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Coverage: England and Wales
Theme: Population

Methods used to revise the national population estimates for mid-2002 to mid-2010

Key points

- The mid-2011 population estimate for England and Wales was 464,000 higher than it would have been had 2011 Census data not been available.
- There are several possible causes for this but the largest single cause is most likely to be underestimation of long-term immigration from central and eastern Europe in the middle part of the decade.
- The identified underestimation of net migration is focussed on the early and middle parts of the decade.
- Over the decade the estimation methods have been improved, meaning that ONS's current migration estimates are considered to be much more accurate.

1. Introduction

This paper forms part of the release of the [revised mid-2002 to mid-2010 national population estimates for England and Wales](#). The revisions create a continuous series between the mid-2001 and the mid-2011 population estimates.

The official mid-2011 estimate of the usually resident population of England and Wales was 56,171,000. This was based on the Census Day estimate of 27 March 2011 plus the effect of births, deaths and migration up to 30 June 2011. The usually resident population excludes short-term migrants, which is anybody who has not been, or does not intend to stay in the UK for a period of at least 12 months.

The former mid-2002 to mid-2010 estimates were based on change as a result of published data on births, deaths and migration since mid-2001. If the 2011 Census estimates had been unavailable the equivalent mid-2011 population estimate would have been 55,707,000, which is 464,000 (0.8 per cent) lower than the official figure.

This paper describes how the potential causes of this 464,000 difference have been determined, and how they have been applied to create the revised mid-2002 to mid-2010 series.

Note that the 464,000 difference in this comparison is slightly smaller than the 476,000 Census Day difference referred to in the July 2012 paper 'Explaining the Difference Between the 2011 Census Estimates and the Rolled-Forward Population Estimates'. This is because that comparison already included the mid-2009 asylum seekers and visitor switchers correction described in Section 11.

2. Principles

The process of creating annual population estimates through the addition of the effects of births, deaths and migration is referred to as 'rolling forward'. Therefore the estimate created using these methods is referred to in this paper as the 'rolled-forward mid-2011 estimate'.

The factors contributing to the 464,000 difference between the official (2011 Census-based) and rolled-forward mid-2011 estimates are referred to in this paper as 'components of difference'.

A key principle is that the components of difference have been derived at a national (England and Wales) level, rather than creating them at local level and aggregating them. This is because there is greater certainty around national-level than local-level comparisons.

It is important to emphasise, however, that there is still substantial estimation around all the identified components of difference as there are inherently no definitive measures against which to validate them. Instead the components should be considered as best approximations, based on the evidence available, of how the difference has arisen.

Another principle is that once identifiable differences have been taken into account, any remaining difference has been allocated to a general 'Other' component rather than being arbitrarily and potentially wrongly assigned to specific causes. This approach is in line with international best practice.

The revised subnational (local and health authority) estimates for England and Wales for mid-2002 to mid-2010 will be published in spring 2013, and will be constrained to the national estimates published in this release.

3. Potential components of difference

In simple terms there are three factors which cause population change: births, deaths and migration. However, at national level there are a number of different types of migration:

1. Standard long-term international migration flows. These estimate the number of people who are either present in or absent from the UK for a period of at least 12 months.
2. Moves of military personnel.
3. Asylum seekers.
4. Cross-border migration, which refers to flows between the four nations of the UK: England, Wales, Scotland and Northern Ireland.

Another potential factor is inaccuracy in the mid-2001 population estimates, the starting point of the subsequent population estimates series. The mid-2001 estimates constitute the 29 April 2001 Census estimates, population change between 29 April and mid-2001, and 275,000 people who were added in to reflect insufficient adjustments for people who had not been enumerated in the 2001 Census.

Any inaccuracy in the 2011 Census results themselves would also influence the size of the difference.

In practice it is assumed that no difference is due to births and deaths, as data on these are based on the national registration system and are of very high quality.

It is also assumed that the asylum seekers data, which are derived from Home Office administrative sources, are accurate, apart from a processing error ONS made in the mid-2009 asylum seekers component, which has been corrected in this release.

Data are not yet available to assess the accuracy of published cross-border flows over the past decade. Therefore any difference that may have arisen cannot yet be estimated. However, small-scale inconsistencies in the former mid-2002 to mid-2010 cross-border migration estimates have been identified and resolved in the revised series.

