

**Publication Policy for Estimates Subject to  
Sampling Errors**

**The Pensioners' Incomes Series  
Methodological Paper No. 5**

**July 2001**

## **Executive summary**

This paper explores the options for a publication policy for estimates that are subject to sampling errors. All estimates in the Pensioners' Incomes Series (PI) are subject to uncertainty, since they are based on information from the randomly-selected households in the Family Resources Survey. It is important to have a publication policy for particularly uncertain estimates in order to minimise the risk of users misinterpreting results.

The paper looks at how uncertainty in the estimates can be measured and discusses different methods of presenting estimates with a high degree of uncertainty. Having considered the context of how estimates from PI are used, it is proposed that a publication policy be applied to estimates of recent income growth only. Alternative methods of presenting information about recent trends, inside and outside the publication, are discussed.

A two-tier publication strategy is proposed, with 'uncertain' recent growth estimates flagged up in the table and 'very uncertain' estimates published as confidence intervals only. This policy would be reviewed in the second half of 2001, in the light of new data, at the same time as the Households Below Average Income policy is examined under the HBAI Methodological Review.

Recent growth estimates for 1994/5-1998/9 are measured against these criteria and the majority are found to be 'very uncertain'. Therefore it is proposed that a 'recent growth' column should not be included in PI tables as standard, but that a separate section should discuss recent trends where the information is reliable. The uncertainty of estimates should be monitored carefully each year to assess whether it would benefit users to include recent growth estimates in the main tables.

It is also proposed that full information on recent growth estimates and their confidence intervals should be published each year, separately from PI.

## **Comments**

Any comments on this paper would be gratefully received:

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## **1. Introduction**

### **1.1 What are sampling errors?**

All estimates published in the *Pensioners' Incomes Series (PI)* are subject to random 'sampling errors'. This is because they are based on a survey of randomly selected households (the Family Resources Survey (FRS)). The mean net income of all pensioner units is used as an example:

Since the survey collects information from a selection of pensioner units, it follows that there are some pensioners in the population who we know nothing about. Therefore we cannot know for sure what the true mean is; we can only estimate it by looking at those pensioners included in the survey. Since it is random, there is a chance that the survey sample is not representative of the population, resulting in an estimated mean that is either too high or too low. The 'sampling error' of the estimate is defined as that part of the difference, between the estimate and the true mean, that is caused purely by the randomness of the sample selection.

There are, of course, other factors which can cause the estimated mean to differ from the true mean – for example if survey respondents are unable to answer a question accurately. This paper concentrates on sampling errors, because the effect of other types of error cannot be measured directly.

Sampling error does not mean that an estimate is necessarily incorrect, but it does mean there is a degree of uncertainty as to whether the estimate is accurate. This applies to all estimates in the PI publication. Indeed, the publication currently contains warnings about interpretation of the estimates. In isolation, an estimated mean income can be regarded as the "best estimate" available of the true mean. When comparing two similar means however, great care should be taken not to claim that one is higher than the other, if this result could have arisen purely due to sampling error. Comparisons of mean income estimates over a short time period are particularly vulnerable to this type of misinterpretation.

### **1.2 Aim of the paper**

The 'degree of uncertainty' in estimates, caused by sampling errors, can be measured (or, strictly speaking, it can be *estimated*). This paper explores how users can best be informed about the uncertainty surrounding estimates in PI. In particular, it explores whether transparent, measurable criteria can be used to classify estimates according to their accuracy.

## **2. Measuring sampling error**

The sampling error around an estimate can be measured by the size of its 'standard error'. [The exact standard error is not known, so it is estimated by looking at the variability in the sample]. The standard error can be converted into a 'confidence interval' which gives an indication of the degree of uncertainty surrounding the estimate, by giving a range of values that the 'true' mean could take. For example, if

mean income were estimated as £201 a week, with a 95% confidence interval of +/- £4, this means that in 95% of all possible survey samples that we could have taken, we would expect the estimated mean to fall within the range [£197,£205]. In other words, we can be 95% confident that the true mean lies within that range.

More detail on how standard errors and confidence intervals are calculated will be included in the forthcoming [PI Methodological Paper No. 6](#), available on the PI web page on the internet. This paper concentrates on the 'confidence interval' measure because it is an easier concept to understand.

The wider that a confidence interval is, the more uncertainty there is, and the less we can infer about the true mean. The two main factors affecting the size of confidence intervals are the sample size and how much the income measure in question varies from pensioner unit to pensioner unit.

The smaller the **sample size** that an estimate is based on, the wider the confidence interval is likely to be. This follows logically from the fact that the fewer people we have information about, the more uncertainty there will be when we make claims about the whole population. For example, there will be more uncertainty, and a wider confidence interval, around the estimated mean income of single male pensioners than of all pensioner units.

The more **variability** in the income measure, the wider the confidence interval is likely to be. This follows from the fact that if there is a wide range of incomes in the population, there is more risk of choosing a survey sample that includes incomes that are very different from the true mean. For example, estimates of mean benefit income are likely to have smaller confidence intervals than estimates of investment income, since the range of possible values of benefit income is much narrower.

