q8: The Committee would value feedback as to whether the rates chosen for younger ages are the most suitable.

Many of the responses received noted that the approach adopted was arbitrary and subjective but agreed that they seemed reasonable.

Other responses did not strongly disagree with the approaches used but suggested possible amendments that could be made:

- "*It would be expected that mortality of normal health lives would be at around the same level as that of assured lives on the "00" series, with some allowance for mortality improvement between 2000 and 2003.*"
- "*…it could be possible (and clearer) to interpolate between the smoker and non-smoker tables, as the combined table is already a combination of those two tables.*"
- "*For ill-health extensions, there is an argument that the mortality curve should be U-shaped on the basis that ill-health retirements at the very youngest ages will be linked to high levels of excess mortality.*"
- "*The approaches adopted for normal health pensioners and widows should be consistent – this does not appear to be the case at the moment.*"
- "*There is evidence of an accident hump around age 20 but this is not incorporated into the graduations.*"

One respondent commented that the approach used to blend the "Dependants" graduation into assured lives tables was inappropriate as it did not take account of the pensioner type. The suggestion was made that the CMI "*makes use of the DH data available on the ONS website. Mortality statistics for the general population and for widows are shown separately.*"

Committee's response
The Committee considered the overall approach for extending to younger ages, which responds to questions 4, 5, 6 and 8 together. The Committee agreed that there was sufficient support to extend all graduations back to younger ages and lowered the starting age to 16 in all cases.

The approach used by the Committee for the final graduations is described in section 6.

2.6 **Old age mortality rates**
The lack of credible data at the oldest ages required an arbitrary approach to calculating mortality rates for the oldest ages. Working Paper 32 explained that the proposed approach involved "blending" the graduated formulae into arbitrary upper limits at age 105. The rates for ages 105-120 would be fixed at these arbitrary limits and μ_{121} would be set equal to 999. Feedback was requested about the proposed approach:

Q7: The Committee would value feedback on the proposal for older ages.

An informal vote at the Institute meeting showed that people were happy with the general approach that fixed the rates for ages 105 to 120 although one speaker felt "…*they are a bit too low*" and that "…*one would want more evidence before saying that these rates are right.*"

Most of the written responses were also happy with the approach. The remaining responses outlined the aspects of the approach that they were not happy with or thought could be improved:

- "*…evidence suggests that mortality generally increases with age and this should be allowed for in the graduated tables.*"
- "*Using a flat hazard function is not consistent with the conclusions of most research papers into this area, which suggest a concave shape.*"
- "*We would question the appropriateness of having a step discontinuity at age 120 within the tables by forcing q_{120}=1 (to 6 d.p.) – especially given the evidence that it is possible to live beyond 120… users may want to apply a constraint that q_x=1 at some age x, but we believe that the choice should be left to individual actuaries to make (and to disclose when sharing assumptions).*"

A couple of comments requested further information about the approach that was used:

- "*an explanation of how the limiting values for q_x were derived from the ONS publication cited in the Working Paper would be useful before reaching a final view, together with a comment on the credibility of the analysis, taking into account data volumes and the "experimental" status attached to the data set by the ONS.*"
- "*greater insight in to the "curve" parameter used in the formula – in particular why has a different value been used compared to the 00 Series and why it is felt that 1.2 is better than (say) 1.1?*"

Committee's response
In the light of comments received, the Committee decided to reappraise the methodology to be used to extend the graduated rates to older ages. In particular, it was decided that rates should not be flat above an arbitrary age but should increase throughout.

The revised methodology for older ages is documented in section 6.

3. Feedback to Working Paper 32: General comments

As noted in the introductory comments to section 2, in this section we review comments made that did not relate particularly closely to any of the specific questions we posed in Working Paper 32. A considerable volume of responses were received, a number of them lengthy, and this section does not aim to capture all the points raised. In order to make this section clearer we have tried to group the comments into various ‘themes’.

3.1 The mortality rates

Few comments were received on the graduated mortality rates themselves, however one response expressed surprise at the level of the rates in comparison with the (population) interim life tables for 2002-4. In addition, the CMI received an e-mail enquiry from an actuary who had been unable to reconcile the graduated values of q_x with crude death rates calculated from information in Working Paper 31.

These two comments alerted us to a discrepancy in the age definition between the data and the graduations software that resulted in the draft tables overstating mortality rates by half-a-year.

An additional response highlighted that the age definition had not been specified in Working Paper 32.

The overstatement of the mortality rates was highlighted in the “Preliminary response to consultation on the draft graduations of SAPS mortality experience” released in March 2008 and widely-publicised via an e-bulletin from the Actuarial Profession and other means. It probably goes without saying that this has been corrected in the final graduations. The Committee can also confirm that the rates are “age exact”. See section 8 for further detail.

3.2 Development of the graduated rates

One respondent commented on the subjective adjustments implicit within the graduations: “*In producing these graduations the CMI appears to have made a number of subjective judgements and decisions as to which anomalies should be avoided within the tables. In general we would prefer to keep the subjective judgements to a minimum – indeed where a lot of subjectivity is required it may suggest that there is a more fundamental problem present such as the assumptions underlying the graduation approach not holding, the parametric form of the mortality curve being inappropriate, or inherent data issues. In particular we are heartened by the comment on page 13 of WP32 that an anomaly between normal health and ill-health curves is a ‘feature of the graduation rather than a feature of the data’. Can the same be said for the anomalies identifies on page 14?*

We are particularly concerned that some of the anomalies of apparently heavier normal health mortality than all pensioner mortality appear to start at ages where the adjustments may be financially material – i.e. the early to mid 70s. We appreciate that the approach adopted is a pragmatic compromise but would offer the following observations. If the anomaly is a statistically significant feature of the data then we do not believe it is appropriate to remove the anomaly – instead it is suggestive that the combined pensioner data included in the all pensioner graduation (but not the Normal Health or Ill-health graduations) has characteristics of longer longevity than the data underlying the Normal Health graduations. In contrast, if the anomaly is not a statistically significant feature of the data then we suggest that it is more appropriate to remove it. However we would draw the CMI’s attention to the fact that the rectification retains a (subtler) inconsistency in that:

- *All pensioner mortality is a combination of normal health and ill-health retirees mortality*

- *Normal health mortality is lighter than ill-health mortality*
- *Consequently all pensioner mortality must be heavier than normal health mortality*
- *But all pensioner mortality is equal to normal health mortality (by virtue of the rectification)*

We would also suggest that WP32 could be enhanced by including the full list of anomalies tested for."

The Committee acknowledges the subjective nature of some elements of the work to produce the draft graduations and believes that the significant issues were signalled within Working Paper 32 and the presentations on the draft graduations and has provided similar detail within this paper. On the more fundamental issue of whether or not anomalies should be retained within the graduations, the Committee has reviewed its position and has not constrained the graduations where perceived 'anomalies' are in fact features of the underlying data. In particular the final graduations do show 'all pensioner' mortality at a lower level than that of the 'Normal Health pensioner' population at certain ages. Statistical analysis[1] has shown that the 'combined' dataset, where it has not been possible to differentiate between Normal Health and Ill-health pensioners, is distinct from the dataset formed by adding the Normal Health pensioner and Ill-health pensioner datasets and so there is no reason to think that the 'combined' mortality rates should lie between the 'Normal health' and 'Ill-health' mortality rates. On the other hand, revisiting the Ill-health graduations on the amended dataset has shown that the underlying data now supports Ill-health pensioner graduations as being consistently higher than that of any of the other datasets graduated.

The same respondent also commented on data quality, noting that Working Paper 32 acknowledges "*…that much of the data for normal health retirees below age 50 'has clearly been misclassified' and makes the assumption that the data for ages 50-plus are 'similarly contaminated.*" They go on to suggest "*It is an unsubstantiated leap of faith, however, to assume that the misclassification is at the same absolute level at all ages (and therefore that the distortion will become insignificant at higher ages). It is plausible that some schemes within the SAPS investigation have a systematic issue with data quality and distortions from poor data quality could be significant at any or all ages. We would encourage the CMI to publish details of their data validation and cleansing processes.*"

Greater detail on data validation has been provided in Working Paper 34; including the additional checks that have been undertaken since the draft graduations were released. The Committee feels it has taken reasonable steps to investigate and rectify the data issues that have been identified but does not claim these are by any means complete and remains reliant on data providers' best endeavours in this area. Additional checks are now in place for future data submissions and the Committee anticipates that further refinements will occur over time.

3.3 The graduation model

Working Paper 32 provided some detail on the model used to produce the draft graduations, but one respondent requested "*… a brief summary of the key aspects of the actual approach adopted (akin to that on page 8 of Working Paper 12).*" More detail is provided in section 6 of this paper regarding the model used for the final graduations. The Committee accepts that this detail might have been helpful to some actuaries to appraise the draft graduations but does not consider this materially distorted the consultation process.

[1] The statistical tests used were a signs test (38 positive and 3 negative) and a chi squared test with probability 2.76E-59 that the two distributions are from the same population.

There were a limited number of comments on the methodology underlying the draft graduations:

- "*We wonder whether the substantial adjustments to the resultant tables to allow for potential anomalies is an indication that the underlying assumption that the mortality follows a GM(r,s) curve could be improved upon? We would encourage the CMI to consider other parametric and non-parametric approaches to see if this reduces the need for subjective adjustments.*"
- "*Given that SAPS data is collected at the member level did the Committee consider analysing the data using any survival analysis methodologies eg: the Cox model? Such methodologies might reduce the number of graduated tables produced – perhaps producing only one graduated base table and an accompanying model where mortality for other combinations of retirement/pension amount etc would be calculated relative to the base table? This might also allow pension amounts to be modelled continuously and allow industry classification to be included relatively easily.*"
- One speaker at the Institute meeting noted that "*The tables are difficult to replicate from the formula, as different parts have been spliced together; I think it should be possible to do it trying to fit a single formula all the way through.*"

Committee's response
The Committee considers that in the region of the data, the graduations are a reasonable reflection of the underlying data. Whilst it may indeed be the case that the fitted GM(r,s) curves could be improved upon, it was also keen not to unduly delay production of the graduations for possibly marginal improvements.

The Committee discussed the possibility of using Cox Proportional Hazards methodology but agreed that the GM(r,s) approach had been used for several reasons, including:

- Speed of producing graduations, as this is a "tried and tested" approach within the CMI.
- Consistency with previous graduation work produced by the CMI, including their acceptance by actuaries.

The Committee intends investigating alternative approaches for future graduations.

3.4 **Further work**
In Working Paper 31 and in the presentations to the sessional meetings, the Committee highlighted two areas of proposed further work to be pursued after finalising the graduations: recent mortality improvements and analysis by industry sector.

There appeared to be acceptance that the draft tables did not include any allowance for future improvements; one speaker at the Institute meeting noting: "*It is quite clear from the data which has been put out that thus far we do not have enough data over a consistent time period to enable us to look at the improvements which have been experienced.*" However another commented that the absence of projections should have been more explicitly acknowledged, saying that "*…when it comes to releasing a paper like this we have to at least nod towards future mortality improvements at the same time as we talk about the specifics of the current experience.*"

Whilst the Committee highlighted that industry analyses was an area of future work, there were several responses that suggested that such analysis was needed in order to inform actuaries' selection of the appropriate graduated table for any particular scheme. Indeed one respondent suggested that "*It would be helpful to have a better idea of the makeup of the schemes that were used in the investigation to understand how relevant the analysis is to any one particular scheme*". Whilst the Committee understands this desire it has limited information currently available in this regard, but will consider whether it can seek further information to enhance future analyses.

One speaker at the Institute meeting expressed some disappointment "… *that postcode data are not yet sufficiently widely available to permit investigations into the relative effectiveness of postcode and pension amount as proxies for lifestyle…*" Given that postcode has only been requested in SAPS submissions since 2007 and that this does not always appear to be readily available to Scheme Actuaries to include in submissions, further analysis in this area is not planned in the foreseeable future.

3.5 **Access to data**

Two respondents requested that the CMI make the underlying data available, one specifically suggesting this should be at no cost. Neither organisation contributes financial support to the CMI, so the Committee did not spend significant time considering these requests! More seriously, whilst the CMI is obviously keen to encourage further research into mortality it also has a responsibility to the data contributors – and ultimately to the data owners (trustees of pension schemes) – to use data in accordance with the understanding on which data have been made available to the CMI. Hence it is not clear that the CMI can make the data available.

4. Underlying data

The total data that has been considered for graduation purposes is summarised in Table 4.1, split by calendar year.

Table 4.1: Summary of graduation data

	Males Lives	Males Amounts (£'000)	Average Amounts (Males) (£ pa)	Females Lives	Females Amounts (£'000)	Average Amounts (Females) (£ pa)
Exposure						
2000	498,563	3,143,808	6,306	355,594	941,111	2,647
2001	939,105	5,631,086	5,996	762,130	1,935,044	2,539
2002	1,233,868	7,533,716	6,106	996,879	2,630,089	2,638
2003	1,162,484	6,947,120	5,976	967,056	2,575,933	2,664
2004	922,742	5,889,906	6,383	690,291	1,922,226	2,785
2005	644,966	4,900,899	7,599	465,201	1,440,473	3,096
2006	150,651	1,201,177	7,973	114,845	348,330	3,033
All	5,552,379	35,247,713	6,348	4,351,996	11,793,207	2,710
Deaths						
2000	18,606	80,757	4,340	12,808	28,527	2,227
2001	35,658	151,625	4,252	26,341	57,462	2,181
2002	48,829	208,993	4,280	36,519	84,295	2,308
2003	47,131	188,865	4,007	35,539	79,641	2,241
2004	37,418	157,360	4,205	26,034	61,683	2,369
2005	23,622	125,371	5,307	17,340	46,315	2,671
2006	5,245	28,869	5,504	3,971	10,144	2,554
All	216,509	941,840	4,350	158,552	368,066	2,321

The changes from the dataset underlying the draft graduations (and described in Working Papers 31 and 32) to the dataset used for the final graduations (described in this Working Paper) arise from additional data testing, revised assumptions and the move from initial exposed to risk to central exposed to risk. These changes are described in Working Paper 34, which also includes an illustration of the effect of the changes in Appendix C. The overall reduction in exposure and deaths arising from these changes is shown below in Table 4.2.

Table 4.2: Summary of changes in data from Working Paper 32

Data included in Working Paper 32 now omitted	Males Lives	Males Amounts (£'000)	Females Lives	Females Amounts (£'000)
Exposure				
2000	7,591	46,861	5,463	16,984
2001	17,887	112,651	15,011	49,007
2002	33,351	190,465	26,314	76,462
2003	34,576	169,614	24,640	62,762
2004	40,949	192,532	33,013	77,813
2005	20,754	96,173	15,587	34,893
2006	5,656	22,413	5,857	11,666
All	160,764	830,708	125,885	329,586
Deaths				
2000	14	–203	9	–174
2001	283	757	206	219
2002	1,223	4,684	1,260	2,485
2003	797	2,836	332	435
2004	1,065	4,394	743	1,290
2005	776	2,416	508	688
2006	225	946	178	264
All	4,383	15,830	3,236	5,208

Pensioner data submitted is labelled as either (a) "Normal Health", (b) "Ill-health" or (c) "Combined" where the data cannot be distinguished between Normal Health and Ill-health pensioners.

Most schemes distinguish pensioners from dependants, but where this is not possible the record is submitted as "Unknown". As the Committee has split pensioners from dependants for graduation purposes, the data shown as "Unknown" have not been used in the graduation process.

The split by type of data is shown in Tables 4.3 and 4.4.

Table 4.3: Split of data by type (Males)

		Number or amount of exposure	Number or amount of deaths
Lives	**Normal Health**	2,036,417	81,031
	Ill-health	346,125	11,927
	Combined	2,617,345	101,067
	Dependant	100,484	4,426
	Unknown	452,008	18,058
	All	5,552,379	216,509
	All less unknown	5,100,371	198,451
Amounts (£'000)	**Normal Health**	14,140,267	391,069
	Ill-health	1,819,938	52,014
	Combined	16,855,114	420,983
	Dependant	172,011	6,587
	Unknown	2,260,382	71,188
	All	35,247,713	941,840
	All less unknown	32,987,331	870,653

Table 4.4: Split of data by type (Females)

		Number or amount of exposure	Number or amount of deaths
Lives	**Normal Health**	947,705	25,165
	Ill-health	207,533	3,957
	Combined	1,209,529	32,176
	Dependant	1,672,940	83,619
	Unknown	314,289	13,635
	All	4,351,996	158,552
	All less unknown	4,037,707	144,917
Amounts (£'000)	**Normal Health**	2,565,716	59,172
	Ill-health	644,429	10,831
	Combined	3,209,904	70,183
	Dependant	4,697,266	203,617
	Unknown	675,891	24,264
	All	11,793,207	368,066
	All less unknown	11,117,315	343,803

The data used for the Light and Heavy tables is shown in Tables 4.5 and 4.6 below. Note that the Lives data are shown for information as only the Amounts data have been graduated for the Light and Heavy tables.

Table 4.5: Summary of data used in the Light tables

		Sex	**Pension amount**	**Number or amount of exposure**	**Number or amount of deaths**
Lives	All pensioners (excluding dependants)	Females	Over £4,750 pa	377,522	7,541
	All pensioners (excluding dependants)	Males	Over £13,000 pa	637,214	11,578
	Dependants	Females	Over £4,750 pa	252,509	9,775
	Normal Health pensioners	Females	Over £4,750 pa	153,979	3,242
	Normal Health pensioners	Males	Over £13,000 pa	294,122	5,423
Amounts (£'000)	All pensioners (excluding dependants)	Females	Over £4,750 pa	3,160,946	59,128
	All pensioners (excluding dependants)	Males	Over £13,000 pa	14,131,305	245,921
	Dependants	Females	Over £4,750 pa	2,315,869	88,650
	Normal Health pensioners	Females	Over £4,750 pa	1,228,390	24,134
	Normal Health pensioners	Males	Over £13,000 pa	6,084,338	109,989

Table 4.6: Summary of data used in the Heavy tables

		Sex	**Pension amount**	**Number or amount of exposure**	**Number or amount of deaths**
Lives	All pensioners (excluding dependants)	Females	Under £750 pa	582,840	17,634
	All pensioners (excluding dependants)	Males	Under £1,500 pa	997,258	57,917
	Dependants	Females	Under £1,500 pa	761,636	43,262
	Normal Health pensioners	Females	Under £750 pa	221,788	6,416
	Normal Health pensioners	Males	Under £1,500 pa	340,798	19,356
Amounts (£'000)	All pensioners (excluding dependants)	Females	Under £750 pa	248,618	7,287
	All pensioners (excluding dependants)	Males	Under £1,500 pa	796,342	44,395
	Dependants	Females	Under £1,500 pa	635,301	35,730
	Normal Health pensioners	Females	Under £750 pa	94,956	2,822
	Normal Health pensioners	Males	Under £1,500 pa	284,172	16,176

5. Tables produced

The 20 tables proposed in Working Paper 32 have been retained for the final graduations. However the table names have been amended in accordance with the feedback summarised in section 2 of this paper. The final tables are as follows:

Table Name	Data Type	Sex	Amounts/Lives	Light/Heavy
S1PFL	All pensioners (excluding dependants)	Female	Lives	-
S1PFA	All pensioners (excluding dependants)	Female	Amounts	-
S1PFA_L	All pensioners (excluding dependants)	Female	Amounts	Light
S1PFA_H	All pensioners (excluding dependants)	Female	Amounts	Heavy
S1PML	All pensioners (excluding dependants)	Male	Lives	-
S1PMA	All pensioners (excluding dependants)	Male	Amounts	-
S1PMA_L	All pensioners (excluding dependants)	Male	Amounts	Light
S1PMA_H	All pensioners (excluding dependants)	Male	Amounts	Heavy
S1DFL	Dependants	Female	Lives	-
S1DFA	Dependants	Female	Amounts	-
S1DFA_L	Dependants	Female	Amounts	Light
S1DFA_H	Dependants	Female	Amounts	Heavy
S1NFA	Normal Health pensioners	Female	Amounts	-
S1NFA_L	Normal Health pensioners	Female	Amounts	Light
S1NFA_H	Normal Health pensioners	Female	Amounts	Heavy
S1NMA	Normal Health pensioners	Male	Amounts	-
S1NMA_L	Normal Health pensioners	Male	Amounts	Light
S1NMA_H	Normal Health pensioners	Male	Amounts	Heavy
S1IFA	Ill-health pensioners	Female	Amounts	-
S1IMA	Ill-health pensioners	Male	Amounts	-

6. Overview of graduation methodology

The Committee retained the same methodology as was used for the draft graduations in Working Paper 32, namely the methodology developed by Forfar, McCutcheon and Wilkie (1988). This involves fitting a formula of the μ_x = GM(r,s) class; for example, the GM(2,3) formula is parameterised as:

$$a_1 + a_2 t + \exp\{b_1 + b_2 t + b_3(2t^2 - 1)\}$$

where t = $(x - 70)/50$. The first two terms of this formula can be described as the "r" part, with two terms, and the exponential can be described as the "s" part, with three terms inside the parentheses.

Values of q_x are then calculated as:

$$q_x = 1 - e^{-\int_0^1 \mu_{x+t}\,dt}$$

The integral has been estimated using the method of approximation adopted for the "00" Series:

$$\int_0^1 \mu_{x+t}\,dt \approx [7\mu_x + 32\mu_{x+1/4} + 12\mu_{x+1/2} + 32\mu_{x+3/4} + 7\mu_{x+1}] / 90.$$

Whilst the methodology was retained, the data on which the tables have been based has been changed from initial exposed to risk to central exposed to risk, as described in Working Paper 34.

For each table, the graduation was performed over an age range that was considered to be sufficiently large for reliable results to be calculated. Extensions to higher and lower ages were then considered separately. The age ranges chosen for final graduations were:

- All pensioners (excluding dependants) – 55 to 95
- Dependants – 45 to 95
- Normal Health pensioners – 60 to 95
- Ill-health pensioners – 35 to 95

Appendix C illustrates how these graduations compare with the data, with graphs of the crude values and the fitted values of μ_x. The graphs also illustrate the 2.5% and the 97.5% confidence limited (the "low gate" and the "high gate") of the crude values of μ_x.

Old age mortality rates

The Committee has no credible data at the oldest ages, and so whatever mortality rates are published will necessarily be subjective. We have therefore decided to extend the tables from the graduated values at age 95 to an upper limit at age 120 in a manner which we believe will provide a sensible and consistent end to the tables.

As noted in the feedback section of this paper, the Committee decided to publish rates that increase continuously up to age 120. Based on recent experimental work published by ONS (2008) on population data in England and Wales, it is possible to obtain approximate values of m_x from ages 91 to 104. The Committee, following the work of Thatcher, Kannisto and Vaupel (1998), extrapolated these data to age 120 using a logistic fit (see Thatcher et al for details).

Charts 6.1 and 6.2 illustrate this for males and females, respectively. In each case, the actual crude values of m_x are shown for 2003, together with the logistic fits based on 2003-2007 data and 2003 data only. The logistic fits have been extended to older ages and, for both males and females, the extrapolated value of m_{120} is around 1.0. The Committee has, therefore adopted values of μ_{120} of 1.000000 and μ_{121} of 999 so that q_{120} has a value of 1.000000.

Chart 6.1: Male England & Wales population mortality rates for calendar year 2003 (m_x) with extrapolation to age 121 and trend of average values of m_x for years 2003 to 2007

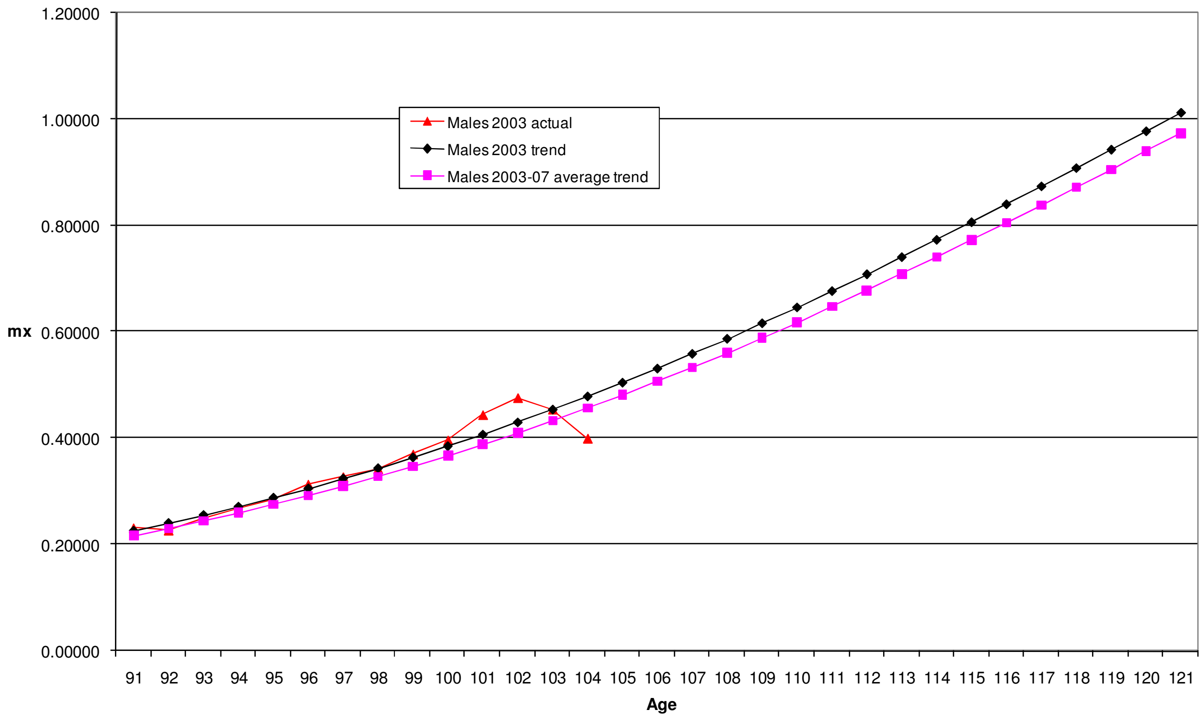
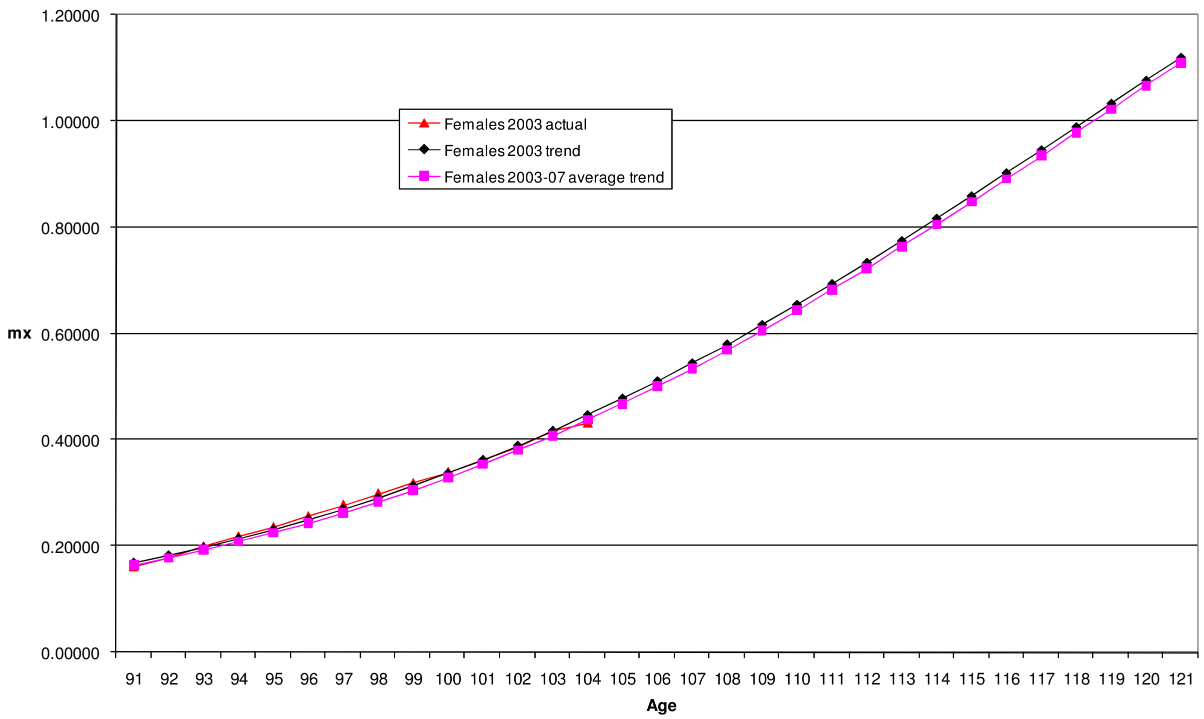


Chart 6.2: Female England & Wales population mortality rates for calendar year 2003 (m_x) with extrapolation to age 121 and trend of average values of m_x for years 2003 to 2007



Extending the graduated tables from age 95 to 120 has been carried out using cubic splines such that the following four criteria are met:

- The value of μ_x is continuous at age 95
- The first differential of μ_x is continuous at age 95
- μ_x is constrained to meet a fixed value of 1.0 at age 120
- The gradient of the curve of μ_x is 1 at age 120.

The fourth criterion is very arbitrary, but the graphs it produces look acceptable.

The formula used was:

$$\mu_x = r + st + ut^2 + vt^3$$

The values of r, s, u and v for each graduation are given in section 7 and t = (x – 70)/50 as above.

This approach is arbitrary but as there is limited data it was felt that it was as good as any other approach. **Users of the tables at higher ages should be aware of how they have been constructed and should only use them when it is deemed appropriate by the user to do so.**

Extension of tables to younger ages

As described in the feedback section of this paper, all tables have been extended downwards to age 16.