All other potential components of difference have been analysed in more detail and their impact on the difference between the mid-2011 rolled-forward and official estimates is considered in this paper.

4. Attributed components of difference

Table 1 shows the components of difference that have been identified and applied to the revised mid-2002 to mid-2010 estimates.

Table 1: Factors explaining the difference between the mid-2011 official and mid-2011 rolled-forward estimates for England and Wales: summary

Factor	Impact on difference	Remainder
Initial difference	n/a	464,200
EU8 immigration	250,000	214,200
Republic of Ireland migration roll-back	65,800	148,500
Migrant switcher roll-back	37,000	111,500
Visitor switcher roll-back	-7,500	119,000
Armed forces adjustment	-7,100	126,100
Cross-border migration correction	2,400	123,700
Mid-2009 asylum seekers and visitor switchers correction	- 11,600	135,300
Removal of historic processing adjustments	800	134,500
Other	134,500	0

Note: totals may not sum due to rounding.

Explanations of what is meant by each of these, how each component of difference has been identified and how they have been spread over the decade, are provided in the following sections. In addition Appendix B provides an explanation of why the allocation of components of difference has changed from the July 2012 paper.

5. EU8 immigration

The 'EU8' countries are the eight countries of central and eastern Europe that joined the European Union in 2004: Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia.

Research (detailed in Appendix A) has identified that immigration from the EU8 countries was underestimated in the middle part of the decade. It is believed that 250,000 immigrants from EU8 countries were missed completely, mainly due to limitations in the coverage of the International Passenger Survey (IPS) at that time. These immigrants have been added to the revised estimates; Table 2 shows how the 250,000 have been distributed over time.

Table 2: Distribution over time of additional 250,000 EU8 immigrants to England and Wales

Year ending	Additional EU8 immigrants
Mid-2005	40,000
Mid-2006	40,000
Mid-2007	56,000
Mid-2008	56,000
Mid-2009	35,000
Mid-2010	13,000
Mid-2011	10,000
Total	250,000

Note: the addition of migrants to the year ending mid-2011 only covers the period up to Census Day.

It should be noted that this 250,000 does not represent the full underestimate of the growth of the EU8-born population between mid-2001 and the 2011 Census. However, part of the difference may be explained by other factors, including the possibility of misrepresentative IPS weightings in the middle part of the decade causing an underallocation of the proportion of immigrants coming from EU8 countries.

6. Republic of Ireland migration roll-back

The methods for estimating long-term migration to and from the Republic of Ireland were changed during the decade. Up to the mid-2008 estimates, data from the Irish Central Statistics Office (CSO) were used. However, from the mid-2009 estimates onwards the source was the International Passenger Survey (IPS).

Analysis of the differences between the CSO and IPS data for the rest of the decade suggests that had the IPS data been used throughout, net migration between the Republic of Ireland and England and Wales would have been 65,800 higher, comprising 23,450 more immigrants and 42,350 fewer emigrants.

Due to the large amount of statistical uncertainty around the CSO and IPS source data for each individual year, this 65,800 has been spread evenly across the revised estimates for each year between 2001/02 and 2007/08. In each of these years this is a change to net migration of 9,400, comprising an increase of 3,350 immigrants and a decrease of 6,050 emigrants.

7. Migrant switcher roll-back

The International Passenger Survey (IPS) asks people how long they intend to stay in their country of destination (either in the UK for arrivals, or out of the UK for departures). If they are staying 12 months or more they are regarded as a migrant; if they are staying less than 12 months they are regarded as a visitor.

However, some people who originally intend to stay for 12 months or more (and so are initially considered to be migrants) actually stay for less than 12 months and so are re-classed as visitors. Such people are termed 'migrant switchers' and ONS migration estimates include adjustments for this.

The methods for estimating the number of migrant switchers were changed for estimates from the start of 2004 onwards but were not applied to the earlier part of the decade due to lack of available data.

However, for the revised estimates for mid-2002 to mid-2004 it has been assumed that the change caused by the new methods during the first six months of 2004 would be representative of the rate of change in the first part of the decade. This assumption leads to the changes shown in Table 3.