For the purposes of developing a publication policy, we need to measure the extent to which estimates are 'reliable' in terms of sampling error. The most obvious method is to look at the (half-)width of the confidence interval. Clearly, an estimate with a confidence interval of +/- £10 is more reliable than one with a confidence interval of +/- £20.

However, the reliability of an estimate will also depend on the size of the estimate itself. For example an estimate of £100 +/- £10 gives a confidence interval of [£90,£110]. In contrast, an estimate of £10 +/- £10 gives a confidence interval of [£0,£20]. Clearly we may want to treat these two estimates differently when advising on their reliability. The simplest way of capturing this effect is to look at the 'relative confidence interval', which is calculated as the (half-)width of the confidence interval as a percentage of the estimate itself. The examples above give relative confidence intervals of 10% and 100% respectively.

Therefore, the two measures used in this paper to assess reliability of estimates are the (half-)width of the **confidence interval** and of the **relative confidence interval**. It should be noted that all further references to these measures in this paper refer to the 'half-width' of the interval. For example, a relative confidence interval of "10%" means that we can be 95% confident that the true value lies between +/- 10% of the estimate.

### **3. Criteria for treatment of unreliable estimates**

Deciding the point at which a confidence interval or relative confidence interval is so large that an estimate is deemed 'unreliable' is to some extent arbitrary. It is best considered in the context of how the estimates might be interpreted and what methods of presentation are available to ensure that estimates are interpreted appropriately.

#### **3.1 Interpretation of estimates**

How users interpret estimates varies according to the type of estimate.

(a) Levels of income: Average (mean and median) incomes and proportions in receipt, in any given year, need to be published as our "best estimates" of the true income or proportion. Users are advised that these estimates give a broad indication of the levels of income, rather than exact amounts, and should be treated with caution. A more detailed section on sampling variability in the forthcoming edition of PI will reinforce this point.

These figures are most commonly used to give a broad indication of income levels for a certain group of pensioners or from a certain source of income, or to compare groups with very different levels of income. In such cases, it is not crucial that the user knows the exact degree of uncertainty in the estimates, because it will not affect their interpretation of the figures. It is important that they are aware of the approximate degree of uncertainty. This could be presented as a general section in the publication on sampling variability and the typical size of confidence intervals.

The degree of uncertainty becomes more important when users compare groups of pensioners with similar income levels, since one group could be misinterpreted as having a higher income even though the observed result could have been caused purely by sampling errors. [In this case the result is said to be 'not statistically significant']. It is very difficult to anticipate all such comparisons, so all estimates would have to be treated in the same way. Including information on the reliability of every single estimate in the publication would take up a lot of space and would be detrimental to the clarity of the tables. Key messages could get diluted by the large volume of statistical information and caveats. A better alternative would be to use the text of the publication to guide users as to which comparisons are valid.

(b) Income growth estimates: Estimates of how much incomes have grown over time represent a special case of comparing two income estimates, since they are calculated by dividing the estimate in one year by the same estimate for an earlier year.

Historical growth rates based on Family Expenditure Survey data (1979-1996/7) do not present any major problems of interpretation, because the time series is long enough (and income growth has been large enough) to mean that virtually all results are statistically significant, and that the relative confidence intervals are likely to be small.

Recent growth rates based on Family Resources Survey (FRS) data are more problematic. These relate to a much shorter time period, since the first year of data is

for 1994/5, with correspondingly lower income growth. This means that relative confidence intervals are larger, and that some estimates may be so uncertain that we cannot say with any confidence whether average income has increased or decreased over the period.

While comparisons between groups of pensioners can be reinforced by looking at results from several different years, there is only one result to look at for a growth rate. [Although intervening years do give some additional information]. Furthermore, unlike other estimates, the degree of uncertainty may change significantly each time we publish.

In summary, general information about uncertainty in the estimates, backed up with results from other years and interpretation in the text, is thought to be sufficient to avoid users misinterpreting estimates of levels, proportions, differences between pensioner subgroups and historical growth estimates. However, a more formal assessment of uncertainty is required for estimates of recent income growth.

### **3.2 Potential methods for presenting unreliable income growth estimates**

Once an estimate has been identified as ‘uncertain’, there are several ways in which it can be presented to help users interpret it correctly. More than one method could be used, depending on the level of uncertainty.

(a) Flag the estimate up in the table as uncertain, for example by placing square brackets around it. This has the advantage of clearly drawing the user’s attention to the uncertainty, while not leading to a ‘crowded’ table. The main disadvantage is that if large numbers of estimates are placed in brackets, the visual impact is lost and users may ignore the warnings.

(b) Give a confidence interval *in addition to* the estimate. This gives the user all the information they need to interpret the estimate appropriately. However, this may result in too much information in each table, with a risk that users may by-pass the confidence intervals and go straight to the estimate itself. A compromise might be to publish them in a separate paper, so that users will have access to all available information.

