GLAINTELLIGENCE UNIT

Census Information Scheme

2011 Census quality assurance: The estimation process

Introduction

This briefing outlines the census estimation process for the 2011 Census estimates. The data it draws upon was released alongside the data tables which formed the first release of 2011 Census information on 16th July 2012. The Office for National Statistics (ONS) released a significant amount of information pertaining to the development of the census estimates and, in particular, the quality assurance process. This briefing note draws together the information for London boroughs and guides the reader thorough each stage of the estimation process from census count to census estimate.

The process of producing a census population estimate begins with the census count. In March 2011 Census questionnaires were posted out to every household in England and Wales to be completed on Census Day (27 March 2011). This massive operation aimed to count, and collect data on, everyone in the country. However it is recognised that no census is successful in capturing 100 per cent of the population and so, once the data from the questionnaires was processed, it was necessary to make adjustments in order to account for under-enumeration. In addition to determining how many people were missed in the census operation, adjustments are also made for bias, overcount, communal establishments and to bring the local authority level data in line with national population structures. Each of these stages is outlined in this briefing.

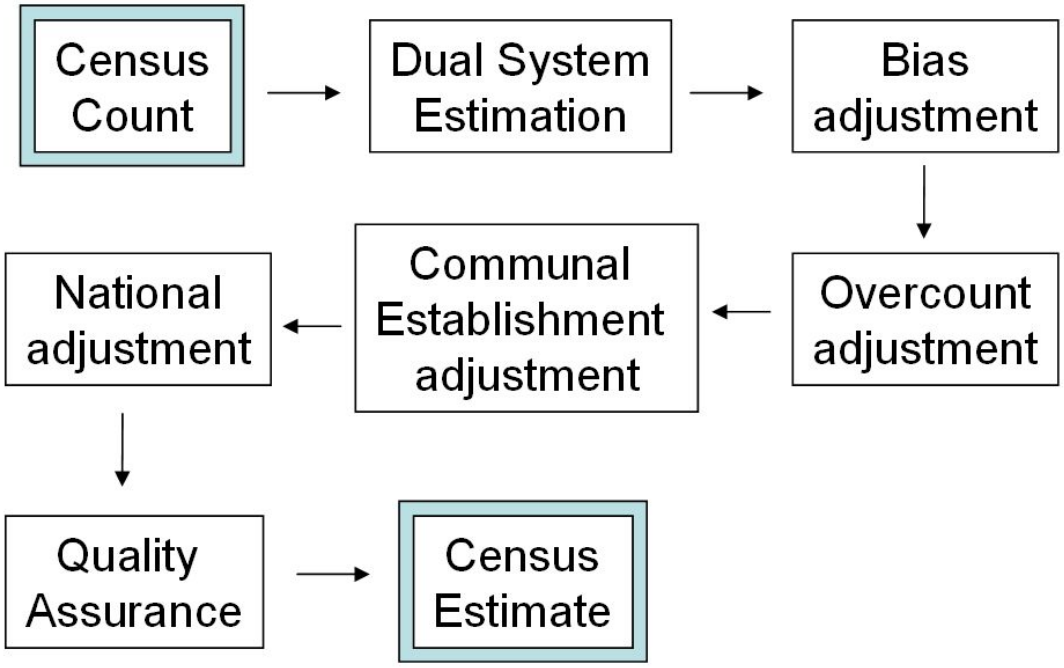
Summary of adjustments in Greater London:

Census Coverage Survey and Dual System Estimation	604,700
Bias Adjustment	133,800
Overcount	-68,400
Communal Establishments adjustment	14,300
National Adjustment	97,500
Total Adjustment	781,900

The estimation process is a technically complex exercise and this briefing does not attempt to provide detailed commentary on statistical methodologies. Instead it is a general guide to the stages of the estimation process. A list of acronyms and a glossary are provided at the end of the document.

The chart below outlines the stages of the estimation process.

Figure 1: The estimation process



Note on Estimation Areas

For the purposes of the estimation process England and Wales was divided into Estimation Areas (EA). These were groups of contiguous local authorities with large enough populations to allow robust estimates to be calculated. Within London EAs equate to single boroughs or aggregations of two or three boroughs.

Tools of the estimation process

The ONS uses a number of tools in the development of its census estimates. These tools are central to the process and gaining an understanding of them is necessary to understand the estimation process itself. Therefore, it is useful to describe three of the main tools used before looking in more detail at the estimation process, they are: the Census Coverage Survey, the Hard to Count index and the Alternate Household Estimate.

Census Coverage Survey

The Census Coverage Survey (CCS) is an independently-run second survey of households in England and Wales conducted directly after the Census operation. Its purpose is to produce estimates, independent of the Census, of households and residents in a representative sample of areas across the country. The sample for the 2011 CCS was 18,200 postcodes in 5,800 output areas equating to 340,000 households (or just over one per cent of households nationally). When developing the sample the ONS ensured that there were clusters of postcodes within every local authority and also that harder to count areas were better represented than easier to count areas (see HtC index below). The number of postcodes used in a single authority is called the postcode sample size.

Field staff were provided with a map which identified the boundary within which they were to conduct the CCS. The survey did not use any census data or address register information; field staff simply visited every address within their defined area. The survey itself was a doorstep interview which asked 13 questions.

Unlike the Census itself the CCS is voluntary. However field staff were successful in obtaining interviews in a high percentage of households (see table 1). The CCS household response rate is the number of households providing a valid CCS response divided by the total number of households within a postcode area. Table 1 below outlines the CCS response rates for London boroughs as well as the number of postcodes that were visited in each authority area (i.e. the sample size).

Table 1: CCS response rates and postcode sample sizes

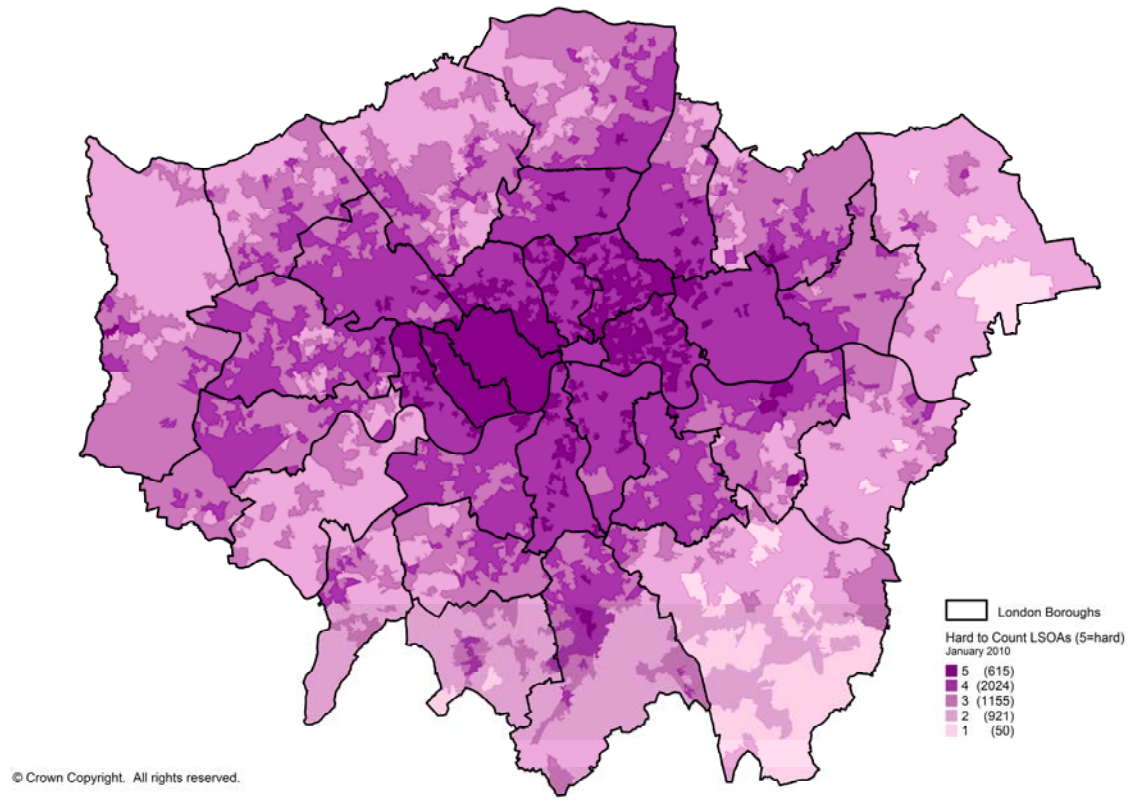
	CCS household response rate (%)	CCS postcode sample size
City of London	89	12
Barking and Dagenham	85	61
Barnet	83	124
Bexley	86	45
Brent	84	134
Bromley	87	105
Camden	77	109
Croydon	83	147
Ealing	86	132
Enfield	86	84
Greenwich	80	97
Hackney	77	123
Hammersmith and Fulham	81	89
Haringey	78	108
Harrow	86	81
Havering	86	54
Hillingdon	82	87
Hounslow	80	87
Islington	81	84
Kensington and Chelsea	74	115
Kingston upon Thames	88	38
Lambeth	82	141
Lewisham	84	131
Merton	82	64
Newham	79	119
Redbridge	80	98
Richmond upon Thames	90	65
Southwark	85	131
Sutton	90	55
Tower Hamlets	80	130
Waltham Forest	82	73
Wandsworth	82	95
Westminster	74	262