The overall effect of this is that migrant switcher net flows have been reduced by 37,000. This means that an estimated 37,000 fewer migrants switched to being visitors, with the result that net international migration has been increased by 37,000.

Table 3: Changes to England and Wales migrant switcher estimates due to roll-back of new methods

Year ending	Inflows	Outflows	Netflows
Mid-2002	-6,800	8,000	-14,800
Mid-2003	-6,800	8,000	-14,800
Mid-2004	-3,400	4,000	-7,400
Total	-17,000	20,000	-37,000

8. Visitor switcher roll-back

Visitor switchers are people who originally intend to stay for less than 12 months but then go on to stay for 12 months or more (either into the UK for arrivals, or out of the UK for departures). This means that they are re-classed from visitors to migrants. Such people are termed 'visitor switchers' and ONS migration estimates include adjustments for this.

The methods for estimating the number of visitor switchers were improved for estimates from the start of 2004 onwards; however, as with migrant switchers they were not applied to the earlier part of the decade due to lack of comparable data.

Also as with migrant switchers, it was assumed that the change caused by the new methods on the visitor switcher estimates for the first six months of 2004 would be representative of the rate of change for the period from mid-2001 to the end of 2003. This assumption leads to the changes shown in Table 4.

The overall effect of this is that visitor switcher net flows have reduced by 7,500. This means that an estimated 7,500 fewer visitors switched to being migrants, with the result that net international migration has also been reduced by 7,500.

Table 4: Changes to England and Wales visitor switcher estimates due to roll-back of new methods

Year ending	Inflows	Outflows	Netflows
Mid-2002	-10,600	-7,600	-3,000
Mid-2003	-10,600	-7,600	-3,000
Mid-2004	-5,300	-3,800	-1,500
Total	-26,500	-19,000	-7,500

9. Armed forces adjustment

Changes in the number of armed forces personnel stationed in England and Wales, as well as movements of armed forces personnel and their dependants between England and Wales and overseas, were accounted for in the previous series of mid-2002 to mid-2010 estimates using a combination of data from Defence Analytical Services and Advice (DASA), the US Air Force and the 2001 Census.

However, over the decade the net change for armed forces and their dependants has been estimated to be 7,100 higher than it should have been. This difference is mainly because the 2001 data used in the estimation process has grown increasingly out of date as the decade has progressed. For the mid-2002 to mid-2010 revised estimates DASA has supplied an annually updated alternative to the 2001 information, allowing the differences to be distributed across the decade.

In addition some of the difference has arisen due to recently-identified processing errors in individual years. These have also been corrected as part of these revisions.

10. Cross-border migration correction

Data to assess the accuracy of published cross-border flows over the decade are not yet available. However, the previous series of mid-2002 to mid-2010 estimates used cross-border migration data containing small differences from ONS's official cross-border migration estimates. For the revised mid-2002 to mid-2010 series it has been decided to switch to using the official cross-border estimates.

The effect of this is small: the net flow from England and Wales to Scotland and Northern Ireland has been reduced by 2,400 over the decade. As this means fewer people have left England and Wales, this accounts for 2,400 of the gap between the rolled-forward and official mid-2011 estimates.

11. Mid-2009 asylum seekers and visitor switchers correction

Processing errors were made during the production of the mid-2009 population estimates. Specifically:

- there were 11,400 emigrant visitor switchers missed. These were people who should have been included in the emigration estimates,
- there were 300 asylum seeker immigrants missed, and
- there were 600 asylum seeker emigrants missed.

The net effect of these errors was that the total population in the original mid-2009 estimates was 11,600 higher than it should have been, with the consequence that the mid-2010 and rolled-forward mid-2011 estimates were also 11,600 too high. However, the errors have been corrected in the revised estimates.

12. Removal of historic processing adjustments

The previous set of estimates for mid-2002 to mid-2006 included small processing adjustments which were not allocated to any specific cause. These had the net effect of removing 800 people over the five-year period. For the revised estimates these adjustments were not retained. The effect of this was to add these 800 people back in, so reducing the difference between the rolled-forward and official mid-2011 estimates by 800.

13. Other

In total 134,500 of the difference was not allocated to any specific cause. Instead it is likely to be due to a combination of potential inaccuracies in any of the following:

- international migration over the decade, aside from the specific migration flows already identified,
- the mid-2001 population estimates,
- the 2011 Census estimates,
- cross-border flows, or
- any other component of population estimates over the decade.