(c) Give a confidence interval *instead of* the estimate. This reduces the risk of users by-passing the confidence interval and using the estimate anyway. It does mean that there is less information in the table, although users could either assume the best estimate is at the centre of the confidence interval or calculate their own growth rate using the income levels published in the same table. Therefore, no information is ‘withheld’ from users, but the fact that only the confidence interval is published should automatically raise their awareness of the uncertainty around the estimate.

(d) Do not publish the estimate or the confidence interval. This is a rather extreme option, since it does not give the user any information other than that the estimate is considered too unreliable. Again, users would be able to calculate their own growth rates from the published levels. Not publishing might be appropriate where none (or

very few) of the results in a given table are meaningful, in order to avoid complicating the table with unnecessary information.

### **3.3 Information available to users if unreliable estimates are not published**

For those recent growth estimates that are too unreliable to publish, there would still be plenty of information available for users to assess trends, without referring to an 'exact' (yet unreliable) figure. As mentioned above, users could calculate growth rates themselves using the published income levels (although they would be advised not to). Broad conclusions about income growth can be incorporated into the text. Furthermore, the full time series will give more information about the broad trends. For example, a time series that shows steady income growth for several years gives more evidence of a genuine increase than a time series that fluctuates from year to year. In some instances, it may be possible to present the time series graphically.

It may also be helpful to include a separate section in the publication looking at recent growth in pensioners' incomes, concentrating on those estimates that are reliable, and drawing on the full time series in each case.

### **3.4 Providing information outside the publication**

Where a method of presentation is chosen that does not include full information about a recent growth estimate or the uncertainty surrounding it, additional information could be provided through means other than the publication. The most objective way of presenting such information would be to publish a list of estimates, standard errors and confidence intervals for each estimate in each table. It would not be an efficient use of resources to include this large volume of information in the publication itself, but it could be published as a separate volume on the internet, with hard copies available on request.

Full information (unreliable estimates with confidence intervals) could also be given in response to ad hoc requests, since there is more scope to include a full discussion of the uncertainty in the estimates.

#### 4. Proposed publication policy

Given the context discussed above, it is proposed that for recent growth estimates, the PI publication should adopt a two-tier strategy:

- Estimates considered ‘uncertain’ should be published inside square brackets to flag up the degree of uncertainty.
- Estimates considered ‘very uncertain’ should have their 95% confidence interval published instead of the estimate itself.

A policy of publishing neither the estimate nor the confidence interval, on grounds of unreliability, should **not** be adopted. However, for tables where all or virtually all recent growth estimates are deemed ‘very uncertain’, neither the estimate nor the confidence interval should be published. This is because publishing a column of wide confidence intervals would make the table considerably less user-friendly, while adding little to users’ understanding of the trends that could not be gleaned from drawing broad conclusions from the full time series. In order to ensure that all the information is in the public domain, it is proposed that all such estimates should be published, with confidence intervals, in a separate publication.

It is proposed that recent growth estimates with either a relative confidence interval of less than or equal to 10% OR a confidence interval of less than or equal to 2.5 percentage points, should be deemed sufficiently ‘reliable’ to be published without warning. That is to say ‘reliable’ in the context of the PI publication which is intended to give broad indications of trends rather than exact estimates.

It follows that any recent growth estimate with a relative confidence interval of more than 10% AND a confidence interval of more than 2.5 percentage points, should be considered ‘uncertain’.

