

Interim 2001-Census-adjusted LFS estimates

Background

The 2001 Census Day estimate for the United Kingdom population was 1.0 million lower than the estimate for mid-2000. This equates to a difference of 1.2 million between the 2001 mid-year population estimate published by ONS on 10 October and the previously published Government Actuary's Department (GAD) projection for the mid 2001 population.

Since the Labour Force Survey (LFS) is a sample survey, which is grossed up to the estimated population total, the revision to the size of the population resulting from the census has important ramifications for the LFS, in terms of revisions to the estimates of the number of people in employment, and economic activity, with smaller effects on the estimates of unemployment and economic inactivity.

Given the importance to macro-economic planning of having the most accurate labour market estimates possible, ONS launched a project to produce interim adjusted LFS estimates for the key national and regional aggregates, i.e. the series published in the monthly labour market statistics First Releases. These are adjusted using a time series of factors based on broad age bands by sex applied to the corresponding (pre-census) LFS data and summed to obtain new aggregate LFS totals.

Publication plans

ONS is publishing the interim LFS estimates in three phases, based on plans for publication of revised population estimates and projections. The plans are as follows:

Phase 1

Interim LFS estimates from March-May 1992 to June-August 2001 were published on 30 October 2002, using the interim revised mid-year population estimates published on 10 October 2002. Interim LFS estimates for the period July-September 2001 to June-August 2002 were published on 8 November, using the interim 2001-based national population projections published by GAD on 1 November. From 30 October until 8 November the latest year's estimates of employment, unemployment etc from the LFS were unavailable.

Interim revised mid-year population estimates below national level were not published until the spring of 2003, so it was only possible to produce 2001-Census-adjusted LFS series at national level during the first phase of the interim reweighting project. The regional labour market First Releases from November 2002 until March 2003 were published containing 'not seasonally adjusted' data consistent with **pre-census** mid-year population estimates.

Phase 2

On 27 February 2003, ONS published final mid-year population estimates for 1991 to 2000. These have been incorporated in the LFS interim estimates, and revised UK interim estimates from 1992-2003 were published as part of the April 2003 Labour Market Statistics First Release on 16 April 2003. The availability of a full set of population mid-year estimates has enabled interim adjusted LFS series to be published at regional level for the first time. Regional estimates from winter 1996/7 (December 1996 - February 1997) to date have been published as part of the April 2003 LMS Regional First Release.

ONS published final mid-year population estimates for 1982-1990 on 27 March 2003. These will be incorporated into the interim UK LFS estimates during April, and revised UK interim LFS estimates for 1984-1991 will be available on the website on 30 April 2003.

Phase 3

ONS will be publishing the final mid-year population estimate for 2002, and producing updated population projections for 2003-4, in August 2003. Under current plans these will be included in a new set of interim LFS estimates, as part of the September 2003 LMS First Releases.

Full LFS reweighting

ONS will complete a full reweighting of all Labour Force Survey (LFS) series and databases on 12 November 2003. At this time fully reweighted LFS estimates will replace the interim 2001-Census-adjusted LFS series. Further details relating to the plans for reweighting of the LFS in 2003 and future years is available here -> <http://www.statistics.gov.uk/cci/nugget.asp?id=342>

It will take some time for annual and occasional publications and datasets to take on the reweighted LFS data. Until such time users should bear in mind that the 2001 Census showed that the population had grown less quickly than was thought when the previously published LFS estimates were calculated. A guide to users of LFS microdata has been produced and is available here -> http://www.statistics.gov.uk/about/Methodology_by_theme/Interim_2001-Census-adjusted_LFS_estimates/downloads/LFS_microdata.pdf