As these different factors may have had an impact throughout the decade or at specific times, it is not possible to be sure when the 134,500 difference has arisen. Therefore the remaining difference for each sex and single year of age has been split evenly through the decade on a cohort basis.

More information on the derivation and split over time of the Other component is included in Appendix A.

14. Difference by sex and age

The overall difference between the mid-2011 Census-based and rolled-forward estimates was 464,000, but there was considerable variation in the differences by age and sex.

Table 5 shows the differences by sex, and how this was affected by the addition of the specifically-allocated components of difference (which is all components apart from Other).

The table shows that the mid-2011 rolled-forward estimates included 139,000 fewer males and 325,000 fewer females than the mid-2011 official estimates. However, after the specifically-allocated components of difference were added the number of males was 36,000 above the official estimates and the number of females was 170,000 below. In order to reconcile the totals for both sexes with the official estimates, the Other component therefore had to lower the male population by 36,000 and raise the female population by 170,000.

Table 5 also shows that the specifically-allocated components added more males than females (53 per cent to 47 per cent). This reflects the sex distributions in ONS's published statistics, which have been used to distribute their respective components of difference. The key factor is the higher likelihood of international migrants to be male.

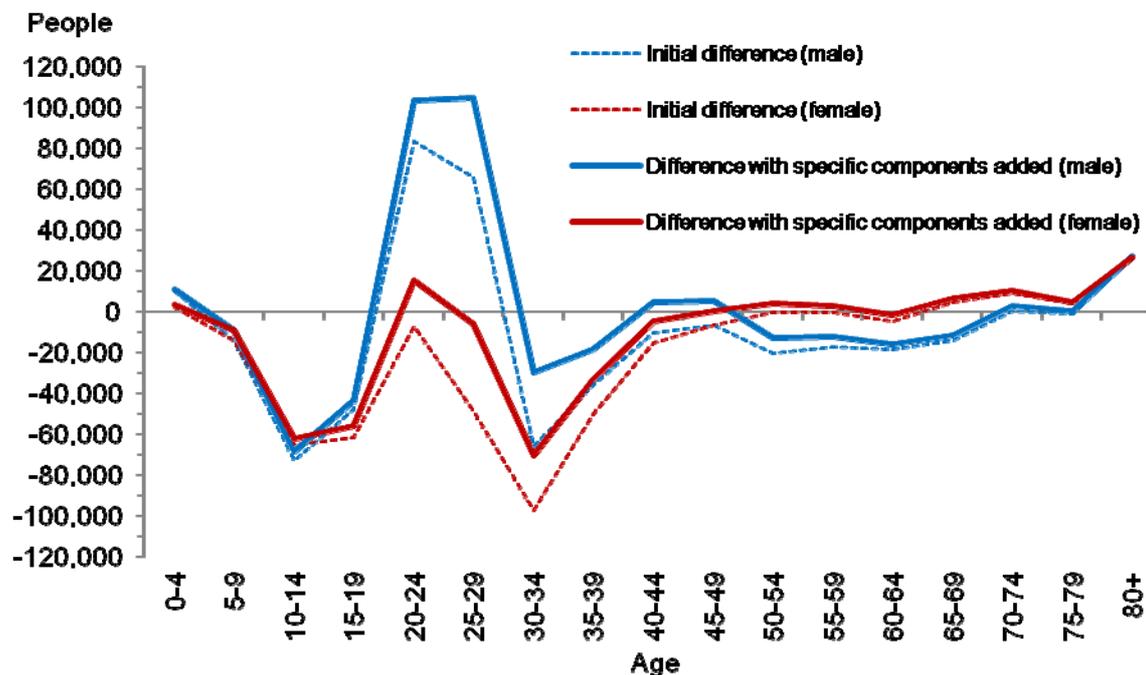
Table 5: Impact of specifically-allocated components on difference between England and Wales mid-2011 rolled-forward and official estimates, by sex

	Male	Female
A. Initial difference	-139,000	-325,000
B. Specifically-allocated components	175,000	154,000
Remainder (A + B)	36,000	-170,000

Note: totals may not sum due to rounding.