For the "Ill-health" graduations, the best-fit curve to the region of the data was used to extend the graduation back to age 16.

For the remaining graduations, the Committee used a GM(1,3) curve that was fitted using the following four criteria:

- The value of μ_x is continuous at the point of joining the graduated curve.
- The first differential of μ_x is continuous at the point of joining the graduated curve.
- It is constrained to meet a fixed value of μ_x at age 16. The fixed values of μ at age 16 were derived from extending back to age 16 the AMN00 ultimate and AFN00 ultimate tables based on the formulae given in Working Paper 21 and are equal to 0.000174 for females and 0.000360 for males.
- In the GM(r,s) formula, the "r" parameter was set at the maximum value (with some rounding) that permitted a solution to be found for the other three parameters and at the same time the values of μ for Light, All and Heavy curves at all ages were such that Light<All<Heavy. This methodology produced values of μ that tended towards the rates for the AMN00/AFN00 rates at the fastest rate whilst maintaining the Light<All<Heavy criterion.

This approach is arbitrary but as there is no sensible data it was felt that it was as good as any other approach. **Users of the tables at lower ages should be aware of how they have been constructed and should only use them when it is deemed appropriate by the user to do so.**

Anomalies

Within the draft tables, some of the graduated rates were amended to remove various anomalies (as described on page 14 of Working Paper 32). The construction of the final tables has been carried out in such a way that there are no anomalies between Light/All/Heavy tables.

The other perceived anomalies in the draft graduations were where graduated values for the "Normal Health" tables were above the corresponding graduated values for the "all pensioner" tables. The Committee has re-examined the data underlying these two tables and has concluded that the differences in the graduations were arising from real differences in the data. In particular, at higher ages the "Normal Health pensioner" populations are experiencing heavier mortality than the "all pensioner (excluding dependants)" populations for both males and females. This could come about for a variety of reasons. One put forward is that the schemes that have been able to differentiate Normal Health pensioners from Ill-health pensioners come from a different "constituency" than schemes that have not been able to supply that split of data. For this reason the Committee felt that it did not want to impose restrictions on the graduations that represent real differences in the underlying data and so these "anomalies" (if that is what they are) have been retained in the graduations.

Also, for ages from the low 90s to 95 the graduated ill-health rates are lower than the rates under some other tables. This is a feature of the underlying data and has been retained in the graduations. In such cases the extensions of the rates to age 120 are also lower.

As a consequence, the final tables are not subject to any constraints and may be reproduced from the parameters set out in section 7.

7. Key statistics

Tables 7.1 to 7.6 set out the key statistics for each of the 20 tables.

For amounts graduations the amounts data was divided by a factor that enables some statistical analysis to be carried out. The divisor used was the average amount for deaths over the fitted ages, as shown in the following tables. However, it should be borne in mind that that the test results for amounts graduations should be viewed as only approximate for this reason and that the serial correlation tests and the chi squared tests are very unreliable.

Table 7.1: Graduations of the Female all pensioner (excl. dependants) experience: key statistics.

Table Name	S1PFL	S1PFA	S1PFA_L	S1PFA_H
Sex	Females	Females	Females	Females
Category	All	All	Light	Heavy
Lives / Amounts	Lives	Amounts	Amounts	Amounts
For ages 55 and over				
GM formula	GM(1,4)	GM(1,4)	GM(1,3)	GM(1,4)
Age range fitted	55-95	55-95	55-95	55-95
Optimised parameters:				
$100\times a_1$	0.515545	0.472908	0.388874	0.512134
T-ratio	25.72	26.58	10.30	9.79
$100\times a_2$				
T-ratio				
b_1	–9.580391	–8.727623	–6.324650	–8.676824
T-ratio	–13.48	–12.57	–12.68	–6.16
b_2	15.585882	13.526032	8.133526	13.780615
T-ratio	9.63	8.57	15.78	4.33
b_3	–4.849745	–3.888949	–1.437076	–4.050432
T-ratio	–7.07	–5.80	–3.33	–2.99
b_4	2.045379	1.450511		1.622786
T-ratio	4.67	3.40		1.91
b_5				
T-ratio				
–Log likelihood	241770.7306	247669.1707	30092.4002	69101.1137
Sign test: +/–	21 / 20	21 / 20	19 / 22	20 / 21
Sign test: p(pos)	0.500000	0.500000	0.377614	0.500000
Runs test: p(runs)	0.500000	0.373166	0.361393	0.263627
K-S test: $p(KS)$	1.000000	1.000000	1.000000	1.000000
Serial correlation test:				
T-ratio 1	0.73	0.35	–0.96	–0.39
T-ratio 2	–2.25	–1.30	–0.67	–1.30
T-ratio 3	–1.55	–2.15	–2.52	–0.90
χ^2 test:				
χ^2	40.70	78.92	38.48	64.14
Degrees of freedom	36	36	37	36
$p(\chi^2)$	0.271054	0.000048	0.402589	0.002677
Divisor for amounts graduation	N/A	2246.45	7772.31	413.85
For ages below 55:				
GM formula	GM(1,3)	GM(1,3)	GM(1,3)	GM(1,3)
Fitted parameters:				
$100\times a_1$	0.015000	0.015000	0.015000	0.015000
b_1	–9.856399	–9.749250	–9.236578	–9.619435
b_2	–4.264226	–4.004584	–3.020259	–3.880470
b_3	–4.041433	–3.911433	–3.498468	–3.908260
For ages above 95:				
r	0.120682	0.420389	0.869873	0.131152
s	-1.484342	-2.805502	-4.732216	-1.479216
u	4.606638	6.349837	8.854813	4.564976
v	-2.242978	-2.964724	-3.992470	-2.216912

Table 7.2: Graduations of the Male all pensioner (excl. dependants) experience: key statistics.

Table Name	S1PML	S1PMA	S1PMA_L	S1PMA_H
Sex	Males	Males	Males	Males
Category	All	All	Light	Heavy
Lives / Amounts	Lives	Amounts	Amounts	Amounts
For ages 55 and over				
GM formula	GM(1,4)	GM(1,3)	GM(0,5)	GM(1,4)
Age range fitted	55-95	55-95	55-95	55-95
Optimised parameters:				
$100 \times a_1$	0.564845	0.295448		1.106143
T-ratio	18.14	19.68		20.11
$100 \times a_2$				
T-ratio				
b_1	–6.671528	–5.214356	–8.347568	–10.082396
T-ratio	–17.82	–57.87	–4.29	–12.47
b_2	10.080168	6.925994	6.162600	18.324270
T-ratio	11.55	78.77	3.17	9.81
b_3	–2.679202	–1.068429	–6.047156	–6.077998
T-ratio	–7.49	–13.51	–2.30	–7.82
b_4	0.884222		0.154471	3.181737
T-ratio	3.72		0.22	6.27
b_5			–2.055734	
T-ratio			–3.00	
–Log likelihood	721137.5532	772086.1340	48750.1213	203646.5408
Sign test: +/–	21 / 20	19 / 22	23 / 18	21 / 20
Sign test: p(pos)	0.500000	0.377614	0.266355	0.500000
Runs test: p(runs)	0.263627	0.160673	0.337905	0.263627
K-S test: $p(KS)$	1.000000	0.848142	1.000000	0.945797
Serial correlation test:				
T-ratio 1	–0.39	0.07	–0.94	0.76
T-ratio 2	–0.81	0.31	–0.33	–0.64
T-ratio 3	–0.67	0.17	–0.26	0.12
χ^2 test:				
χ^2	51.49	114.38	63.37	88.54
Degrees of freedom	36	37	36	36
$p(\chi^2)$	0.045408	0.000000	0.003240	0.000003
Divisor for amounts graduation	N/A	4430.15	21242.92	466.38
For ages below 55:				
GM formula	GM(1,3)	GM(1,3)	GM(1,3)	GM(1,3)
Fitted parameters:				
$100 \times a_1$	0.015000	0.035000	0.035000	0.035400
b_1	–6.297496	–7.985708	–5.315611	–11.214783
b_2	0.058787	–0.365294	4.611331	–6.437636
b_3	–1.581195	–2.942478	–0.913173	–5.823541
For ages above 95:				
r	-0.169791	-0.031997	1.817600	-1.687189
s	0.192274	-0.479782	-8.236109	6.600594
u	2.124825	3.055555	13.019418	-6.139621
v	-1.147308	-1.543776	-5.600909	2.226216

Table 7.3: Graduations of the Female dependants experience: key statistics.

Table Name	S1DFL	S1DFA	S1DFA_L	S1DFA_H
Sex	Females	Females	Females	Females
Category	All	All	Light	Heavy
Lives / Amounts	Lives	Amounts	Amounts	Amounts
For ages 45 and over				
GM formula	GM(1,2)	GM(1,2)	GM(1,2)	GM(1,2)
Age range fitted	45-95	45-95	45-95	45-95
Optimised parameters:				
$100 \times a_1$	0.181877	0.151191	0.109378	0.244082
T-ratio	8.30	9.57	3.35	6.01
$100 \times a_2$				
T-ratio				
b_1	–4.142089	–4.349894	–4.615924	–4.052298
T-ratio	–272.06	–307.39	–116.36	–170.19
b_2	5.502171	5.816172	6.244140	5.349837
T-ratio	134.36	151.68	58.19	85.87
b_3				
T-ratio				
b_4				
T-ratio				
b_5				
T-ratio				
–Log likelihood	294136.5083	300500.0004	34963.2799	150296.2147
Sign test: +/–	24 / 27	24 / 27	21 / 24	24 /26
Sign test: p(pos)	0.389884	0.389884	0.382996	0.443862
Runs test: p(runs)	0.489231	0.397020	0.500000	0.500000
K-S test: $p(KS)$	1.000000	0.840625	0.953980	1.000000
Serial correlation test:				
T-ratio 1	–0.95	–0.27	0.67	1.68
T-ratio 2	0.06	1.00	1.36	–0.37
T-ratio 3	–0.50	0.42	1.31	–0.24
χ^2 test:				
χ^2	52.26	126.19	64.32	75.73
Degrees of freedom	48	48	42	47
$p(\chi^2)$	0.311984	0.000000	0.014907	0.004974
Divisor for amounts graduation	N/A	2411.39	9037.31	826.70
For ages below 45:				
GM formula	GM(1,3)	GM(1,3)	GM(1,3)	GM(1,3)
Fitted parameters:				
$100 \times a_1$	–0.050000	–0.050000	–0.050000	–0.050000
b_1	–6.264513	–6.311159	–6.252936	–6.757227
b_2	–0.189413	–0.034145	0.376265	–1.176996
b_3	–0.932123	–0.771307	–0.482427	–1.362702
For ages above 95:				
r	0.259262	0.296906	0.293911	0.282410
s	-2.031895	-2.283531	-2.370849	-2.092205
u	5.286004	5.676344	5.859965	5.337180
v	-2.513371	-2.689719	-2.783027	-2.527385

Table 7.4: Graduations of the Female Normal Health pensioner experience: key statistics.

Table Name	S1NFA	S1NFA_L	S1NFA_H
Sex	Females	Females	Females
Category	All	Light	Heavy
Lives / Amounts	Amounts	Amounts	Amounts
For ages 60 and over			
GM formula	GM(1,3)	GM(0,4)	GM(1,3)
Age range fitted	60-95	60-95	60-95
Optimised parameters:			
$100 \times a_1$	0.328165		0.355573
T-ratio	9.12		3.67
$100 \times a_2$			
T-ratio			
b_1	–6.650330	–3.308621	–6.460172
T-ratio	–20.29	–3.95	–9.92
b_2	8.373961	2.369566	7.893948
T-ratio	24.40	0.95	11.76
b_3	–1.890562	1.171113	–2.001334
T-ratio	–6.79	1.36	–3.61
b_4		–1.201217	
T-ratio		–1.49	
b_5			
T-ratio			
–Log likelihood	99701.5720	12723.0462	24916.5007
Sign test: +/–	19 / 17	16 / 20	19 / 17
Sign test: p(pos)	0.433970	0.308860	0.433970
Runs test: p(runs)	0.112802	0.100415	0.194317
K-S test: $p(KS)$	0.912821	1.000000	1.000000
Serial correlation test:			
T-ratio 1	–0.42	–1.94	–0.37
T-ratio 2	–0.83	–0.40	–0.20
T-ratio 3	–1.10	–0.63	–1.26
χ^2 test:			
χ^2	68.01	30.00	33.54
Degrees of freedom	32	32	32
$p(\chi^2)$	0.000212	0.568089	0.392417
Divisor for amounts graduation	2326.54	7420.49	439.83
For ages below 60:			
GM formula	GM(1,3)	GM(1,3)	GM(1,3)
Fitted parameters:			
$100 \times a_1$	0.015000	0.015000	0.014000
b_1	–6.592283	–5.333955	–5.869013
b_2	1.693431	4.133498	2.532301
b_3	–1.662866	–0.629745	–1.264445
For ages above 95:			
r	1.097434	1.101848	1.091471
s	-5.610405	-5.636888	-5.574625
u	9.928508	9.968232	9.874837
v	-4.415537	-4.433192	-4.391683

Table 7.5: Graduations of the Male Normal Health pensioner experience: key statistics.

Table Name	S1NMA	S1NMA_L	S1NMA_H
Sex	Males	Males	Males
Category	All	Light	Heavy
Lives / Amounts	Amounts	Amounts	Amounts
For ages 60 and over			
GM formula	GM(1,3)	GM(1,3)	GM(1,4)
Age range fitted	60-95	60-95	60-95
Optimised parameters:			
$100 \times a_1$	0.240240	0.347088	1.173528
T-ratio	6.23	5.69	9.98
$100 \times a_2$			
T-ratio			
b_1	–5.381599	–6.862716	–11.871189
T-ratio	–29.38	–10.39	–6.47
b_2	7.143142	9.087591	21.609792
T-ratio	37.84	13.50	5.31
b_3	–1.220212	–2.109259	–7.721164
T-ratio	–7.86	–3.68	–4.41
b_4			3.871673
T-ratio			3.62
b_5			
T-ratio			
–Log likelihood	307744.8480	21289.1262	66289.0427
Sign test: +/–	17 / 19	18 / 18	17 / 19
Sign test: p(pos)	0.433970	0.500000	0.433970
Runs test: p(runs)	0.310768	–0.304639	0.441775
K-S test: $p(KS)$	0.991891	0.990697	1.000000
Serial correlation test:			
T-ratio 1	0.49	–0.39	–0.10
T-ratio 2	–0.11	–0.32	–0.99
T-ratio 3	–1.18	0.65	–1.23
χ^2 test:			
χ^2	64.34	54.02	49.09
Degrees of freedom	32	32	31
$p(\chi^2)$	0.000601	0.008804	0.020621
Divisor for amounts graduation	4770.14	20270.90	837.11
For ages below 60:			
GM formula	GM(1,3)	GM(1,3)	GM(1,3)
Fitted parameters:			
$100 \times a_1$	0.025000	0.035000	0.032000
b_1	–3.889181	–7.267505	–7.189041
b_2	5.197111	1.175306	–0.818470
b_3	0.290389	–2.232961	–2.867300
For ages above 95:			
r	-0.047564	0.105922	-1.608740
s	-0.380783	-1.136405	6.252723
u	2.904258	3.955044	-5.679226
v	-1.475911	-1.924561	2.035243

Table 7.6: Graduations of the Female and Male Ill-health pensioners experience: key statistics.

Table Name	S1IFA	S1IMA
Sex	Females	Males
Category	All	All
Lives / Amounts	Amounts	Amounts
For ages 16 and over		
GM formula	GM(2,3)	GM(1,3)
Age range fitted	35-95	35-95
Optimised parameters:		
$100 \times a_1$	1.128763	0.893197
T-ratio	12.79	16.43
$100 \times a_2$	0.775802	
T-ratio	3.51	
b_1	–9.843523	–4.932982
T-ratio	–8.42	–15.23
b_2	11.130954	5.990451
T-ratio	10.23	25.91
b_3	–4.992333	–1.317565
T-ratio	–4.78	–4.26
b_4		
T-ratio		
b_5		
T-ratio		
–Log likelihood	18714.8931	50911.7927
Sign test: +/–	29 / 30	31 / 29
Sign test: p(pos)	0.500000	0.448711
Runs test: p(runs)	0.017529	0.178019
K-S test: $p(KS)$	0.900193	1.000000
Serial correlation test:		
T-ratio 1	0.98	–0.55
T-ratio 2	–0.73	0.18
T-ratio 3	–1.35	0.18
χ^2 test:		
χ^2	115.38	125.93
Degrees of freedom	54	56
$p(\chi^2)$	0.000002	0.000000
Divisor for amounts graduation	2739.53	4362.68
For ages above 95:		
r	2.864642	0.983257
s	-12.990662	-4.634991
u	19.387398	8.320211
v	-8.261378	-3.668477

8. Final graduated rates

The final graduated rates of q_x and μ_x are given in Appendix A in Tables A1 to A40.

The weighted average date of the exposed to risk periods differs between the various graduated datasets, ranging from late 2002 to early 2003, as illustrated in Table 8.1 below. In particular, the dates tend to be slightly earlier for lives data compared to the corresponding amounts data.

However the Committee considers it appropriate that all the tables are deemed to apply at a single date. Accordingly:

- The force of mortality, μ_x, applies to the mid-point of the exposure period which is deemed to be 1 March 2003.
- The values of q_x apply to the year centred on this date and are therefore deemed to apply to a life attaining age x on 1 September 2002 and gives the probability of death before the attainment of age $x+1$ on 1 September 2003. The age definition is therefore age exact – not last, nearest or next.

Note that these dates are arbitrary but are very close to the actual dates applicable to the All pensioners (excluding dependants) datasets on an amounts basis for both males and females. Many of the other graduations datasets have earlier weighted mid-points; some of these are illustrated in Table 8.1. Note also that these applicable dates are earlier than stated in Working Paper 32.

Table 8.1: Weighted mid-point of various graduations datasets.

Dataset	**Weighted mid-point**
All pensioners (excluding dependants), females, lives	16 February 2003
All pensioners (excluding dependants) , females, amounts	19 February 2003
All pensioners (excluding dependants), males, lives	21 January 2003
All pensioners (excluding dependants), males, amounts	2 March 2003
Dependants, lives	5 December 2002
Dependants, amounts	19 February 2003

Comparisons of the rates for each pensioner series, i.e. Lives versus Amounts and Light versus All versus Heavy, are illustrated in graphical form in Appendix B.

The remainder of this section presents comparisons of 100 Actual / Expected values for the dataset compared to the graduated rates.

Table 8.2 shows a comparison of all-ages 100 A/E values for different categories of "Lives" data all compared to the tables based on All pensioners (excluding dependants). This illustrates the overall mortality of each group compared to the All pensioners graduations.

Table 8.2: All ages 100 Actual/Expected for different categories of "Lives" data compared to the S1PML and S1PFL tables

Data Type	100 A/E for Males compared with S1PML	100 A/E for Females compared with S1PFL
All pensioners (excluding dependants)	100	100
All pensioners (excluding dependants); Light data	65	87
All pensioners (excluding dependants); Heavy data	115	108
Normal Health pensioners	97	96
Ill-health pensioners	155	145
Combined	99	99
Dependants	103	104
Unknown	97	102
All	100	102

Table 8.3 shows a comparison by age band of the All pensioners (excluding dependants) data with the corresponding table. It will be observed that, in each case, the graduated table is a close fit to the underlying data for ages from 55 to 94 but the data shows significantly higher mortality at younger ages and lighter mortality at older ages than the corresponding table.

Table 8.3: 100 Actual/Expected by age band for the All pensioner (excluding dependants) dataset compared to the corresponding graduated table.

Age Band	100 A/E for Males, Lives compared with S1PML	100 A/E for Males, Amounts compared with S1PMA	100 A/E for Females, Lives compared with S1PFL	100 A/E for Females, Amounts compared with S1PFA
Under 50	248	450	276	334
50-54	106	120	108	111
55-59	100	98	101	97
60-64	101	100	99	104
65-69	100	102	101	100
70-74	100	99	98	99
75-79	100	100	101	101
80-84	99	100	99	100
85-89	101	101	100	100
90-94	100	99	100	100
95 and over	90	93	85	86
All	100	100	100	100

Table 8.4 shows a comparison for all-ages combined of the All pensioners (excluding dependants) data with the corresponding table by calendar year. It will be observed that for the male data there appears to be a very steep fall in mortality compared to the base tables over this period, whereas there is no clear pattern for females. The Committee intends to investigate improvement rates within the dataset in the near future, but stresses that inappropriate conclusions should not be inferred from these comparisons, given the heterogeneity between the schemes included within each calendar year and the relatively low volume of data yet received for the later years.

Table 8.4: 100 Actual/Expected for all ages combined for the All pensioner dataset (excluding dependants) compared to the corresponding graduated table by calendar year.

Calendar Year	100 A/E for Males, Lives compared with S1PML	100 A/E for Males, Amounts compared with S1PMA	100 A/E for Females, Lives compared with S1PFL	100 A/E for Females, Amounts compared with S1PFA
2000	105	108	102	105
2001	103	108	99	104
2002	103	106	101	103
2003	102	98	101	96
2004	97	94	100	97
2005	91	92	96	97
2006	86	88	93	106
All	100	100	100	100

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Appendix A: Tables of mortality rates

Table	Table Name	Data Type	Sex	Amounts/ Lives	Light/ Heavy		Page
A1	S1PFL	All pensioners (excl. dependants)	Female	Lives	-	q_x	44
A2	S1PFL	All pensioners (excl. dependants)	Female	Lives	-	μ_x	45
A3	S1PFA	All pensioners (excl. dependants)	Female	Amounts	-	q_x	46
A4	S1PFA	All pensioners (excl. dependants)	Female	Amounts	-	μ_x	47
A5	S1PFA_L	All pensioners (excl. dependants)	Female	Amounts	Light	q_x	48
A6	S1PFA_L	All pensioners (excl. dependants)	Female	Amounts	Light	μ_x	49
A7	S1PFA_H	All pensioners (excl. dependants)	Female	Amounts	Heavy	q_x	50
A8	S1PFA_H	All pensioners (excl. dependants)	Female	Amounts	Heavy	μ_x	51
A9	S1PML	All pensioners (excl. dependants)	Male	Lives	-	q_x	52
A10	S1PML	All pensioners (excl. dependants)	Male	Lives	-	μ_x	53
A11	S1PMA	All pensioners (excl. dependants)	Male	Amounts	-	q_x	54
A12	S1PMA	All pensioners (excl. dependants)	Male	Amounts	-	μ_x	55
A13	S1PMA_L	All pensioners (excl. dependants)	Male	Amounts	Light	q_x	56
A14	S1PMA_L	All pensioners (excl. dependants)	Male	Amounts	Light	μ_x	57
A15	S1PMA_H	All pensioners (excl. dependants)	Male	Amounts	Heavy	q_x	58
A16	S1PMA_H	All pensioners (excl. dependants)	Male	Amounts	Heavy	μ_x	59
A17	S1DFL	Dependants	Female	Lives	-	q_x	60
A18	S1DFL	Dependants	Female	Lives	-	μ_x	61
A19	S1DFA	Dependants	Female	Amounts	-	q_x	62
A20	S1DFA	Dependants	Female	Amounts	-	μ_x	63
A21	S1DFA_L	Dependants	Female	Amounts	Light	q_x	64
A22	S1DFA_L	Dependants	Female	Amounts	Light	μ_x	65
A23	S1DFA_H	Dependants	Female	Amounts	Heavy	q_x	66
A24	S1DFA_H	Dependants	Female	Amounts	Heavy	μ_x	67
A25	S1NFA	Normal Health pensioners	Female	Amounts	-	q_x	68
A26	S1NFA	Normal Health pensioners	Female	Amounts	-	μ_x	69
A27	S1NFA_L	Normal Health pensioners	Female	Amounts	Light	q_x	70
A28	S1NFA_L	Normal Health pensioners	Female	Amounts	Light	μ_x	71
A29	S1NFA_H	Normal Health pensioners	Female	Amounts	Heavy	q_x	72
A30	S1NFA_H	Normal Health pensioners	Female	Amounts	Heavy	μ_x	73
A31	S1NMA	Normal Health pensioners	Male	Amounts	-	q_x	74
A32	S1NMA	Normal Health pensioners	Male	Amounts	-	μ_x	75
A33	S1NMA_L	Normal Health pensioners	Male	Amounts	Light	q_x	76
A34	S1NMA_L	Normal Health pensioners	Male	Amounts	Light	μ_x	77
A35	S1NMA_H	Normal Health pensioners	Male	Amounts	Heavy	q_x	78
A36	S1NMA_H	Normal Health pensioners	Male	Amounts	Heavy	μ_x	79
A37	S1IFA	Ill-health pensioners	Female	Amounts	-	q_x	80
A38	S1IFA	Ill-health pensioners	Female	Amounts	-	μ_x	81
A39	S1IMA	Ill-health pensioners	Male	Amounts	-	q_x	82
A40	S1IMA	Ill-health pensioners	Male	Amounts	-	μ_x	83

Table A1: Pensioners (excluding dependants), females, all, lives – S1PFL – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.004740	85	0.084366
16	0.000177	51	0.004915	86	0.093590
17	0.000185	52	0.005065	87	0.103710
18	0.000196	53	0.005187	88	0.114824
19	0.000208	54	0.005279	89	0.127049
20	0.000224	55	0.005348	90	0.140516
21	0.000243	56	0.005430	91	0.155380
22	0.000267	57	0.005540	92	0.171816
23	0.000295	58	0.005685	93	0.190025
24	0.000329	59	0.005873	94	0.210235
25	0.000370	60	0.006115	95	0.232303
26	0.000419	61	0.006422	96	0.254792
27	0.000476	62	0.006808	97	0.277225
28	0.000542	63	0.007286	98	0.299489
29	0.000620	64	0.007874	99	0.321487
30	0.000708	65	0.008587	100	0.343128
31	0.000810	66	0.009446	101	0.364335
32	0.000925	67	0.010470	102	0.385038
33	0.001053	68	0.011680	103	0.405177
34	0.001197	69	0.013096	104	0.424702
35	0.001355	70	0.014742	105	0.443570
36	0.001529	71	0.016640	106	0.461745
37	0.001717	72	0.018813	107	0.479200
38	0.001919	73	0.021284	108	0.495911
39	0.002135	74	0.024077	109	0.511861
40	0.002362	75	0.027218	110	0.527039
41	0.002600	76	0.030731	111	0.541435
42	0.002846	77	0.034643	112	0.555045
43	0.003097	78	0.038982	113	0.567866
44	0.003351	79	0.043779	114	0.579899
45	0.003604	80	0.049067	115	0.591145
46	0.003854	81	0.054883	116	0.601606
47	0.004096	82	0.061269	117	0.611287
48	0.004327	83	0.068274	118	0.620191
49	0.004542	84	0.075952	119	0.628320
				120	1.000000

Table A2: Pensioners (excluding dependants), females, all, lives – S1PFL – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.004655	85	0.083411
16	0.000174	51	0.004843	86	0.093028
17	0.000181	52	0.005007	87	0.103682
18	0.000190	53	0.005144	88	0.115508
19	0.000201	54	0.005252	89	0.128668
20	0.000215	55	0.005329	90	0.143356
21	0.000233	56	0.005400	91	0.159805
22	0.000254	57	0.005495	92	0.178297
23	0.000280	58	0.005622	93	0.199171
24	0.000311	59	0.005788	94	0.222837
25	0.000349	60	0.006002	95	0.249798
26	0.000393	61	0.006276	96	0.279078
27	0.000446	62	0.006623	97	0.309245
28	0.000508	63	0.007055	98	0.340189
29	0.000579	64	0.007589	99	0.371805
30	0.000662	65	0.008242	100	0.403983
31	0.000757	66	0.009032	101	0.436617
32	0.000865	67	0.009979	102	0.469599
33	0.000987	68	0.011104	103	0.502821
34	0.001123	69	0.012428	104	0.536175
35	0.001274	70	0.013976	105	0.569554
36	0.001440	71	0.015771	106	0.602850
37	0.001621	72	0.017836	107	0.635955
38	0.001817	73	0.020199	108	0.668763
39	0.002027	74	0.022884	109	0.701164
40	0.002249	75	0.025920	110	0.733052
41	0.002483	76	0.029336	111	0.764319
42	0.002725	77	0.033161	112	0.794856
43	0.002975	78	0.037430	113	0.824558
44	0.003229	79	0.042178	114	0.853315
45	0.003484	80	0.047445	115	0.881020
46	0.003737	81	0.053276	116	0.907566
47	0.003984	82	0.059724	117	0.932844
48	0.004222	83	0.066848	118	0.956748
49	0.004447	84	0.074716	119	0.979169
				120	1.000000