Interim LFS publication plans - schedule

Population estimates/projections	Release date	LFS interim estimates	Release date
Phase 1			
ONS interim revised UK level mid-year estimates for 1982 to 2000 and final 2001 mid-year estimates	10 October 2002	UK series, March-May 1992 to June-August 2001	30 October 2002
GAD interim 2001-based UK population projections	1 November 2002	UK series, July-September 2001 to June-August 2002	8 November 2002
ONS interim revised UK level mid-year estimates for 1982 to 1991	10 October 2002	Annual UK series, March-May 1984 to March-May 1991	11 November 2002
Phase 2			
ONS final mid-year population estimates for 1991 to 2000	27 February 2003	UK series, March-May 1992 to December 2002 - February 2003 Regional series, December 1996 - February 1997 to December 2002 - February 2003	16 April 2003
ONS final mid-year population estimates for 1982 to 1990	27 March 2003	UK series for March-May 1984 to March-May 1991	end - April 2003
Phase 3			
ONS mid-year population estimates for 2002	mid August 2003	UK and regional series for June-August 2001 to May-July 2003	17 September 2003
ONS Quarterly Population Estimates for 2003 & projections for 2004	end-August 2003		

Methodology for producing interim 2001-Census-adjusted LFS estimates

Slightly different methods were used to produce the UK and regional interim series, since there are different levels of data available for each of these. Wherever possible we have used the same data sources and interim reweighting methods.

UK estimates

1. Population totals on the new basis were calculated for each month between July 1983 and July 2003. These were calculated, as they are for use in the normal full LFS weighting (or grossing) process, on a straight line interpolation basis such that:

where MYE^1 for July of year $t = x_t$ and MYE^1 for July of year $t+1 = x_{t+1}$

then estimate for August $_t = x_t + (x_{t+1} - x_t) / 12$; September $_t = x_t + 2(x_{t+1} - x_t) / 12$;

October $_t = x_t + 3(x_{t+1} - x_t) / 12$; and so on up to June $_{t+1} = x_{t+1} + 11(x_{t+1} - x_t) / 12$

¹ Mid-year estimate

Monthly totals were calculated separately for each of the following age bands by sex:

Men	Women
16+	16+
16-17	16-17
18-24	18-24
25-49	25-49
50-64	50-59
65+	60+

Note: Working age for men is 16-64; working age for women is 16-59, so separate age bands are needed.

2. Adjustment factors were calculated by dividing the revised monthly population estimates by sex and age band by the old population estimate for the same sex / age band, for example:

adjustment factor for men aged 16-17 for month $t =$

$$AF_t(\text{Men (16-17)}) = (\text{Men(16-17)}_t \text{ new}) / (\text{Men(16-17)}_t \text{ old})$$

For 1984-1991 adjustment factors were needed only for April of each year. From spring 1992 factors were needed for each month.

3. LFS estimates for the labour market statistics First Release were calculated as usual from the survey database, including both weighting using pre-2001 Census population estimates and seasonal adjustment. Adjustment factors were applied to both the seasonally adjusted and not seasonally adjusted series. Adjustment factors for the central month were applied to each three-month period.

Monthly adjustment factors were calculated by age for tables 2, 9, 12 & 13 (as described below) and summed to give both 16+ and working age totals. This method has the advantage over other methods of allowing complete additivity by age without additional constraining.

The details of the method are described below on a table by table basis:

Table 1 LFS Summary

This table includes levels & rates series for LFS population, economically active, employment, unemployment; & economically inactive, by sex and for all people, for those aged 16+, and for those of working age (16-59/64).

Monthly adjustment factors are calculated by age for tables 2, 9, 12 & 13 (described below) and the totals are included in Table 1.

Table 2 Employment by age

The age breakdown is calculated in the following way:

- (i) Old monthly employment estimates by age and sex are multiplied by equivalent adjustment factors as calculated in 2 above.
- (ii) These new adjusted estimates are summed to give totals for all aged 16+ and working age by sex for each month.
- (iii) Rates are calculated using the new levels.
- (iv) Implied 16+ adjustment factors are calculated using the new 16+ estimates calculated in (ii), for use in other tables. Similarly for working age.

Table 3 Full-time, part-time & temporary workers

Estimates in this table are for age 16+ only.

- (i) All estimates in this table are multiplied by the 16+ adjustment factors by sex calculated in Table 2 (iv) above. It is not possible to apply age-specific factors since published estimates do not include age by employment type seasonally adjusted. There is a risk that differential changes in employment type by age (within sex) will be missed by this scaling method.
- (ii) Sum male and female to give total for all people in each category.
- (iii) Rates are calculated using the new levels.
- (iv) The percentages by reasons for temporary/part-time working in the second half of the table remain unchanged for men and women but are recalculated for all people.