Source: Office for National Statistics

Hard to Count Index

The Hard to Count (HtC) index is a tool developed by the ONS to assist in their census operations. It was designed to identify Lower Super Output Areas (LSOA) where households would be less likely to participate in the census. There are a number of factors which indicate the likelihood of a household's participation. Among these are household tenure and location and the age, ethnicity and family status of the householder (ONS, 2009). Administrative data were used to determine how prevalent these characteristics were within LSOAs and this was used to assign an HtC value between one and five (five being the hardest to count). Figure 2 shows the HtC index 2010. The HtC index used by ONS in their census operations was updated using more recent data.

Figure 2: Hard to Count index in London, 2010



Source: Office for National Statistics

The HtC index was initially used by the ONS during their census fieldwork follow-up operation in order to more effectively target resources. The ONS was able to divert resources away from areas where participation was likely to be high to areas where response was predicted to be much lower. This practice is partly credited with the improved response rates many local authorities saw in comparison to the 2001 Census (particularly in the hardest to count areas).

The HtC index also played a central role in the estimation process The CCS sample was designed so that robust EA level estimates could be produced by age band, sex and HtC level.

The Alternate Household Estimate

The ONS produced an 'Alternate Household Estimate' (AHE) to use in some of the calculations in the estimation process. It is 'alternate' because it is a separate calculation from the household estimate derived from the census estimation process. Exactly how the AHE is used is covered elsewhere in this briefing.

To create the alternate household estimate:

Start with Usually Resident Household counts. The starting point for the AHE is total number of households from which a Census questionnaire was returned.

Add in Dummy forms. During the field operation the ONS field staff completed a 'dummy form' when they could not obtain a response from an address. It was assumed that these addresses had no residents. However in some cases a response was subsequently received from some households with dummy forms. From this the ONS was able to estimate the proportion of households with dummy forms likely to contain residents. This ratio was then applied to the total dummy forms to get the number of households to add into the AHE.

Add in Blank Questionnaires. Forms that were returned blank or incomplete were also reviewed. In some cases it was possible to identify that the household was occupied (e.g. someone had written on the form "I'm not filling this in"). The proportion of households returning blank forms likely to contain residents was calculated. This proportion was applied to the total blank forms to get the number of households to add into the AHE.

Add in unaccounted for addresses. Some addresses on the ONS register of addresses did not fall into any of the above categories. That is to say that no form was returned completed or not, the address was not taken off the register by the field staff and no dummy form was created. Fifteen per cent of these unaccounted for addresses (UAF) were checked by field staff and either taken off the ONS register (deactivated) or had a dummy questionnaire created. The proportion of UAFs likely to contain residents was calculated. This ratio was then applied to the total UAFs to get the number of households to add into the AHE.

Add in additional addresses. The ONS register of addresses used in the Census operation was created using data up to an including December 2010. This was because the questionnaires needed to be printed in time to be posted out for Census Day. This meant there was a three-month period where any newly built properties would not be on the ONS register. The newly built addresses for the period January to March 2011 were collected and the proportion of these likely to be occupied was determined. This number was then added into the AHE.

Alternate Household Estimate: The calculation to arrived at the AHE is: Usually resident households + dummy forms + blank questionnaires + UAFs + additional addresses = AHE.

The Estimation Process

This section of the briefing will explain each stage of the estimation process and how the AHE, CCS and HtC outlined above are put to use.

Census Count

The Census operation sent forms out to households and required them to be completed and returned (either online on by post). A field team of ONS staff then followed-up non-responding households. Once this initial operation was complete the returned questionnaires were processed and the data collated. The numbers of people and households collected through the census questionnaire is the count.

An accurate count is important because the better the count is the less need there is for adjustment afterwards and therefore the more confidence there is in the final estimate. However no census can capture everyone in the country and so the count does need to be adjusted in order to obtain a more accurate estimate of the total population.

Table 2 below sets out the counts of usually resident persons for each London borough.

Table 2: 2011 Census Counts of London Boroughs

	Count of usual residents
City of London	6,800
Barking and Dagenham	170,700
Barnet	324,700
Bexley	219,700
Brent	273,900
Bromley	294,400
Camden	191,500
Croydon	327,300
Ealing	312,600
Enfield	283,500
Greenwich	230,800
Hackney	212,800
Hammersmith and Fulham	159,500
Haringey	221,100
Harrow	221,900
Havering	226,000
Hillingdon	254,800
Hounslow	234,100
Islington	188,400
Kensington and Chelsea	129,600
Kingston upon Thames	149,000
Lambeth	264,100
Lewisham	243,000
Merton	186,600
Newham	266,000
Redbridge	257,000
Richmond upon Thames	175,700
Southwark	251,900
Sutton	180,800
Tower Hamlets	230,600
Waltham Forest	232,400
Wandsworth	283,700
Westminster	186,800
London	7,391,900

Source: Office for National Statistics

Totals may not sum due to rounding

Dual System Estimation

To accurately estimate the number of people missed in the initial Census operation the ONS use a method called Dual System Estimation (DSE). This method not only identifies the number of households and persons missed by the Census but also identifies the characteristics of those individuals (age, sex, ethnicity, etc.). The process of adding people in is called imputation.

DSE uses two sets of data to estimate how many people have been missed. The first set of data is the Census itself. The second set of data is the Census Coverage Survey (CCS). The DSE process is as follows:

1. For the postcode areas in the CCS, households identified in the CCS are matched with households in the Census

2. Any household in the CCS that can't be matched to the Census is taken to be a household the Census missed. These extra households are added to the census count. A lot of effort was taken to match Census and CCS records as accurately as possible as households appearing on both the Census and CCS that are not matched will be counted twice in the DSE estimates.

3. Using the ratios of matched to unmatched households, an estimate is made of the households that were missed by both Census and CCS. The overall DSE adjustment is then the sum of the two components: households in the CCS but not in the Census, and households not in either the CCS or the Census.

4. A similar calculation produces the DSE adjustment for persons.

The adjustment factors were then applied to the Census counts for all households and persons. To ensure the factors were representative, separate DSE factors were calculated for each age-band, sex, and HtC level for each Estimation Area (EA). So, for example a DSE was calculated for Males aged 35-39 for Hard to Count level 2 in Ealing and a ratio of the number of actual persons to the number counted in the Census is produced. This is repeated for all age bands and all HtC levels for both sexes.

Table 3 shows the number of people added-in to the Census from this process for London boroughs. It also shows the DSE figure as a percentage of the count, and figure 3 displays this as a chart. A higher percentage indicates more people were missed in the initial Census operation.