Table A3: Pensioners (excluding dependants), females, all, amounts – S1PFA – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.004368	85	0.078145
16	0.000177	51	0.004535	86	0.087076
17	0.000185	52	0.004679	87	0.096895
18	0.000195	53	0.004800	88	0.107686
19	0.000207	54	0.004894	89	0.119543
20	0.000222	55	0.004967	90	0.132571
21	0.000240	56	0.005054	91	0.146886
22	0.000263	57	0.005166	92	0.162620
23	0.000289	58	0.005309	93	0.179917
24	0.000322	59	0.005491	94	0.198936
25	0.000360	60	0.005720	95	0.219611
26	0.000405	61	0.006006	96	0.241049
27	0.000458	62	0.006358	97	0.262863
28	0.000520	63	0.006789	98	0.284885
29	0.000591	64	0.007313	99	0.306959
30	0.000673	65	0.007944	100	0.328943
31	0.000766	66	0.008699	101	0.350711
32	0.000871	67	0.009594	102	0.372148
33	0.000989	68	0.010649	103	0.393153
34	0.001120	69	0.011884	104	0.413638
35	0.001265	70	0.013321	105	0.433529
36	0.001422	71	0.014981	106	0.452760
37	0.001594	72	0.016890	107	0.471278
38	0.001778	73	0.019073	108	0.489038
39	0.001974	74	0.021555	109	0.506004
40	0.002181	75	0.024366	110	0.522149
41	0.002397	76	0.027535	111	0.537450
42	0.002621	77	0.031093	112	0.551891
43	0.002851	78	0.035073	113	0.565460
44	0.003083	79	0.039511	114	0.578151
45	0.003315	80	0.044445	115	0.589957
46	0.003544	81	0.049916	116	0.600877
47	0.003768	82	0.055970	117	0.610908
48	0.003981	83	0.062656	118	0.620049
49	0.004183	84	0.070027	119	0.628299
				120	1.000000

Table A4: Pensioners (excluding dependants), females, all, amounts – S1PFA – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.004288	85	0.076831
16	0.000174	51	0.004465	86	0.086065
17	0.000181	52	0.004622	87	0.096320
18	0.000190	53	0.004755	88	0.107714
19	0.000201	54	0.004863	89	0.120386
20	0.000214	55	0.004943	90	0.134497
21	0.000231	56	0.005019	91	0.150234
22	0.000251	57	0.005118	92	0.167819
23	0.000275	58	0.005245	93	0.187511
24	0.000305	59	0.005408	94	0.209619
25	0.000340	60	0.005613	95	0.234507
26	0.000381	61	0.005870	96	0.261660
27	0.000430	62	0.006189	97	0.290193
28	0.000488	63	0.006581	98	0.319964
29	0.000554	64	0.007060	99	0.350830
30	0.000630	65	0.007639	100	0.382649
31	0.000718	66	0.008334	101	0.415278
32	0.000817	67	0.009163	102	0.448576
33	0.000928	68	0.010145	103	0.482400
34	0.001053	69	0.011299	104	0.516608
35	0.001191	70	0.012647	105	0.551057
36	0.001342	71	0.014212	106	0.585606
37	0.001507	72	0.016020	107	0.620111
38	0.001685	73	0.018096	108	0.654431
39	0.001876	74	0.020470	109	0.688423
40	0.002078	75	0.023170	110	0.721944
41	0.002290	76	0.026229	111	0.754854
42	0.002511	77	0.029682	112	0.787009
43	0.002739	78	0.033566	113	0.818266
44	0.002971	79	0.037922	114	0.848485
45	0.003204	80	0.042794	115	0.877521
46	0.003436	81	0.048231	116	0.905234
47	0.003664	82	0.054288	117	0.931481
48	0.003884	83	0.061026	118	0.956119
49	0.004093	84	0.068514	119	0.979006
				120	1.000000

Table A5: Pensioners (excluding dependants), females, light, amounts – S1PFA_L – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.003751	85	0.072369
16	0.000177	51	0.003920	86	0.081189
17	0.000184	52	0.004075	87	0.090899
18	0.000193	53	0.004213	88	0.101550
19	0.000204	54	0.004333	89	0.113186
20	0.000217	55	0.004439	90	0.125849
21	0.000234	56	0.004559	91	0.139574
22	0.000253	57	0.004703	92	0.154386
23	0.000276	58	0.004876	93	0.170304
24	0.000303	59	0.005081	94	0.187335
25	0.000336	60	0.005326	95	0.205519
26	0.000374	61	0.005616	96	0.224938
27	0.000418	62	0.005960	97	0.245397
28	0.000469	63	0.006366	98	0.266647
29	0.000528	64	0.006845	99	0.288455
30	0.000595	65	0.007408	100	0.310600
31	0.000671	66	0.008068	101	0.332884
32	0.000756	67	0.008839	102	0.355122
33	0.000852	68	0.009739	103	0.377153
34	0.000958	69	0.010786	104	0.398830
35	0.001075	70	0.012000	105	0.420027
36	0.001203	71	0.013406	106	0.440633
37	0.001343	72	0.015027	107	0.460556
38	0.001493	73	0.016893	108	0.479715
39	0.001654	74	0.019035	109	0.498046
40	0.001824	75	0.021485	110	0.515496
41	0.002003	76	0.024282	111	0.532023
42	0.002190	77	0.027463	112	0.547592
43	0.002384	78	0.031072	113	0.562180
44	0.002582	79	0.035153	114	0.575766
45	0.002783	80	0.039755	115	0.588337
46	0.002985	81	0.044926	116	0.599881
47	0.003185	82	0.050720	117	0.610390
48	0.003381	83	0.057188	118	0.619856
49	0.003571	84	0.064387	119	0.628272
				120	1.000000

Table A6: Pensioners (excluding dependants), females, light, amounts – S1PFA_L – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.003669	85	0.070680
16	0.000174	51	0.003845	86	0.079727
17	0.000180	52	0.004008	87	0.089801
18	0.000188	53	0.004156	88	0.100991
19	0.000198	54	0.004286	89	0.113385
20	0.000210	55	0.004396	90	0.127079
21	0.000225	56	0.004506	91	0.142166
22	0.000243	57	0.004638	92	0.158745
23	0.000264	58	0.004796	93	0.176913
24	0.000289	59	0.004985	94	0.196769
25	0.000319	60	0.005210	95	0.218409
26	0.000354	61	0.005478	96	0.242089
27	0.000395	62	0.005795	97	0.267870
28	0.000442	63	0.006171	98	0.295560
29	0.000497	64	0.006615	99	0.324968
30	0.000560	65	0.007137	100	0.355903
31	0.000631	66	0.007750	101	0.388172
32	0.000712	67	0.008469	102	0.421584
33	0.000803	68	0.009310	103	0.455948
34	0.000904	69	0.010289	104	0.491071
35	0.001015	70	0.011428	105	0.526763
36	0.001138	71	0.012750	106	0.562831
37	0.001272	72	0.014280	107	0.599084
38	0.001417	73	0.016045	108	0.635330
39	0.001573	74	0.018078	109	0.671378
40	0.001739	75	0.020412	110	0.707036
41	0.001914	76	0.023087	111	0.742112
42	0.002098	77	0.026143	112	0.776415
43	0.002289	78	0.029627	113	0.809752
44	0.002485	79	0.033587	114	0.841934
45	0.002686	80	0.038078	115	0.872767
46	0.002888	81	0.043158	116	0.902060
47	0.003090	82	0.048889	117	0.929621
48	0.003289	83	0.055338	118	0.955259
49	0.003483	84	0.062577	119	0.978783
				120	1.000000

Table A7: Pensioners (excluding dependants), females, heavy, amounts – S1PFA_H – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.004715	85	0.087501
16	0.000177	51	0.004907	86	0.097016
17	0.000185	52	0.005075	87	0.107437
18	0.000195	53	0.005218	88	0.118854
19	0.000207	54	0.005333	89	0.131367
20	0.000223	55	0.005427	90	0.145093
21	0.000241	56	0.005538	91	0.160160
22	0.000264	57	0.005681	92	0.176715
23	0.000292	58	0.005865	93	0.194920
24	0.000325	59	0.006098	94	0.214955
25	0.000364	60	0.006389	95	0.236671
26	0.000411	61	0.006751	96	0.258779
27	0.000466	62	0.007196	97	0.280846
28	0.000530	63	0.007738	98	0.302762
29	0.000605	64	0.008393	99	0.324429
30	0.000690	65	0.009177	100	0.345758
31	0.000788	66	0.010108	101	0.366671
32	0.000899	67	0.011205	102	0.387099
33	0.001023	68	0.012489	103	0.406984
34	0.001161	69	0.013980	104	0.426273
35	0.001315	70	0.015702	105	0.444924
36	0.001483	71	0.017675	106	0.462902
37	0.001666	72	0.019925	107	0.480176
38	0.001863	73	0.022477	108	0.496725
39	0.002074	74	0.025354	109	0.512530
40	0.002297	75	0.028585	110	0.527578
41	0.002531	76	0.032196	111	0.541860
42	0.002775	77	0.036217	112	0.555372
43	0.003025	78	0.040680	113	0.568108
44	0.003279	79	0.045616	114	0.580070
45	0.003535	80	0.051064	115	0.591258
46	0.003789	81	0.057061	116	0.601675
47	0.004037	82	0.063651	117	0.611322
48	0.004277	83	0.070884	118	0.620204
49	0.004504	84	0.078814	119	0.628322
				120	1.000000

Table A8: Pensioners (excluding dependants), females, heavy, amounts – S1PFA_H – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.004623	85	0.086672
16	0.000174	51	0.004826	86	0.096632
17	0.000181	52	0.005008	87	0.107656
18	0.000190	53	0.005165	88	0.119871
19	0.000201	54	0.005294	89	0.133430
20	0.000215	55	0.005395	90	0.148510
21	0.000231	56	0.005492	91	0.165323
22	0.000252	57	0.005619	92	0.184119
23	0.000277	58	0.005782	93	0.205194
24	0.000307	59	0.005990	94	0.228904
25	0.000344	60	0.006252	95	0.255674
26	0.000387	61	0.006579	96	0.284614
27	0.000437	62	0.006983	97	0.314439
28	0.000497	63	0.007478	98	0.345042
29	0.000566	64	0.008078	99	0.376319
30	0.000646	65	0.008800	100	0.408161
31	0.000737	66	0.009663	101	0.440463
32	0.000841	67	0.010684	102	0.473118
33	0.000959	68	0.011885	103	0.506020
34	0.001090	69	0.013286	104	0.539062
35	0.001236	70	0.014911	105	0.572138
36	0.001397	71	0.016784	106	0.605142
37	0.001573	72	0.018930	107	0.637967
38	0.001764	73	0.021375	108	0.670507
39	0.001968	74	0.024148	109	0.702655
40	0.002186	75	0.027277	110	0.734305
41	0.002415	76	0.030793	111	0.765350
42	0.002655	77	0.034731	112	0.795685
43	0.002903	78	0.039127	113	0.825202
44	0.003157	79	0.044020	114	0.853796
45	0.003413	80	0.049453	115	0.881359
46	0.003669	81	0.055476	116	0.907786
47	0.003922	82	0.062143	117	0.932970
48	0.004168	83	0.069515	118	0.956805
49	0.004403	84	0.077664	119	0.979183
				120	1.000000

Table A9: Pensioners (excluding dependants), males, all, lives – S1PML – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.005541	85	0.120346
16	0.000375	51	0.005812	86	0.131813
17	0.000408	52	0.006082	87	0.144142
18	0.000444	53	0.006349	88	0.157384
19	0.000485	54	0.006612	89	0.171591
20	0.000531	55	0.006879	90	0.186821
21	0.000581	56	0.007193	91	0.203131
22	0.000638	57	0.007574	92	0.220587
23	0.000700	58	0.008032	93	0.239251
24	0.000768	59	0.008580	94	0.259194
25	0.000844	60	0.009231	95	0.280182
26	0.000926	61	0.009999	96	0.301053
27	0.001016	62	0.010901	97	0.321482
28	0.001114	63	0.011953	98	0.341436
29	0.001221	64	0.013174	99	0.360886
30	0.001336	65	0.014584	100	0.379809
31	0.001461	66	0.016202	101	0.398183
32	0.001595	67	0.018051	102	0.415993
33	0.001738	68	0.020152	103	0.433225
34	0.001892	69	0.022530	104	0.449868
35	0.002055	70	0.025209	105	0.465916
36	0.002228	71	0.028213	106	0.481364
37	0.002412	72	0.031569	107	0.496208
38	0.002605	73	0.035303	108	0.510449
39	0.002808	74	0.039442	109	0.524088
40	0.003020	75	0.044015	110	0.537126
41	0.003242	76	0.049049	111	0.549568
42	0.003473	77	0.054575	112	0.561419
43	0.003711	78	0.060621	113	0.572685
44	0.003957	79	0.067221	114	0.583371
45	0.004210	80	0.074406	115	0.593485
46	0.004469	81	0.082209	116	0.603034
47	0.004732	82	0.090667	117	0.612024
48	0.005000	83	0.099816	118	0.620464
49	0.005269	84	0.109695	119	0.628359
				120	1.000000

Table A10: Pensioners (excluding dependants), males, all, lives – S1PML – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.005420	85	0.122035
16	0.000360	51	0.005693	86	0.134599
17	0.000391	52	0.005965	87	0.148294
18	0.000425	53	0.006235	88	0.163223
19	0.000464	54	0.006502	89	0.179500
20	0.000507	55	0.006764	90	0.197255
21	0.000555	56	0.007051	91	0.216636
22	0.000609	57	0.007399	92	0.237809
23	0.000668	58	0.007820	93	0.260966
24	0.000733	59	0.008325	94	0.286326
25	0.000805	60	0.008927	95	0.314139
26	0.000884	61	0.009640	96	0.343423
27	0.000970	62	0.010481	97	0.372976
28	0.001065	63	0.011466	98	0.402742
29	0.001167	64	0.012613	99	0.432665
30	0.001278	65	0.013943	100	0.462692
31	0.001398	66	0.015475	101	0.492766
32	0.001527	67	0.017234	102	0.522833
33	0.001666	68	0.019241	103	0.552837
34	0.001815	69	0.021523	104	0.582724
35	0.001973	70	0.024105	105	0.612438
36	0.002142	71	0.027016	106	0.641925
37	0.002321	72	0.030284	107	0.671129
38	0.002510	73	0.033940	108	0.699995
39	0.002708	74	0.038016	109	0.728469
40	0.002917	75	0.042546	110	0.756495
41	0.003135	76	0.047565	111	0.784017
42	0.003362	77	0.053112	112	0.810982
43	0.003597	78	0.059227	113	0.837333
44	0.003841	79	0.065952	114	0.863016
45	0.004091	80	0.073335	115	0.887976
46	0.004348	81	0.081425	116	0.912158
47	0.004610	82	0.090278	117	0.935506
48	0.004877	83	0.099952	118	0.957966
49	0.005147	84	0.110513	119	0.979482
				120	1.000000

Table A11: Pensioners (excluding dependants), males, all, amounts – S1PMA – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.003385	85	0.107154
16	0.000361	51	0.003644	86	0.118666
17	0.000364	52	0.003909	87	0.131151
18	0.000368	53	0.004176	88	0.144648
19	0.000373	54	0.004445	89	0.159188
20	0.000379	55	0.004720	90	0.174797
21	0.000386	56	0.005032	91	0.191494
22	0.000395	57	0.005394	92	0.209287
23	0.000406	58	0.005815	93	0.228175
24	0.000419	59	0.006302	94	0.248146
25	0.000434	60	0.006865	95	0.268972
26	0.000453	61	0.007515	96	0.289802
27	0.000475	62	0.008263	97	0.310370
28	0.000502	63	0.009123	98	0.330614
29	0.000533	64	0.010109	99	0.350480
30	0.000569	65	0.011239	100	0.369920
31	0.000611	66	0.012529	101	0.388890
32	0.000660	67	0.014000	102	0.407354
33	0.000716	68	0.015674	103	0.425282
34	0.000781	69	0.017576	104	0.442646
35	0.000854	70	0.019730	105	0.459424
36	0.000937	71	0.022166	106	0.475600
37	0.001031	72	0.024914	107	0.491160
38	0.001136	73	0.028008	108	0.506093
39	0.001252	74	0.031483	109	0.520392
40	0.001382	75	0.035378	110	0.534051
41	0.001524	76	0.039732	111	0.547070
42	0.001679	77	0.044589	112	0.559448
43	0.001848	78	0.049992	113	0.571185
44	0.002031	79	0.055989	114	0.582284
45	0.002227	80	0.062626	115	0.592748
46	0.002436	81	0.069954	116	0.602582
47	0.002657	82	0.078021	117	0.611790
48	0.002890	83	0.086878	118	0.620377
49	0.003133	84	0.096573	119	0.628346
				120	1.000000

Table A12: Pensioners (excluding dependants), males, all, amounts – S1PMA – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.003263	85	0.107258
16	0.000360	51	0.003519	86	0.119622
17	0.000363	52	0.003783	87	0.133229
18	0.000366	53	0.004050	88	0.148174
19	0.000371	54	0.004320	89	0.164558
20	0.000376	55	0.004590	90	0.182482
21	0.000382	56	0.004880	91	0.202054
22	0.000390	57	0.005217	92	0.223382
23	0.000400	58	0.005610	93	0.246579
24	0.000412	59	0.006065	94	0.271756
25	0.000426	60	0.006591	95	0.299029
26	0.000443	61	0.007200	96	0.327671
27	0.000464	62	0.007902	97	0.356831
28	0.000488	63	0.008711	98	0.386435
29	0.000516	64	0.009640	99	0.416409
30	0.000550	65	0.010706	100	0.446678
31	0.000589	66	0.011926	101	0.477168
32	0.000635	67	0.013321	102	0.507806
33	0.000687	68	0.014912	103	0.538517
34	0.000747	69	0.016724	104	0.569227
35	0.000816	70	0.018783	105	0.599862
36	0.000894	71	0.021119	106	0.630348
37	0.000983	72	0.023765	107	0.660611
38	0.001082	73	0.026755	108	0.690577
39	0.001193	74	0.030128	109	0.720171
40	0.001316	75	0.033926	110	0.749319
41	0.001452	76	0.038194	111	0.777948
42	0.001601	77	0.042983	112	0.805984
43	0.001763	78	0.048344	113	0.833351
44	0.001939	79	0.054336	114	0.859977
45	0.002129	80	0.061019	115	0.885786
46	0.002332	81	0.068459	116	0.910705
47	0.002547	82	0.076727	117	0.934661
48	0.002775	83	0.085896	118	0.957578
49	0.003014	84	0.096045	119	0.979382
				120	1.000000

Table A13: Pensioners (excluding dependants), males, light, amounts – S1PMA_L – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.001885	85	0.095025
16	0.000361	51	0.002080	86	0.107507
17	0.000363	52	0.002298	87	0.120989
18	0.000365	53	0.002540	88	0.135312
19	0.000368	54	0.002808	89	0.150238
20	0.000371	55	0.003102	90	0.165441
21	0.000375	56	0.003418	91	0.180506
22	0.000379	57	0.003756	92	0.194936
23	0.000385	58	0.004119	93	0.208166
24	0.000391	59	0.004513	94	0.219585
25	0.000398	60	0.004943	95	0.229501
26	0.000406	61	0.005416	96	0.241117
27	0.000415	62	0.005940	97	0.255013
28	0.000426	63	0.006523	98	0.270862
29	0.000438	64	0.007178	99	0.288336
30	0.000453	65	0.007917	100	0.307115
31	0.000469	66	0.008754	101	0.326892
32	0.000488	67	0.009709	102	0.347376
33	0.000510	68	0.010802	103	0.368297
34	0.000535	69	0.012057	104	0.389409
35	0.000563	70	0.013504	105	0.410488
36	0.000596	71	0.015174	106	0.431335
37	0.000633	72	0.017108	107	0.451776
38	0.000675	73	0.019351	108	0.471658
39	0.000723	74	0.021953	109	0.490853
40	0.000777	75	0.024973	110	0.509250
41	0.000838	76	0.028478	111	0.526758
42	0.000908	77	0.032542	112	0.543304
43	0.000986	78	0.037243	113	0.558825
44	0.001075	79	0.042669	114	0.573274
45	0.001175	80	0.048908	115	0.586609
46	0.001286	81	0.056048	116	0.598800
47	0.001412	82	0.064173	117	0.609819
48	0.001552	83	0.073350	118	0.619640
49	0.001710	84	0.083629	119	0.628240
				120	1.000000

Table A14: Pensioners (excluding dependants), males, light, amounts – S1PMA_L – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.001796	85	0.093361
16	0.000360	51	0.001981	86	0.106564
17	0.000362	52	0.002188	87	0.121133
18	0.000364	53	0.002417	88	0.136986
19	0.000367	54	0.002673	89	0.153954
20	0.000370	55	0.002955	90	0.171754
21	0.000373	56	0.003262	91	0.189979
22	0.000377	57	0.003589	92	0.208084
23	0.000382	58	0.003941	93	0.225385
24	0.000388	59	0.004320	94	0.241082
25	0.000394	60	0.004733	95	0.254286
26	0.000401	61	0.005186	96	0.267741
27	0.000410	62	0.005685	97	0.284622
28	0.000420	63	0.006240	98	0.304659
29	0.000432	64	0.006861	99	0.327584
30	0.000445	65	0.007561	100	0.353129
31	0.000461	66	0.008352	101	0.381023
32	0.000478	67	0.009253	102	0.410999
33	0.000498	68	0.010283	103	0.442788
34	0.000522	69	0.011466	104	0.476120
35	0.000548	70	0.012828	105	0.510727
36	0.000579	71	0.014402	106	0.546340
37	0.000613	72	0.016225	107	0.582690
38	0.000653	73	0.018341	108	0.619508
39	0.000698	74	0.020802	109	0.656526
40	0.000749	75	0.023665	110	0.693475
41	0.000807	76	0.027000	111	0.730085
42	0.000872	77	0.030882	112	0.766089
43	0.000946	78	0.035397	113	0.801216
44	0.001029	79	0.040642	114	0.835199
45	0.001123	80	0.046718	115	0.867768
46	0.001229	81	0.053737	116	0.898654
47	0.001348	82	0.061809	117	0.927590
48	0.001481	83	0.071042	118	0.954305
49	0.001629	84	0.081534	119	0.978531
				120	1.000000

Table A15: Pensioners (excluding dependants), males, heavy, amounts – S1PMA_H – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.009844	85	0.128076
16	0.000361	51	0.010311	86	0.139341
17	0.000364	52	0.010704	87	0.151648
18	0.000369	53	0.011014	88	0.165162
19	0.000375	54	0.011231	89	0.180084
20	0.000383	55	0.011375	90	0.196650
21	0.000395	56	0.011544	91	0.215137
22	0.000410	57	0.011774	92	0.235867
23	0.000431	58	0.012082	93	0.259212
24	0.000458	59	0.012488	94	0.285596
25	0.000492	60	0.013014	95	0.314370
26	0.000537	61	0.013684	96	0.341540
27	0.000595	62	0.014524	97	0.366317
28	0.000667	63	0.015561	98	0.388957
29	0.000757	64	0.016821	99	0.409688
30	0.000868	65	0.018333	100	0.428711
31	0.001004	66	0.020122	101	0.446207
32	0.001168	67	0.022211	102	0.462336
33	0.001364	68	0.024624	103	0.477244
34	0.001595	69	0.027377	104	0.491062
35	0.001866	70	0.030488	105	0.503906
36	0.002178	71	0.033968	106	0.515886
37	0.002534	72	0.037826	107	0.527098
38	0.002936	73	0.042072	108	0.537632
39	0.003383	74	0.046709	109	0.547571
40	0.003875	75	0.051746	110	0.556991
41	0.004408	76	0.057187	111	0.565961
42	0.004979	77	0.063044	112	0.574546
43	0.005582	78	0.069328	113	0.582808
44	0.006208	79	0.076060	114	0.590801
45	0.006848	80	0.083264	115	0.598578
46	0.007492	81	0.090978	116	0.606187
47	0.008126	82	0.099248	117	0.613675
48	0.008739	83	0.108134	118	0.621082
49	0.009316	84	0.117712	119	0.628448
				120	1.000000

Table A16: Pensioners (excluding dependants), males, heavy, amounts – S1PMA_H – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.009636	85	0.130962
16	0.000360	51	0.010140	86	0.143341
17	0.000363	52	0.010577	87	0.157006
18	0.000366	53	0.010933	88	0.172188
19	0.000372	54	0.011201	89	0.189176
20	0.000379	55	0.011372	90	0.208326
21	0.000389	56	0.011517	91	0.230080
22	0.000402	57	0.011715	92	0.254990
23	0.000420	58	0.011985	93	0.283743
24	0.000443	59	0.012343	94	0.317208
25	0.000474	60	0.012811	95	0.356480
26	0.000513	61	0.013413	96	0.397990
27	0.000564	62	0.014174	97	0.437367
28	0.000628	63	0.015121	98	0.474718
29	0.000709	64	0.016283	99	0.510148
30	0.000809	65	0.017689	100	0.543766
31	0.000932	66	0.019365	101	0.575679
32	0.001081	67	0.021340	102	0.605992
33	0.001261	68	0.023639	103	0.634812
34	0.001474	69	0.026284	104	0.662248
35	0.001725	70	0.029297	105	0.688405
36	0.002017	71	0.032694	106	0.713390
37	0.002351	72	0.036490	107	0.737310
38	0.002731	73	0.040700	108	0.760273
39	0.003157	74	0.045336	109	0.782384
40	0.003628	75	0.050409	110	0.803751
41	0.004144	76	0.055932	111	0.824481
42	0.004699	77	0.061922	112	0.844681
43	0.005290	78	0.068398	113	0.864456
44	0.005909	79	0.075387	114	0.883915
45	0.006548	80	0.082923	115	0.903164
46	0.007196	81	0.091053	116	0.922310
47	0.007842	82	0.099835	117	0.941460
48	0.008473	83	0.109345	118	0.960720
49	0.009075	84	0.119680	119	0.980198
				120	1.000000

Table A17: Dependants, females, all, lives – S1DFL – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.003672	85	0.085462
16	0.000200	51	0.003887	86	0.094726
17	0.000255	52	0.004128	87	0.104956
18	0.000313	53	0.004396	88	0.116240
19	0.000374	54	0.004696	89	0.128668
20	0.000438	55	0.005030	90	0.142336
21	0.000505	56	0.005403	91	0.157340
22	0.000576	57	0.005819	92	0.173780
23	0.000649	58	0.006284	93	0.191754
24	0.000726	59	0.006802	94	0.211357
25	0.000806	60	0.007380	95	0.232435
26	0.000889	61	0.008025	96	0.254020
27	0.000976	62	0.008745	97	0.275745
28	0.001065	63	0.009548	98	0.297478
29	0.001158	64	0.010443	99	0.319098
30	0.001253	65	0.011442	100	0.340494
31	0.001351	66	0.012555	101	0.361568
32	0.001451	67	0.013797	102	0.382234
33	0.001554	68	0.015181	103	0.402415
34	0.001659	69	0.016724	104	0.422045
35	0.001766	70	0.018443	105	0.441067
36	0.001874	71	0.020359	106	0.459434
37	0.001984	72	0.022494	107	0.477106
38	0.002096	73	0.024871	108	0.494052
39	0.002208	74	0.027518	109	0.510244
40	0.002321	75	0.030465	110	0.525664
41	0.002435	76	0.033743	111	0.540296
42	0.002548	77	0.037390	112	0.554130
43	0.002661	78	0.041445	113	0.567159
44	0.002774	79	0.045951	114	0.579379
45	0.002887	80	0.050957	115	0.590788
46	0.003012	81	0.056514	116	0.601385
47	0.003150	82	0.062679	117	0.611171
48	0.003305	83	0.069513	118	0.620147
49	0.003478	84	0.077084	119	0.628313
				120	1.000000

Table A18: Dependants, females, all, lives – S1DFL – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.003578	85	0.084610
16	0.000174	51	0.003782	86	0.094240
17	0.000227	52	0.004011	87	0.104991
18	0.000283	53	0.004266	88	0.116993
19	0.000343	54	0.004551	89	0.130391
20	0.000405	55	0.004868	90	0.145347
21	0.000471	56	0.005223	91	0.162044
22	0.000540	57	0.005619	92	0.180682
23	0.000612	58	0.006061	93	0.201489
24	0.000687	59	0.006555	94	0.224715
25	0.000766	60	0.007106	95	0.250644
26	0.000848	61	0.007721	96	0.278612
27	0.000933	62	0.008407	97	0.307672
28	0.001021	63	0.009174	98	0.337703
29	0.001111	64	0.010029	99	0.368586
30	0.001205	65	0.010984	100	0.400198
31	0.001302	66	0.012050	101	0.432420
32	0.001401	67	0.013241	102	0.465131
33	0.001503	68	0.014569	103	0.498211
34	0.001607	69	0.016053	104	0.531537
35	0.001713	70	0.017708	105	0.564991
36	0.001821	71	0.019557	106	0.598451
37	0.001931	72	0.021620	107	0.631797
38	0.002042	73	0.023924	108	0.664908
39	0.002154	74	0.026495	109	0.697663
40	0.002267	75	0.029365	110	0.729943
41	0.002381	76	0.032570	111	0.761625
42	0.002495	77	0.036147	112	0.792590
43	0.002608	78	0.040140	113	0.822716
44	0.002721	79	0.044598	114	0.851884
45	0.002833	80	0.049575	115	0.879972
46	0.002951	81	0.055130	116	0.906861
47	0.003083	82	0.061331	117	0.932428
48	0.003230	83	0.068254	118	0.956554
49	0.003395	84	0.075982	119	0.979118
				120	1.000000

