General Details	
Dataset Title:	Income: Model-Based Estimates at Ward level, 2001/02
Domain(s):	Economic Deprivation, People and Society: Income and Lifestyles
Time Period of Dataset(s):	1st April 2001 to 31st March 2002
Geographic Coverage:	England & Wales
Lowest Area Output:	Census Area Statistics Wards (2003 Boundaries)
Supplier:	Office for National Statistics (ONS)
Department:	Methodology Directorate
National Statistics Data?	Experimental Statistics - this information has been developed in accordance with the principles set out in the National Statistics Code of Practice but has yet to be fully accredited as a National Statistic.
No. of Variables (excluding area names and codes):	12

Scope and Purpose

The Office for National Statistics (ONS) has produced a second set of model-based income estimates for wards in England and Wales. These estimates were produced to fulfil users' requirements for more up to date income information at the local level, on boundaries consistent with the 2001 Census.

Model-based estimates of average household income on 2003 Census Area Statistics (CAS) ward boundaries have been produced for 2001/02. Estimates and confidence intervals have been produced for four different income types:

1) Average weekly household total income (unequivalised).
2) Average weekly household net income (unequivalised).
3) Average weekly household net income before housing costs (equivalised).
4) Average weekly household net income after housing costs (equivalised).

Differing geographical boundaries and data sources used in producing the 2001/02 estimates mean that they are not comparable with the preceding estimates for 1998/99. As a result the 1998/99 estimates have been removed from the Neighbourhood Statistics website and replaced with the 2001/02 estimates to prevent erroneous comparisons. For more information please see the technical report for the estimates.

The 2001/02 estimates have been produced using the same methodology as employed for 1998/99. This modelling methodology enables survey data to be combined with census and administrative data to improve the quality of estimates at small area level. As the estimates are model-based they are different to standard direct estimates obtained from surveys and from statistics provided by administrative sources.

The model-based approach gives estimates that are of a different nature from standard survey estimates because they are dependent upon correctly specifying the relationship between weekly household income and the census/administrative information. The main limitation of estimates for small areas, either those estimated directly from responses to surveys or model-based, is that they are subject to variability. ONS has

produced confidence intervals associated with the model-based estimates in order to make the accuracy of the estimates clear.

Five further limitations of the estimates must be considered:

- the consistency and accuracy of income estimates for other, often larger, geographical areas;
- the conclusions that may be drawn from the estimates on the overall distribution of income and the ranking of specific areas;
- consistency between the four different types of income;
- consistency with different time periods; and
- comparability with the 1998/99 estimates.

The model-based methodology has been developed to ensure that the ward estimates are constrained to the published Family Resources Survey (FRS) direct Government Office Region (GOR) estimates for England and the direct estimate for the country of Wales. For example, the model-based estimates for the wards in Wales aggregate to the FRS estimate of average weekly household income for Wales. However, the model-based estimates will not be consistent with FRS estimates of average weekly household income for other geographical levels.

The methodology used to produce the model-based estimates is relatively new and as a result may be subject to consultation, modification and further development. In view of this ongoing work the current ward level model-based estimates are being published as Experimental Statistics. More information on Experimental Statistics can be found on the National Statistics website. The GOR level estimates are not produced by the model, they are obtained directly from the Family Resource Survey and are classified as National Statistics.

Guidance on Use and Interpretation

It is important to take into account the variability in the estimates when interpreting their ranking. For example, the confidence interval around the highest ranked ward suggests that the estimate lies among the group of wards with the highest income levels rather than being the ward with the highest average ward income. Estimates for two particular wards can only be described as significantly different if the confidence intervals for the estimates do not overlap.

Estimates have been produced for four different types of income. In some cases slight inconsistencies (when examining the estimates) may occur between the income types for a particular ward, e.g. a ward may have a larger estimate for net income when compared with total income. Although there may be some such inconsistencies the models selected are the best possible to describe the general pattern of income over all wards. This reinforces the need to look at the confidence interval for the income estimates, not just the estimate, since the confidence intervals summarise the variability in the estimates caused by the modelling process.

These estimates have been produced on 2003 CAS ward boundaries and therefore cannot be translated onto any other boundary system. Users must be aware of this when using the estimates in any application or drawing conclusions from the data. The

estimates are also based on 2001/02 survey data and so are only valid for this period.