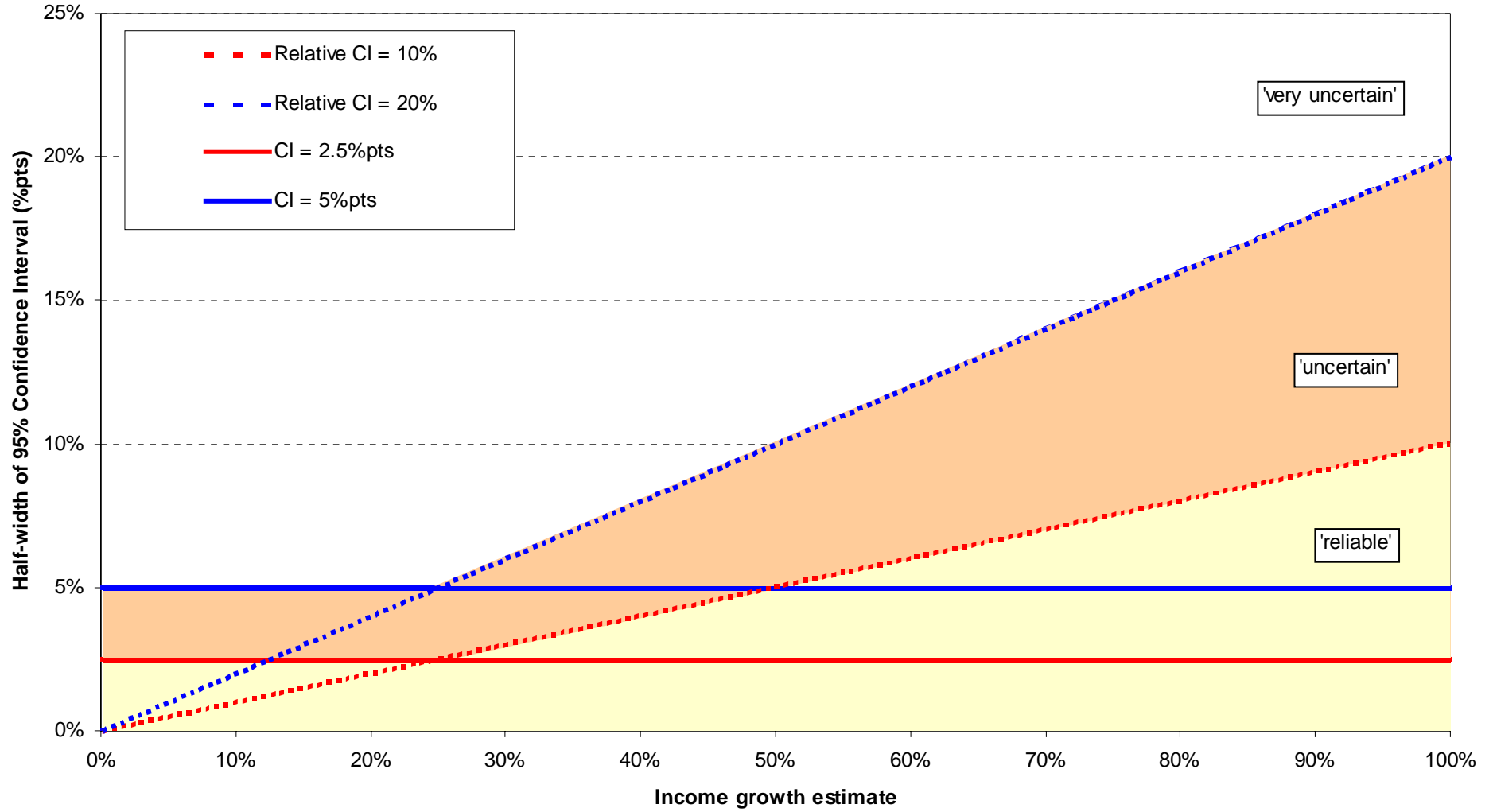
For example, recent growth estimates of 4% (+/- 2 %pts) and 50% (+/- 4 %pts) would be considered ‘reliable’, while estimates of 4% (+/- 3 %pts) and 50% (+/- 8 %pts) would be placed in square brackets and flagged up as ‘uncertain’.

It is further proposed that recent growth estimates with a relative confidence interval of more than 20% AND a confidence interval of more than 5 percentage points, should be considered ‘very uncertain’.

For example, recent growth estimates of 4% (+/- 6 %pts) and 50% (+/- 12 %pts) would be replaced in the publication with the confidence intervals [-2%,+10%] and [+38%,+62%] respectively.

The impact of the proposed publication policy on a wide range of possible estimates is demonstrated in Figure 1. The lower shaded area represents the range of possible confidence intervals where the estimate would be deemed ‘reliable’. Estimates above this line are considered ‘uncertain’. Those estimates that are also above the second shaded area are considered ‘very uncertain’.

Figure 1: Publication policy for growth estimates



## **5. Consistency with HBAI publication policy**

In past years, the publication policy used for growth estimates in Households Below Average Income (HBAI) – based on the same source data as PI – has been that:

- Estimates where the confidence interval is greater than 2.5 percentage points AND the relative confidence interval is greater than 30% are flagged up as ‘uncertain’.
- Estimates where the confidence interval is greater than 10 percentage points are regarded as ‘very uncertain’ and the confidence interval only is published.

Consistency in the methodology of HBAI and PI is desirable, where appropriate. However, there are compelling reasons why a ‘stricter’ publication policy would be more appropriate for PI.

The HBAI publication currently includes income growth estimates in two tables only (Tables A1 and A4). These estimates are based on the equivalised household income of individuals according to their family status or economic status. They are intended to give a broad indication of trends in living standards, as part of the overall picture presented in the publication.

In contrast, estimates in PI are often used as an indicator of income growth for a particular group of pensioners, outside the context of the publication as a whole. The estimates are designed to measure cash incomes (rather than the more ‘inexact’ concept of living standards) received by pensioner units (excluding the income of other members of the household). Therefore, there is more risk than with HBAI estimates of users drawing conclusions about precise changes in the incomes actually received by pensioners, when in many cases the estimates are not accurate enough to draw firm conclusions.

The aim of any publication policy of this type is to guide users as to how accurately the estimates are likely to reflect true changes in income. Therefore the design of the policy should depend on how the estimates are presented and interpreted. In the case of PI, it is thought that users’ interests are best served by adopting a ‘stricter’ policy towards highlighting uncertainty than in HBAI.