Table A19: Dependants, females, all, amounts – S1DFA – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.002844	85	0.076774
16	0.000197	51	0.003009	86	0.085657
17	0.000243	52	0.003193	87	0.095533
18	0.000292	53	0.003401	88	0.106500
19	0.000343	54	0.003634	89	0.118662
20	0.000396	55	0.003895	90	0.132127
21	0.000451	56	0.004189	91	0.147008
22	0.000508	57	0.004519	92	0.163420
23	0.000568	58	0.004889	93	0.181480
24	0.000629	59	0.005305	94	0.201304
25	0.000693	60	0.005773	95	0.222740
26	0.000758	61	0.006297	96	0.244767
27	0.000826	62	0.006886	97	0.266991
28	0.000896	63	0.007547	98	0.289265
29	0.000967	64	0.008289	99	0.311456
30	0.001040	65	0.009122	100	0.333443
31	0.001115	66	0.010057	101	0.355117
32	0.001191	67	0.011106	102	0.376382
33	0.001269	68	0.012283	103	0.397153
34	0.001348	69	0.013604	104	0.417359
35	0.001428	70	0.015086	105	0.436936
36	0.001509	71	0.016748	106	0.455833
37	0.001591	72	0.018611	107	0.474005
38	0.001674	73	0.020700	108	0.491418
39	0.001757	74	0.023042	109	0.508043
40	0.001840	75	0.025665	110	0.523858
41	0.001924	76	0.028604	111	0.538848
42	0.002007	77	0.031895	112	0.553002
43	0.002090	78	0.035579	113	0.566310
44	0.002173	79	0.039700	114	0.578770
45	0.002257	80	0.044308	115	0.590379
46	0.002348	81	0.049459	116	0.601137
47	0.002452	82	0.055212	117	0.611044
48	0.002568	83	0.061634	118	0.620100
49	0.002698	84	0.068795	119	0.628307
				120	1.000000

Table A20: Dependants, females, all, amounts – S1DFA – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.002772	85	0.075412
16	0.000174	51	0.002928	86	0.084528
17	0.000220	52	0.003102	87	0.094769
18	0.000267	53	0.003299	88	0.106273
19	0.000317	54	0.003519	89	0.119196
20	0.000369	55	0.003767	90	0.133714
21	0.000423	56	0.004045	91	0.150022
22	0.000479	57	0.004357	92	0.168342
23	0.000538	58	0.004708	93	0.188922
24	0.000598	59	0.005102	94	0.212041
25	0.000661	60	0.005545	95	0.238012
26	0.000726	61	0.006043	96	0.266157
27	0.000792	62	0.006602	97	0.295487
28	0.000861	63	0.007230	98	0.325872
29	0.000931	64	0.007935	99	0.357184
30	0.001004	65	0.008728	100	0.389292
31	0.001078	66	0.009618	101	0.422068
32	0.001153	67	0.010618	102	0.455383
33	0.001231	68	0.011741	103	0.489108
34	0.001309	69	0.013003	104	0.523113
35	0.001389	70	0.014420	105	0.557269
36	0.001470	71	0.016012	106	0.591448
37	0.001551	72	0.017801	107	0.625520
38	0.001634	73	0.019811	108	0.659357
39	0.001717	74	0.022068	109	0.692828
40	0.001800	75	0.024604	110	0.725805
41	0.001884	76	0.027452	111	0.758159
42	0.001968	77	0.030652	112	0.789761
43	0.002051	78	0.034247	113	0.820481
44	0.002134	79	0.038285	114	0.850191
45	0.002216	80	0.042822	115	0.878762
46	0.002303	81	0.047917	116	0.906063
47	0.002401	82	0.053642	117	0.931967
48	0.002511	83	0.060073	118	0.956344
49	0.002634	84	0.067297	119	0.979064
				120	1.000000

Table A21: Dependants, females, light, amounts – S1DFA_L – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.001959	85	0.067312
16	0.000191	51	0.002074	86	0.075783
17	0.000225	52	0.002204	87	0.085288
18	0.000260	53	0.002352	88	0.095939
19	0.000297	54	0.002519	89	0.107857
20	0.000335	55	0.002709	90	0.121170
21	0.000373	56	0.002924	91	0.136015
22	0.000413	57	0.003167	92	0.152531
23	0.000454	58	0.003442	93	0.170863
24	0.000496	59	0.003754	94	0.191154
25	0.000539	60	0.004108	95	0.213244
26	0.000583	61	0.004508	96	0.235967
27	0.000628	62	0.004962	97	0.258885
28	0.000674	63	0.005475	98	0.281845
29	0.000720	64	0.006056	99	0.304705
30	0.000768	65	0.006715	100	0.327341
31	0.000817	66	0.007460	101	0.349640
32	0.000866	67	0.008304	102	0.371500
33	0.000916	68	0.009259	103	0.392837
34	0.000967	69	0.010340	104	0.413574
35	0.001019	70	0.011564	105	0.433647
36	0.001071	71	0.012948	106	0.453004
37	0.001124	72	0.014514	107	0.471600
38	0.001177	73	0.016286	108	0.489400
39	0.001230	74	0.018289	109	0.506375
40	0.001284	75	0.020554	110	0.522505
41	0.001338	76	0.023114	111	0.537774
42	0.001393	77	0.026007	112	0.552172
43	0.001447	78	0.029273	113	0.565692
44	0.001501	79	0.032961	114	0.578331
45	0.001557	80	0.037123	115	0.590086
46	0.001619	81	0.041816	116	0.600960
47	0.001688	82	0.047107	117	0.610953
48	0.001768	83	0.053065	118	0.620067
49	0.001857	84	0.059772	119	0.628302
				120	1.000000

Table A22: Dependants, females, light, amounts – S1DFA_L – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.001908	85	0.065491
16	0.000174	51	0.002016	86	0.074057
17	0.000208	52	0.002139	87	0.083762
18	0.000243	53	0.002278	88	0.094759
19	0.000279	54	0.002435	89	0.107217
20	0.000316	55	0.002614	90	0.121333
21	0.000354	56	0.002816	91	0.137327
22	0.000393	57	0.003045	92	0.155448
23	0.000433	58	0.003304	93	0.175980
24	0.000475	59	0.003598	94	0.199243
25	0.000517	60	0.003932	95	0.225600
26	0.000561	61	0.004309	96	0.254288
27	0.000605	62	0.004737	97	0.284192
28	0.000651	63	0.005221	98	0.315177
29	0.000697	64	0.005770	99	0.347109
30	0.000744	65	0.006392	100	0.379855
31	0.000793	66	0.007097	101	0.413282
32	0.000842	67	0.007896	102	0.447255
33	0.000892	68	0.008800	103	0.481642
34	0.000942	69	0.009825	104	0.516309
35	0.000993	70	0.010987	105	0.551121
36	0.001045	71	0.012303	106	0.585946
37	0.001098	72	0.013794	107	0.620650
38	0.001151	73	0.015483	108	0.655099
39	0.001204	74	0.017397	109	0.689160
40	0.001258	75	0.019566	110	0.722700
41	0.001312	76	0.022023	111	0.755583
42	0.001366	77	0.024806	112	0.787678
43	0.001421	78	0.027961	113	0.818850
44	0.001475	79	0.031534	114	0.848966
45	0.001530	80	0.035583	115	0.877892
46	0.001588	81	0.040171	116	0.905495
47	0.001653	82	0.045369	117	0.931640
48	0.001728	83	0.051258	118	0.956196
49	0.001812	84	0.057931	119	0.979027
				120	1.000000

Table A23: Dependants, females, heavy, amounts – S1DFA_H – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.004589	85	0.089501
16	0.000206	51	0.004832	86	0.098842
17	0.000275	52	0.005102	87	0.109126
18	0.000347	53	0.005402	88	0.120434
19	0.000425	54	0.005736	89	0.132850
20	0.000507	55	0.006108	90	0.146461
21	0.000595	56	0.006521	91	0.161360
22	0.000687	57	0.006982	92	0.177634
23	0.000785	58	0.007493	93	0.195376
24	0.000887	59	0.008063	94	0.214672
25	0.000994	60	0.008696	95	0.235379
26	0.001107	61	0.009400	96	0.256606
27	0.001223	62	0.010183	97	0.278007
28	0.001345	63	0.011054	98	0.299445
29	0.001470	64	0.012023	99	0.320799
30	0.001599	65	0.013099	100	0.341957
31	0.001732	66	0.014296	101	0.362819
32	0.001868	67	0.015626	102	0.383296
33	0.002008	68	0.017105	103	0.403310
34	0.002149	69	0.018748	104	0.422793
35	0.002292	70	0.020573	105	0.441688
36	0.002437	71	0.022600	106	0.459943
37	0.002582	72	0.024851	107	0.477520
38	0.002728	73	0.027350	108	0.494382
39	0.002873	74	0.030124	109	0.510505
40	0.003017	75	0.033202	110	0.525866
41	0.003159	76	0.036616	111	0.540449
42	0.003299	77	0.040402	112	0.554243
43	0.003435	78	0.044597	113	0.567239
44	0.003567	79	0.049245	114	0.579434
45	0.003698	80	0.054391	115	0.590822
46	0.003840	81	0.060085	116	0.601405
47	0.003999	82	0.066382	117	0.611181
48	0.004175	83	0.073341	118	0.620151
49	0.004371	84	0.081024	119	0.628314
				120	1.000000

Table A24: Dependants, females, heavy, amounts – S1DFA_H – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.004486	85	0.088964
16	0.000174	51	0.004717	86	0.098735
17	0.000240	52	0.004974	87	0.109609
18	0.000310	53	0.005260	88	0.121712
19	0.000385	54	0.005579	89	0.135181
20	0.000465	55	0.005933	90	0.150172
21	0.000550	56	0.006327	91	0.166855
22	0.000640	57	0.006766	92	0.185422
23	0.000735	58	0.007255	93	0.206087
24	0.000835	59	0.007798	94	0.229084
25	0.000940	60	0.008403	95	0.254679
26	0.001050	61	0.009077	96	0.282266
27	0.001165	62	0.009826	97	0.310969
28	0.001284	63	0.010660	98	0.340666
29	0.001408	64	0.011588	99	0.371235
30	0.001535	65	0.012621	100	0.402557
31	0.001667	66	0.013771	101	0.434508
32	0.001801	67	0.015051	102	0.466969
33	0.001939	68	0.016475	103	0.499817
34	0.002080	69	0.018059	104	0.532932
35	0.002223	70	0.019823	105	0.566192
36	0.002367	71	0.021786	106	0.599475
37	0.002513	72	0.023971	107	0.632661
38	0.002659	73	0.026402	108	0.665628
39	0.002805	74	0.029108	109	0.698255
40	0.002950	75	0.032120	110	0.730420
41	0.003093	76	0.035472	111	0.762003
42	0.003235	77	0.039202	112	0.792881
43	0.003373	78	0.043353	113	0.822934
44	0.003508	79	0.047973	114	0.852040
45	0.003639	80	0.053115	115	0.880078
46	0.003774	81	0.058838	116	0.906926
47	0.003925	82	0.065207	117	0.932464
48	0.004092	83	0.072295	118	0.956570
49	0.004279	84	0.080184	119	0.979122
				120	1.000000

Table A25: Normal Health pensioners, females, all, amounts – S1NFA – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.002400	85	0.079835
16	0.000176	51	0.002598	86	0.089085
17	0.000181	52	0.002806	87	0.099118
18	0.000187	53	0.003025	88	0.109949
19	0.000194	54	0.003252	89	0.121585
20	0.000202	55	0.003490	90	0.134025
21	0.000211	56	0.003735	91	0.147259
22	0.000222	57	0.003989	92	0.161268
23	0.000234	58	0.004249	93	0.176022
24	0.000249	59	0.004516	94	0.191480
25	0.000265	60	0.004795	95	0.207777
26	0.000284	61	0.005121	96	0.225519
27	0.000305	62	0.005510	97	0.244623
28	0.000329	63	0.005973	98	0.264811
29	0.000357	64	0.006522	99	0.285820
30	0.000388	65	0.007171	100	0.307401
31	0.000423	66	0.007936	101	0.329321
32	0.000463	67	0.008832	102	0.351370
33	0.000507	68	0.009882	103	0.373355
34	0.000556	69	0.011104	104	0.395105
35	0.000611	70	0.012524	105	0.416468
36	0.000673	71	0.014168	106	0.437312
37	0.000740	72	0.016063	107	0.457524
38	0.000815	73	0.018241	108	0.477007
39	0.000897	74	0.020734	109	0.495681
40	0.000986	75	0.023577	110	0.513479
41	0.001085	76	0.026806	111	0.530349
42	0.001191	77	0.030462	112	0.546246
43	0.001307	78	0.034582	113	0.561139
44	0.001433	79	0.039208	114	0.575000
45	0.001568	80	0.044382	115	0.587810
46	0.001714	81	0.050143	116	0.599554
47	0.001870	82	0.056533	117	0.610218
48	0.002036	83	0.063588	118	0.619792
49	0.002213	84	0.071345	119	0.628262
				120	1.000000

Table A26: Normal Health pensioners, females, all, amounts – S1NFA – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.002307	85	0.078461
16	0.000174	51	0.002500	86	0.088096
17	0.000179	52	0.002704	87	0.098678
18	0.000184	53	0.002918	88	0.110255
19	0.000190	54	0.003142	89	0.122875
20	0.000198	55	0.003375	90	0.136580
21	0.000206	56	0.003618	91	0.151407
22	0.000216	57	0.003868	92	0.167386
23	0.000228	58	0.004126	93	0.184540
24	0.000241	59	0.004391	94	0.202882
25	0.000257	60	0.004661	95	0.222416
26	0.000274	61	0.004961	96	0.243832
27	0.000294	62	0.005318	97	0.267680
28	0.000317	63	0.005745	98	0.293748
29	0.000343	64	0.006252	99	0.321825
30	0.000372	65	0.006852	100	0.351698
31	0.000405	66	0.007561	101	0.383155
32	0.000442	67	0.008395	102	0.415985
33	0.000484	68	0.009374	103	0.449976
34	0.000531	69	0.010517	104	0.484915
35	0.000583	70	0.011849	105	0.520590
36	0.000641	71	0.013396	106	0.556791
37	0.000705	72	0.015186	107	0.593304
38	0.000776	73	0.017250	108	0.629918
39	0.000855	74	0.019623	109	0.666420
40	0.000941	75	0.022341	110	0.702600
41	0.001035	76	0.025444	111	0.738245
42	0.001137	77	0.028975	112	0.773143
43	0.001249	78	0.032978	113	0.807081
44	0.001370	79	0.037501	114	0.839849
45	0.001500	80	0.042594	115	0.871235
46	0.001641	81	0.048308	116	0.901025
47	0.001792	82	0.054697	117	0.929009
48	0.001953	83	0.061816	118	0.954974
49	0.002125	84	0.069719	119	0.978708
				120	1.000000

Table A27: Normal Health pensioners, females, light, amounts – S1NFA_L – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.001641	85	0.075433
16	0.000176	51	0.001801	86	0.084623
17	0.000179	52	0.001975	87	0.094700
18	0.000184	53	0.002167	88	0.105689
19	0.000189	54	0.002376	89	0.117603
20	0.000194	55	0.002604	90	0.130441
21	0.000200	56	0.002853	91	0.144181
22	0.000207	57	0.003125	92	0.158781
23	0.000215	58	0.003420	93	0.174178
24	0.000224	59	0.003741	94	0.190285
25	0.000234	60	0.004092	95	0.206904
26	0.000246	61	0.004491	96	0.224673
27	0.000259	62	0.004948	97	0.243812
28	0.000273	63	0.005471	98	0.264043
29	0.000289	64	0.006069	99	0.285099
30	0.000308	65	0.006754	100	0.306731
31	0.000328	66	0.007537	101	0.328705
32	0.000351	67	0.008434	102	0.350809
33	0.000377	68	0.009459	103	0.372849
34	0.000405	69	0.010632	104	0.394653
35	0.000437	70	0.011973	105	0.416069
36	0.000473	71	0.013505	106	0.436964
37	0.000512	72	0.015256	107	0.457224
38	0.000556	73	0.017253	108	0.476753
39	0.000605	74	0.019530	109	0.495469
40	0.000660	75	0.022121	110	0.513306
41	0.000720	76	0.025068	111	0.530210
42	0.000787	77	0.028411	112	0.546138
43	0.000861	78	0.032198	113	0.561057
44	0.000943	79	0.036476	114	0.574942
45	0.001033	80	0.041298	115	0.587771
46	0.001133	81	0.046717	116	0.599530
47	0.001242	82	0.052786	117	0.610206
48	0.001363	83	0.059561	118	0.619787
49	0.001495	84	0.067094	119	0.628262
				120	1.000000

Table A28: Normal Health pensioners, females, light, amounts – S1NFA_L – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.001567	85	0.073778
16	0.000174	51	0.001720	86	0.083250
17	0.000178	52	0.001887	87	0.093768
18	0.000182	53	0.002070	88	0.105399
19	0.000186	54	0.002271	89	0.118204
20	0.000191	55	0.002490	90	0.132231
21	0.000197	56	0.002729	91	0.147519
22	0.000204	57	0.002990	92	0.164087
23	0.000211	58	0.003274	93	0.181931
24	0.000220	59	0.003582	94	0.201026
25	0.000229	60	0.003918	95	0.221313
26	0.000240	61	0.004292	96	0.242734
27	0.000252	62	0.004721	97	0.266597
28	0.000266	63	0.005211	98	0.292689
29	0.000281	64	0.005773	99	0.320797
30	0.000298	65	0.006417	100	0.350709
31	0.000317	66	0.007154	101	0.382212
32	0.000339	67	0.007997	102	0.415093
33	0.000363	68	0.008963	103	0.449139
34	0.000390	69	0.010070	104	0.484137
35	0.000421	70	0.011336	105	0.519875
36	0.000454	71	0.012786	106	0.556140
37	0.000492	72	0.014446	107	0.592719
38	0.000534	73	0.016343	108	0.629399
39	0.000580	74	0.018512	109	0.665968
40	0.000632	75	0.020988	110	0.702212
41	0.000689	76	0.023813	111	0.737919
42	0.000753	77	0.027031	112	0.772876
43	0.000823	78	0.030692	113	0.806870
44	0.000901	79	0.034850	114	0.839689
45	0.000987	80	0.039564	115	0.871120
46	0.001082	81	0.044895	116	0.900949
47	0.001186	82	0.050911	117	0.928965
48	0.001301	83	0.057682	118	0.954954
49	0.001428	84	0.065279	119	0.978703
				120	1.000000

Table A29: Normal Health pensioners, females, heavy, amounts – S1NFA_H – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.002674	85	0.090296
16	0.000177	51	0.002910	86	0.099570
17	0.000183	52	0.003161	87	0.109456
18	0.000190	53	0.003429	88	0.119942
19	0.000199	54	0.003713	89	0.131008
20	0.000208	55	0.004014	90	0.142627
21	0.000219	56	0.004331	91	0.154764
22	0.000232	57	0.004666	92	0.167376
23	0.000247	58	0.005017	93	0.180412
24	0.000263	59	0.005385	94	0.193813
25	0.000282	60	0.005778	95	0.208956
26	0.000303	61	0.006234	96	0.226661
27	0.000327	62	0.006774	97	0.245716
28	0.000354	63	0.007410	98	0.265848
29	0.000385	64	0.008156	99	0.286793
30	0.000419	65	0.009028	100	0.308304
31	0.000458	66	0.010044	101	0.330153
32	0.000501	67	0.011223	102	0.352127
33	0.000549	68	0.012587	103	0.374038
34	0.000603	69	0.014157	104	0.395714
35	0.000663	70	0.015960	105	0.417006
36	0.000729	71	0.018020	106	0.437781
37	0.000803	72	0.020366	107	0.457928
38	0.000884	73	0.023026	108	0.477350
39	0.000973	74	0.026032	109	0.495967
40	0.001071	75	0.029413	110	0.513714
41	0.001179	76	0.033201	111	0.530537
42	0.001296	77	0.037427	112	0.546393
43	0.001424	78	0.042123	113	0.561248
44	0.001564	79	0.047317	114	0.575079
45	0.001716	80	0.053037	115	0.587863
46	0.001880	81	0.059309	116	0.599586
47	0.002057	82	0.066155	117	0.610235
48	0.002248	83	0.073594	118	0.619798
49	0.002454	84	0.081638	119	0.628263
				120	1.000000

Table A30: Normal Health pensioners, females, heavy, amounts – S1NFA_H – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.002565	85	0.089772
16	0.000174	51	0.002793	86	0.099629
17	0.000180	52	0.003037	87	0.110270
18	0.000187	53	0.003298	88	0.121710
19	0.000194	54	0.003575	89	0.133959
20	0.000203	55	0.003868	90	0.147018
21	0.000214	56	0.004179	91	0.160879
22	0.000226	57	0.004506	92	0.175529
23	0.000239	58	0.004850	93	0.190941
24	0.000255	59	0.005212	94	0.207083
25	0.000272	60	0.005590	95	0.223907
26	0.000292	61	0.006011	96	0.245316
27	0.000315	62	0.006510	97	0.269144
28	0.000340	63	0.007100	98	0.295180
29	0.000369	64	0.007793	99	0.323214
30	0.000402	65	0.008606	100	0.353034
31	0.000438	66	0.009556	101	0.384430
32	0.000479	67	0.010661	102	0.417191
33	0.000525	68	0.011943	103	0.451106
34	0.000576	69	0.013425	104	0.485965
35	0.000632	70	0.015132	105	0.521556
36	0.000695	71	0.017090	106	0.557670
37	0.000765	72	0.019328	107	0.594094
38	0.000842	73	0.021879	108	0.630618
39	0.000927	74	0.024773	109	0.667032
40	0.001021	75	0.028046	110	0.703125
41	0.001124	76	0.031734	111	0.738685
42	0.001236	77	0.035874	112	0.773503
43	0.001359	78	0.040503	113	0.807367
44	0.001493	79	0.045660	114	0.840066
45	0.001639	80	0.051383	115	0.871390
46	0.001797	81	0.057711	116	0.901127
47	0.001968	82	0.064680	117	0.929068
48	0.002153	83	0.072325	118	0.955001
49	0.002351	84	0.080680	119	0.978715
				120	1.000000

Table A31: Normal Health pensioners, males, all, amounts – S1NMA – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.002450	85	0.108920
16	0.000364	51	0.002670	86	0.120721
17	0.000374	52	0.002912	87	0.133493
18	0.000384	53	0.003180	88	0.147264
19	0.000395	54	0.003477	89	0.162059
20	0.000408	55	0.003805	90	0.177892
21	0.000421	56	0.004168	91	0.194770
22	0.000435	57	0.004570	92	0.212690
23	0.000451	58	0.005015	93	0.231637
24	0.000469	59	0.005509	94	0.251585
25	0.000488	60	0.006061	95	0.272306
26	0.000508	61	0.006697	96	0.292994
27	0.000531	62	0.007432	97	0.313401
28	0.000556	63	0.008283	98	0.333468
29	0.000583	64	0.009263	99	0.353146
30	0.000612	65	0.010389	100	0.372390
31	0.000645	66	0.011682	101	0.391160
32	0.000680	67	0.013163	102	0.409423
33	0.000719	68	0.014853	103	0.427150
34	0.000762	69	0.016779	104	0.444317
35	0.000809	70	0.018969	105	0.460905
36	0.000861	71	0.021452	106	0.476898
37	0.000917	72	0.024260	107	0.492282
38	0.000979	73	0.027429	108	0.507051
39	0.001047	74	0.030995	109	0.521196
40	0.001123	75	0.034998	110	0.534714
41	0.001205	76	0.039479	111	0.547604
42	0.001296	77	0.044483	112	0.559865
43	0.001396	78	0.050054	113	0.571500
44	0.001506	79	0.056239	114	0.582510
45	0.001628	80	0.063086	115	0.592901
46	0.001762	81	0.070644	116	0.602675
47	0.001909	82	0.078959	117	0.611838
48	0.002072	83	0.088080	118	0.620394
49	0.002252	84	0.098053	119	0.628349
				120	1.000000

Table A32: Normal Health pensioners, males, all, amounts – S1NMA – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.002351	85	0.109065
16	0.000360	51	0.002560	86	0.121778
17	0.000369	52	0.002791	87	0.135745
18	0.000379	53	0.003046	88	0.151056
19	0.000390	54	0.003329	89	0.167802
20	0.000401	55	0.003642	90	0.186075
21	0.000414	56	0.003988	91	0.205970
22	0.000428	57	0.004371	92	0.227579
23	0.000443	58	0.004796	93	0.250996
24	0.000460	59	0.005267	94	0.276313
25	0.000478	60	0.005790	95	0.303620
26	0.000498	61	0.006383	96	0.332215
27	0.000519	62	0.007072	97	0.361292
28	0.000543	63	0.007868	98	0.390779
29	0.000569	64	0.008788	99	0.420606
30	0.000597	65	0.009848	100	0.450702
31	0.000628	66	0.011067	101	0.480996
32	0.000662	67	0.012467	102	0.511418
33	0.000699	68	0.014069	103	0.541895
34	0.000740	69	0.015900	104	0.572359
35	0.000785	70	0.017988	105	0.602737
36	0.000834	71	0.020364	106	0.632959
37	0.000888	72	0.023062	107	0.662954
38	0.000948	73	0.026119	108	0.692651
39	0.001013	74	0.029575	109	0.721979
40	0.001084	75	0.033474	110	0.750868
41	0.001163	76	0.037862	111	0.779247
42	0.001250	77	0.042792	112	0.807044
43	0.001345	78	0.048318	113	0.834190
44	0.001450	79	0.054497	114	0.860612
45	0.001566	80	0.061393	115	0.886241
46	0.001694	81	0.069072	116	0.911005
47	0.001835	82	0.077603	117	0.934834
48	0.001990	83	0.087060	118	0.957657
49	0.002161	84	0.097520	119	0.979402
				120	1.000000

Table A33: Normal Health pensioners, males, light, amounts – S1NMA_L – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.002434	85	0.094880
16	0.000361	51	0.002633	86	0.106667
17	0.000364	52	0.002843	87	0.119505
18	0.000367	53	0.003061	88	0.133412
19	0.000371	54	0.003289	89	0.148391
20	0.000376	55	0.003524	90	0.164432
21	0.000381	56	0.003765	91	0.181511
22	0.000388	57	0.004012	92	0.199588
23	0.000396	58	0.004263	93	0.218604
24	0.000405	59	0.004516	94	0.238486
25	0.000417	60	0.004779	95	0.259034
26	0.000430	61	0.005089	96	0.279713
27	0.000445	62	0.005465	97	0.300317
28	0.000463	63	0.005921	98	0.320754
29	0.000484	64	0.006470	99	0.340945
30	0.000508	65	0.007128	100	0.360816
31	0.000536	66	0.007916	101	0.380302
32	0.000569	67	0.008855	102	0.399348
33	0.000606	68	0.009969	103	0.417902
34	0.000647	69	0.011286	104	0.435922
35	0.000695	70	0.012837	105	0.453371
36	0.000749	71	0.014657	106	0.470220
37	0.000809	72	0.016782	107	0.486443
38	0.000877	73	0.019255	108	0.502019
39	0.000953	74	0.022120	109	0.516934
40	0.001037	75	0.025426	110	0.531174
41	0.001130	76	0.029224	111	0.544732
42	0.001233	77	0.033568	112	0.557602
43	0.001345	78	0.038515	113	0.569780
44	0.001468	79	0.044124	114	0.581265
45	0.001602	80	0.050452	115	0.592057
46	0.001746	81	0.057560	116	0.602159
47	0.001901	82	0.065504	117	0.611570
48	0.002068	83	0.074340	118	0.620295
49	0.002246	84	0.084117	119	0.628335
				120	1.000000

Table A34: Normal Health pensioners, males, light, amounts – S1NMA_L – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.002341	85	0.093570
16	0.000360	51	0.002535	86	0.106021
17	0.000362	52	0.002740	87	0.119799
18	0.000365	53	0.002955	88	0.134985
19	0.000369	54	0.003179	89	0.151651
20	0.000373	55	0.003411	90	0.169867
21	0.000378	56	0.003650	91	0.189693
22	0.000384	57	0.003896	92	0.211179
23	0.000392	58	0.004146	93	0.234363
24	0.000400	59	0.004399	94	0.259271
25	0.000411	60	0.004654	95	0.285910
26	0.000423	61	0.004936	96	0.313827
27	0.000437	62	0.005279	97	0.342505
28	0.000454	63	0.005695	98	0.371853
29	0.000473	64	0.006197	99	0.401779
30	0.000496	65	0.006802	100	0.432190
31	0.000522	66	0.007527	101	0.462993
32	0.000552	67	0.008394	102	0.494097
33	0.000586	68	0.009425	103	0.525408
34	0.000626	69	0.010648	104	0.556835
35	0.000671	70	0.012093	105	0.588286
36	0.000721	71	0.013794	106	0.619667
37	0.000778	72	0.015789	107	0.650886
38	0.000843	73	0.018120	108	0.681852
39	0.000914	74	0.020833	109	0.712471
40	0.000994	75	0.023980	110	0.742651
41	0.001083	76	0.027616	111	0.772300
42	0.001181	77	0.031800	112	0.801326
43	0.001288	78	0.036597	113	0.829636
44	0.001406	79	0.042076	114	0.857137
45	0.001534	80	0.048310	115	0.883738
46	0.001673	81	0.055375	116	0.909346
47	0.001823	82	0.063350	117	0.933869
48	0.001985	83	0.072319	118	0.957213
49	0.002157	84	0.082364	119	0.979288
				120	1.000000