Chart 1 shows how much difference the Other component had to reconcile by sex and 5-year age group. For example, it can be seen that the rolled-forward estimates for males aged 20 to 24 were originally (dashed lines) about 85,000 higher than the official mid-2011 estimates. However, once the specifically-allocated components were added they became about 105,000 higher (solid lines). In consequence the Other component had to reduce the population of 20 to 24 year old males by 105,000 to ensure the population of that group was consistent with the official mid-2011 estimates.

Chart 1: Impact of specifically-allocated components on difference between England and Wales mid-2011 rolled-forward and official estimates, by sex and 5-year age group



The chart shows that the specifically-allocated components of difference add the largest number of people to the young adult groupings, with smaller impacts for children and older adults. This reflects the age distributions in ONS's published statistics, in particular the high proportion of international migrants who are young adults. The key effects are:

- the number of people in their teenage years remains below the official mid-2011 totals,
- the number of young adult males has moved further above the official mid-2011 totals, and
- for people in their 30s there are still fewer than the mid-2011 totals, but the difference has reduced.

What might be causing this variation in differences by sex and age? There are a number of possible reasons:

- Inaccuracy in the age balance of published migration estimates. The 2011 Census data released on 11 December 2012 suggest that ONS may have estimated too high a proportion of immigrants to the young adult categories, and too few to the children and older adult categories. This requires more research, but certainly has potential to be contributing to the differences shown above.
- Inaccuracy in the sex balance of published migration estimates. The published long-term international migration statistics show that migrants are more likely to be male, but it could be that a higher proportion than currently estimated are female. Census data on the sex breakdown of immigrants have not yet been published but will ultimately provide a valuable resource for further research.
- Inaccuracies in individual sex and age groups in the mid-2001 population estimates and / or the 2011 Census estimates, as a result of uncertainties in the estimation process.

15. Future work

The mid-2002 to mid-2010 revised population estimates are at national (England and Wales) level. ONS intends to publish the revisions at subnational (local and health authority) level in spring 2013. The subnational publication will also include analysis and information on the methods used.

ONS does not intend to revise its published Long Term International Migration (LTIM) estimates to reflect the additional migration flows that have been added to the revised mid-2002 to mid-2010 population estimates. It intends to publish a report in 2013 that will analyse the quality of LTIM since 2001, including the impacts of improvements made to the methods during this period.

Additionally, the IPS was improved in 2009 to provide better coverage of points of entry across the UK, countering limitations of the IPS that may have caused underestimation of certain groups of migrants in the past. Therefore any revisions to past years will not affect the quality of more recent and future estimates.

16. Conclusion

Determining what has caused the difference between the mid-2011 Census-based and rolled-forward mid-year estimates is not straightforward and necessarily involves a good deal of estimation. All sources are liable to inaccuracy and although the Census results are a comprehensive source for 2011, they cannot provide certainty over the exact patterns of migration over the decade.

Nevertheless, it seems likely that there has been substantial underestimation of net migration over the decade, and that underestimation of immigration from EU8 countries has had the single largest impact. Most of this underestimation occurred in the middle part of the decade, with the IPS improvements leading to much more accurate figures from 2009 onwards. A combination of other factors over the decade has also contributed a large proportion of the difference.

These findings and the subsequent allocation of the difference mean that the revised mid-2002 to mid-2010 estimates offer a much improved series, meeting the need for a continuous series between the mid-2001 and official mid-2011 estimates.

There is still research to be done on the causes of the differences by age and sex over the decade. However, there are no plans to make further revisions to population estimates for the mid-2002 to mid-2010 period. Any findings of subsequent research will instead help determine the methods for future estimates, ensuring that ONS's population estimates continue to be of the highest possible quality.

Appendix A: Derivation of EU8 immigration and Other components of difference

Analysis of migration by Census country of birth groupings

2001 and 2011 Census data on population by country of birth were used to examine, for different country of birth groupings, how much the usual resident population of England and Wales had changed over the decade. An estimate of the number of deaths occurring in each of these groups was then made, leading to an implied net migration figure.