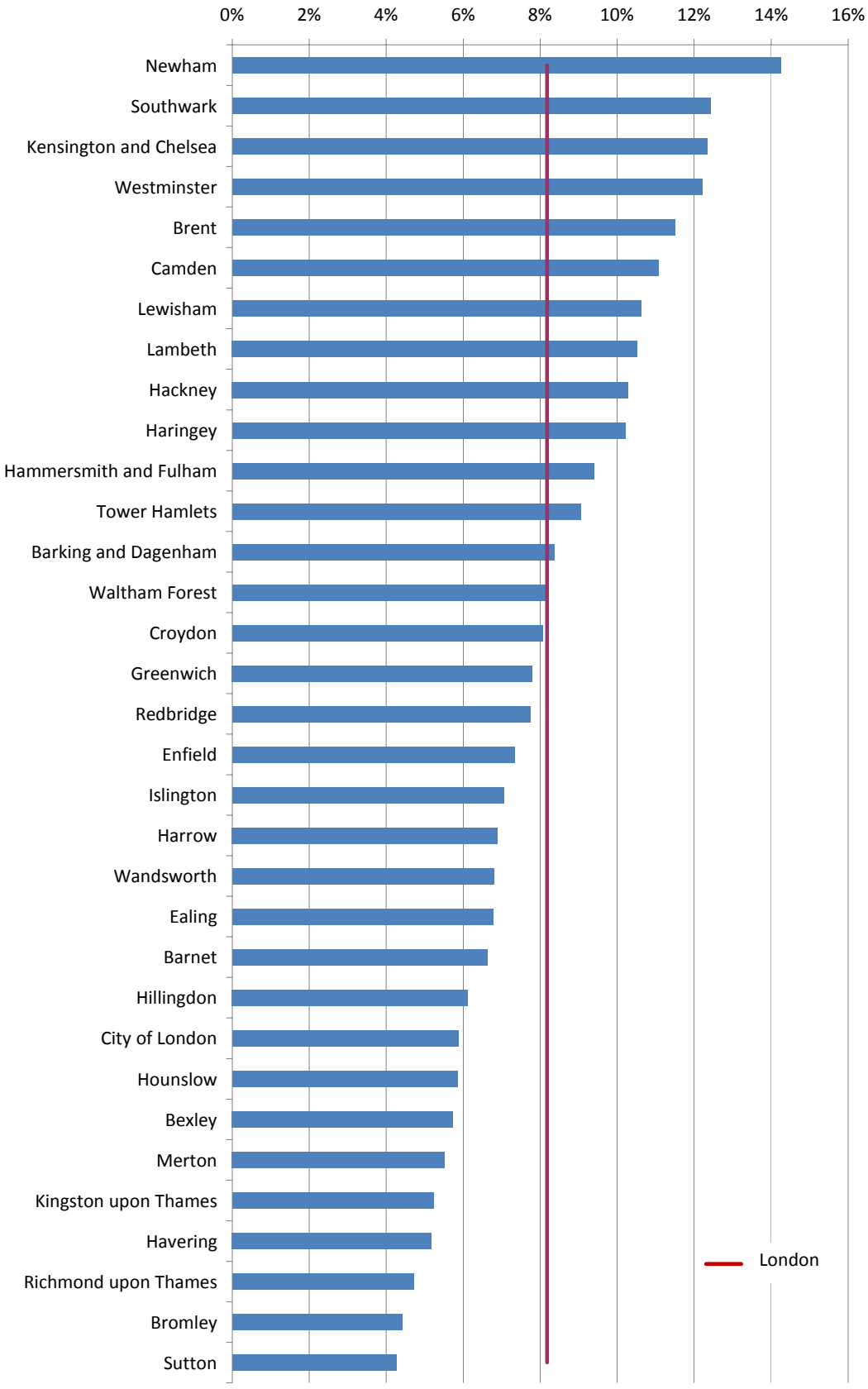
Table 3: Dual System Estimation

	Census Count	Dual System Estimation	DSE % of count
City of London	6,800	400	5.88
Barking and Dagenham	170,700	14,300	8.38
Barnet	324,700	21,500	6.62
Bexley	219,700	12,600	5.74
Brent	273,900	31,500	11.50
Bromley	294,400	13,000	4.42
Camden	191,500	21,200	11.07
Croydon	327,300	26,400	8.07
Ealing	312,600	21,200	6.78
Enfield	283,500	20,800	7.34
Greenwich	230,800	18,000	7.80
Hackney	212,800	21,900	10.29
Hammersmith and Fulham	159,500	15,000	9.40
Haringey	221,100	22,600	10.22
Harrow	221,900	15,300	6.89
Havering	226,000	11,700	5.18
Hillingdon	254,800	15,600	6.12
Hounslow	234,100	13,700	5.85
Islington	188,400	13,300	7.06
Kensington and Chelsea	129,600	16,000	12.35
Kingston upon Thames	149,000	7,800	5.23
Lambeth	264,100	27,800	10.53
Lewisham	243,000	25,800	10.62
Merton	186,600	10,300	5.52
Newham	266,000	37,900	14.25
Redbridge	257,000	19,900	7.74
Richmond upon Thames	175,700	8,300	4.72
Southwark	251,900	31,300	12.43
Sutton	180,800	7,700	4.26
Tower Hamlets	230,600	20,900	9.06
Waltham Forest	232,400	19,100	8.22
Wandsworth	283,700	19,300	6.80
Westminster	186,800	22,800	12.21
London	7,391,900	604,700	8.18

Source: Office for National Statistics

Totals may not sum due to rounding

Figure 3: Imputation using DSE as a percentage of Census count



Source: Office for National Statistics

Bias Adjustment

Once the additional people identified through the DSE are added onto the original census count there are some additional small adjustments that need to be made. First of these is the bias adjustment.

The Dual System Estimation works under the assumption that individuals and households not captured on the Census questionnaire have as good a chance as any other individual or household of being captured by the CCS. However this assumption is not always valid and this can bias the results. The bias occurs in two types:

Between Households

Between household bias occurs when whole households that are not likely to be counted in the Census are also not likely to be counted in the CCS.

- e.g. a household that will always refuse the complete the Census and the CCS
- e.g. a household that refuses to fill in the CCS on the basis that they have only just done the Census

Within Household

Within household bias occurs when persons that are not likely to be counted in the Census (within a counted household) are also not likely to be counted in the CCS.

- e.g. partner of a single parent mother due to benefit fraud

Estimating Between Household Bias

The alternate household estimate (see above) is compared to the number of households in an area, as determined by the Dual System Estimation method. If the AHE is greater than the DSE for the sample then there is between household bias and this will need to be adjusted for.

The number of households is increased to accurately reflect the AHE estimate. The members of these imputed households and their characteristics are added to the person totals using a model. The model splits the additional persons by age and sex and the ratios are determined by CCS coverage levels and vary according to HtC and EA.

Estimating Within Household Bias

The ONS compare the Census data to social survey data to identify any disparities in household size and structures. If the social survey data found significantly lower coverage within households than the CCS then there is within household bias and this will need to be adjusted for.