These estimates provide a sound and reliable basis for comparing average income at ward level. The modelling of four types of income means that the estimates are suitable for a wide range of uses and in particular may prove to be useful for validating other income sources. More specifically, the information should help those in central government, local authorities and other organisations who are working on a range of initiatives designed to combat poverty, inequality and social exclusion.

Further guidance on the appropriate use and interpretation of the estimates can be found in the User Guide.

Administrative Procedures - Background Information

The model-based approach to making estimates of income for wards has been adopted because standard estimation procedures based on direct estimation from surveys do not provide reliable estimates at the small area level. Most surveys are designed to provide reliable estimates at national or regional levels, and at ward level the sample sizes are small, or in the majority of cases, zero.

The model-based process involves finding a relationship between survey data (data available on income) and other data drawn from administrative and census data sources. This relationship can then be used to 'borrow strength' from the administrative and census sources, known as covariates, to provide estimates on income for wards.

The 2001/02 model-based income estimates for wards are based on the relationship or model between Family Resources Survey data describing average household income at the household level and the selected covariates at the ward level. A model fitting process is used to select from the set of covariates, those with a strong relationship to the survey data. Separate models for England and Wales were investigated and the conclusion was that a single model was appropriate. In total, four models were produced representing each income type for England and Wales.

Each model is constructed using survey data from the sampled areas only. But as the relationships identified by the model are assumed to apply nationally the fitted model can be used to obtain estimates and confidence intervals for all wards.

The survey data used within the modelling process was obtained from the 2001/02 Family Resources Survey (FRS). The choice of the FRS enabled each of the four survey variables on income to be modelled. The estimates produced are values of the average ward income for the following four income types:

1) Average weekly household total income (unequivalised).
2) Average weekly household net income (unequivalised).
3) Average weekly household net income before housing costs (equivalised).
4) Average weekly household net income after housing costs (equivalised).

Although the survey data used in the modelling process were obtained from the FRS, two of the income types were defined by a different study that is based on FRS data. Net weekly household income (equivalised) both before and after housing costs is defined and calculated in the Households Below Average Income (HBAI) report.

Although all four types of income for a particular household are calculated using the same FRS survey data the HBAI methodology makes some changes to the original data set.

The HBAI data set is a cut-down version of the FRS data since the HBAI excludes households containing a married adult whose spouse is temporarily absent. An adjustment is also made to sample cases at the top of the income distribution to correct for volatility in the highest income captured in the survey. For more details on these adjustments and the reasons for them see the HBAI documentation.

The covariate data sets considered for inclusion in the models were:

- 2001 Census data;
- Department for Work and Pensions (DWP) - claimant counts, 2001/02;
- County/Regional indicators;
- HM Land Registry dwelling price data, 2001; and
- Council Tax data, 2002.

A benchmarking or scaling process was used to ensure that the model-based ward estimates were consistent with the direct estimates of average weekly household income published in the FRS report for 2001/02 for GORs in England and the direct estimate for the country of Wales.

Details of the general methodology for small area estimation developed by the ONS can be found in the Small Area Estimation Project (SAEP) report.

Concepts and Definitions

Confidence Interval

In the context of model-based estimates, the confidence interval represents the uncertainty in the modelling process. The interval reflects the range between which the true value of average weekly household income is believed to lie, at a given level of confidence. At the 95% confidence level, assuming the model holds, on average the confidence interval is expected to contain the true value around 95% of the time.

Confidence intervals are not supplied with the GOR income estimates. This is because the GOR estimates are not produced by the model, they are obtained directly from the Family Resource Survey, therefore no confidence intervals are required.

Equivalised Income

Equivalisation adjusts household income values to take account of household size and composition, enabling more appropriate comparisons to be made between households. For instance, consider the income of two households, A and B, who have the same weekly income, but A contains a couple with no children and B contains a couple with two children. On the basis of income alone, households A and B would appear to be of similar wealth. However, household B is less wealthy as there are two children to support.

Income Definitions

Total household weekly income (unequivalised) - is the sum of the gross income of every member of the household plus any income from benefits such as Working Families Tax Credit. The Total income measure for 2001/02 is consistent with the Gross income measure for 1998/99. It is calculated as the sum of income from:

- earnings (gross);
- self-employment;
- investments;
- disability benefits;
- retirement pensions and income support;
- other benefits;
- other pensions; and
- other/remaining sources.