Table 7 Actual Weekly Hours

This table includes total weekly hours and average weekly hours by sex and for all people, in total and for full-time, part-time and second job employment. Hours information is not collected for people on college-based schemes. Estimates are for age 16+.

- (i) Assume average hours for male/female all/full-time / part time / those with second jobs are unaffected. Average hours estimates for all people are recalculated under (iii) below.

(ii) Multiply male / female all/full-time/part-time/second job employment estimates calculated in Table 3 by average hours estimates in (i) to give revised total hours for each of these categories. Sum male and female to give total for all people in each category. An adjustment is made to remove the hours of government trainees on college-based schemes.

(iii) Divide the hours total for all people in each category in (ii) by all people all/ full-time / total part-time employment from Table 3 to give revised average hours estimates for all people .

Table 8 Usual weekly hours of work

This table includes numbers of men, women and all people, for all employment, employees and self-employed, who work in different bands of usual weekly hours. It also shows the percentage breakdown by hours bands within each category. Estimates are for age 16+

(i) Retain old percentage breakdown within each category for males and females.

(ii) Use revised estimates of employees / self employed by sex calculated in table 3 and recalculate levels on basis of percentages in (i). Sum male and female to give total for all people in each category.

(iii) Recalculate percentages for all people.

Table 9 ILO unemployment by age & duration

(i) This table is calculated consistently with table 2. Age groups are slightly different to those given in table 2, but this does not materially affect the method, since the combined age group (50+) is separated into component parts by subtracting levels of working age unemployment from 16+ unemployment and this estimate is used to derive the 50-59/64 figures.

(ii) Rates are calculated by dividing the revised levels by economic activity from Table 12 below.

Table 12 Economic activity by age

(i) Levels in this table are calculated as the sum of employment + unemployment by age band and sex from Tables 2 and 9 above.

(ii) Rates are recalculated by dividing levels by revised LFS population totals.

Table 13 Economic inactivity by age

(i) Since economic activity plus economic inactivity is equal to the LFS population, levels in this table are calculated by residual (population minus economic activity)

(ii) Rates are recalculated by dividing levels by revised LFS population totals.

Table 14 Reasons for inactivity

Reasons for inactivity are given for working age only.

- (i) Pre-census proportions for "reasons for inactivity" for men and women are unchanged. These are multiplied by the working-age adjustment factors by sex calculated in Table 2 (iv) above.
- (ii) Sum men and women to give total for all people in each category.

Table 18(1) Regional LM Summary

Estimates for this table are dealt with under in the Interim Region LFS section below, under "regional summary SA".

Table 22 Educational status of young people

- (i) Estimates by age calculated in tables 2, 9, 12 and 13 above are used for totals by economic status.
- (ii) Assume educational status proportions are unaffected. Apply these rates to the new levels.

Regional population estimates

1. The sub-national mid year estimates (MYEs) published by ONS on 27 February 2003 included data from 1991-2000 only. Sub-national estimates for 2001 had been published in the autumn and were not revised. Whilst GAD have produced projections for the countries of the UK, for 2002, 2003 & beyond (on 1 November 2002), they have not produced any projections below country level, and will not do so before November 2003. This means that there are effectively no 2001 Census-based population estimates or projections for the regions of England, beyond 2001.

2. In order to produce regional interim revised LFS estimates for 2002-3, ONS has produced a special set of interim regional population estimates for 2002-3, purely for this purpose. These have been produced using the published 2001 Census-consistent population estimates for 1991-2001, and the latest published (pre-census) sub-national population projections for 2001-3.

3. The growth rates from 2001 to 2002 in the pre-census sub-national population projections, by region, sex and broad age-band were applied to the equivalent published census-consistent population estimates for 2001. For example, the new London 16-17 year old male population estimate for 2002 was calculated as:

$$\text{Lon16-17(m) 2002 (new)} = \text{Lon16-17(m) 2001 (new)} * \text{Lon16-17(m) 2002 (old)} / \text{Lon16-17(m) 2001 (old)}$$

Age bands used were consistent with those used in the LMS First Releases, detailed under point 1 of the UK interim estimates above.