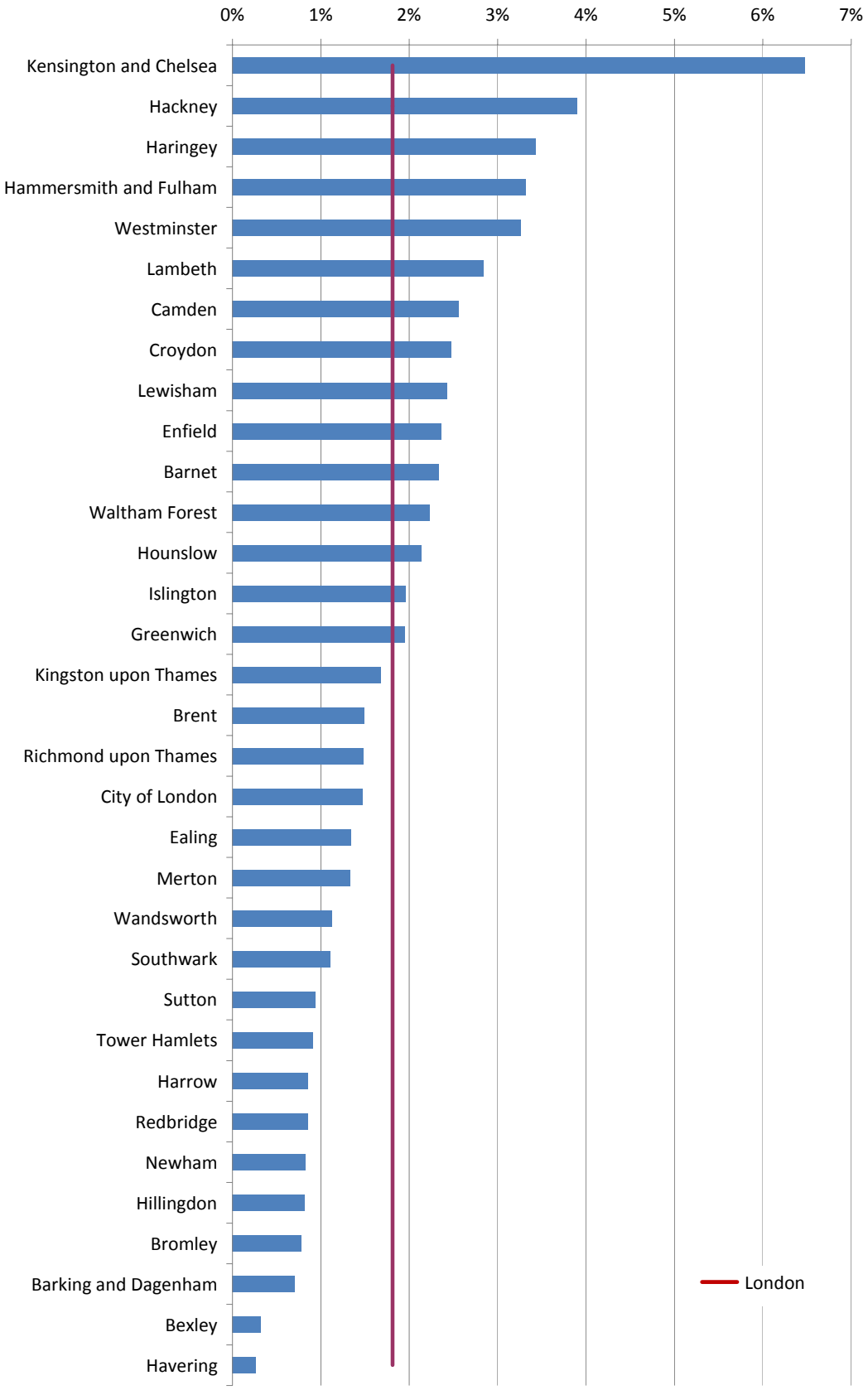
Table 4: Bias adjustment

	Census Count	Bias Adjustment	Bias % of count
City of London	6,800	100	1.47
Barking and Dagenham	170,700	1,200	0.70
Barnet	324,700	7,600	2.34
Bexley	219,700	700	0.32
Brent	273,900	4,100	1.50
Bromley	294,400	2,300	0.78
Camden	191,500	4,900	2.56
Croydon	327,300	8,100	2.47
Ealing	312,600	4,200	1.34
Enfield	283,500	6,700	2.36
Greenwich	230,800	4,500	1.95
Hackney	212,800	8,300	3.90
Hammersmith and Fulham	159,500	5,300	3.32
Haringey	221,100	7,600	3.44
Harrow	221,900	1,900	0.86
Havering	226,000	600	0.27
Hillingdon	254,800	2,100	0.82
Hounslow	234,100	5,000	2.14
Islington	188,400	3,700	1.96
Kensington and Chelsea	129,600	8,400	6.48
Kingston upon Thames	149,000	2,500	1.68
Lambeth	264,100	7,500	2.84
Lewisham	243,000	5,900	2.43
Merton	186,600	2,500	1.34
Newham	266,000	2,200	0.83
Redbridge	257,000	2,200	0.86
Richmond upon Thames	175,700	2,600	1.48
Southwark	251,900	2,800	1.11
Sutton	180,800	1,700	0.94
Tower Hamlets	230,600	2,100	0.91
Waltham Forest	232,400	5,200	2.24
Wandsworth	283,700	3,200	1.13
Westminster	186,800	6,100	3.27
London	7,391,900	133,800	1.81

Source: Office for National Statistics

Totals may not sum due to rounding

Figure 4: Bias adjustment as a percentage of Census count



Source: Office for National Statistic

Overcount Adjustment

So far the estimation process has concentrated on imputing those persons and households that were missed by the Census. However it is also important to ensure that there is no overcount. There are two types of overcount:

- Duplication – person is counted twice
- Wrong location – person is counted once but in the wrong place

Examples of duplication are students who are counted both at their term-time address and their parent's address or children whose parents are separated and who are recorded at both parents' addresses. An example of a wrong location is a student who is counted at their parents' house rather than their term-time address or a person who moved house before Census Day but filled in their form early.

Analysis of the Census and the CCS is used to identify patterns within age groups and within HtC areas for both sexes and these are then extrapolated to the whole population of an EA. Any overcount is then subtracted from the census count.