Net household weekly income (unequivalised) - is the sum of the net income of every member of the household. It is calculated using the same components as gross income but income is net of:

- income tax payments;
- national insurance contributions;
- domestic rates/council tax;
- contributions to occupational pension schemes;
- all maintenance and child support payments, which are deducted from the income of the person making the payments; and
- parental contribution to students living away from home.

Net household weekly income before housing costs (equivalised) - is composed of the same elements as net household weekly income but is subject to the McClements Equivalence Scale

Net household weekly income after housing costs (equivalised) - is composed of the same elements of net household weekly income but is subject to the following deductions prior to the McClements Equivalence Scale being applied:

- rent (gross of housing benefit);
- water rates, community water charges and council water charges;
- mortgage interest payments (net of any tax relief);
- structural insurance premiums (for owner occupiers); and
- ground rent and service charges.

Data Classifications

Standard Classifications used (if any):	Not Applicable.
Further Details about Classifications:	Not Applicable.

Edit and Imputation Procedures

Not Applicable.

Validation and Quality Assurance

The model-based estimates of income are not produced using the standard methodology for estimating household income from the FRS. This section provides a summary of the measures taken to ensure the methodology used was sound and appropriate and the input data and modelling processes were accurate.

The SAEP methodology has been extensively reviewed by academics with expert knowledge of small area estimation. In addition the application of the methodology to estimating income has been reviewed both for the 1998/99 estimates and for the 2001/02 estimates. The review for 2001/02 ensured the Methodology Directorate had applied the methodology correctly and provided appropriate guidance on usage of the estimates in light of their incomparability with those for 1998/99.

Detailed information on the survey and covariate data were obtained in order to ensure that the most appropriate data were used and that ONS had a clear understanding of the overall scope and content of each of the key sources.

An evaluation of possible sources in terms of sampling methodology, sample coverage and types of income measured led to the choice of the FRS.

In addition, all survey and covariate data sources were subject to a series of basic quality checks, e.g. checking distributions, relationships between variables and comparisons with published statistics.

A range of diagnostic tests were used to assess the appropriateness of the models developed and to see whether the models were correctly specified. The results of the diagnostic tests showed that the models are well specified and that the assumptions are valid. This provided confidence in the accuracy of the estimates and the confidence intervals produced from the models.

An extensive two stage validation process aimed specifically at establishing the plausibility of the income estimates was undertaken both for the 1998/99 and the 2001/02 estimates. The first stage of the validation for both years involved validation of the estimates by comparison with other income data sources. For the 2001/02 model-based estimates of average income these included:

- Inland Revenue data, 2001/02, England and Wales;
- Index of Multiple Deprivation, 2004, England only;
- Index of Multiple Deprivation, 2000, Wales only;
- New Earnings Survey data, 2001;
- Labour Force Survey data, 2001; and
- General Household Survey data, 2001/02.

The model-based estimates were compared with the data sources graphically, both by actual value and by rank. Their relationship was also measured statistically. More details on the validation of the income estimates may be requested from the ONS contact address set out below ('Sources for Further Information or Advice' section).

The second stage in the validation process involved establishing the plausibility of the estimates via consultation with users. The 1998/99 model-based estimates validation was a large scale user consultation exercise that involved local users, academics and income experts. This consultation enabled the ONS to invite users of the income estimates to comment upon the plausibility of the estimates and also their usefulness. The comments received supported the plausibility of the estimates and emphasise how informative they are to users. The user consultation process also highlighted the significant user need for updating the model-based estimates of income. The user consultation for 2001/02 was a smaller scale consultation, similarly aimed at establishing the plausibility of the estimates and the clarity of the guidance explaining the incomparability of the estimates with those for 1998/99. Again, the comments received support the plausibility of the estimates and indicate a user need for estimates of income that are comparable for different time periods and estimates of income for Super Output Area boundaries.

Geographic Referencing

Model-based estimates have been produced on 2003 CAS ward boundaries. Both survey and all covariate data sources had to be available on the relevant 2003 ward geography.

The survey data were provided at household level with grid reference coordinates attached. This enabled ONS to locate households and allocate them to the appropriate wards.

The majority of the covariate data was supplied on 2003 ward boundaries, the exception was the 2001 House Price data from the Land Registry, which was supplied for all 8 million property sales over the period 1996 to 2003. ONS used a Geographical Information System (GIS) to match the postcode sector of each property to an x-y co-ordinate on the ground. This enabled each record to be allocated to a CAS ward and information on those wards, such as the mean and the median house price to be calculated. Please note, due to small sample sizes estimates were not produced for the wards within the City of London and the Isles of Scilly Local Authority Districts. Instead estimates have been provided for the Local Authorities (please see Appendix A for details).