4. Growth rates from 2002 to 2003 in the sub-national projections were then applied to the rescaled 2002 estimate calculated above.

5. The resulting rescaled estimates for 2002 & 2003 were then constrained to the published GAD projection for England, by sex and broad age band
6. Published interim GAD projections for Scotland, Wales & Northern Ireland, for 2002-3 were used directly.
7. Estimates of the communal establishment population were calculated for each year and subtracted from the population totals to give LFS household population totals.

Regional interim LFS estimates

1. The regional interim LFS estimates use the same basic methodology as that used for the UK estimates described above. Regional population totals were interpolated using a straight line method, consistent with the approach for the UK, but for each quarter rather than each month, with the mid-year estimate (MYE) being used for the Summer (June-August) quarter:

where MYE for Summer of year $t = x_t$ and MYE for Summer of year $t+1 = x_{t+1}$

then estimate for Summer $_t = x_t$; Autumn $_t = x_t + (x_{t+1} - x_t)/4$;

Winter $_t = x_t + 2(x_{t+1} - x_t)/4$; Spring $_t = x_t + 3(x_{t+1} - x_t)/4$;

and Summer $_{t+1} = x_{t+1} + 4(x_{t+1} - x_t)/4 = x_{t+1}$

Quarterly totals were calculated separately for each region, for each of the following age bands by sex:

Men	Women
16+	16+
16-17	16-17
18-24	18-24
25-49	25-49
50-64	50-59
65+	60+

Note: Working age for men is 16-64; working age for women is 16-59, so separate age bands are needed.

2. A matrix of adjustment factors was calculated for each region by dividing the revised quarterly population estimates by sex and age band by the old population estimate for the same sex / age band, i.e.:

*adjustment factor for men 16-17 in London for quarter $t =$
 $London(Men(16-17)_t \text{ new}) / London (Men(16-17)_t \text{ old})$*

3. The regional interim system used quarterly rather than monthly adjustment factors to take account of the available regional data broken down by age. In the UK interim series, the adjustment factors were applied to the seasonally adjusted series by sex and age. Seasonally adjusted regional LFS estimates however, are only held for 16+ and working age, not for all age bands. Regional LFS estimates by broad age band (consistent with the UK totals) are only calculated for non-seasonally adjusted (NSA) data, and only for **seasonal quarters**. In order to utilise an age-based methodology consistent with the UK approach outlined above, the adjustment factors had to be applied to these NSA pre-census regional LFS series.

4. The regional age-based factors outlined above were then applied to the regional pre-census estimates of employment, activity & inactivity by age. This produced a census-adjusted NSA regional series for each **seasonal quarter**, for employment, activity & inactivity. Unemployment was calculated as economic activity minus employment.

5. Pre-census monthly regional LFS series are only readily available for 16+ and working age totals, so cannot be census-adjusted directly using an age-based methodology. Instead, age-based derived factors from the previous seasonal quarter were used to adjust the non-seasonally adjusted (NSA) LFS series for the next two months. For employment in each region therefore:

adjusted SN02 = census-adjusted SN02 from new table 2 (seasonal quarter)

*adjusted OD02 = old OD02 * adjusted SN02 / old SN02*

*adjusted N02J = old N02J * adjusted SN02 / old SN02*

adjusted D02F = census-adjusted D02F from new table 2 (seasonal quarter)

where:

SN02 = September - November 2002; OD02 = October - December 2002;

N02J = November 2002 - January 2003; and D02F = December 2002 - February 2003

Factors were applied separately for men and women, and summed to give adjusted estimates for all people. This method was repeated for economic activity using the estimates calculated in table 9 (below). Estimates of unemployment were calculated as the residual of economic activity and employment.