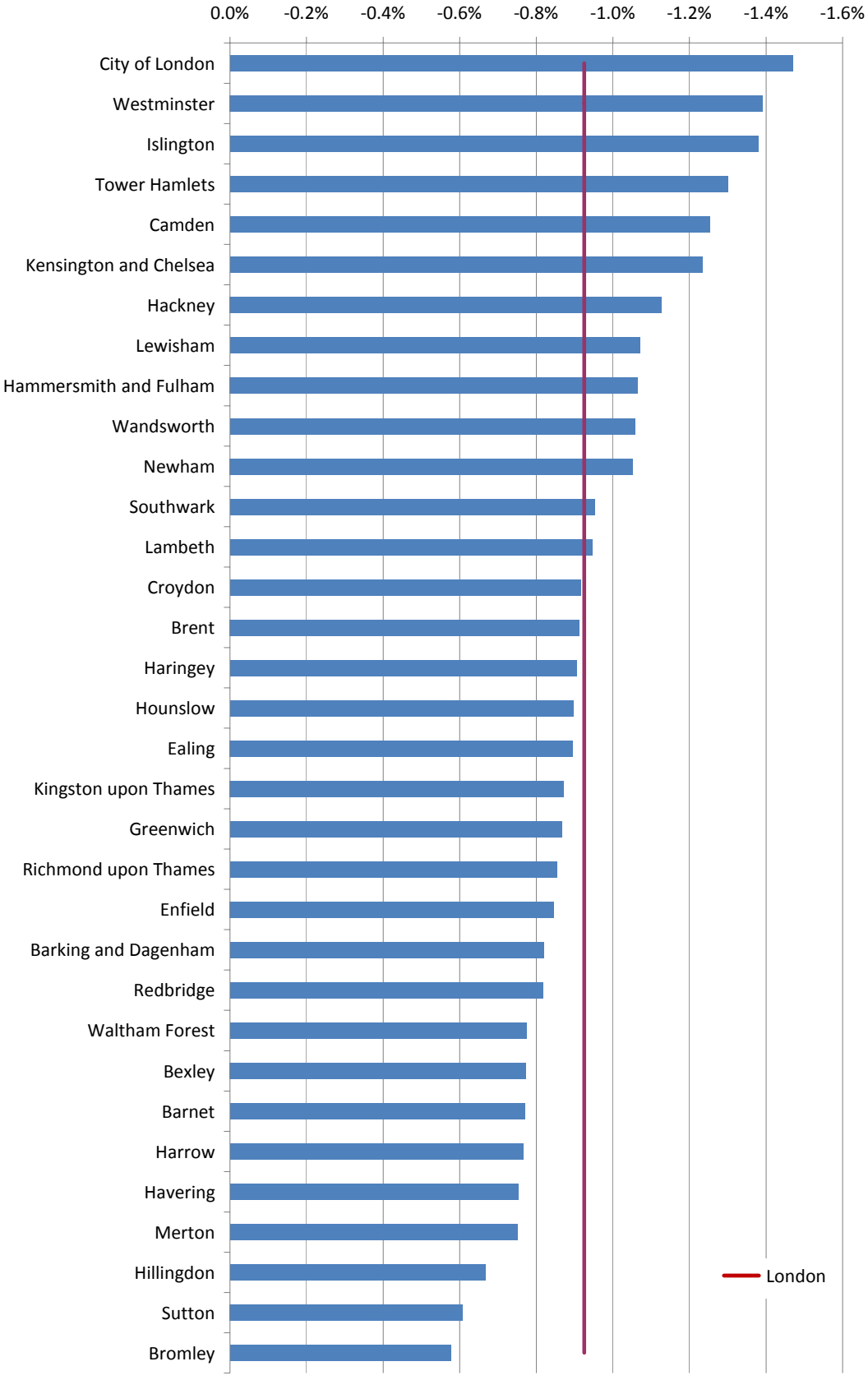
Table 5: Overcount adjustment

	Census Count	Overcount	Overcount % of count
City of London	6,800	-100	-1.47
Barking and Dagenham	170,700	-1,400	-0.82
Barnet	324,700	-2,500	-0.77
Bexley	219,700	-1,700	-0.77
Brent	273,900	-2,500	-0.91
Bromley	294,400	-1,700	-0.58
Camden	191,500	-2,400	-1.25
Croydon	327,300	-3,000	-0.92
Ealing	312,600	-2,800	-0.90
Enfield	283,500	-2,400	-0.85
Greenwich	230,800	-2,000	-0.87
Hackney	212,800	-2,400	-1.13
Hammersmith and Fulham	159,500	-1,700	-1.07
Haringey	221,100	-2,000	-0.90
Harrow	221,900	-1,700	-0.77
Havering	226,000	-1,700	-0.75
Hillingdon	254,800	-1,700	-0.67
Hounslow	234,100	-2,100	-0.90
Islington	188,400	-2,600	-1.38
Kensington and Chelsea	129,600	-1,600	-1.23
Kingston upon Thames	149,000	-1,300	-0.87
Lambeth	264,100	-2,500	-0.95
Lewisham	243,000	-2,600	-1.07
Merton	186,600	-1,400	-0.75
Newham	266,000	-2,800	-1.05
Redbridge	257,000	-2,100	-0.82
Richmond upon Thames	175,700	-1,500	-0.85
Southwark	251,900	-2,400	-0.95
Sutton	180,800	-1,100	-0.61
Tower Hamlets	230,600	-3,000	-1.30
Waltham Forest	232,400	-1,800	-0.77
Wandsworth	283,700	-3,000	-1.06
Westminster	186,800	-2,600	-1.39
London	7,391,900	-68,400	-0.93

Source: Office for National Statistics

Totals may not sum due to rounding

Figure 5: Overcount adjustment as a percentage of Census count



Source: Office for National Statistic

Communal Establishment Adjustment

Communal Establishments (CE) are defined as 'managed residential accommodation'. They include halls of residence, nursing homes, prisons and armed forces bases, among others. CEs were enumerated differently to households during the census operation. Instead of posting forms back to ONS Special Enumerators visited each residence and collected questionnaires. As a result of this difference in methodology CEs have to be treated separately in the estimation process as well. For estimation, CEs are split:

- Small CE – has 99 or fewer bed spaces
- Large CE – has 100 or more bed spaces

Small CEs are adjusted according to the DSE methodology and as such are included in the Census Coverage Survey. Missed individuals are identified, have attributes attached to them, and are distributed across the EA in line with the methodology outline above.

Large CEs are treated differently. They are not covered by the CCS and so cannot be assessed using the DSE. Instead they are reviewed on a case-by-case basis using administrative data and in consultation with the CE itself.

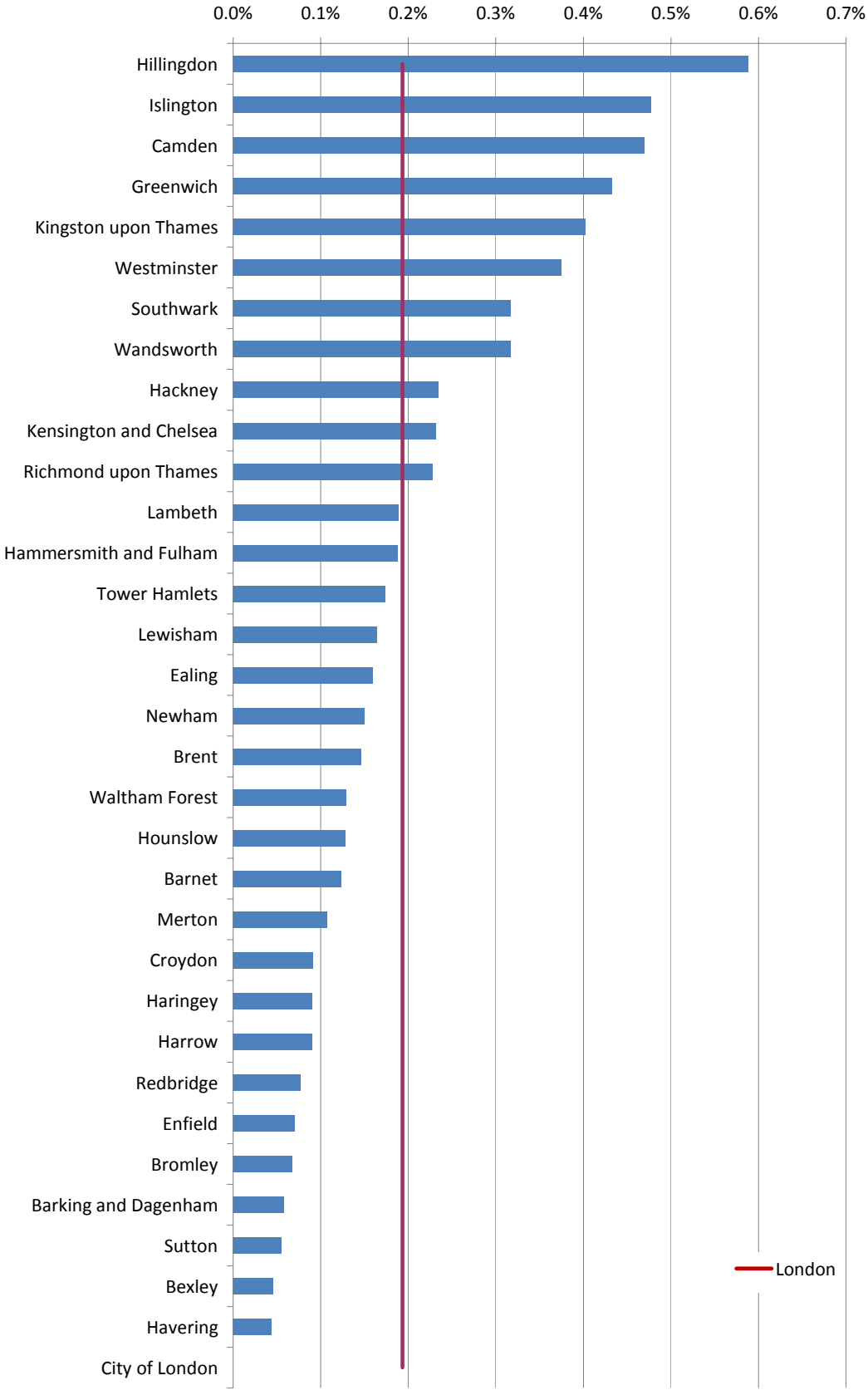
Table 6: Communal Establishment adjustment