Table A35: Normal Health pensioners, males, heavy, amounts – S1NMA_H – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.007926	85	0.128402
16	0.000365	51	0.008481	86	0.139542
17	0.000376	52	0.009037	87	0.151648
18	0.000390	53	0.009588	88	0.164886
19	0.000407	54	0.010129	89	0.179463
20	0.000428	55	0.010655	90	0.195624
21	0.000453	56	0.011158	91	0.213662
22	0.000483	57	0.011635	92	0.233920
23	0.000520	58	0.012078	93	0.256804
24	0.000562	59	0.012483	94	0.282779
25	0.000613	60	0.012872	95	0.311248
26	0.000673	61	0.013361	96	0.338224
27	0.000743	62	0.014005	97	0.362900
28	0.000824	63	0.014834	98	0.385515
29	0.000919	64	0.015885	99	0.406284
30	0.001027	65	0.017193	100	0.425398
31	0.001152	66	0.018792	101	0.443026
32	0.001294	67	0.020717	102	0.459320
33	0.001456	68	0.022997	103	0.474420
34	0.001638	69	0.025660	104	0.488448
35	0.001842	70	0.028728	105	0.501517
36	0.002070	71	0.032215	106	0.513730
37	0.002322	72	0.036134	107	0.525180
38	0.002601	73	0.040490	108	0.535952
39	0.002906	74	0.045285	109	0.546124
40	0.003239	75	0.050517	110	0.555770
41	0.003600	76	0.056183	111	0.564955
42	0.003988	77	0.062282	112	0.573742
43	0.004403	78	0.068815	113	0.582188
44	0.004844	79	0.075786	114	0.590347
45	0.005311	80	0.083210	115	0.598267
46	0.005799	81	0.091109	116	0.605995
47	0.006309	82	0.099519	117	0.613574
48	0.006835	83	0.108489	118	0.621045
49	0.007375	84	0.118088	119	0.628443
				120	1.000000

Table A36: Normal Health pensioners, males, heavy, amounts – S1NMA_H – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.007679	85	0.131376
16	0.000360	51	0.008237	86	0.143660
17	0.000370	52	0.008798	87	0.157138
18	0.000383	53	0.009357	88	0.172039
19	0.000398	54	0.009910	89	0.188648
20	0.000417	55	0.010449	90	0.207324
21	0.000440	56	0.010970	91	0.228516
22	0.000468	57	0.011467	92	0.252788
23	0.000501	58	0.011933	93	0.280851
24	0.000540	59	0.012363	94	0.313610
25	0.000586	60	0.012753	95	0.352220
26	0.000642	61	0.013180	96	0.393185
27	0.000706	62	0.013749	97	0.432146
28	0.000782	63	0.014490	98	0.469201
29	0.000869	64	0.015439	99	0.504448
30	0.000971	65	0.016631	100	0.537985
31	0.001088	66	0.018104	101	0.569909
32	0.001221	67	0.019894	102	0.600318
33	0.001373	68	0.022036	103	0.629311
34	0.001544	69	0.024562	104	0.656983
35	0.001738	70	0.027499	105	0.683434
36	0.001954	71	0.030871	106	0.708760
37	0.002194	72	0.034696	107	0.733060
38	0.002460	73	0.038988	108	0.756431
39	0.002753	74	0.043757	109	0.778971
40	0.003073	75	0.049008	110	0.800778
41	0.003421	76	0.054748	111	0.821949
42	0.003796	77	0.060981	112	0.842582
43	0.004200	78	0.067716	113	0.862775
44	0.004630	79	0.074965	114	0.882625
45	0.005086	80	0.082750	115	0.902230
46	0.005567	81	0.091102	116	0.921688
47	0.006069	82	0.100066	117	0.941096
48	0.006591	83	0.109706	118	0.960552
49	0.007129	84	0.120105	119	0.980154
				120	1.000000

Table A37: Ill-health pensioners, females, all, amounts – S1IFA – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.008250	85	0.102470
16	0.002982	51	0.008414	86	0.110990
17	0.003137	52	0.008582	87	0.119452
18	0.003291	53	0.008756	88	0.127722
19	0.003446	54	0.008938	89	0.135660
20	0.003601	55	0.009130	90	0.143130
21	0.003755	56	0.009337	91	0.149998
22	0.003910	57	0.009562	92	0.156138
23	0.004064	58	0.009813	93	0.161437
24	0.004219	59	0.010095	94	0.165795
25	0.004373	60	0.010419	95	0.170068
26	0.004528	61	0.010796	96	0.177816
27	0.004682	62	0.011240	97	0.189554
28	0.004837	63	0.011768	98	0.204796
29	0.004991	64	0.012399	99	0.223027
30	0.005146	65	0.013157	100	0.243729
31	0.005300	66	0.014068	101	0.266389
32	0.005454	67	0.015164	102	0.290515
33	0.005609	68	0.016478	103	0.315644
34	0.005763	69	0.018046	104	0.341351
35	0.005917	70	0.019910	105	0.367251
36	0.006071	71	0.022110	106	0.393002
37	0.006226	72	0.024689	107	0.418308
38	0.006380	73	0.027689	108	0.442916
39	0.006534	74	0.031151	109	0.466612
40	0.006688	75	0.035108	110	0.489222
41	0.006843	76	0.039590	111	0.510604
42	0.006997	77	0.044618	112	0.530647
43	0.007151	78	0.050200	113	0.549264
44	0.007306	79	0.056334	114	0.566389
45	0.007461	80	0.062999	115	0.581971
46	0.007617	81	0.070162	116	0.595971
47	0.007773	82	0.077769	117	0.608356
48	0.007930	83	0.085749	118	0.619097
49	0.008089	84	0.094017	119	0.628162
				120	1.000000

Table A38: Ill-health pensioners, females, all, amounts – S1IFA – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.008203	85	0.103383
16	0.002909	51	0.008366	86	0.112861
17	0.003064	52	0.008534	87	0.122438
18	0.003219	53	0.008706	88	0.131964
19	0.003374	54	0.008885	89	0.141281
20	0.003530	55	0.009073	90	0.150220
21	0.003685	56	0.009274	91	0.158612
22	0.003840	57	0.009491	92	0.166287
23	0.003995	58	0.009730	93	0.173086
24	0.004150	59	0.009998	94	0.178862
25	0.004305	60	0.010302	95	0.183488
26	0.004461	61	0.010654	96	0.190234
27	0.004616	62	0.011067	97	0.202180
28	0.004771	63	0.011555	98	0.218929
29	0.004926	64	0.012137	99	0.240085
30	0.005081	65	0.012837	100	0.265250
31	0.005236	66	0.013678	101	0.294030
32	0.005392	67	0.014690	102	0.326026
33	0.005547	68	0.015907	103	0.360843
34	0.005702	69	0.017366	104	0.398083
35	0.005857	70	0.019107	105	0.437351
36	0.006012	71	0.021173	106	0.478250
37	0.006167	72	0.023609	107	0.520383
38	0.006323	73	0.026462	108	0.563353
39	0.006478	74	0.029779	109	0.606765
40	0.006633	75	0.033601	110	0.650222
41	0.006788	76	0.037970	111	0.693326
42	0.006944	77	0.042919	112	0.735682
43	0.007099	78	0.048471	113	0.776893
44	0.007255	79	0.054641	114	0.816563
45	0.007411	80	0.061427	115	0.854294
46	0.007568	81	0.068814	116	0.889691
47	0.007725	82	0.076766	117	0.922356
48	0.007883	83	0.085232	118	0.951894
49	0.008042	84	0.094135	119	0.977907
				120	1.000000

Table A39: Ill-health pensioners, males, all, amounts – S1IMA – values of q_x

Age x	q_x	Age x	q_x	Age x	q_x
		50	0.010619	85	0.133016
16	0.008894	51	0.010918	86	0.143380
17	0.008895	52	0.011264	87	0.154251
18	0.008896	53	0.011663	88	0.165615
19	0.008896	54	0.012122	89	0.177452
20	0.008898	55	0.012649	90	0.189737
21	0.008899	56	0.013252	91	0.202443
22	0.008901	57	0.013942	92	0.215535
23	0.008903	58	0.014728	93	0.228976
24	0.008905	59	0.015622	94	0.242725
25	0.008908	60	0.016636	95	0.256927
26	0.008912	61	0.017784	96	0.272244
27	0.008917	62	0.019079	97	0.288663
28	0.008922	63	0.020537	98	0.305970
29	0.008929	64	0.022175	99	0.323965
30	0.008938	65	0.024010	100	0.342455
31	0.008948	66	0.026060	101	0.361261
32	0.008960	67	0.028344	102	0.380217
33	0.008975	68	0.030884	103	0.399171
34	0.008993	69	0.033699	104	0.417987
35	0.009014	70	0.036811	105	0.436541
36	0.009040	71	0.040242	106	0.454724
37	0.009071	72	0.044014	107	0.472442
38	0.009108	73	0.048149	108	0.489610
39	0.009151	74	0.052670	109	0.506160
40	0.009203	75	0.057597	110	0.522029
41	0.009265	76	0.062952	111	0.537169
42	0.009338	77	0.068755	112	0.551537
43	0.009424	78	0.075024	113	0.565099
44	0.009526	79	0.081774	114	0.577828
45	0.009645	80	0.089022	115	0.589700
46	0.009785	81	0.096778	116	0.600698
47	0.009948	82	0.105051	117	0.610805
48	0.010139	83	0.113848	118	0.620008
49	0.010361	84	0.123170	119	0.628293
				120	1.000000

Table A40: Ill-health pensioners, males, all, amounts – S1IMA – values of μ_x

Age x	μ_x	Age x	μ_x	Age x	μ_x
		50	0.010539	85	0.136968
16	0.008934	51	0.010820	86	0.148625
17	0.008934	52	0.011145	87	0.161022
18	0.008935	53	0.011520	88	0.174170
19	0.008936	54	0.011953	89	0.188077
20	0.008937	55	0.012450	90	0.202746
21	0.008938	56	0.013021	91	0.218174
22	0.008940	57	0.013675	92	0.234354
23	0.008941	58	0.014422	93	0.251275
24	0.008944	59	0.015272	94	0.268916
25	0.008946	60	0.016239	95	0.287255
26	0.008950	61	0.017336	96	0.307030
27	0.008954	62	0.018577	97	0.328882
28	0.008959	63	0.019978	98	0.352637
29	0.008966	64	0.021555	99	0.378117
30	0.008973	65	0.023328	100	0.405147
31	0.008983	66	0.025315	101	0.433551
32	0.008994	67	0.027537	102	0.463152
33	0.009007	68	0.030016	103	0.493774
34	0.009024	69	0.032775	104	0.525242
35	0.009044	70	0.035838	105	0.557379
36	0.009067	71	0.039230	106	0.590009
37	0.009096	72	0.042979	107	0.622956
38	0.009130	73	0.047111	108	0.656044
39	0.009170	74	0.051654	109	0.689097
40	0.009218	75	0.056637	110	0.721939
41	0.009275	76	0.062089	111	0.754393
42	0.009343	77	0.068039	112	0.786284
43	0.009423	78	0.074517	113	0.817436
44	0.009518	79	0.081552	114	0.847672
45	0.009628	80	0.089172	115	0.876816
46	0.009759	81	0.097405	116	0.904693
47	0.009911	82	0.106277	117	0.931126
48	0.010090	83	0.115813	118	0.955938
49	0.010297	84	0.126037	119	0.978955
				120	1.000000

Appendix B: Comparative graphs of μ_x

The following graphs of the graduated tables show ages 16 to 60 and 50 to 120 separately. This is because the rates at higher ages can be seen more clearly using a logarithmic scale for the *y* axis, whereas this is not necessary at lower ages.

Chart B1: Female All pensioner series – values of μ_x – ages 16 to 60

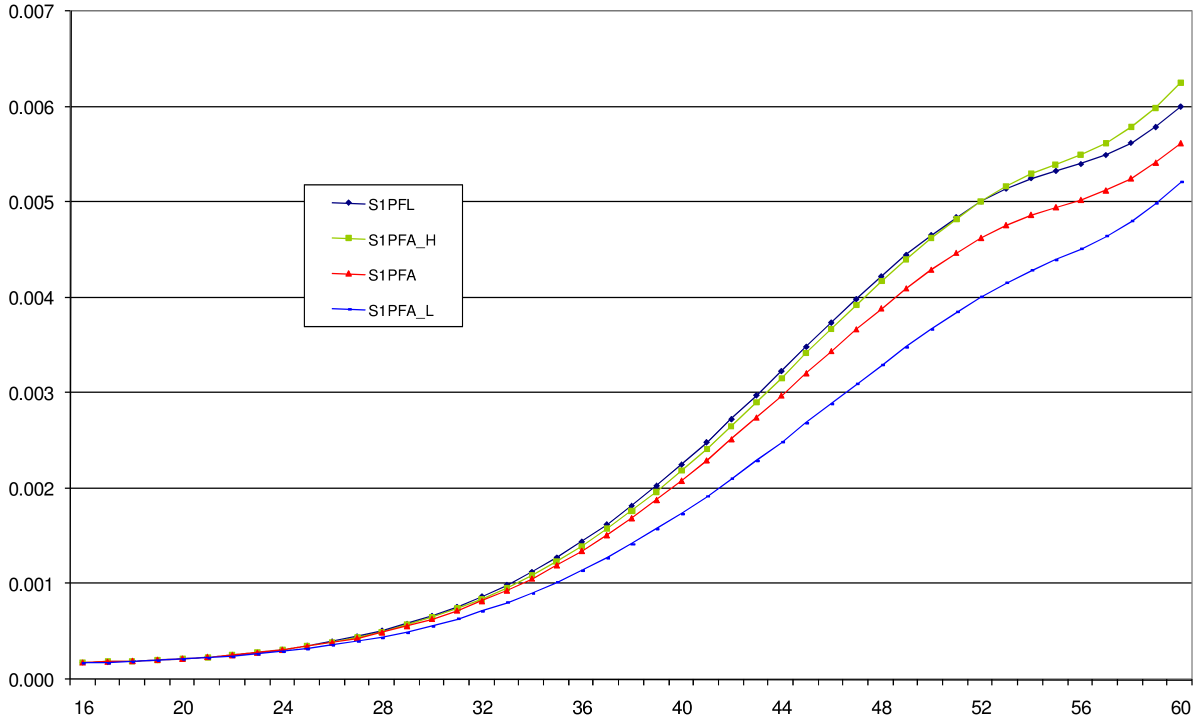


Chart B2: Female All pensioner series – values of μ_x – ages 50 to 120
Logarithmic *y* axis

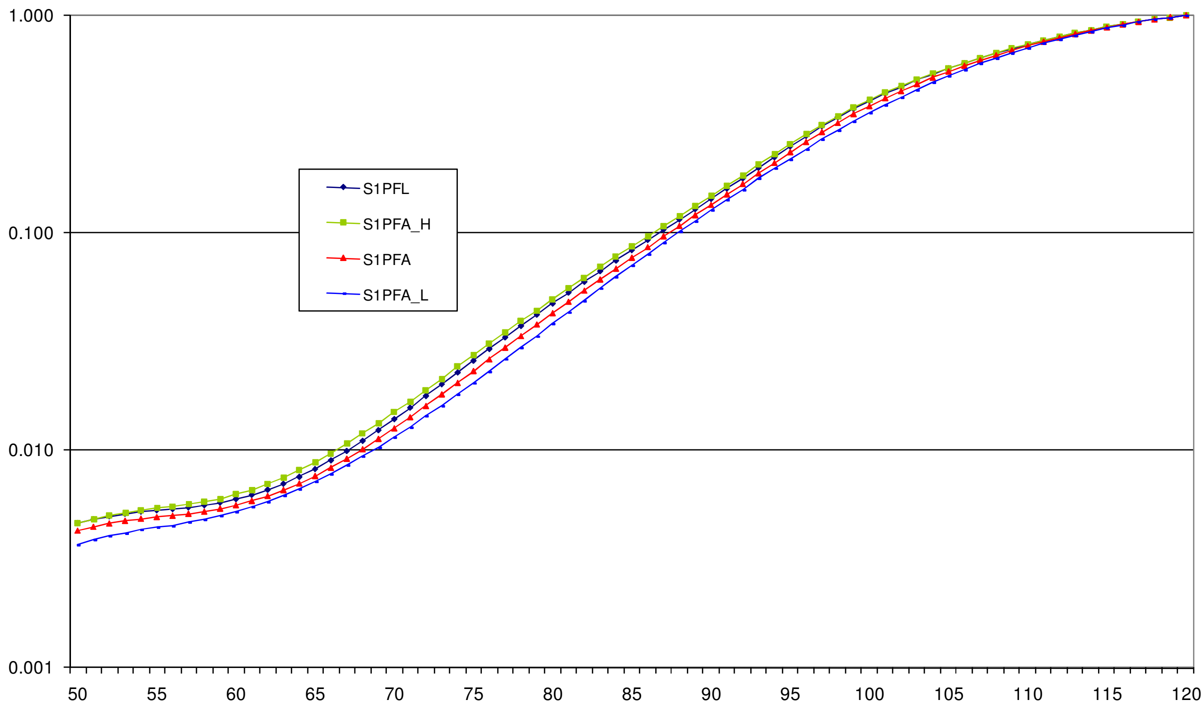


Chart B3: Male All pensioner series – values of μ_x – ages 16 to 60

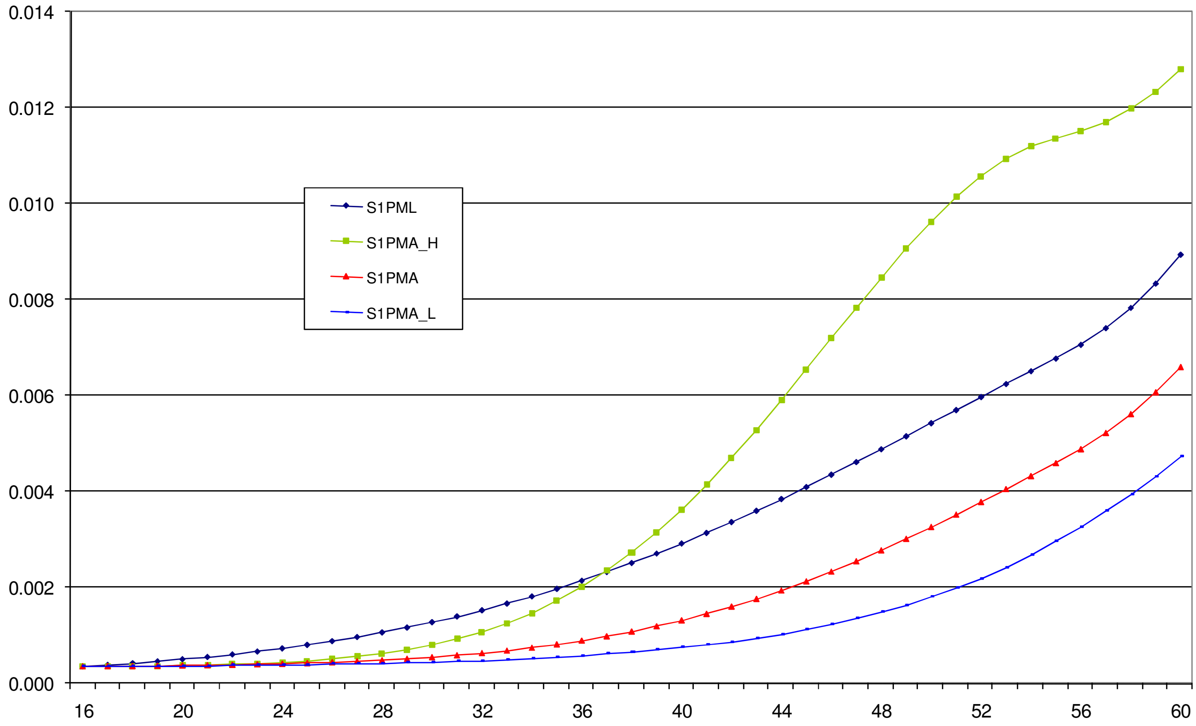


Chart B4: Male all pensioner series – values of μ_x – ages 50 to 120
Logarithmic y axis

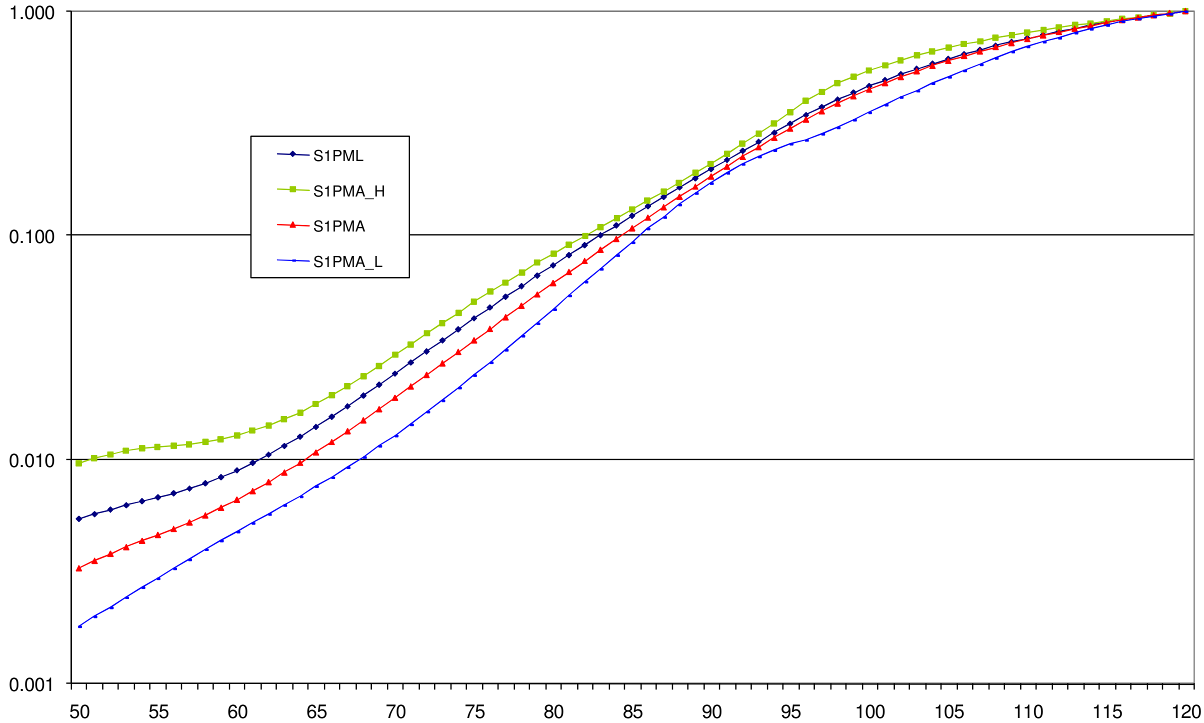


Chart B5: Female dependants series – values of μ_x – ages 16 to 60

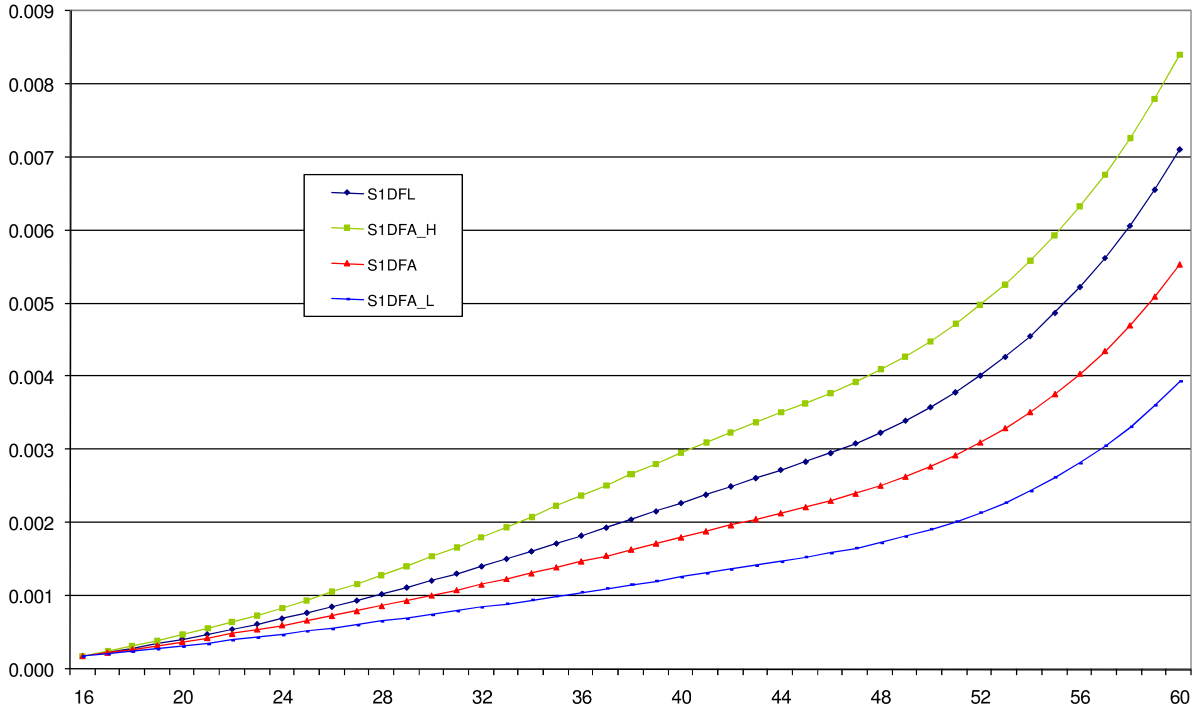


Chart B6: Female dependants series – values of μ_x – ages 50 to 120
Logarithmic y axis

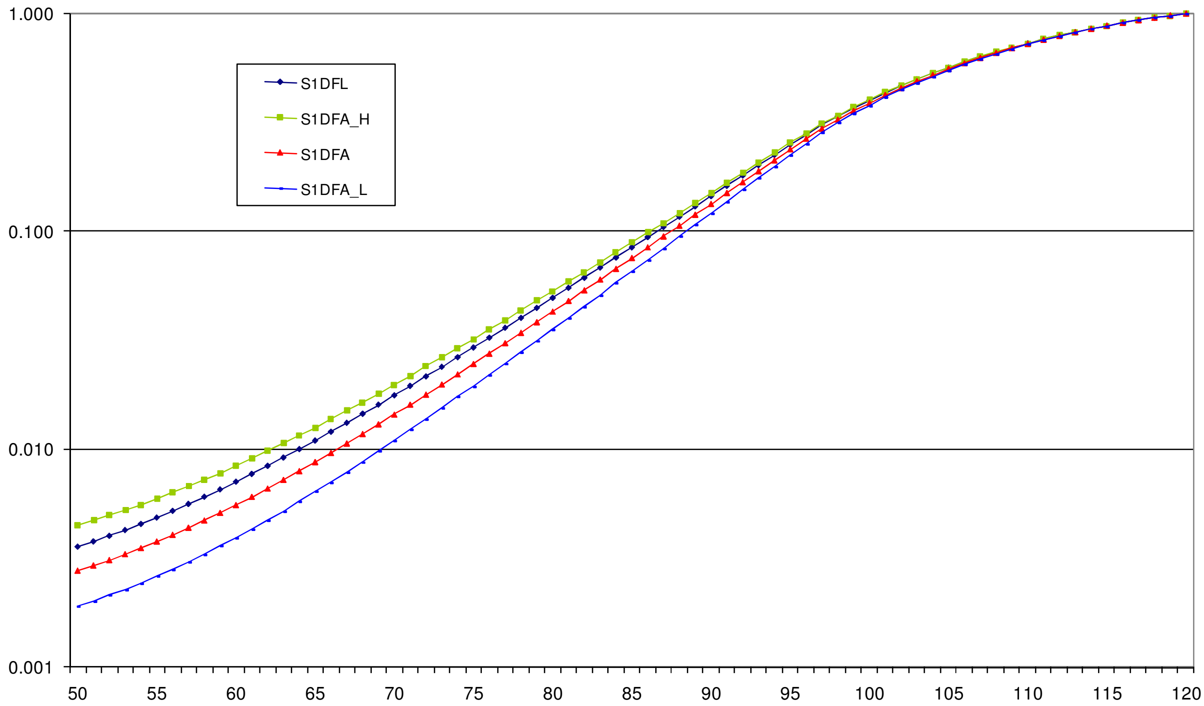


Chart B7: Female Normal Health retirees series – values of μ_x – ages 16 to 60

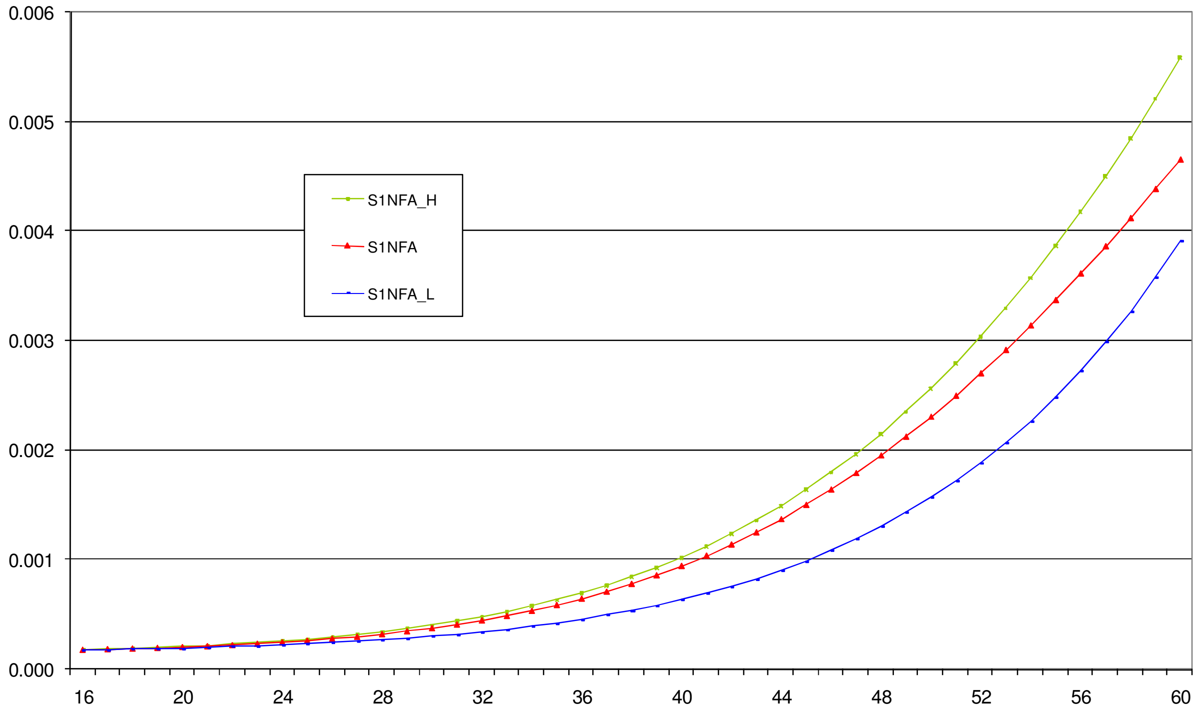


Chart B8: Female Normal Health retirees series – values of μ_x – ages 50 to 120
Logarithmic y axis