Both the HBAI and PI publication policies will be reviewed as part of the HBAI Methodological Review in the second half of 2001. However, the need to develop a publication policy for PI is more urgent, since there is no policy already in place. Therefore, we are seeking to adopt this policy for the 1999/00 edition of PI.

## 6. Results: Reliability of PI estimates

Growth estimates (and their confidence intervals) were calculated for the period 1994/5-1998/9 for a wide range of PI mean income measures. Figure 2 shows the confidence interval<sup>1</sup> of each calculated estimate. [N.B. A small number of outliers fall outside the range covered by the chart]. The ‘kinked’ lines show the limits of uncertainty corresponding to the publication policy proposed in this paper (as in Figure 1). The straight dotted line shows where the relative confidence interval equals 100%.

The vast majority (90%) of recent growth estimates would be deemed ‘uncertain’ (above the lower ‘kinked’ line) under the proposed publication policy. This includes over two-thirds of all estimates that would be deemed ‘very uncertain’ (above the upper ‘kinked’ line). Indeed, a large number of estimates had a relative confidence interval of more than 100%, i.e. we cannot even tell (with 95% confidence) whether the average income level actually increased or decreased over the period.

The most reliable recent growth estimates were those based on Table 1 in the publication. This is not surprising, because this table deals with all pensioner units, pensioner couples and single pensioners, so estimates will be based on relatively large sample sizes. Details of these estimates are given in Annex A.

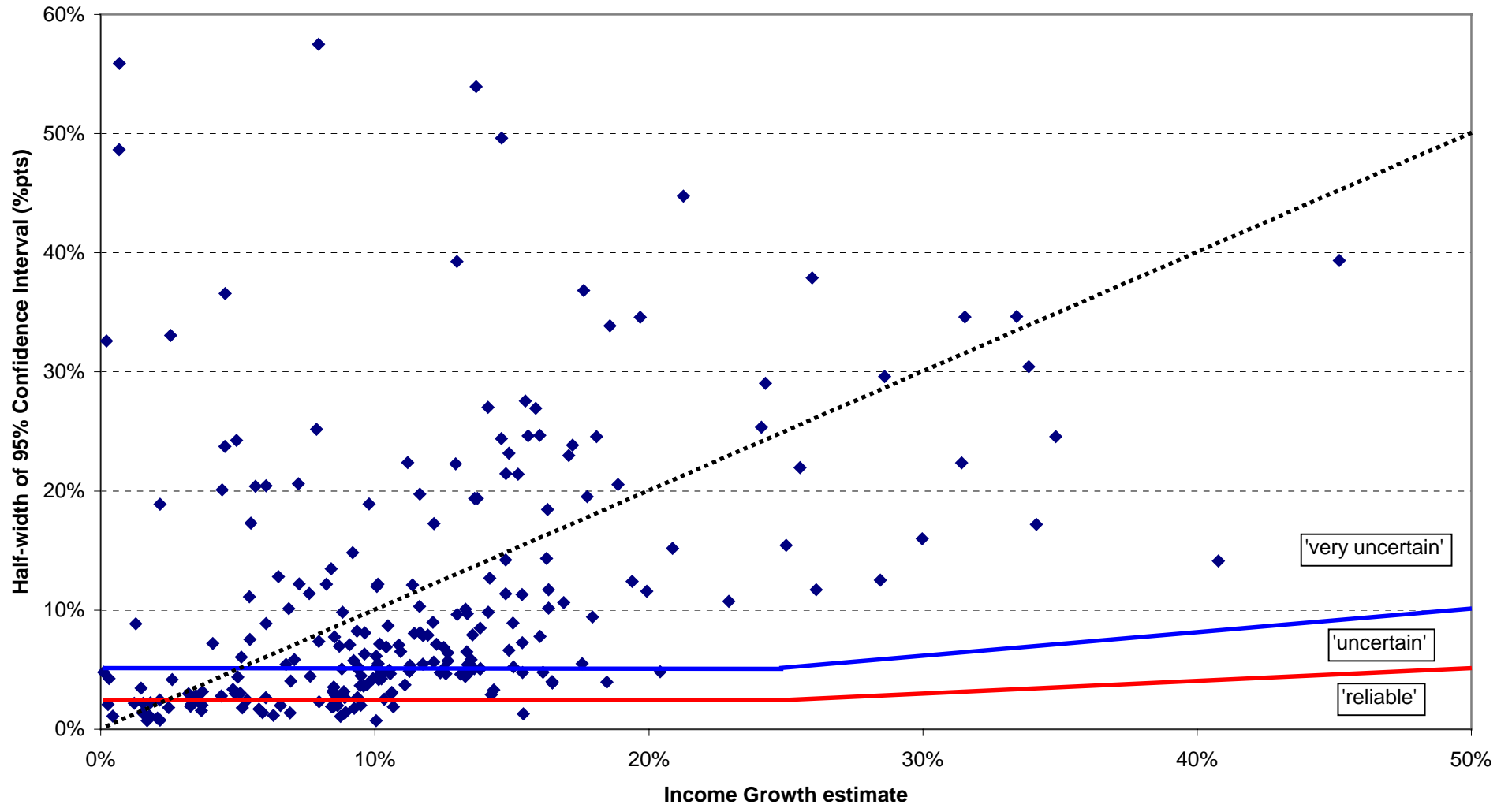
Even among these estimates, 26 out of 30 estimates were ‘uncertain’, of which 16 were ‘very uncertain’. Other tables had even more ‘very uncertain’ estimates of recent growth. For some tables, *all* such estimates were ‘very uncertain’ (e.g. Table 19). Therefore, there seems to be little evidence to support the introduction of a ‘recent growth’ column *as standard* in PI tables.