	Census Count	Communal Establishments Adjustment	CE % of count
City of London	6,800	0	-
Barking and Dagenham	170,700	100	0.06
Barnet	324,700	400	0.12
Bexley	219,700	100	0.05
Brent	273,900	400	0.15
Bromley	294,400	200	0.07
Camden	191,500	900	0.47
Croydon	327,300	300	0.09
Ealing	312,600	500	0.16
Enfield	283,500	200	0.07
Greenwich	230,800	1,000	0.43
Hackney	212,800	500	0.23
Hammersmith and Fulham	159,500	300	0.19
Haringey	221,100	200	0.09
Harrow	221,900	200	0.09
Havering	226,000	100	0.04
Hillingdon	254,800	1,500	0.59
Hounslow	234,100	300	0.13
Islington	188,400	900	0.48
Kensington and Chelsea	129,600	300	0.23
Kingston upon Thames	149,000	600	0.40
Lambeth	264,100	500	0.19
Lewisham	243,000	400	0.16
Merton	186,600	200	0.11
Newham	266,000	400	0.15
Redbridge	257,000	200	0.08
Richmond upon Thames	175,700	400	0.23
Southwark	251,900	800	0.32
Sutton	180,800	100	0.06
Tower Hamlets	230,600	400	0.17
Waltham Forest	232,400	300	0.13
Wandsworth	283,700	900	0.32
Westminster	186,800	700	0.37
London	7,391,900	14,300	0.19

Source: Office for National Statistics

Totals may not sum due to rounding

Figure 6: Communal Establishment adjustment as a percentage of Census count



Source: Office for National Statistic

National Adjustment

Most of the Census adjustments made through the estimation process are bottom up. The final stage of the process is to ensure that when all of the local authority areas are added up, the sum agrees with the national total. Obviously there is no number to compare to so instead the ONS use sex ratios. This is the ratio of males to females in the country as a whole and while the population may be unknown there are other sources of data that mean ONS have a good understanding of sex ratios.

All of the stages so far are added together and the sex ratio is calculated. This is compared to other sources (ONS Longitudinal Study, Lifetime Labour Market Database) to see whether it is consistent. Any changes made at the national level then need to be redistributed back down to the local level.

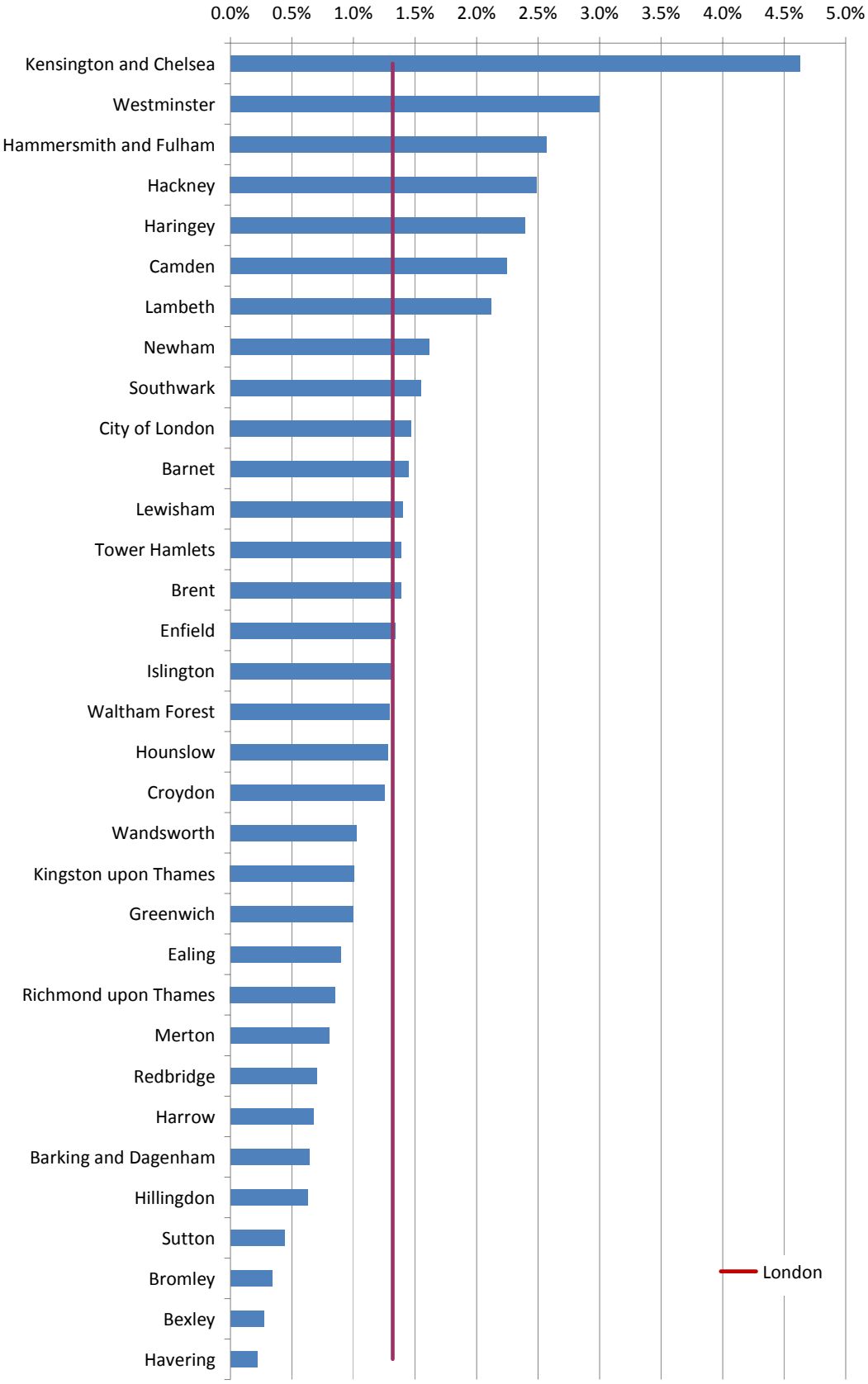
Table 7: National Adjustment

	Census Count	National Adjustment	National Adj. % of count
City of London	6,800	100	1.47
Barking and Dagenham	170,700	1,100	0.64
Barnet	324,700	4,700	1.45
Bexley	219,700	600	0.27
Brent	273,900	3,800	1.39
Bromley	294,400	1,000	0.34
Camden	191,500	4,300	2.25
Croydon	327,300	4,100	1.25
Ealing	312,600	2,800	0.90
Enfield	283,500	3,800	1.34
Greenwich	230,800	2,300	1.00
Hackney	212,800	5,300	2.49
Hammersmith and Fulham	159,500	4,100	2.57
Haringey	221,100	5,300	2.40
Harrow	221,900	1,500	0.68
Havering	226,000	500	0.22
Hillingdon	254,800	1,600	0.63
Hounslow	234,100	3,000	1.28
Islington	188,400	2,500	1.33
Kensington and Chelsea	129,600	6,000	4.63
Kingston upon Thames	149,000	1,500	1.01
Lambeth	264,100	5,600	2.12
Lewisham	243,000	3,400	1.40
Merton	186,600	1,500	0.80
Newham	266,000	4,300	1.62
Redbridge	257,000	1,800	0.70
Richmond upon Thames	175,700	1,500	0.85
Southwark	251,900	3,900	1.55
Sutton	180,800	800	0.44
Tower Hamlets	230,600	3,200	1.39
Waltham Forest	232,400	3,000	1.29
Wandsworth	283,700	2,900	1.02
Westminster	186,800	5,600	3.00
London	7,391,900	97,500	1.32

Source: Office for National Statistics

Totals may not sum due to rounding

Figure 7: National adjustment as a percentage of Census count



Source: Office for National Statistic

Census Estimate & Quality Assurance

The final stage of the process is to have the estimates signed-off by the Quality Assurance (QA) Panel. The QA process was carried out alongside the estimation process as well as providing a final check at the end. There were three QA panels, each with different responsibilities:

QA Steering Group – ONS experts working on the Census. They reviewed the estimates as they were produced and steered the analysis that was carried out. The group met around 50 times.