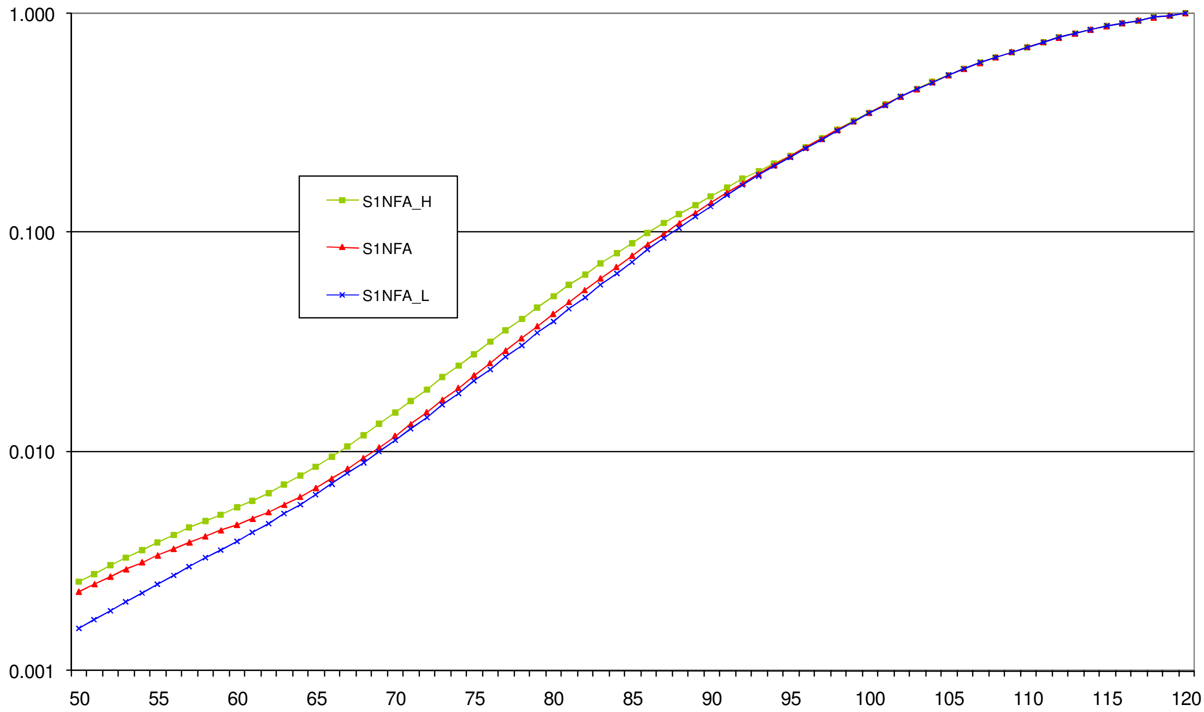


Chart B9: Male Normal Health retirees series – values of μ_x – ages 16 to 60

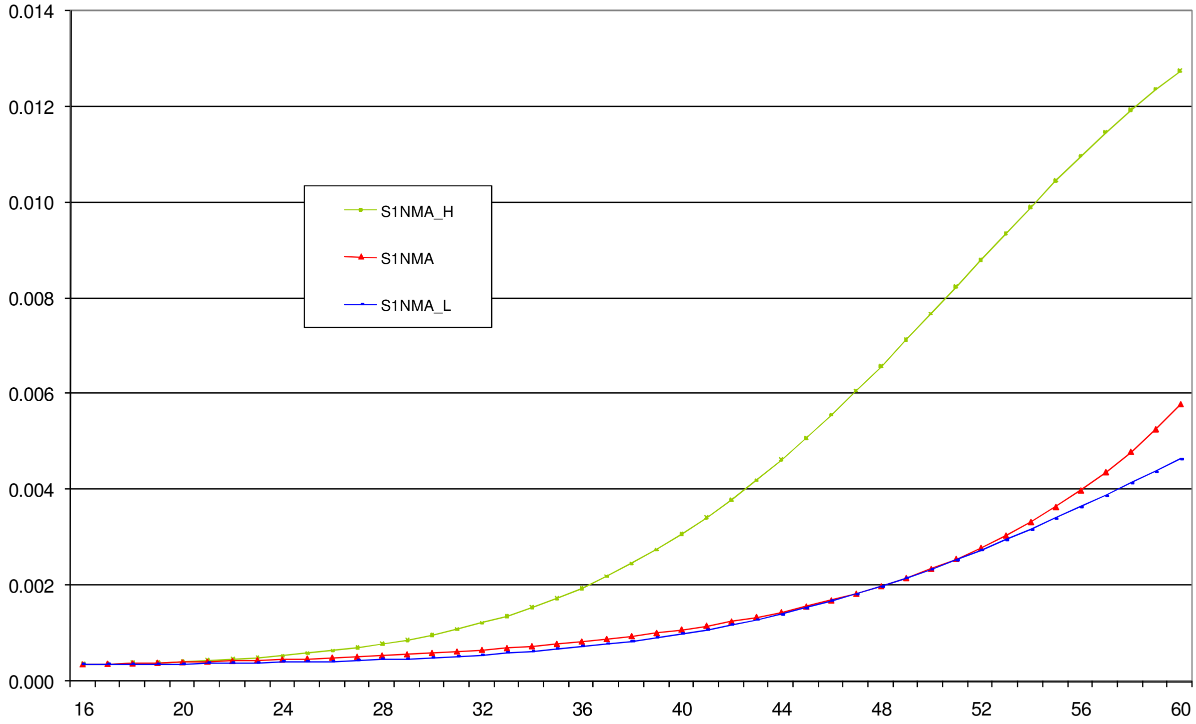


Chart B10: Male Normal Health retirees series – values of μ_x – ages 50 to 120
Logarithmic y axis

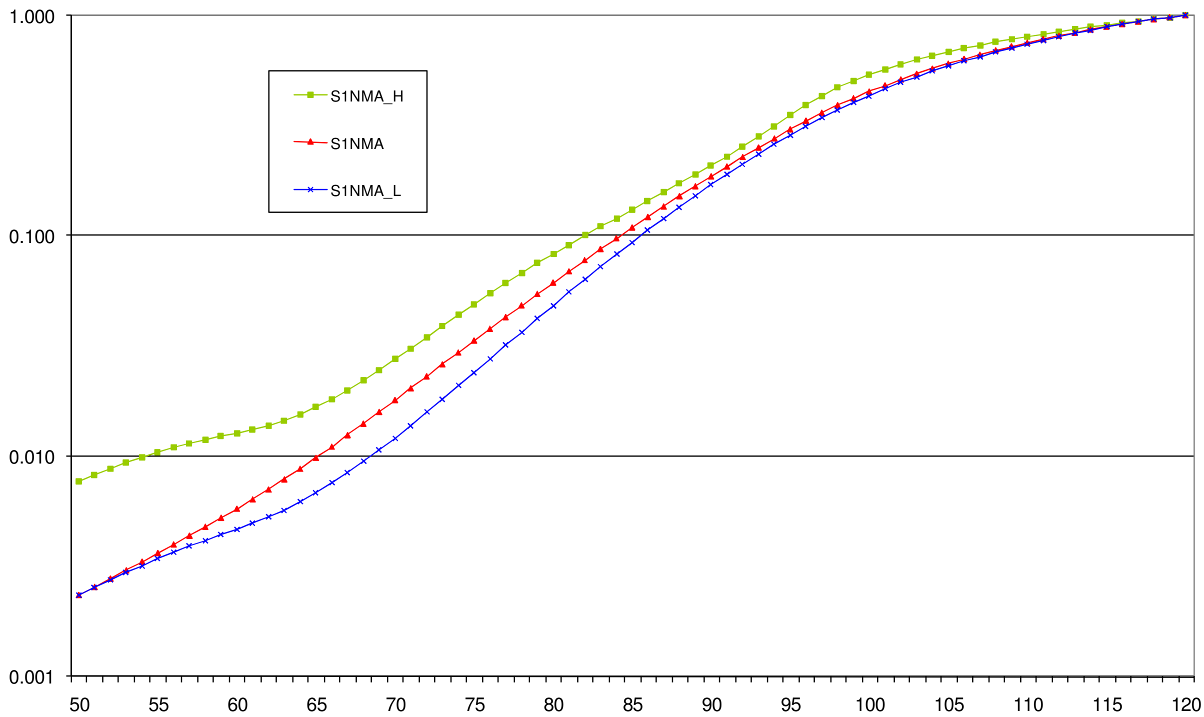


Chart B11: Male and female Ill-health retiree series – values of μ_x – ages 16 to 60

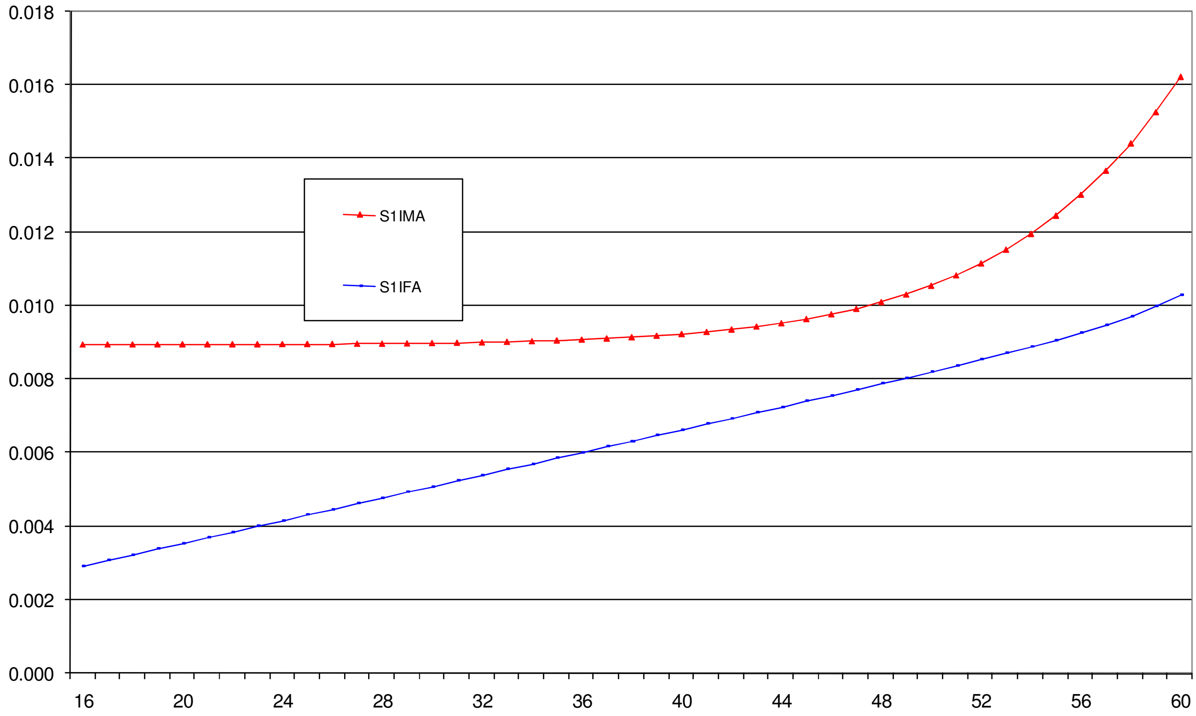
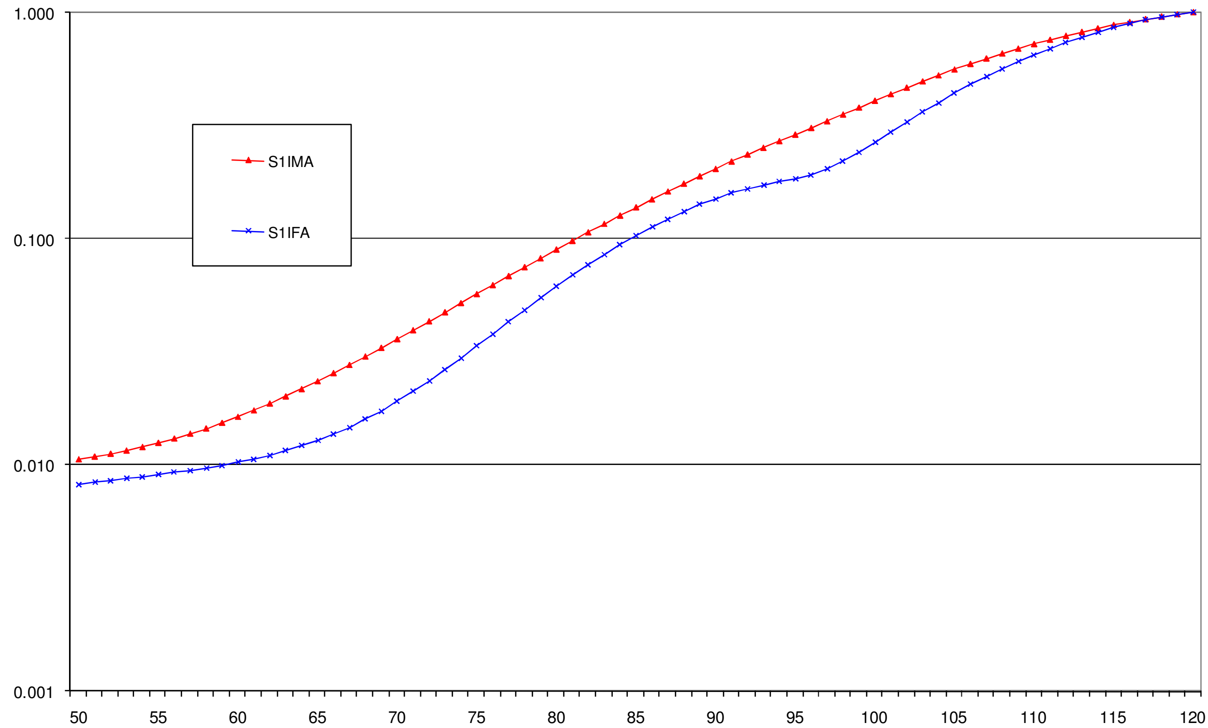


Chart B12: Male and female Ill-health retiree series – values of μ_x – ages 50 to 120
Logarithmic y axis



Appendix C: Comparisons of the graduations with the underlying data

The graphs in this appendix illustrate how the graduations compare with the data. Note that in these graphs the fitted values of $\mu_{x+½}$ are those prior to adjustments at younger and older ages.

Each graph shows the crude values and the fitted values of $\mu_{x+½}$, together with the 2.5% and the 97.5% confidence limits (the "low gate" and the "high gate") of the crude values of $\mu_{x+½}$. A log scale is used on the *y*-axis.

Chart C1: Female All Pensioners Lives – crude and graduated values of $\mu_{x+½}$

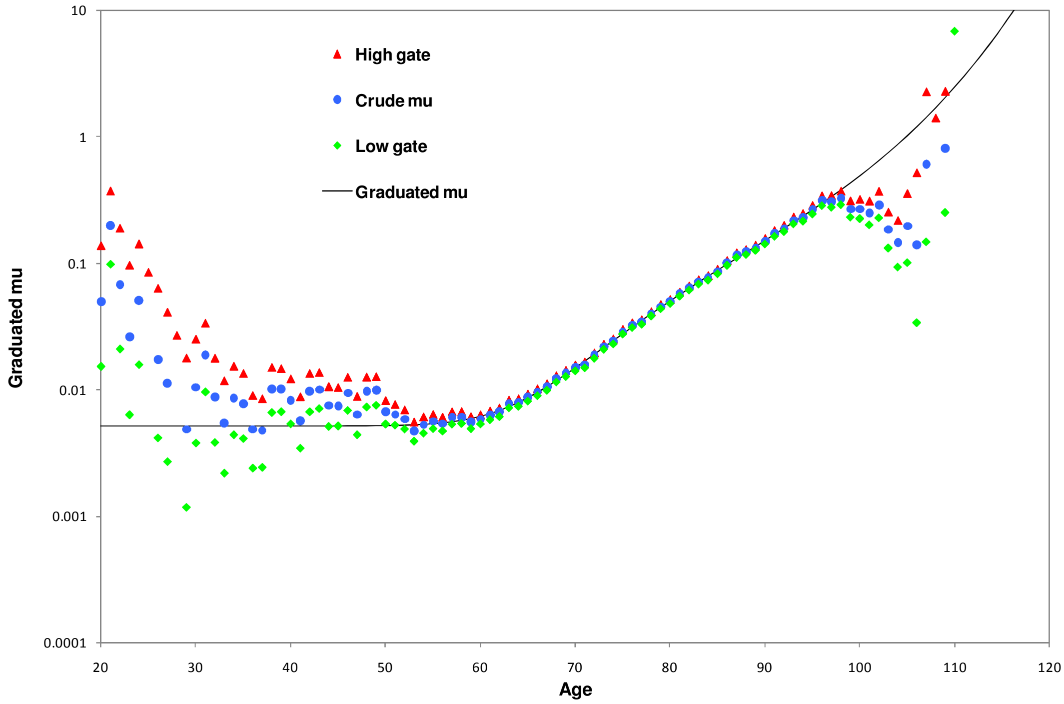


Chart C2: Female All Pensioners Amounts – crude and graduated values of $\mu_{x+½}$

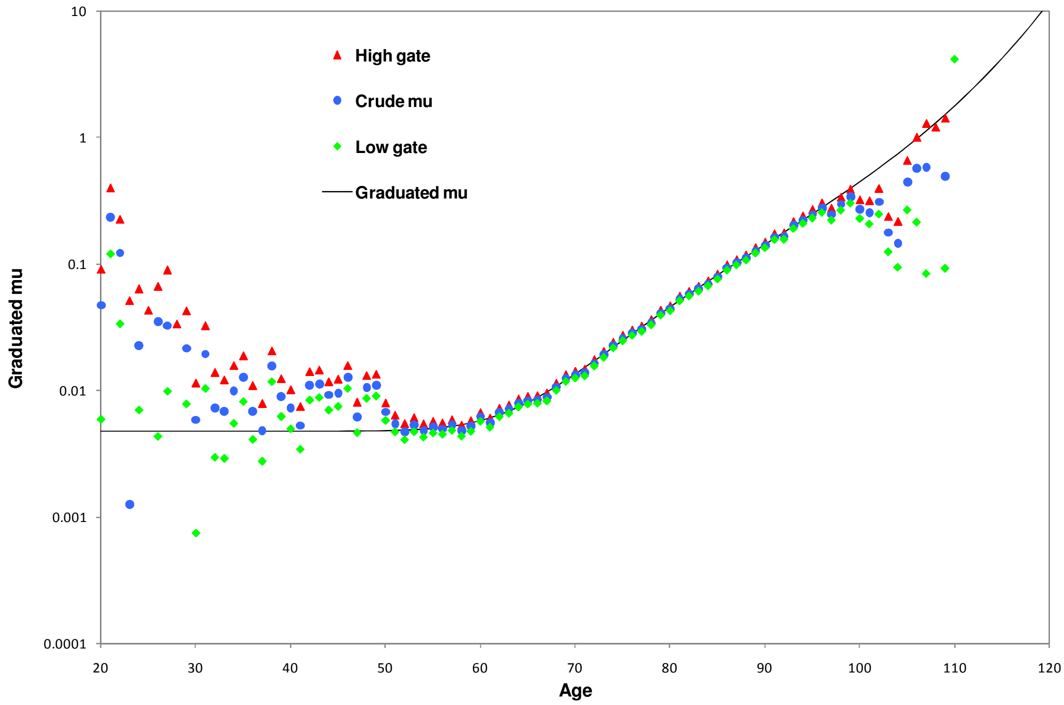


Chart C3: Female Light Pensioners Amounts – crude and graduated values of $\mu_{x+1/2}$

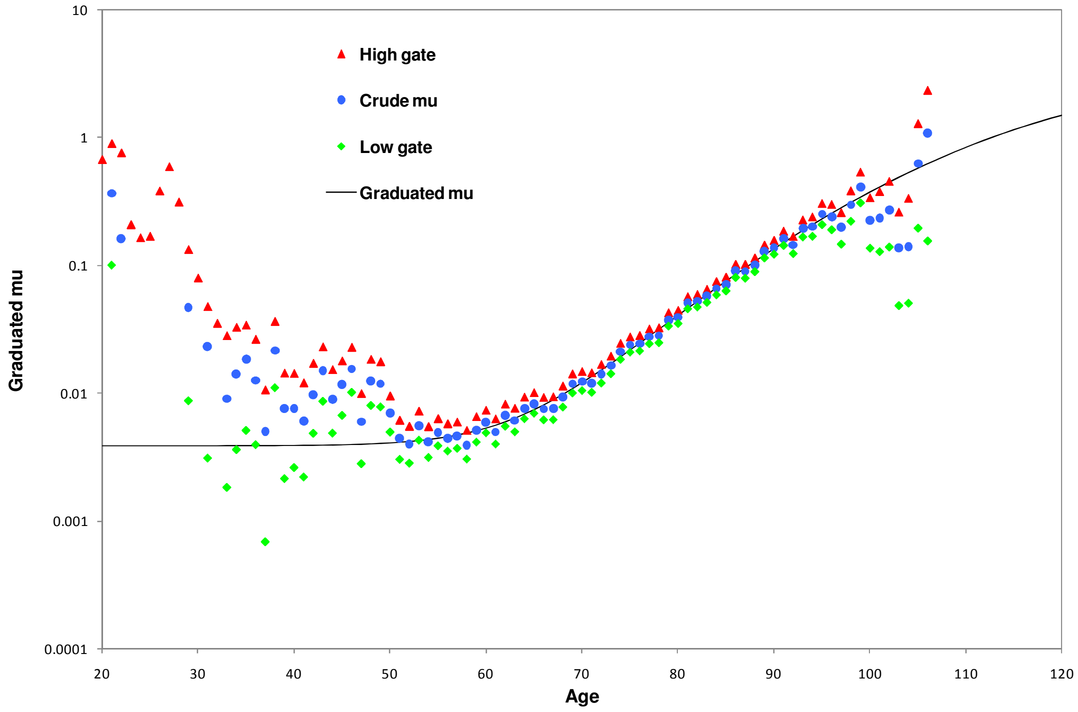


Chart C4: Female Heavy Pensioners Amounts – crude and graduated values of $\mu_{x+1/2}$

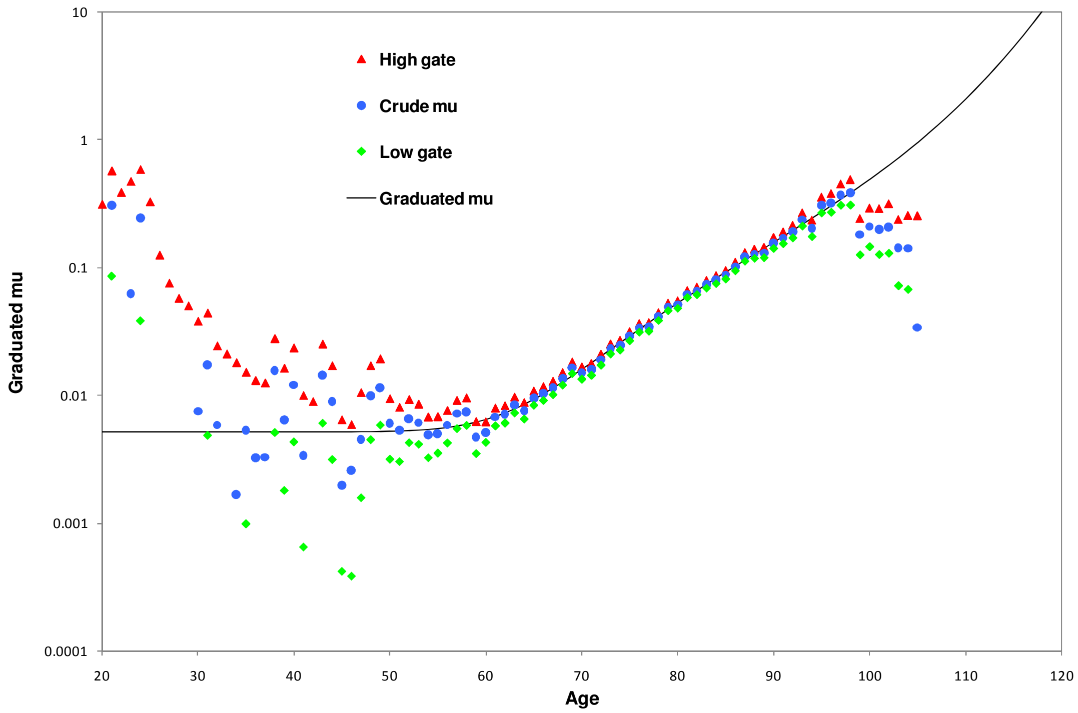


Chart C5: Male All Pensioners Lives – crude and graduated values of $\mu_{x+½}$

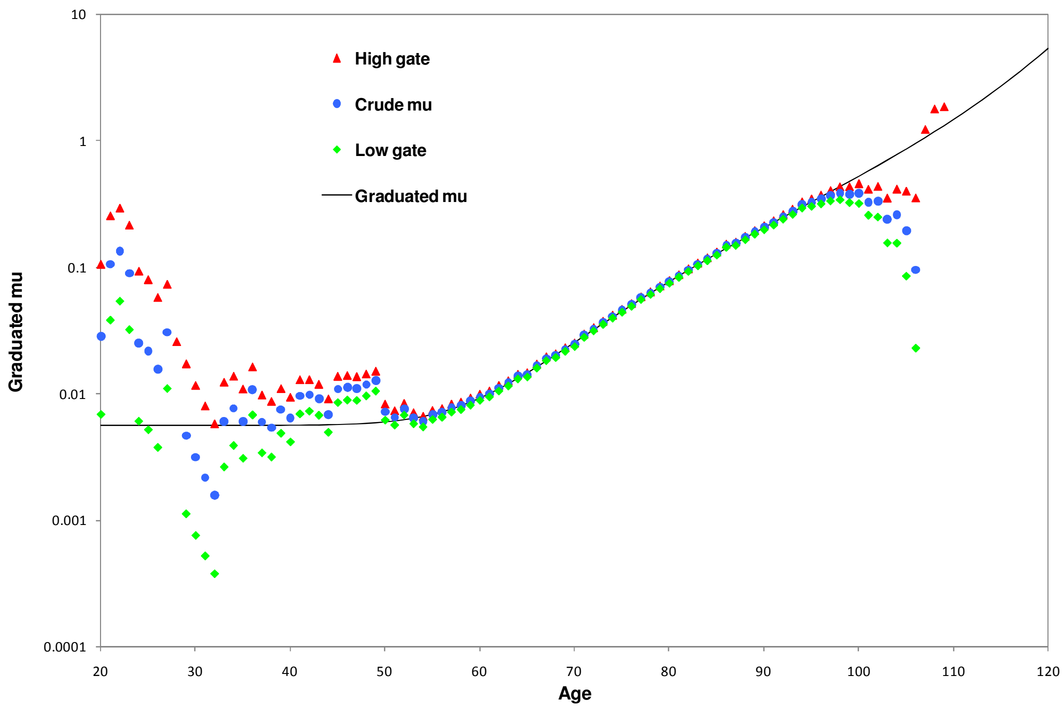


Chart C6: Male All Pensioners Amounts – crude and graduated values of $\mu_{x+½}$

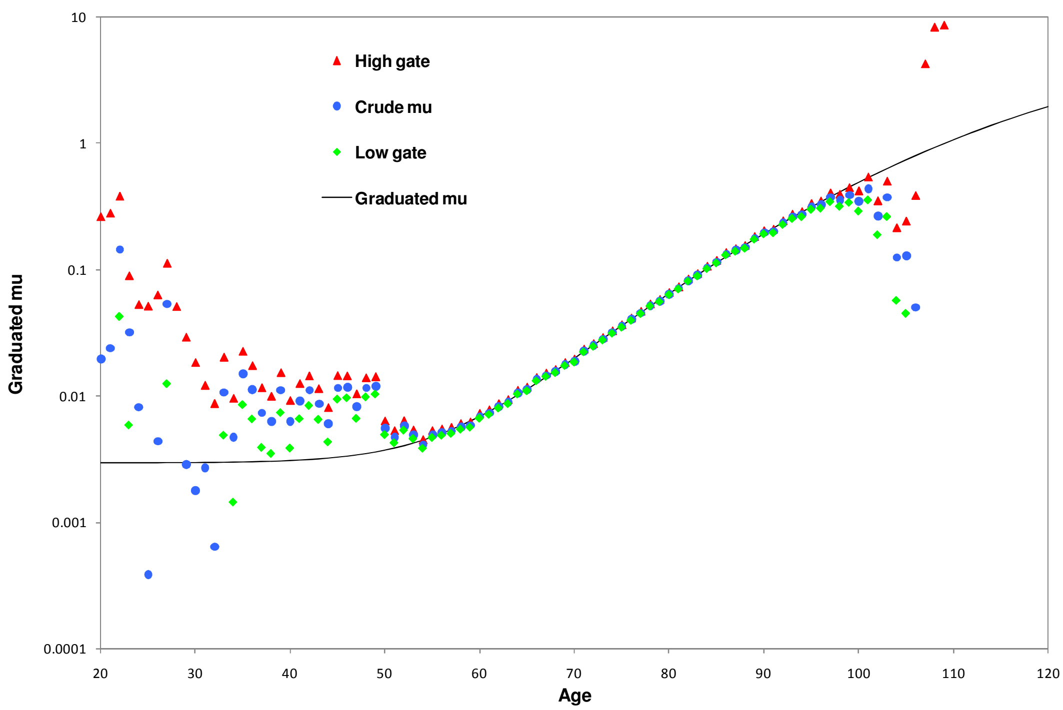


Chart C7: Male Light Pensioners Amounts – crude and graduated values of $\mu_{x+½}$