The resulting figures are shown in Table 6. It is important to note, however, that ONS does not currently produce data on deaths by country of origin, so the deaths figures are based on:

- limited actual deaths data from earlier in the decade (ONS did produce data on deaths by country of birth up to 2005), and
- estimates of the number who are likely to have died given death rates in the population as a whole, plus the 2001 Census age structure of different country of birth groupings.

A 'Post-2001 adjustment' column has been included in Table 6 to take account of the 275,000 people who, earlier in the decade, were added to the mid-2001 estimates due to adjustments for people who were believed not to have been enumerated in the 2001 Census. These 275,000 were not broken down by country of birth but, with the knowledge that they were mostly added to local authorities with a higher than average proportion of non-UK born residents, it is assumed that 75,000 were non-UK born and 200,000 were UK-born.

Table 6: Implied net migration to England and Wales between the 2001 and 2011 censuses, by country of birth grouping

Country of birth grouping	2001 Census usual resident population estimate	Post-2001 adjustment	2011 Census usual resident population estimate	Growth	Estimated deaths	Implied net migration
EU8	105,000		885,000	780,000	25,000	800,000
EU15 ¹	1,155,000	25,000	1,330,000	150,000	150,000	300,000
Asia	1,595,000	25,000	2,585,000	965,000	200,000	1,175,000
Africa	810,000	25,000	1,315,000	480,000	75,000	550,000
America	540,000		675,000	135,000	50,000	175,000
All non-UK	4,635,000	75,000	7,505,000	2,795,000	400,000	3,200,000
UK-born	47,405,000	200,000	48,570,000	965,000	See note ²	-850,000

Notes:

1. The EU15 are those countries which were in the EU at the time of the 2001 Census. UK-born migrants are not included in this group.

2. For the UK-born simply taking the number of deaths (4,680,000) is not appropriate, as the size of the population will also be influenced by births (6,580,000) and migration to Scotland and Northern Ireland (-80,000). The total effect of these is to add 1,820,000 onto the 2001 population. This differs from the other groupings, where births are not a factor and net migration to Scotland and Northern Ireland will be small in absolute terms.
3. The census estimates in this table are rounded to the nearest 5,000, and the estimated deaths and implied net migration to the nearest 25,000. The 75,000 non-UK-born people added to the mid-2001 estimates have been split between the three largest country of birth groupings.

Table 7 compares the implied net migration figures with ONS's LTIM statistics for the same groupings. LTIM accounts for all international migration for periods of 12 months or more.

LTIM figures were available for the EU8, EU15, non-UK-born and UK-born groupings. However, for Asia, Africa and America the values were approximated by taking the net flows from the IPS, assuming an increase due to switchers, and then for each of Asia and Africa adding in 100,000 as a broad estimate of asylum seekers and people granted asylum or exceptional leave to remain.

Table 7: Comparison of implied intercensal net migration to England and Wales with ONS's Long-Term International Migration statistics (2001 to 2010)

Country of birth grouping	Census-implied net migration	LTIM net migration	Difference
EU8	800,000	325,000	475,000
EU15 ¹	300,000	200,000	100,000
Asia	1,175,000	1,350,000	-175,000
Africa	550,000	450,000	100,000
America	175,000	125,000	50,000
All non-UK	3,200,000	2,650,000	550,000
UK-born	-850,000	-800,000	-50,000
Total	2,350,000	1,850,000	500,000

Notes:

1. The EU15 are those countries which were in the EU at the time of the 2001 Census. UK-born migrants are not included in this group.
2. All data in this table are rounded to the nearest 25,000.

This suggests that in the period between the censuses LTIM substantially underestimated the net flow of migrants born in the EU8 countries. There are smaller differences for other groupings. All differences will be subject to some alteration due to the other adjustments identified above. In particular the EU15-born difference is likely to be substantially reduced

by the addition of the proportion of the 65,800 net migrants from the Republic of Ireland who were EU15-born.

The total implied underestimation is approximately 500,000 – this is to be expected as it approximately corresponds with the difference between the mid-2011 Census-based and mid-2011 rolled-forward estimates, with the inconsistency being due to rounding.

Analysis of Annual Population Survey (APS) and Labour Force Survey (LFS) data

Data from the APS (available from 2004 onwards) and 2001 data from the LFS were used to corroborate growth in the non-UK-born population over the decade. The specific comparisons were with the LFS for the period Jan – Dec 2001 and the APS for the period Jan – Dec 2011 (both approximating to the mid-year position). Table 8 compares these with Census data for both 2001 and 2011.