Main QA Panel – Staff from across ONS and representatives of the Welsh Government. They reviewed each of the 348 local authority estimates. If they felt further work was needed they could return estimates to the Census team for further analysis. All estimates required sign-off from this panel. The group met 31 times.

High Level QA Panel – Experts from across ONS, academics, an expert user and representatives of the devolved administrations (Scotland and Northern Ireland). Their responsibility was to look at the emerging regional and national picture. Like the main panel they had the power to request further work be carried out. They reviewed local authority estimates as required and also had responsibility for quality assuring the estimation process and reviewing any methodological changes. All estimates required sign-off from this panel. The group met 12 times.

Quality Assurance Data

Each panel had at its disposal a range of data sources against which to compare the emerging Census estimates. The panels used:

Checks against other estimates and administrative data – sources including the NHS Patient Register, Mid-Year Estimates, School Census and Council Tax data as well as specific data on students from HESA, the armed forces and international migration were used. Some of this data was provided in the Local Authority QA Packs released with the Census estimates on 16th July 2012.

Demographic analysis – This involved reviewing demographic data such as fertility rates to identify any anomalous aspects within estimates.

Local authority profiles – The ONS produced profiles of each local authority for the QA panels. These contained detailed information on HtC areas, multiple deprivation, enumeration challenges and statistical data on the authority (council tax, electoral roll, patient register, gas/electricity meters) as well as information on communal establishments.

Operational intelligence – This is data which was gathered during the Census operation. It includes response and return rates, information on dummy forms, the number of internet responses and details of the Census Coverage Survey.

Sign Off

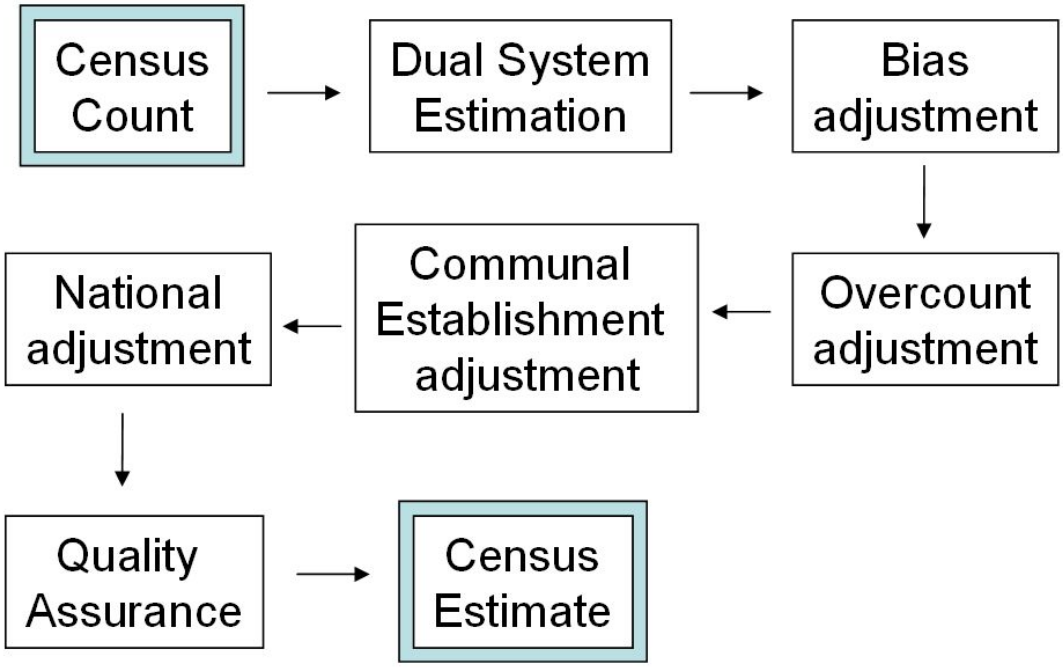
Once the panels were satisfied with the estimates and their components they recommended them to the National Statistician for sign off. This completed the estimation process.

Table 8 below shows each of the components of adjustment for the London boroughs. Table 9 shows the total adjustment as a percentage of the original count.

Summary

The role of the estimation process is to ensure that the published census data more accurately reflect the population totals and characteristics than the census count alone would. Certain groups of individuals and types of household are less likely to participate in the census and the tools and processes outlined above are designed to ensure they are included in the census. This is particularly important as the hardest to count groups are often also those in most need of the resources and funding contingent on census data.

Figure 8: The estimation process



Additional information on the estimation process, including methodology papers on each stage of the process, can be found in the quality assurance section of the Office for National Statistics website.

Table 8: Component Parts of the Census Estimate

	Census Count	Dual System Estimation	Bias Adjust.	Overcount Adjust.	Communal Est. Adjust.	National Adjust.	Census Estimate
City of London	6,800	400	100	-100	0	100	7,400
Barking and Dagenham	170,700	14,300	1,200	-1,400	100	1,100	185,900
Barnet	324,700	21,500	7,600	-2,500	400	4,700	356,400
Bexley	219,700	12,600	700	-1,700	100	600	232,000
Brent	273,900	31,500	4,100	-2,500	400	3,800	311,200
Bromley	294,400	13,000	2,300	-1,700	200	1,000	309,400
Camden	191,500	21,200	4,900	-2,400	900	4,300	220,300
Croydon	327,300	26,400	8,100	-3,000	300	4,100	363,400
Ealing	312,600	21,200	4,200	-2,800	500	2,800	338,400
Enfield	283,500	20,800	6,700	-2,400	200	3,800	312,500
Greenwich	230,800	18,000	4,500	-2,000	1,000	2,300	254,600
Hackney	212,800	21,900	8,300	-2,400	500	5,300	246,300
Hammersmith and Fulham	159,500	15,000	5,300	-1,700	300	4,100	182,500
Haringey	221,100	22,600	7,600	-2,000	200	5,300	254,900
Harrow	221,900	15,300	1,900	-1,700	200	1,500	239,100
Havering	226,000	11,700	600	-1,700	100	500	237,200
Hillingdon	254,800	15,600	2,100	-1,700	1,500	1,600	273,900
Hounslow	234,100	13,700	5,000	-2,100	300	3,000	254,000
Islington	188,400	13,300	3,700	-2,600	900	2,500	206,100
Kensington and Chelsea	129,600	16,000	8,400	-1,600	300	6,000	158,700
Kingston upon Thames	149,000	7,800	2,500	-1,300	600	1,500	160,100
Lambeth	264,100	27,800	7,500	-2,500	500	5,600	303,100
Lewisham	243,000	25,800	5,900	-2,600	400	3,400	275,900
Merton	186,600	10,300	2,500	-1,400	200	1,500	199,700
Newham	266,000	37,900	2,200	-2,800	400	4,300	308,000
Redbridge	257,000	19,900	2,200	-2,100	200	1,800	279,000
Richmond upon Thames	175,700	8,300	2,600	-1,500	400	1,500	187,000
Southwark	251,900	31,300	2,800	-2,400	800	3,900	288,300
Sutton	180,800	7,700	1,700	-1,100	100	800	190,100
Tower Hamlets	230,600	20,900	2,100	-3,000	400	3,200	254,100
Waltham Forest	232,400	19,100	5,200	-1,800	300	3,000	258,200
Wandsworth	283,700	19,300	3,200	-3,000	900	2,900	307,000
Westminster	186,800	22,800	6,100	-2,600	700	5,600	219,400
London	7,391,900	604,700	133,800	-68,400	14,300	97,500	8,173,900