Data Quality

Relevance:	These estimates provide a sound and reliable basis for comparing average income at ward level. The modelling of four types of income means that the estimates are suitable for a wide range of uses and in particular may prove to be useful for validating other income sources. More specifically, the information should help those in central government, local authorities and other organisations who are working on a range of initiatives designed to combat poverty, inequality and social exclusion. The extensive quality checks performed during the process of producing the estimates and on the final estimates themselves have ensured the accuracy of the estimates. In turn this has ensured that they are relevant to the user.

Accuracy:	The ONS has made every effort to ensure that the model-based estimates are as accurate as possible. This has involved ensuring the methodology was robust, that the data sources used were the most appropriate, accurate and up-to-date at the time, that the models produced were correctly specified and finally that the estimates were accurate and plausible. The accuracy of the estimates is indicated primarily by the confidence intervals that have been calculated for every ward estimate. In order to assess the precision of each estimate it is accompanied by a 95% confidence interval. This means that assuming the model holds, on average the confidence interval is expected to contain the true value 95% of the time. For example, if a ward estimate of average weekly household income is £400 and the 95% confidence interval is (£350, £450) we know that 95% of the time the average weekly household income for that ward will fall within this range given that the modelling assumptions are true.
Timeliness and Punctuality:	These estimates have been produced on 2003 CAS ward boundaries and therefore cannot be translated onto any other boundary system. Users must be aware of this when using the estimates in any application or drawing conclusions from the data. The estimates are also based on 2001/02 survey data and so are only valid for this period. In order to further fulfil user requirements, the ONS is assessing the availability of the data sources needed to produce future model-based estimates of average income that will be comparable over time.
Accessibility and Clarity:	The model-based estimates of average weekly household income have also been benchmarked so that the ward level estimates add up to the direct estimates for GORs in England and the direct estimate for the country of Wales from the FRS for 2001/02. Further assistance on the appropriate use and interpretation of the estimates has been provided in a guidance document associated with this metadata
Comparability:	The 2001/02 estimates are a second set of model-based average income estimates produced by the ONS, however, differing geographical boundaries and data sources used in producing the 2001/02 estimates mean that they are not comparable with the preceding estimates for 1998/99. As a result the 1998/99 estimates have been removed and replaced with these more up to date estimates.

Coherence:	The 2001/02 estimates have been produced using the same methodology as employed for 1998/99. This modelling methodology enables survey data to be combined with census and administrative data to improve the quality of estimates at small area level.

Disclosure Control

The Office for National Statistics carries out a number of checks to safeguard confidentiality. In accordance with standard procedures this dataset has been reviewed and approved for release.

Sources for Further Information or Advice

Further guidance on the appropriate use and interpretation of the estimates is available on the Neighbourhood Statistics website

Further information on the general methodology developed by the Office for National Statistics for Small Area Estimation is available in the Small Area Estimation Project Report.

For technical details on the modelling methodology employed to produce the income estimates or any other information, please e-mail: aba@ons.gov.uk or telephone: 01329 813677

Appendix A: Local Authority Estimates of Income for City of London and Isles of Scilly

LA Code	LA Name	Average Weekly Household Total Income Estimate	Average Weekly Household Total Income 95% Confidence Interval Lower Limit	Average Weekly Household Total Income 95% Confidence Interval Upper Limit	Net Weekly Household Income Estimate	Net Weekly Household Income 95% Confidence Interval Lower Limit	Net Weekly Household Income 95% Confidence Interval Upper Limit	Net Weekly Household Income Estimate (equivalised before housing costs)	Net Weekly Household Income (equivalised before housing costs) 95% Confidence Interval Lower Limit	Net Weekly Household Income (equivalised before housing costs) 95% Confidence Interval Upper Limit	Net Weekly Household Income Estimate (equivalised after housing costs)	Net Weekly Household Income (equivalised after housing costs) 95% Confidence Interval Lower Limit	Net Weekly Household Income (equivalised after housing costs) 95% Confidence Interval Upper Limit
00AA	City of London	970.00	810.00	1150.00	700.00	600.00	810.00	630.00	540.00	740.00	640.00	540.00	750.00
15UH	Isles of Scilly	470.00	390.00	570.00	380.00	320.00	450.00	350.00	300.00	400.00	310.00	270.00	360.00