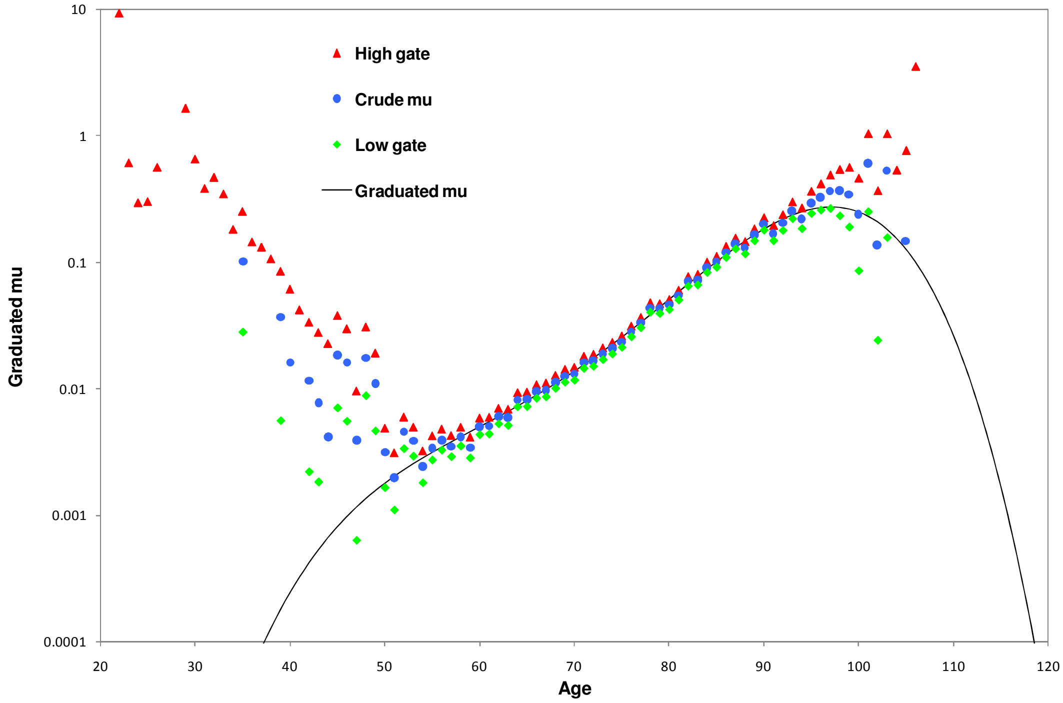


Chart C8: Male Heavy Pensioners Amounts – crude and graduated values of $\mu_{x+½}$

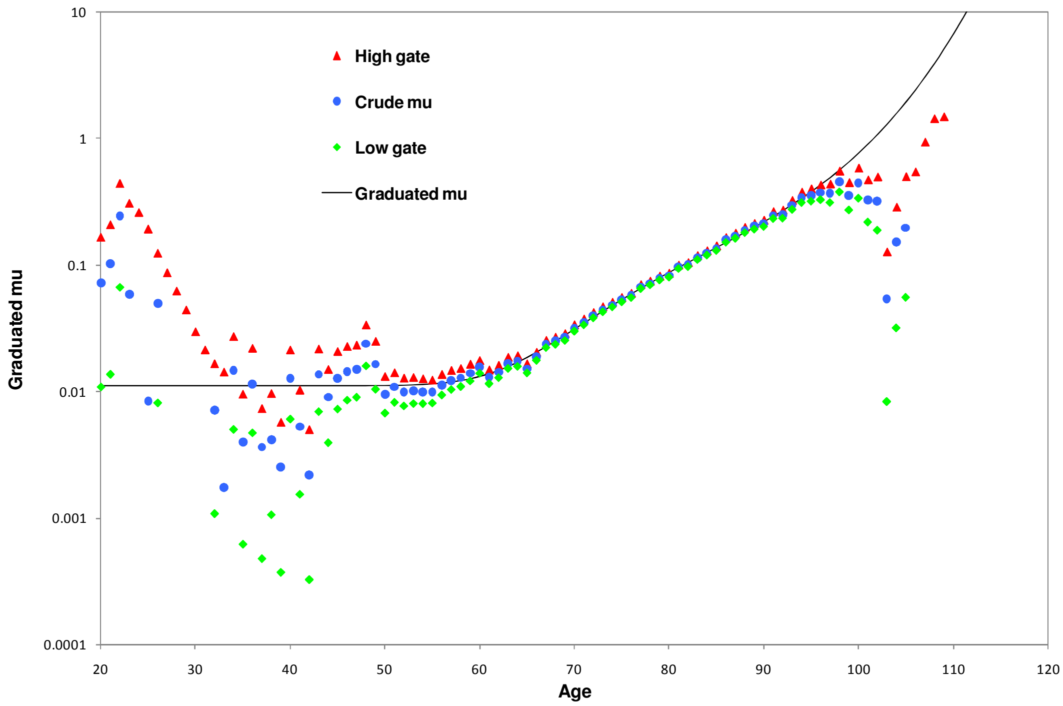


Chart C9: Female All Dependants Lives – crude and graduated values of $\mu_{x+½}$

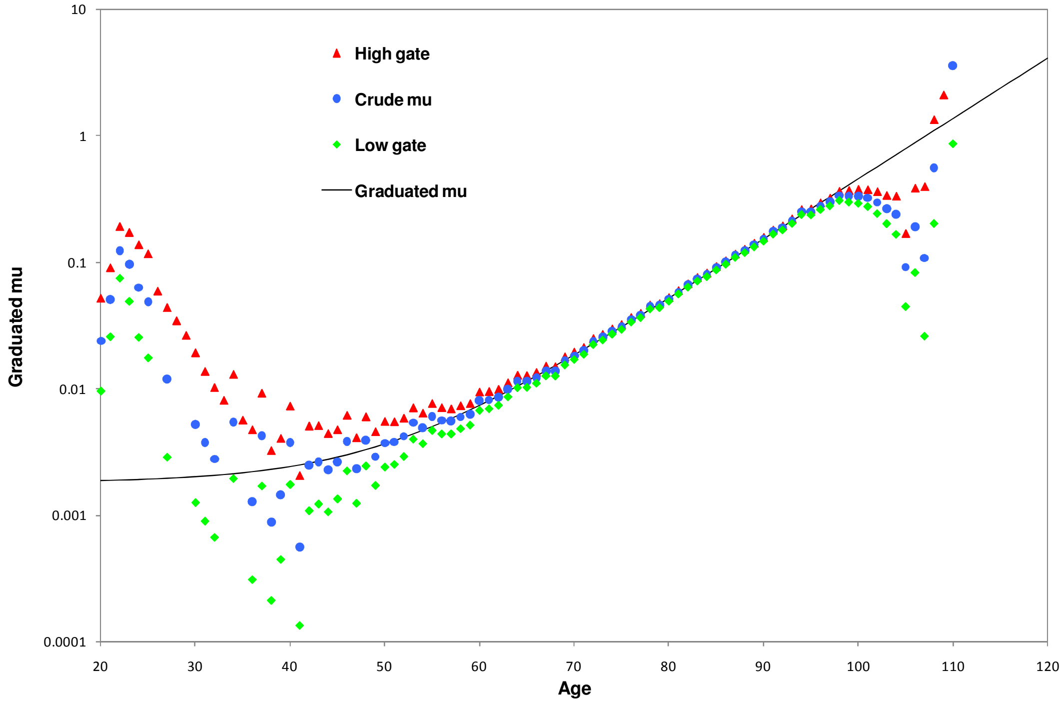


Chart C10: Female All Dependants Amounts – crude and graduated values of $\mu_{x+½}$

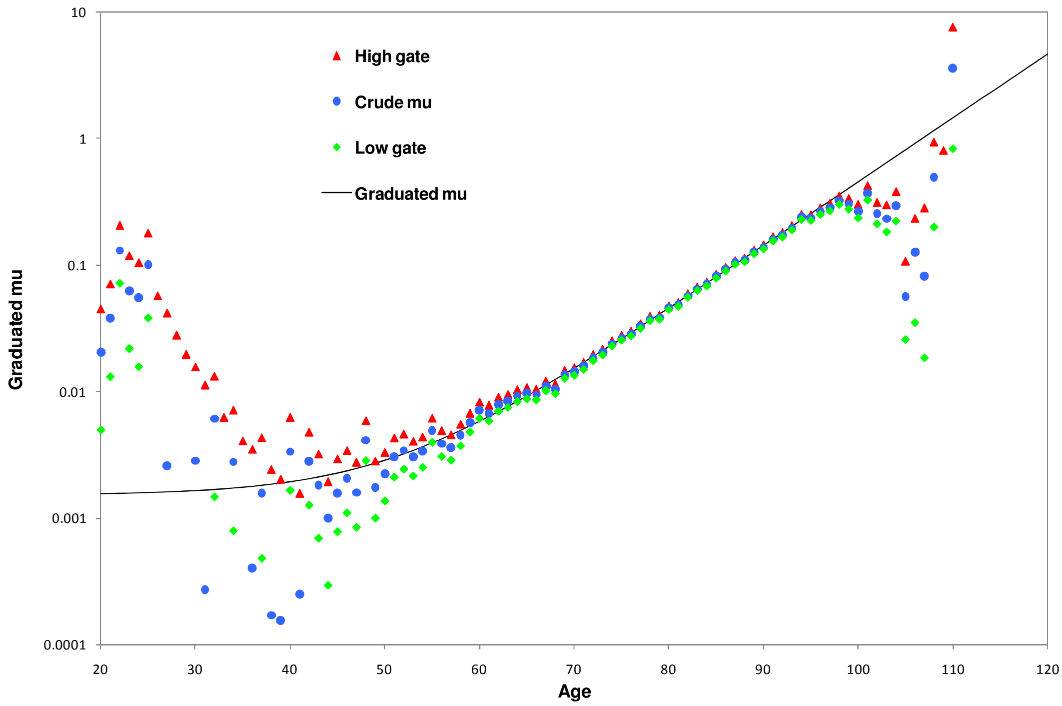


Chart C11: Female Light Dependants Amounts – crude and graduated values of $\mu_{x+½}$

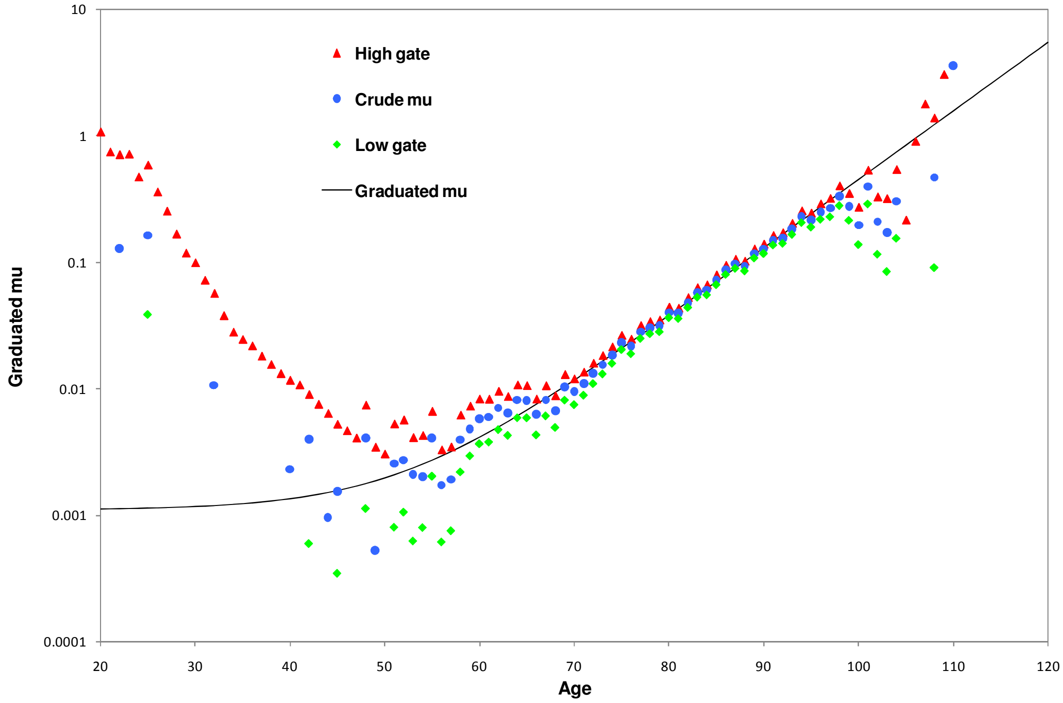


Chart C12: Female Heavy Dependants Amounts – crude and graduated values of $\mu_{x+½}$

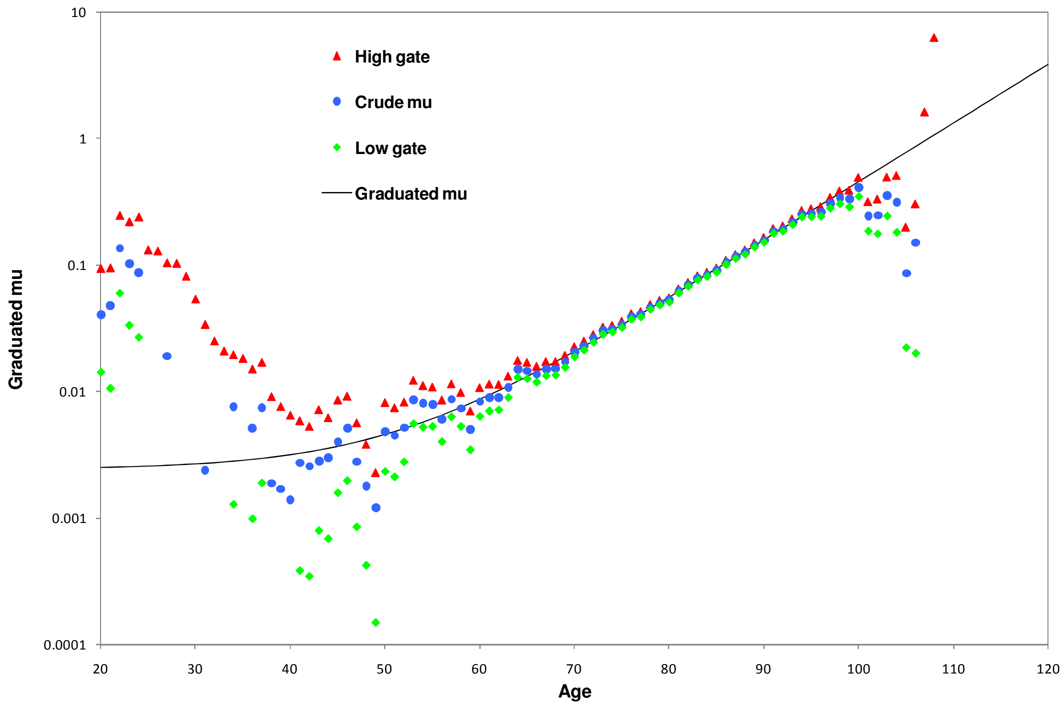


Chart C13: Female All Normal Health Pensioners Amounts – crude and graduated values of $\mu_{x+½}$

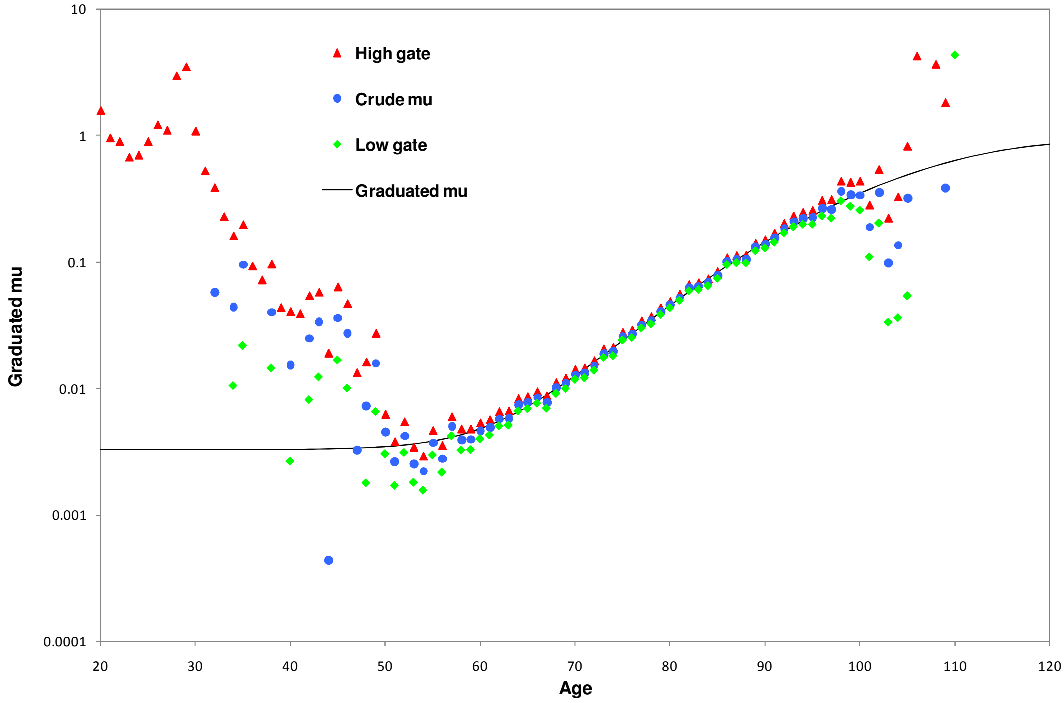


Chart C14: Female Light Normal Health Pensioners Amounts – crude and graduated values of $\mu_{x+½}$

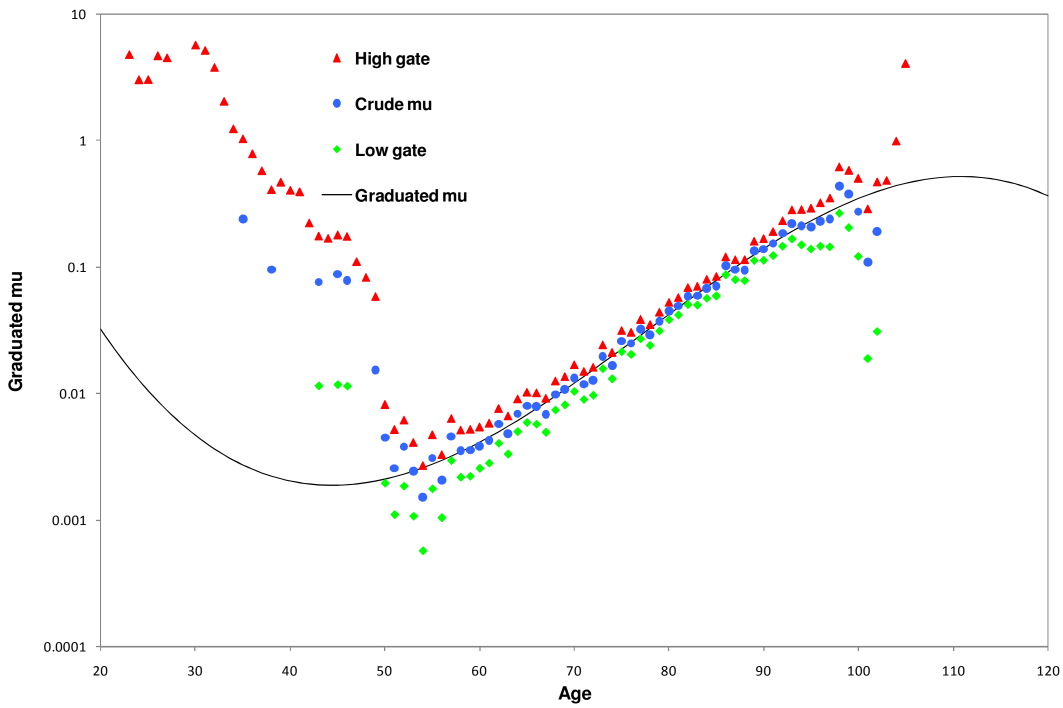


Chart C15: Female Heavy Normal Health Pensioners Amounts – crude and graduated values of $\mu_{x+½}$

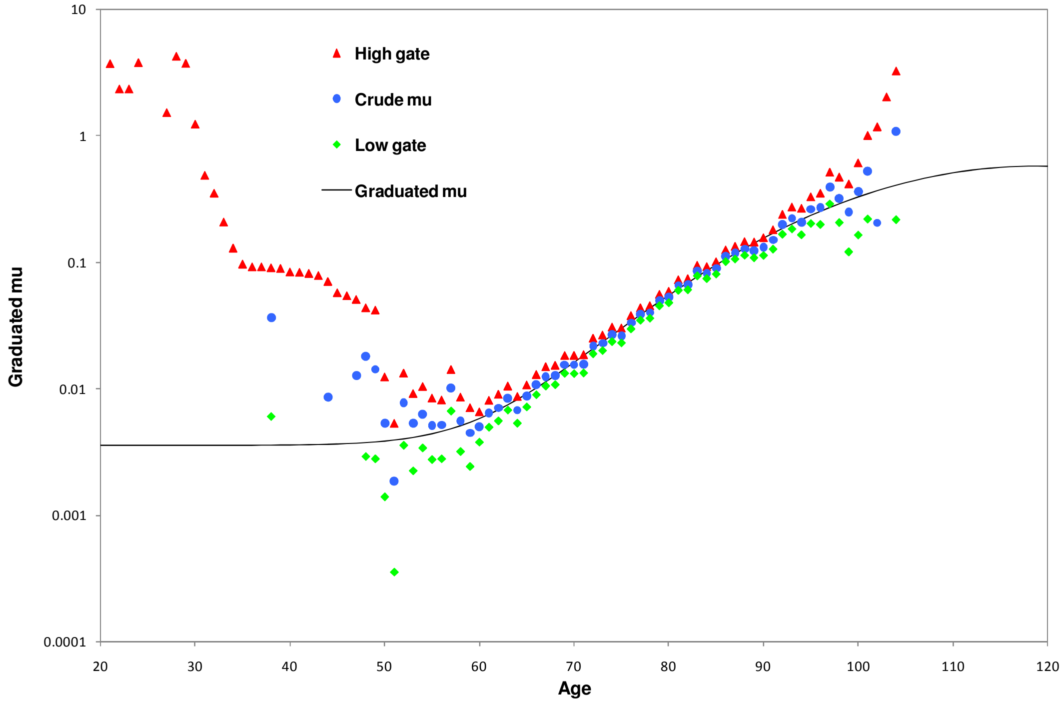


Chart C16: Male All Normal Health Pensioners Amounts – crude and graduated values of $\mu_{x+½}$

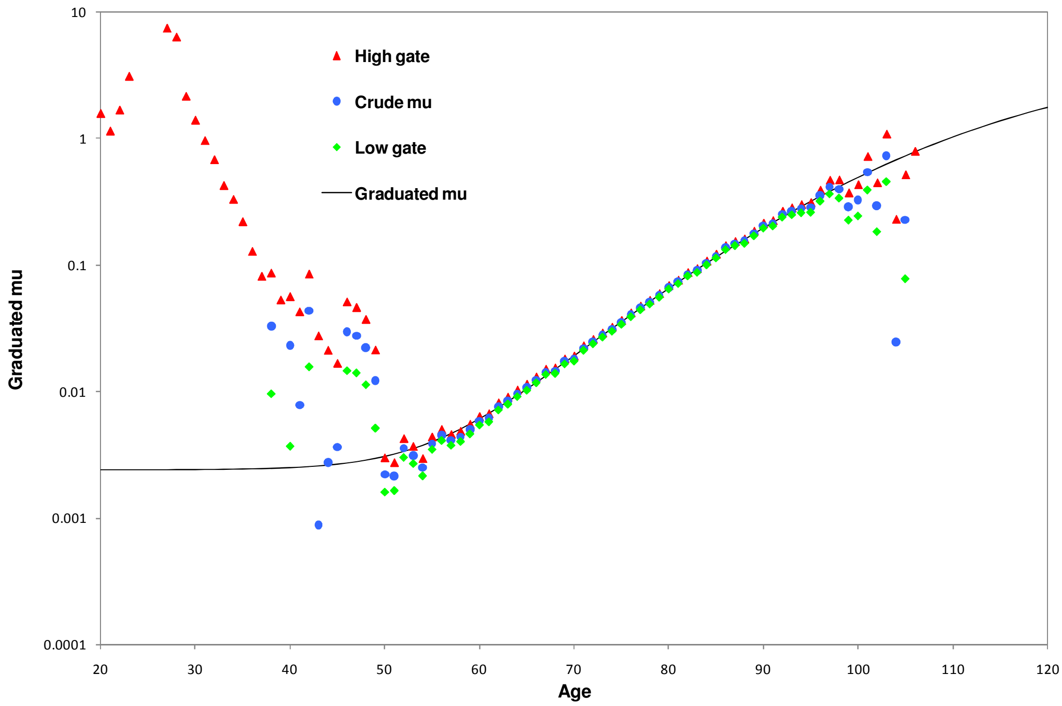


Chart C17: Male Light Normal Health Pensioners Amounts – crude and graduated values of $\mu_{x+½}$

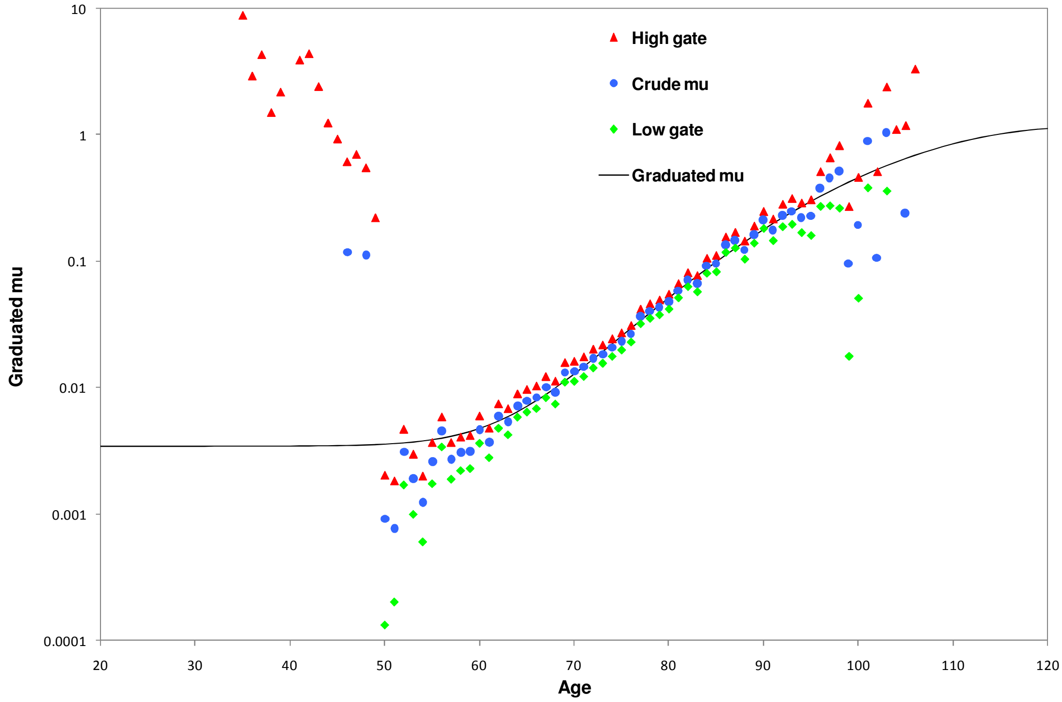


Chart C18: Male Heavy Normal Health Pensioners Amounts – crude and graduated values of $\mu_{x+½}$

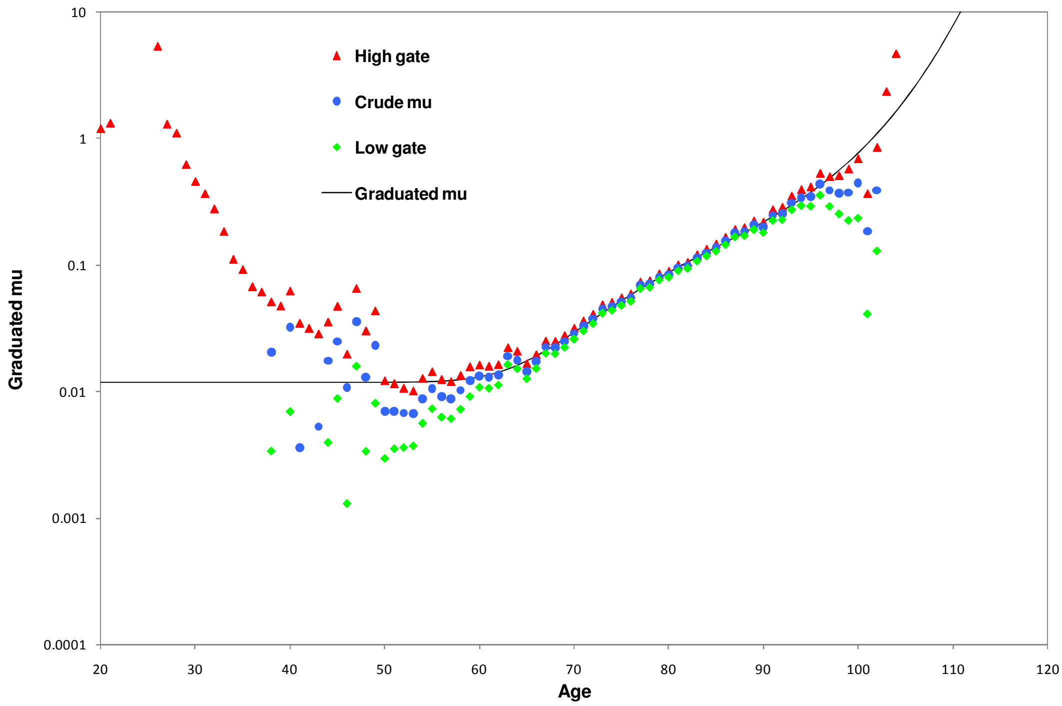


Chart C19: Female All Ill-health Pensioners Amounts – crude and graduated values of $\mu_{x+½}$