Source: Office for National Statistics

Totals may not sum due to rounding

Table 9: Difference between Census Count an Census Estimate

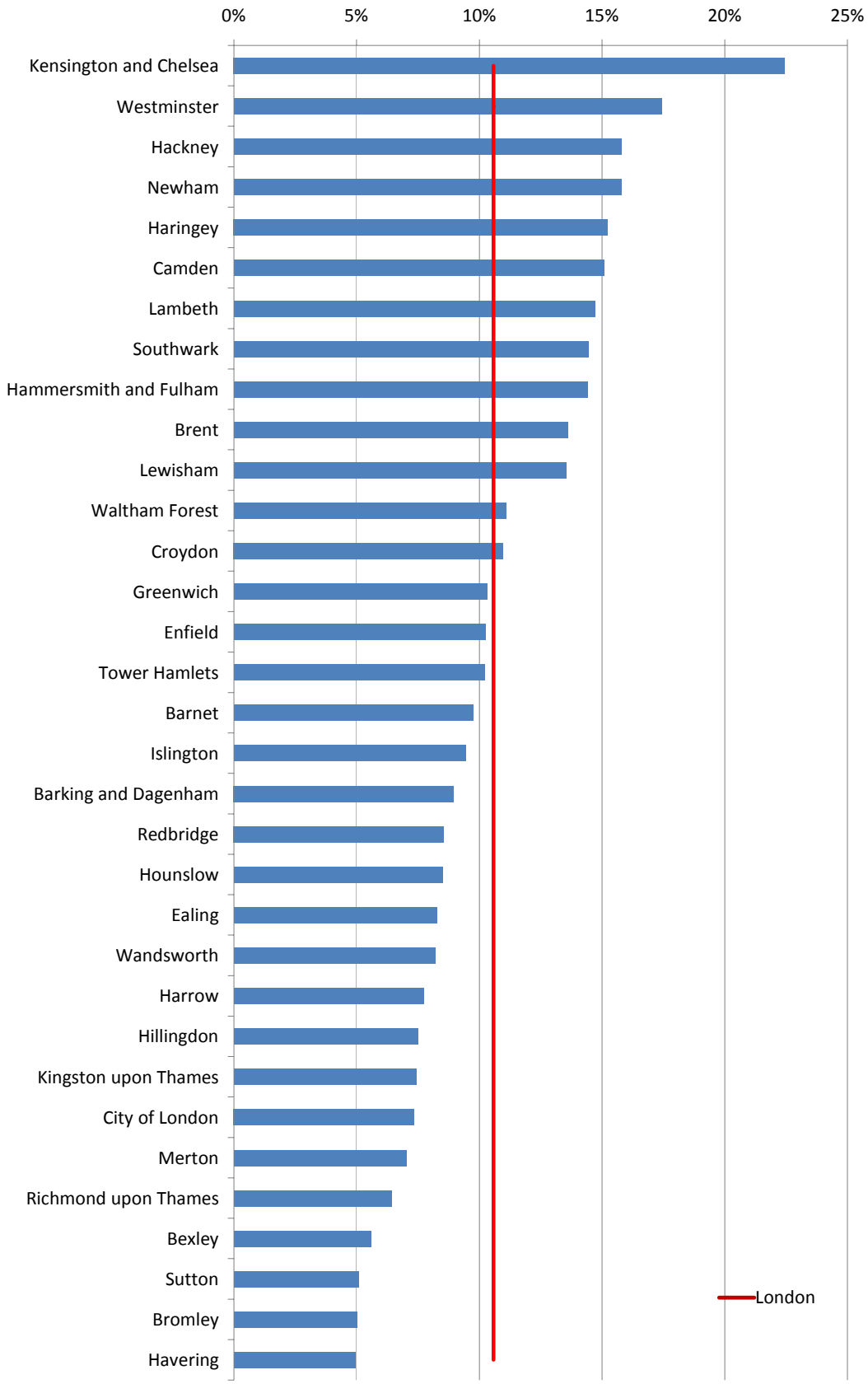
	Census Count	Census Estimate	Total Imputation	Imputation % of Count
City of London	6,800	7,400	500	7.35
Barking and Dagenham	170,700	185,900	15,300	8.96
Barnet	324,700	356,400	31,700	9.76
Bexley	219,700	232,000	12,300	5.60
Brent	273,900	311,200	37,300	13.62
Bromley	294,400	309,400	14,800	5.03
Camden	191,500	220,300	28,900	15.09
Croydon	327,300	363,400	35,900	10.97
Ealing	312,600	338,400	25,900	8.29
Enfield	283,500	312,500	29,100	10.26
Greenwich	230,800	254,600	23,800	10.31
Hackney	212,800	246,300	33,600	15.79
Hammersmith and Fulham	159,500	182,500	23,000	14.42
Haringey	221,100	254,900	33,700	15.24
Harrow	221,900	239,100	17,200	7.75
Havering	226,000	237,200	11,200	4.96
Hillingdon	254,800	273,900	19,100	7.50
Hounslow	234,100	254,000	19,900	8.50
Islington	188,400	206,100	17,800	9.45
Kensington and Chelsea	129,600	158,700	29,100	22.45
Kingston upon Thames	149,000	160,100	11,100	7.45
Lambeth	264,100	303,100	38,900	14.73
Lewisham	243,000	275,900	32,900	13.54
Merton	186,600	199,700	13,100	7.02
Newham	266,000	308,000	42,000	15.79
Redbridge	257,000	279,000	22,000	8.56
Richmond upon Thames	175,700	187,000	11,300	6.43
Southwark	251,900	288,300	36,400	14.45
Sutton	180,800	190,100	9,200	5.09
Tower Hamlets	230,600	254,100	23,600	10.23
Waltham Forest	232,400	258,200	25,800	11.10
Wandsworth	283,700	307,000	23,300	8.21
Westminster	186,800	219,400	32,600	17.45
London	7,391,900	8,173,900	781,900	10.58

Source: Office for National Statistics

Totals may not sum due to rounding

Note: The person response rate is the 'census count' as a percentage of the 'census estimate' (see GLA Intelligence Update 14-2012).

Figure 9: Total imputation as a percentage of Census count



Source: Office for National Statistic

List of Acronyms

AHE – Alternate Household Estimate
CE – Communal Establishment
CCS – Census Coverage Survey
DSE – Dual System Estimation
EA – Estimation Area
HtC – Hard to Count
HESA - Higher Education Statistics Agency
LSOA – Lower Super Output Areas
ONS – Office for National Statistics
UAF – Unaccounted for Address

Glossary

Alternate household estimate
An estimate of the number of usually resident households used as a comparison and quality assurance tool in the estimation process.

Between Household Bias
When a household not likely to be counted in the census is also not likely to be counted in the CCS.

Census Coverage Survey
An independently-run second survey of households in England and Wales conducted directly after the Census operation. Its purpose is to produce estimates, independent of the Census, of households and residents in a representative sample of areas across the country.

Census Day
The day on which the census questionnaire was completed and to which the data refers. For the 2011 Census this was 27th March 2011.

Communal Establishment
A residential institution which is enumerated separately from other dwellings for census purposes. Examples include prisons, nursing homes and student halls of residence.

Count
The total number of persons and households recorded on census questionnaires.

Dual System Estimation
The process of using the census and the CCS to determine how many people were missed during the initial census operation and what their characteristics are.

Dummy form
A form used by ONS staff to indicate that an address has no occupants.

Enumeration
The process of counting a population.

Enumerator
A member of ONS field staff responsible for collecting census and CCS data from households.

Estimate
The final census population figure for a specified area as published by the ONS.

Hard to Count
An index which categorises LSOAs according to how likely households within the area were to participate in the 2011 Census.

Household
An address with at least one usually resident occupant.

Imputation
Adding persons and households into the census estimate.

Lower Super Output Area
A small geographic area created by aggregating a number of Output Areas. They typically contain around 1,500 people and are relatively socially homogenous.

Usually resident
A person who is in the UK and intends to stay, or has stayed, for 12 months. Or, a person who has a UK address and is outside the UK and intends to be outside the UK for less than 12 months.

Within household bias
When a person (within a counted household) not likely to be counted by the census is also unlikely to be counted by the CCS.

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For more information please contact Wil Tonkiss Census Analyst/Trainer, Intelligence Unit,
Greater London Authority, City Hall, The Queen's Walk, London SE1 2AA
Tel: 020 7983 5523 e-mail: william.tonkiss@london.gov.uk