It is worth noting that estimates of recent growth in benefit income tended to be significantly more reliable than for other income components. This follows from the fact that there is *comparatively* little variation, from pensioner to pensioner, in the total amount of benefit income received. In contrast, pensioners receive a wide range of different incomes from occupational pensions and investments, so average estimates are more uncertain.

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<sup>1</sup> Confidence intervals were based on standard errors calculated under the assumption of simple random sampling, multiplied by generalised design factor to take account of the design of the sample survey. The effect of using generalised design factors on these results is thought to be small.

Figure 2: PI growth estimates, 1994/5-1998/9, compared to proposed publication policy



## 7. Conclusions

The practical implications of adopting the proposed publication policy for the 1999/00 edition of the Pensioners' Incomes Series are discussed below.

It is thought that introducing a standard column for 'income growth 1994/5-1999/00' would not be worthwhile, since most estimates are 'very uncertain'. However, it is desirable to present key estimates of recent growth somewhere in the publication. Therefore it is proposed that the next edition of PI should include a separate section on "recent income growth" giving key estimates (subject to the publication policy). A separate section would also have the advantage of allowing a more detailed discussion of what the estimates actually tell us about income growth, and with what degree of certainty. An example of such a section is given at Annex B.

This would mean that a large number of recent income growth estimates would not be explicitly included in the publication (although users could, against our advice, calculate their own growth estimates from published figures). It is proposed that these are published along with their confidence intervals in a separate paper. This will ensure that they are in the public domain, but that the PI publication is not 'flooded' with estimates that add nothing to users' understanding of pensioners' incomes.

Alternative methods of presenting key recent growth trends in the main body of the publication were discussed above. These included presenting estimates for intervening years in the tables (as is current practice) and in charts, as well as commenting on broad trends in the text. These can all add to users' understanding of the broad trends, without presenting 'precise' percentage growth estimates with spurious accuracy. Therefore, it is proposed to use these methods in PI 1999/00 wherever possible.

Future editions of the Pensioners' Incomes Series may see more estimates moving away from the 'very uncertain' category. This is because we can look at estimates over a longer time period, with typically larger total growth in income. Assuming that the (absolute) confidence intervals remain broadly constant, the relative confidence intervals will fall. This is the equivalent to the points plotted in Figure 2 experiencing a shift to the right. For many income measures, it may take several years before reliable growth estimates are available. Certainly, we should not expect a significant increase in 'reliable' recent growth estimates when looking at 1994/5-1999/00. However, since recent growth estimates are important to many PI users, it is crucial that the reliability of estimates is monitored very closely each year.

## 8. Summary of recommendations

- 1) A publication policy should be adopted for PI 1999/00 and applied to recent growth estimates (based on FRS data) only.
- 2) Generalised information on the uncertainty of other types of estimate should be included in an enhanced section on sampling variability in the publication.
- 3) Recent growth estimates with a confidence interval of more than +/- 2.5 percentage points AND a relative confidence interval of more than +/- 10% should be regarded as 'uncertain' and flagged up by placing them in square brackets.
- 4) Recent growth estimates with a confidence interval of more than +/- 5 percentage points AND a relative confidence interval of more than +/- 20% should be regarded as 'very uncertain' and should be published in the form of a 95% confidence interval only.
- 5) Where all or virtually all recent growth estimates in a given table are considered 'very uncertain', the estimates should not be published in the publication on the grounds that they may 'overload' the table with statistical information without adding to users' understanding of the trends.
- 6) Results observed for recent growth estimates 1994/5-1998/9 would mean that, under recommendation 5, recent growth estimates would be included in one table at best (Table 1). Therefore, it is proposed that such estimates should be included in a separate section in the publication on 'recent growth', where there would be more space to guide users on interpretation (see example at Annex B).
- 7) Recent growth estimates and/or confidence intervals for all recent growth estimates should appear in a separate publication, so that users can have access to all available information.
- 8) Alternative methods (such as the full time series in tables and charts, and comments in text) should be used wherever possible in the publication to give indications of broad trends in pensioners' incomes.
- 9) The PI publication policy should be reviewed again at the same time as the HBAI publication policy, as part of the HBAI Methodological Review.
- 10) Replies to ad hoc requests for recent growth estimates, where the estimate is considered 'very uncertain', should be given in the form of an estimate *and* a confidence interval.