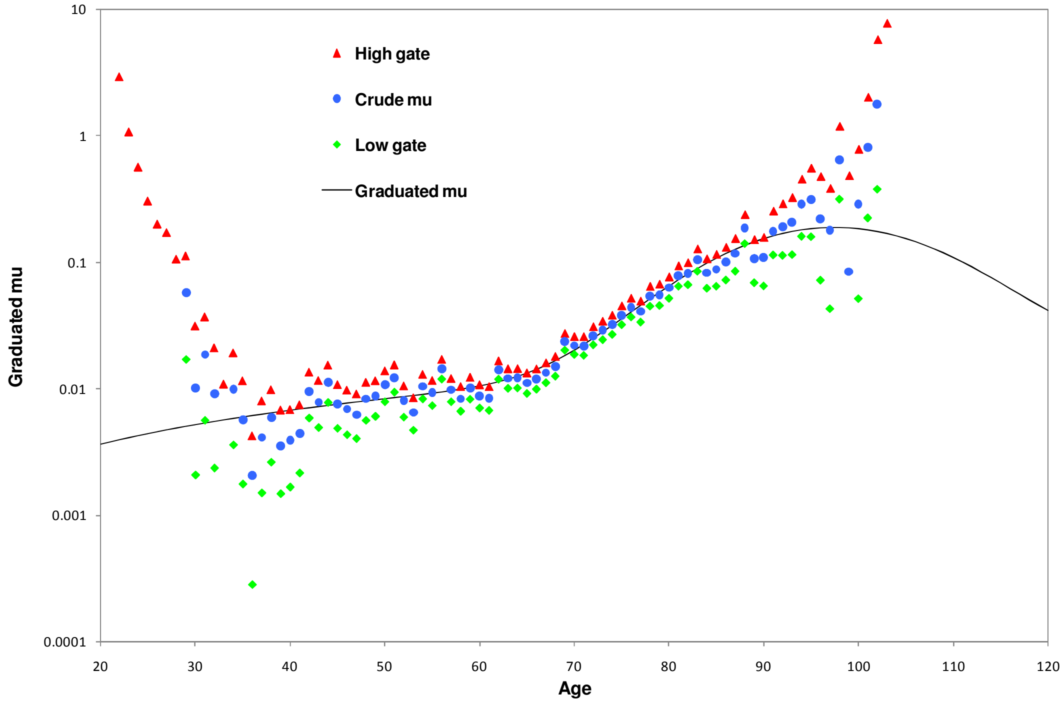
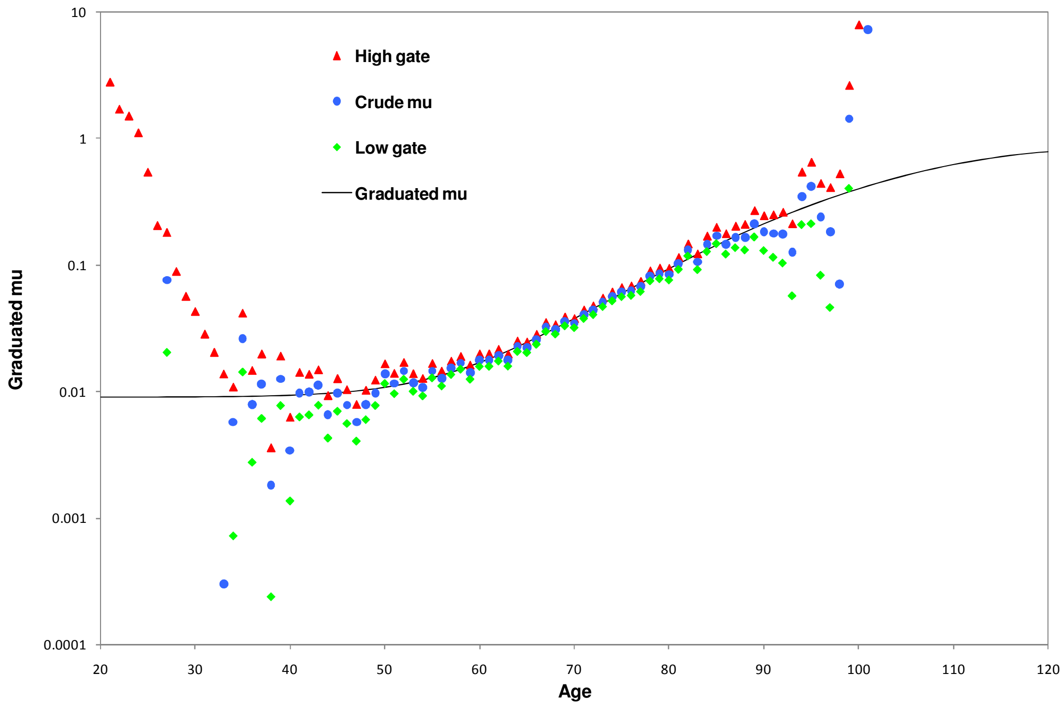


Chart C20: Male All Ill-health Pensioners Amounts – crude and graduated values of $\mu_{x+½}$



Appendix D: Specimen expectation of life (eol) and annuity values

Table D1: Comparative complete period expectation of life (eol) and annuity values (at 5% p.a. interest) with no allowance for mortality improvement

Table	eol(50)	eol(65)	eol(80)	ä(50)	ä (65)	ä(80)
S1PFL	32.679	19.944	9.095	16.087	12.557	7.384
S1PFA	33.443	20.605	9.501	16.258	12.809	7.629
S1PFA_L	34.284	21.297	9.923	16.450	13.066	7.880
S1PFA_H	32.314	19.611	8.912	16.009	12.423	7.273
S1PML	29.007	16.726	7.318	15.223	11.215	6.264
S1PMA	31.008	18.073	7.901	15.799	11.816	6.65
S1PMA_L	33.350	19.864	8.625	16.402	12.585	7.110
S1PMA_H	26.789	15.675	6.930	14.467	10.722	6.011
S1DFL	31.952	19.250	9.009	15.928	12.223	7.328
S1DFA	33.461	20.348	9.539	16.313	12.677	7.656
S1DFA_L	35.239	21.650	10.166	16.750	13.201	8.039
S1DFA_H	31.015	18.680	8.781	15.658	11.974	7.184
S1NFA	34.121	20.750	9.488	16.504	12.880	7.612
S1NFA_L	34.792	21.132	9.736	16.688	13.022	7.768
S1NFA_H	32.698	19.527	8.905	16.180	12.379	7.241
S1NMA	31.383	18.132	7.828	15.947	11.861	6.606
S1NMA_L	33.261	19.840	8.523	16.376	12.602	7.059
S1NMA_H	27.219	15.873	6.931	14.630	10.829	6.011
S1IFA	29.870	18.389	8.529	15.237	11.855	6.945
S1IMA	25.468	14.811	6.845	14.049	10.259	5.925

Note: Expectations of life have been calculated using the approximation a(x,0%) +0.5 – $\mu_x/12$

Table D2: Values relative to S1PFA (female) and S1PMA (male)

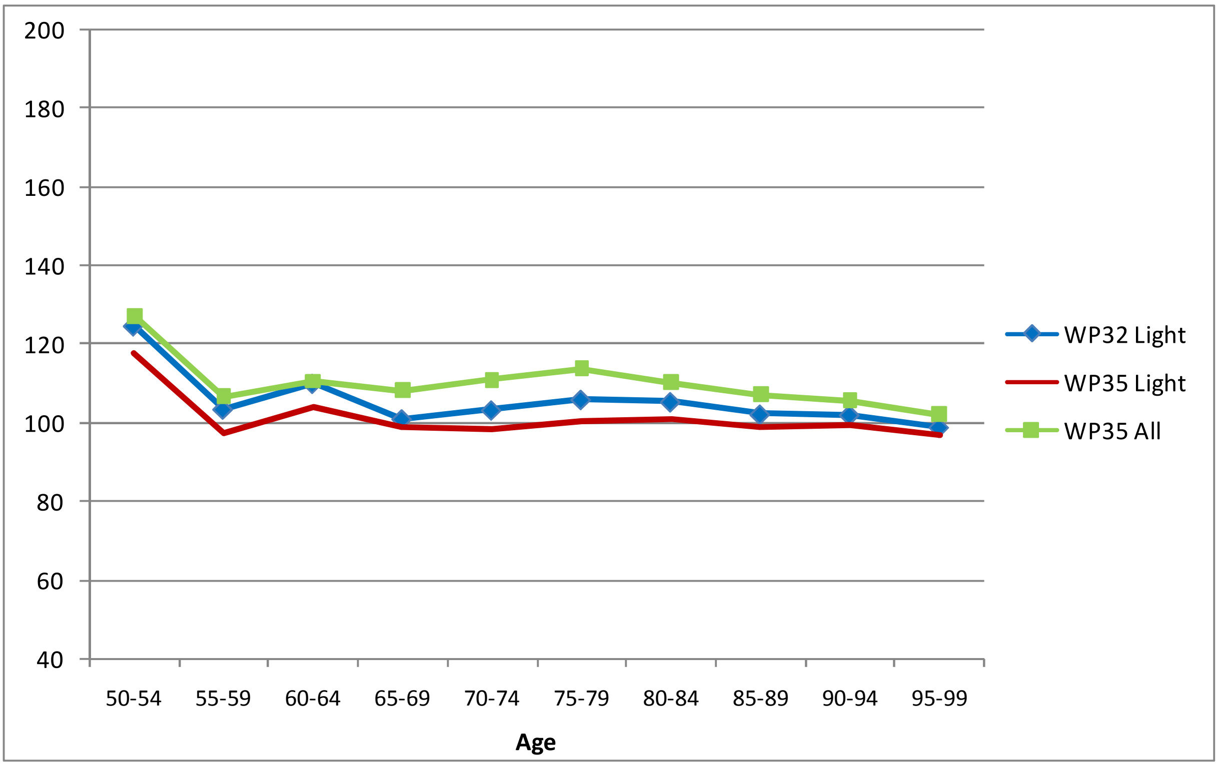
Table	eol(50)	eol(65)	eol(80)	ä(50)	ä(65)	ä(80)
S1PFL	0.977	0.968	0.957	0.989	0.980	0.968
S1PFA	1.000	1.000	1.000	1.000	1.000	1.000
S1PFA_L	1.025	1.034	1.044	1.012	1.020	1.033
S1PFA_H	0.966	0.952	0.938	0.985	0.970	0.953
S1PML	0.935	0.925	0.926	0.964	0.949	0.942
S1PMA	1.000	1.000	1.000	1.000	1.000	1.000
S1PMA_L	1.076	1.099	1.092	1.038	1.065	1.069
S1PMA_H	0.864	0.867	0.877	0.916	0.907	0.904
S1DFL	0.955	0.934	0.948	0.980	0.954	0.961
S1DFA	1.001	0.988	1.004	1.003	0.990	1.004
S1DFA_L	1.054	1.051	1.070	1.030	1.031	1.054
S1DFA_H	0.927	0.907	0.924	0.963	0.935	0.942
S1NFA	1.020	1.007	0.999	1.015	1.006	0.998
S1NFA_L	1.040	1.026	1.025	1.026	1.017	1.018
S1NFA_H	0.978	0.948	0.937	0.995	0.966	0.949
S1NMA	1.012	1.003	0.991	1.009	1.004	0.993
S1NMA_L	1.073	1.098	1.079	1.037	1.067	1.062
S1NMA_H	0.878	0.878	0.877	0.926	0.916	0.904
S1IFA	0.893	0.892	0.898	0.937	0.926	0.910
S1IMA	0.821	0.820	0.866	0.889	0.868	0.891

Appendix E: Illustration of the change to the pension amount bands

The following charts illustrate the impact of the change to the pension amount bands for the "Light" and "Heavy" tables. They compare data sub-divided using the Heavy and Light pension bands proposed in the draft graduations (in Working Paper 32) with the Heavy and Light bands used in the final graduations (in this paper). In all cases the data used is that underlying the final graduations dataset. In each chart, the two sub-divisions of data are compared against the relevant Heavy/Light SAPS table. The associated All data (i.e. all pensioners (excluding dependants) amounts or all dependant amounts) are also shown on the same comparison basis.

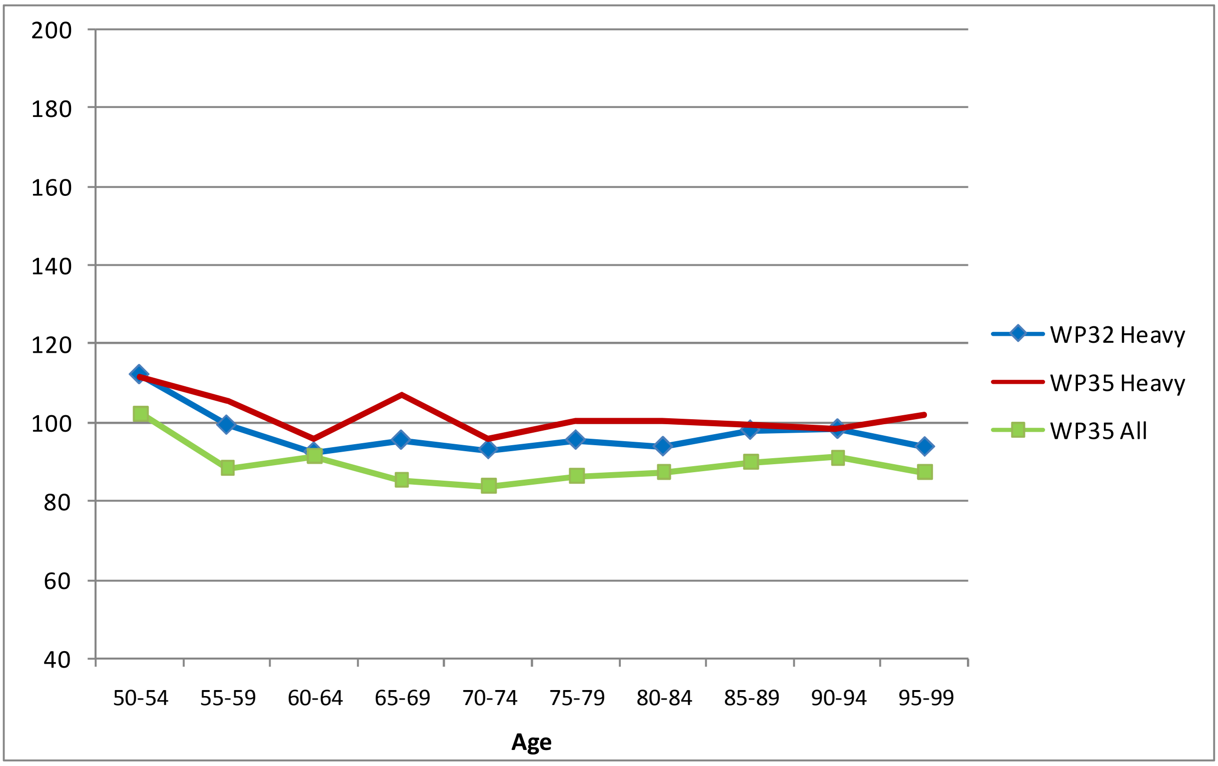
In nearly all cases, the more extreme Working Paper 35 Heavy and Light bands move the experience further away from the All amounts experience than the equivalent Working Paper 32 bands. The only exception is the Female Dependants Heavy data, where little differentiation is seen between the <£3,000 band (used in Working Paper 32) and the <£1,500 band (used in Working Paper 35).

Chart E1: 100A/E values for specified Female Pensioner datasets compared to S1PFA_L



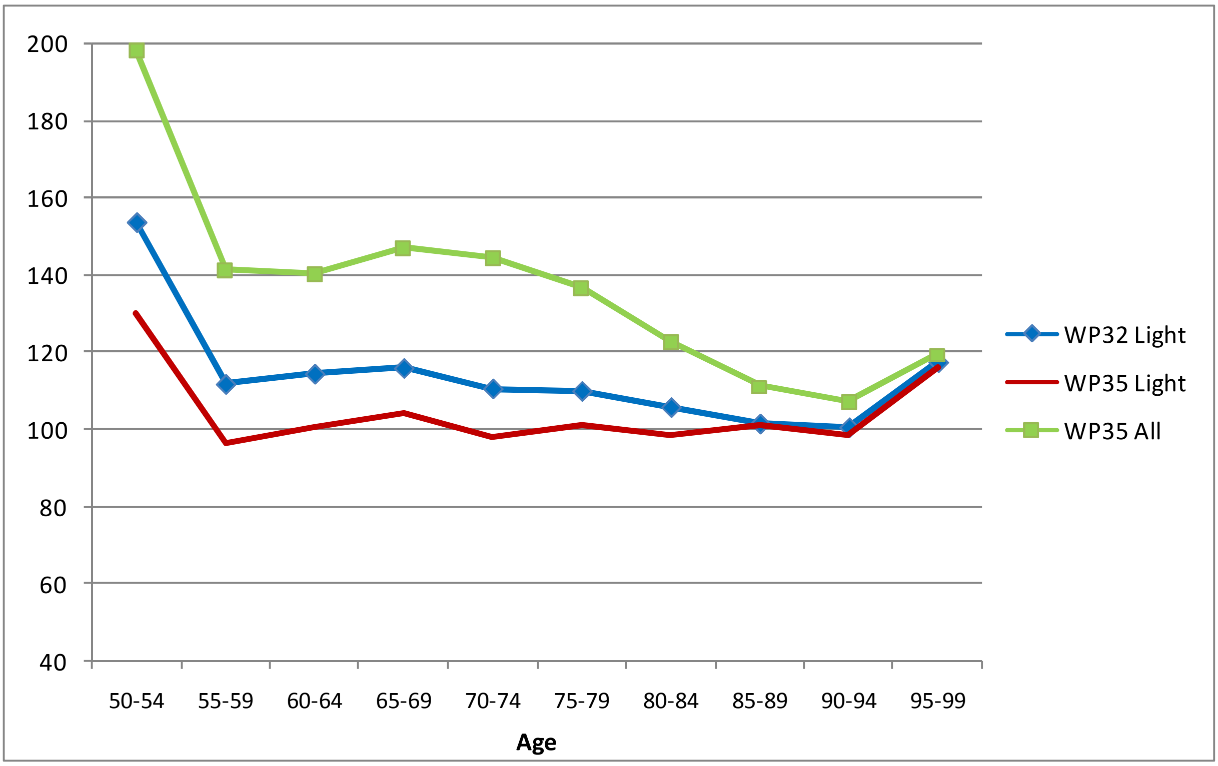
Female Pensioners Light Data: > £3,000 p.a. for WP32
> £4,750 p.a. for WP35

Chart E2: 100A/E values for specified Female Pensioner datasets compared to S1PFA_H



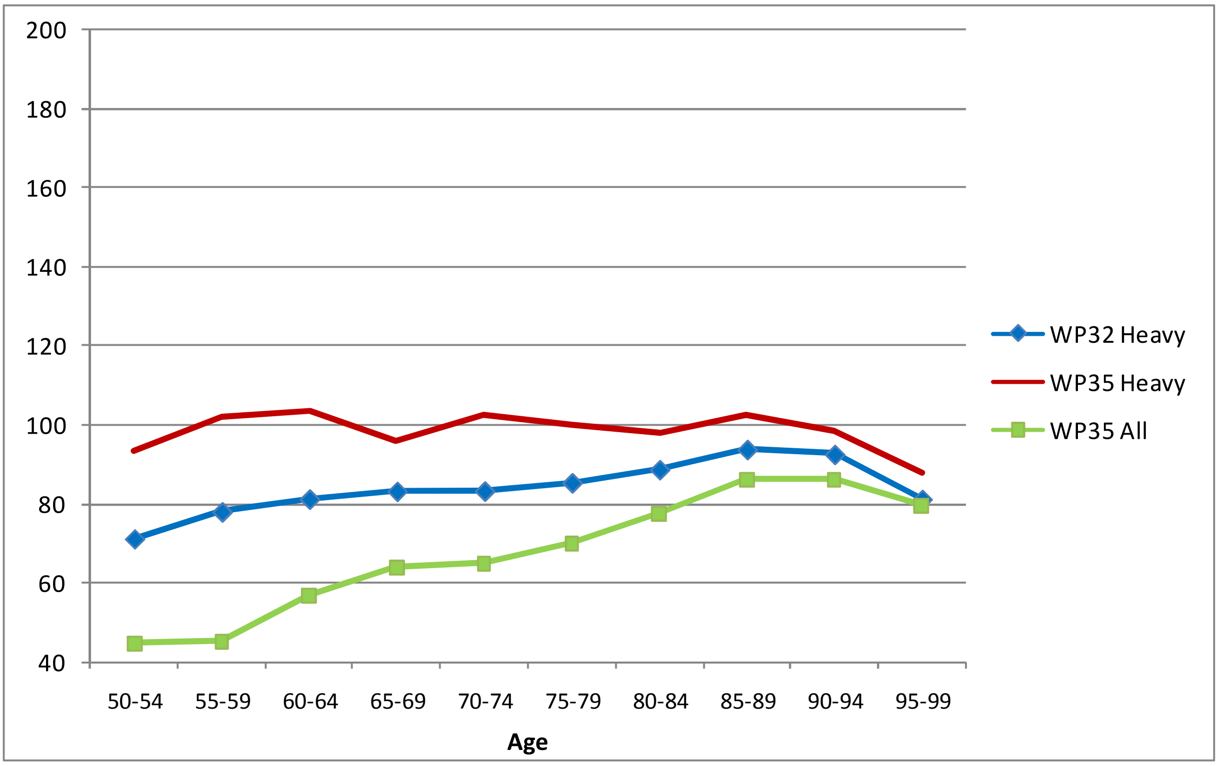
Female Pensioners Heavy Data: < £3,000 p.a. for WP32
< £750 p.a. for WP35

Chart E3: 100A/E values for specified Male Pensioner datasets compared to S1PMA_L



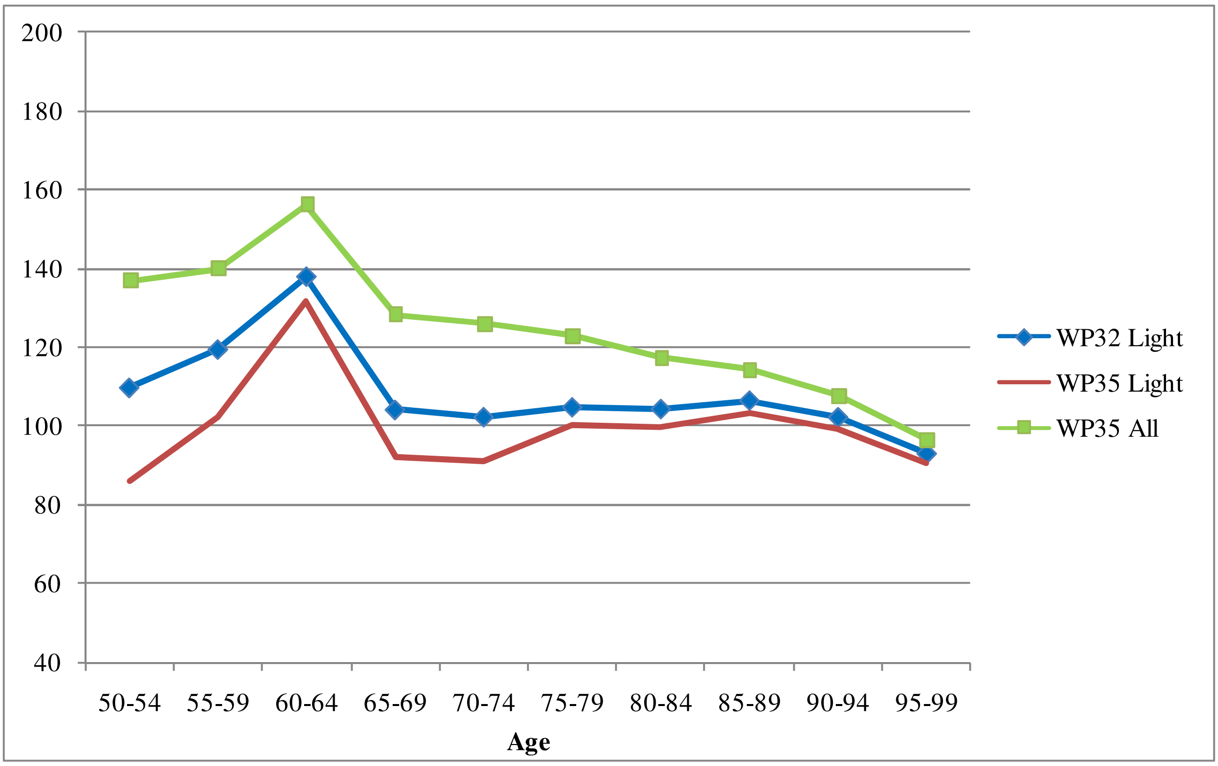
Male Pensioners Light Data: > £8,500 p.a. for WP32
> £13,000 p.a. for WP35

Chart E4: 100A/E values for specified Male Pensioner datasets compared to S1PMA_H



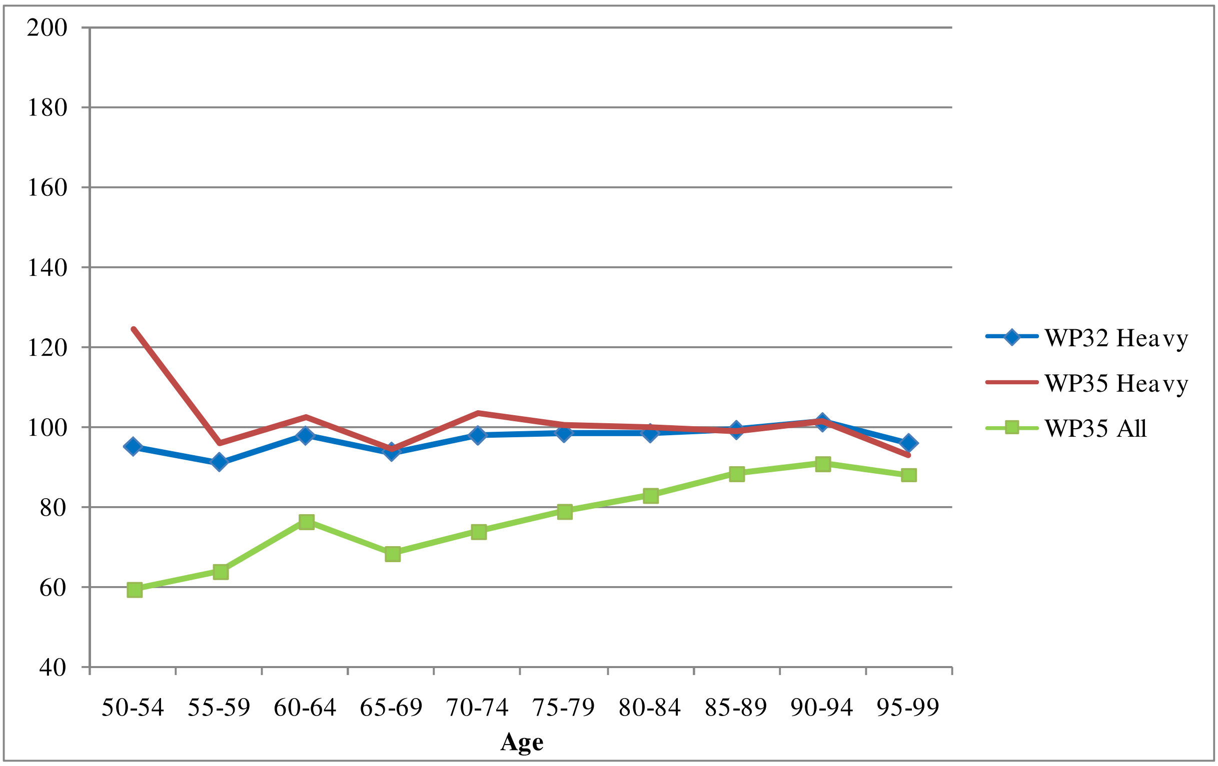
Male Pensioners Heavy Data: < £8,500 p.a. for WP32
< £1,500 p.a. for WP35

Chart E5: 100A/E values for specified Female Dependant datasets compared to S1DFA_L



Female Dependants Light Data: > £3,000 p.a. for WP32
> £4,750 p.a. for WP35

Chart E6: 100A/E values for specified Female Dependant datasets compared to S1DFA_H



Female Dependants Heavy Data: < £3,000 p.a. for WP32
< £1,500 p.a. for WP35