6. The quarterly census-based population totals for 16+ and working age were interpolated to give census-based monthly population totals, using the same straight line interpolation method as given under point 1. above:

where period $t = SN02$ and period $t+1 = D02F$:

$SN02 = x_t$; $OD02 = x_t + (x_{t+1} - x_t)/3$; $N02J = x_{t+2} + (x_{t+1} - x_t)/3$;

and $D02F = x_{t+3} + (x_{t+1} - x_t)/3 = x_{t+1}$

and:

$SN02 = \text{September} - \text{November } 2002$; $OD02 = \text{October} - \text{December } 2002$;

$N02J = \text{November } 2002 - \text{January } 2003$; and $D02F = \text{December } 2002 - \text{February } 2003$

Monthly estimates of economic inactivity were calculated as the residual of the interpolated monthly population series and the adjusted monthly economic activity series, in order to ensure additivity within each region.

7. Methods used for the individual regional LFS tables are described below: All table numbers relate to the Regional First Release (RFR).

Table 2 - Employment by age (seasonal quarters)

(i) Old seasonal quarter employment estimates by age and sex for each region were multiplied by equivalent regional seasonal quarter adjustment factors (as described above) to give census-adjusted regional employment estimates by sex and broad age-band. For Northern Ireland, the 25-49 age-band was calculated as a single group since this is the level that their pre-census estimates were published.

(ii) These census-adjusted estimates were summed to give regional employment totals for all aged 16+, and working age (16-59/64), by sex for each seasonal quarter.

(iii) Employment rates were recalculated using census-adjusted activity & inactivity totals in tables 9 and 10 (below), for men, women & people..

Table 3 - Full-time, part-time & temporary workers (seasonal quarters)

(i) Estimates in this table are age 16+

(ii) First column is a repeat of the 16+ employment total calculated under (ii) in Table 2.

(iii) Estimates in the top half of the table were calculated by sex, such that proportions of each employment type relative to the pre-census 16+ employment total were maintained, and applied to the new census-adjusted 16+ employment total. Estimates by sex were summed to give estimate for all people.

(iv) Total for temporary employees in the bottom half of the table is a repeat of the total for people in the top half. Pre-census "reasons for temporary working"

proportions were maintained, and applied to the new census-adjusted temporary employees total.

(v) The part-time workers total in the bottom half was recalculated using an implied 16+ adjustment factor (new 16+ employment total for people / old 16+ employment total). Pre-census "reasons for part-time working" proportions were then applied to the new total.

Table 6 - Actual weekly hours of work (seasonal quarters)

(i) pre-census average hours for male / female full-time / part time / those with second jobs were assumed not to be affected by the population revisions. Total average hour estimates were also unchanged for men & women, but were recalculated for all people.

(ii) male / female average hours were then multiplied by census-adjusted 16+ employment totals calculated in table 2 (above) to give adjusted total hours series by sex. These were summed to give estimates of total hours for all people.

(iii) New total average hours for people were recalculated by dividing the adjusted total hours series calculated in (ii) by the adjusted employment total for all people calculated in table 2.

(iv) Repeat (iii) for full-time / part-time / 2nd jobs average hours for all people, using the respective employment and average hours totals by sex.

Regional total hours series described in (ii) are calculated slightly more simplistically than in the UK interim method, in that no adjustment is made in the regional series for the hours of those in employment who are on college-based government training schemes. For this reason the regional hours will be slightly overstated.

Table 9 - Economic activity by age

(i) Estimates of economic activity by age were calculated in the same way as employment (table 2).

(ii) Rates are calculated as the levels in table 9 divided by sum of levels in tables 9 & 10, for men, women & all people.

Table 10 - Economic inactivity by age

(i) Estimates of economic inactivity by age were calculated in the same way as employment (table 2) & activity (table 9).

(ii) Rates are calculated as level in table 10 divided by sum of levels in tables 9 & 10, for men, women & all people.

Table 11 - Economic inactivity - reasons

- (i) First 2 columns are same as 16+ and working age totals in table 10.
- (ii) All other columns were calculated by sex, such that proportions of each inactivity type relative to the pre-census working age inactivity total were maintained, and applied to the new census-adjusted working age inactivity total. Estimates by sex were summed to give estimate for all people.

Regional Summary - not seasonally adjusted (NSA)

Employment

- (i) 16+ and working age seasonal quarter totals were calculated in table 2 (above).
- (ii) Monthly estimates were calculated using derived factors calculated on the basis of the previous seasonal quarter, applied to the pre-census monthly data, as described under point 5. above.
- (iii) Employment rates were recalculated on the basis of adjusted monthly activity & inactivity totals (described below), for men, women and all people.