## Annex A: Confidence intervals for recent growth rates

### Table 1: The average incomes of pensioner units, 1994/5-1998/9

Results based upon data from the FRS

Incomes in £ per week, July 1998 prices

			Change in average income 1994/5 - 1998/9				Growth rate as it would be published in PI
	1994/5	1998/9	Estimated % growth	95% C.I. (%pts)	Relative C.I. (%)	C.I. range	
<b>All pensioner units</b>							
<b>Gross income</b>	203	224	11%	+/- 5	44%	[6%,15%]	[11%]
Of which:							
Benefit income	108	115	7%	+/- 1	20%	[6%,8%]	7%
Occupational pension	51	58	15%	+/- 7	44%	[8%,22%]	[8%,22%]
Investment income	28	31	12%	+/- 17	142%	[-5%,29%]	[-5%,29%]
Earnings	16	19	15%	+/- 21	145%	[-7%,36%]	[-7%,36%]
Other income	1	2	76%	+/- 70	93%	[6%,146%]	[6%,146%]
<b>Net income before housing costs</b>							
Mean	175	192	10%	+/- 4	39%	[6%,13%]	[10%]
Median	134	148	11%	+/- 3	29%	[8%,14%]	[11%]
<b>Net income after housing costs</b>							
Mean	150	170	13%	+/- 4	33%	[9%,18%]	[13%]
Median	109	125	14%	+/- 3	23%	[11%,18%]	[14%]
<b>Pensioner couples</b>							
<b>Gross income</b>	294	322	10%	+/- 6	66%	[3%,16%]	[3%,16%]
Of which:							
Benefit income	133	138	4%	+/- 2	42%	[2%,5%]	4%
Occupational pension	84	94	12%	+/- 8	70%	[4%,20%]	[4%,20%]
Investment income	45	52	15%	+/- 21	141%	[-6%,37%]	[-6%,37%]
Earnings	31	37	18%	+/- 25	136%	[-6%,43%]	[-6%,43%]
Other income	1	2	109%	+/- 114	105%	[-5%,223%]	[-5%,223%]
<b>Net income before housing costs</b>							
Mean	250	272	9%	+/- 5	58%	[4%,14%]	[4%,14%]
Median	197	214	9%	+/- 4	42%	[5%,12%]	[9%]
<b>Net income after housing costs</b>							
Mean	226	253	12%	+/- 6	46%	[7%,18%]	[7%,18%]
Median	175	195	11%	+/- 5	43%	[6%,16%]	[6%,16%]
<b>Single pensioners</b>							
<b>Gross income</b>	147	162	10%	+/- 5	45%	[6%,15%]	[10%]
Of which:							
Benefit income	92	101	9%	+/- 2	19%	[7%,11%]	9%
Occupational pension	30	35	18%	+/- 9	53%	[9%,27%]	[9%,27%]
Investment income	17	18	4%	+/- 20	454%	[-16%,25%]	[-16%,25%]
Earnings	7	7	0%	+/- 33	15605%	[-32%,33%]	[-32%,33%]
Other income	1	1	50%	+/- 75	148%	[-24%,125%]	[-24%,125%]
<b>Net income before housing costs</b>							
Mean	129	141	9%	+/- 4	39%	[6%,13%]	[9%]
Median	109	118	8%	+/- 2	23%	[7%,10%]	8%
<b>Net income after housing costs</b>							
Mean	103	117	13%	+/- 5	35%	[9%,18%]	[13%]
Median	76	88	16%	+/- 4	24%	[13%,20%]	[16%]

Notes:

- (1) All average amounts are means unless otherwise stated.
- (2) Components may not sum to totals due to rounding.
- (3) "C.I." refers to the Confidence Interval around the estimate.
- (4) Income growth rates in brackets are more uncertain than other estimates and should be treated with caution. Growth rates that are very uncertain are given as a 95% confidence interval only (see Section 6: Sampling errors).

## **Annex B: Example of recent income growth section for inclusion in the publication**

### **(c) Recent income growth**

All estimates presented in this publication are based on sample surveys and are therefore subject to a degree of uncertainty (see Section 6). When comparing two estimates (such as the income of two different groups of pensioners, or the change in incomes between two points in time), there is even greater uncertainty. If the difference is large relative to the uncertainty (such as long-term growth estimates based on FES data, 1979-1996/7), the comparison is more likely to be meaningful than for smaller differences (such as short-term growth estimates based on FRS data). For the latter, uncertainty tends to be so large relative to the estimate itself that it tells us little about the scale of genuine income growth. In many cases, the uncertainty is so great that we cannot tell whether the income measure has increased or decreased over the period.

Recent growth estimates are more reliable for larger groups of pensioners. Estimates for all pensioner units, couples and singles are presented in this section. ‘Uncertain’ estimates are highlighted by placing them in brackets. For ‘very uncertain’ estimates, a 95% confidence interval is given – this means that we can be 95% certain that the true growth rate lies within this range. Full details of this publication policy are given in Section 6.

For most tables in the publication, recent growth estimates have not been included because they are subject to confidence intervals so wide that they tell us little or nothing about trends. Users are advised to draw broad conclusions only about such trends, by looking at the full time series of estimates in the tables and charts. Full details of all growth rates, with confidence intervals, are included in a separate publication available on the PI web page on the internet (or paper copies can be ordered from the contact point on page 5).

**Table 1(ii)** shows that the average (mean) net income of all pensioner units increased by around 10% between 1994/5 and 1998/9, although this estimate should be treated with caution. Indeed, the 95% confidence interval suggests that the growth rate could be between 6% and 13%. Over the same period, average real earnings in the whole economy increased by 4%. Therefore, not only has average income grown in real terms since 1994/5, but the evidence also suggests that it increased at a faster rate than earnings.

Estimated income growth rates for single pensioners and pensioner couples appear broadly in line with the overall growth rate, although estimates are not reliable enough to make meaningful comparisons between the different groups. This view is supported by the full time series which, while providing evidence of an upward trend in average income, fluctuate too much to draw any firm conclusions about the rate of growth.

Recent growth in benefit income can be estimated with more certainty than other income sources, since there is less variation in amounts received. The average for all pensioner units increased by 7% between 1994/5 and 1998/9 – up 4% among couples and 9% among singles. Recent growth estimates for other sources of income are subject to a high level of uncertainty. We can be 95% confident that there was a real increase in average occupational pension income (of between 8% and 22%) over the period. However, while our best estimates of average income from investment income and earnings were higher in 1998/9 than in 1994/5, we cannot say with any confidence whether they have increased or decreased. This is borne out by looking at the full time series, which in each case is subject to unpredictable fluctuations from year to year.

It should be noted that changes in average income do not simply reflect the changes experienced by individual pensioners, but also reflect changes in the composition of the pensioner group, e.g. as new retirees with higher incomes join the group (see Section 9(d)).

## Annex B: Example of recent income growth section for inclusion in the publication

**Table 1(ii): Recent growth in average incomes of pensioner units, 1994/5-1998/9**

	<i>Results based upon data from the FRS</i>					<i>Incomes in £ per week, July 1998 prices</i>
	1994/5	1995/6	1996/7	1997/8	1998/9	% Growth 1994/5-1998/9
<b>All pensioner units</b>						
<b>Gross income</b>	203	200	212	216	224	[11%]
Of which:						
Benefit income	108	109	112	113	115	7%
Occupational pension	51	51	55	57	58	[8% to 22%]
Investment income	28	25	28	28	31	[-5%, to 29%]
Earnings	16	14	17	16	19	[-7% to 36%]
Other income	1	1	1	1	2	[6% to 146%]
<b>Net income before housing costs</b>						
Mean	175	174	184	186	192	[10%]
Median	134	136	145	146	148	[11%]
<b>Net income after housing costs</b>						
Mean	150	150	160	163	170	[13%]
Median	109	111	118	123	125	[14%]
<b>Pensioner couples</b>						
<b>Gross income</b>	294	286	309	314	322	[3% to 16%]
Of which:						
Benefit income	133	133	137	138	138	4%
Occupational pension	84	85	90	93	94	[4% to 20%]
Investment income	45	41	47	50	52	[-6% to 37%]
Earnings	31	26	34	32	37	[-6% to 43%]
Other income	1	1	1	2	2	[-5% to 223%]
<b>Net income before housing costs</b>						
Mean	250	246	265	267	272	[4% to 14%]
Median	197	194	209	209	214	[9%]
<b>Net income after housing costs</b>						
Mean	226	223	241	245	253	[7% to 18%]
Median	175	172	184	189	195	[6% to 16%]
<b>Single pensioners</b>						
<b>Gross income</b>	147	146	152	154	162	[10%]
Of which:						
Benefit income	92	94	97	98	101	9%
Occupational pension	30	29	33	34	35	[9% to 27%]
Investment income	17	15	15	15	18	[-16% to 25%]
Earnings	7	6	6	7	7	[-32% to 33%]
Other income	1	1	1	1	1	[-24% to 125%]
<b>Net income before housing costs</b>						
Mean	129	129	133	136	141	[9%]
Median	109	111	115	117	118	8%
<b>Net income after housing costs</b>						
Mean	103	104	108	111	117	[13%]
Median	76	78	81	84	88	[16%]

**Notes:**

(1) Estimates of less than £0.50 or 0.5% are labelled \*.

(2) Estimates based on survey data are subject to sampling error and should be treated with caution. In particular, recent growth estimates in square brackets should be regarded as uncertain. Very uncertain estimates are given as a range, in the form of a 95% confidence interval (see Section 6).

Please also see 'General notes and definitions' on page 18.