Economic Activity

- (i) Economic activity level were calculated in the same way as employment, using the seasonal quarter economic activity totals calculated in table 9 (above).
- (ii) Economic activity rates were calculated using the adjusted economic activity & inactivity totals (part (i) and below).

Unemployment

- (i) Unemployment levels were calculated as the residual of economic activity minus employment.
- (ii) Unemployment rates were recalculated using the reweighted rolling monthly activity levels for men, women, and all people.

Economic Inactivity

- (i) Economic inactivity levels were calculated as the residual of population minus economic activity. The economic inactivity totals are calculated by residual in order to constrain the estimates to the interpolated population totals.
- (ii) Economic inactivity rates were recalculated using the adjusted inactivity and population totals for men, women & all people.

Population

Population totals for 16+ and working age were calculated by straight line interpolation methods, consistent with those used during normal LFS grossing, and in the UK interim system. This is described in more detail under point 5. above.

Regional Summary - seasonally adjusted (SA)

Employment

(i) Monthly totals for 16+ and working age were produced using an adjustment factor derived from the regional NSA census-adjusted series. Dividing the adjusted NSA employment series by the old (pre-census) NSA employment series for men & women gives a series of adjustment factors which can then be applied to the old (pre-census) SA monthly employment series.

So, for September - November 2002 (SN02):

Employment(SA)SN02 adjusted =

*Employment(SA)SN02 old * Employment(NSA)SN02 adjusted /
Employment(NSA)SN02 old*

(ii) Totals for men and women were then summed.

(iii) Rates were recalculated using adjusted monthly economic activity & inactivity totals (described below), for men, women and all people.

Economic Activity

(i) SA economic activity levels were calculated in the same way as SA employment above, using adjustment factors derived from the pre-census and adjusted regional NSA economic activity monthly series for men and women, summing to get totals for all people.

(ii) Economic activity rates were calculated using the adjusted monthly SA economic activity & inactivity totals (part (i) and below).

Unemployment

SA unemployment levels and rates were calculated in the same way as NSA unemployment, but using the adjusted SA employment and economic activity series.

Economic Inactivity

(i) As with the NSA series, monthly economic inactivity levels were calculated as the residual of population minus economic activity.

(ii) Inactivity rates were recalculated using the SA adjusted economic inactivity and population totals for men, women & all people.

Population

The LFS uses a single set of population estimates for SA & NSA data. The population totals shown in the SA regional summary come directly from the NSA population totals calculated above.

Notes

There are particular points that users of the regional interim LFS estimates should note:

- (i) The regional population series for 2002-3 are projections based on pre-census growth assumptions. Given the regional variations in the census-based population revisions, there are likely to be changes to the regional population estimates for 2002-3 when the revised estimates become available later in 2003.
- (ii) The LFS series are no longer fully additive. Whilst interim estimates for England & Great Britain are fully additive, estimates for the UK included in the national First Release & the summary regional tables no longer equal the sum of the regions - but this difference is small, and no more than 20,000 in any period.
- (iii) Using a seasonal quarter factor to adjust the next 2 monthly periods has introduced a very slight step in the adjusted regional monthly series, but again this is very small.
- (iv) There is the potential for slight “residual” effect in the regional unemployment series, since they are calculated as adjusted economic activity minus employment. This may result in larger relative revisions to the unemployment series when the full reweighting exercise is completed.
- (v) The interim adjusted regional series force additivity by using the economic inactivity series as a residual. Any errors within the regional activity series, and indeed some within the population series, will therefore be transferred to the economic inactivity series. These are not expected to be significant.
- (vi) Regional total hours are slightly overstated because no account is taken of college based schemes within the adjusted regional employment totals. This is small, and not more than 1.5 million hours for all regions together.

Further information and printed copies of the revised LFS tables may be obtained from Alex Clifton-Fearnside, Labour Force Survey reweighting, tel. +44 (0)20 7533 6140, fax +44 (0)20 7533 6173, email alex.clifton-fearnside@ons.gov.uk

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