Table 8: Census and LFS/APS comparisons by country of birth, 2001 and 2011

Country of birth grouping	2001 Census	2001 LFS	2011 Census	2011 APS
All non-UK-born	4,635,000	4,415,000	7,505,000	7,065,000
EU8-born	105,000	115,000 ¹	885,000	870,000

Note: the 2001 LFS figure for EU8-born covers the whole UK. A few thousand of these would be expected to be in Scotland and Northern Ireland.

The APS/LFS data are not directly comparable with the Census estimates for a number of reasons:

1. They are a sample rather than a Census, so have more uncertainty.
2. They represent an average from survey data over the course of 12 months, rather than a specific point in time.
3. The 2001 Census took place on 29 April and the 2011 Census on 27 March. Therefore, regarding the APS/LFS data as an approximation to the mid-year figure, the Census data will exclude changes between the Census Days and the respective mid-years.
4. The APS/LFS data exclude residents of most types of communal establishment. Students in halls of residence will be included by proxy if their parents live in England and Wales too, but this is assumed not to be the case for most foreign-born students.
5. The APS/LFS is a voluntary survey and it is not known whether the response rates for UK-borns and non-UK-borns are identical. If one group is more likely to respond than the other, this would introduce bias.
6. The 2011 APS data have not yet been weighted to take account of the additional population identified by the Census, of whom a proportion would be expected to be non-UK-born.

7. A small proportion of the LFS/APS populations would be expected to be short-term migrants.

In both 2001 and 2011 the LFS/APS figures are lower than the census figures, and these are likely to be partly or entirely a reflection of these factors. A direct comparison is clearly not appropriate. However, what these figures do show is that the LFS/APS figures are broadly of the same order of magnitude as the censuses, thus giving corroboration of the census values.

Accuracy of the 2001 mid-year estimates and the 2011 Census

As the censuses are surveys, and have to estimate the number of people who did not appear on the census form, there is inevitable potential for estimation uncertainty.

Both the 2001 and 2011 Census results have 95 per cent sampling confidence intervals around them: this is a common statistical measure which means, in effect, that if a survey of that size were repeated 100 times, the results would be expected to fall within the confidence limits of the true value on 95 of the 100 occasions.

The 2001 Census results have sampling confidence intervals of +/- 104,000. The 2001 mid-year estimates include an additional 275,000 people who were believed to have been missed out of the census, but this 275,000 itself is subject to uncertainty.

Overall, therefore, there are a number of uncertainties around the mid-2001 population. However, any potential inaccuracy is not readily quantifiable and could have either a positive or negative effect.

The methods for the 2011 Census built on the lessons learned from 2001. However, it is an estimate and has sampling confidence intervals of +/- 83,000, and there remains potential for other biases to have occurred. Therefore, although it is believed that the 2011 Census results provide the best estimate of the population, there is some uncertainty that could have a positive or negative effect.

Allocating difference due to migration and other factors

Taking into account the various adjustments for Republic of Ireland flows, switcher flows, armed forces, cross-border migration, the mid-2009 corrections and the processing adjustments, there is a remaining difference of 384,500 between the mid-2011 official and rolled-forward estimates.

The analysis above shows that underestimation of net migration is likely to be important, with particularly strong evidence of an underestimation of net migration of EU8-born people.

Although much of the underestimation of EU8 migrants is likely to be as a result of people being missed by the IPS in the middle of the decade, another factor is that the EU8 visitor switcher adjustment may have been insufficient. In other words, a higher than estimated number of people from EU8 countries may have had the original intention of staying in the UK for less than 12 months, but actually stayed for 12 months or more and so became long-term migrants.

A further factor is that weightings used in the IPS may have been slightly misrepresentative in the middle part of the decade before some lower volume regional points of entry/exit were

better surveyed. This may have caused a slight skew in nationality, potentially leading to an unduly low proportion of migrants being categorised as EU8s.

There is potential for inaccuracies in the migration estimates for other nationality groups too, affecting either immigration or emigration. In addition, as indicated, there is potential for inaccuracy in both the mid-2001 population estimates and the 2011 Census estimates.

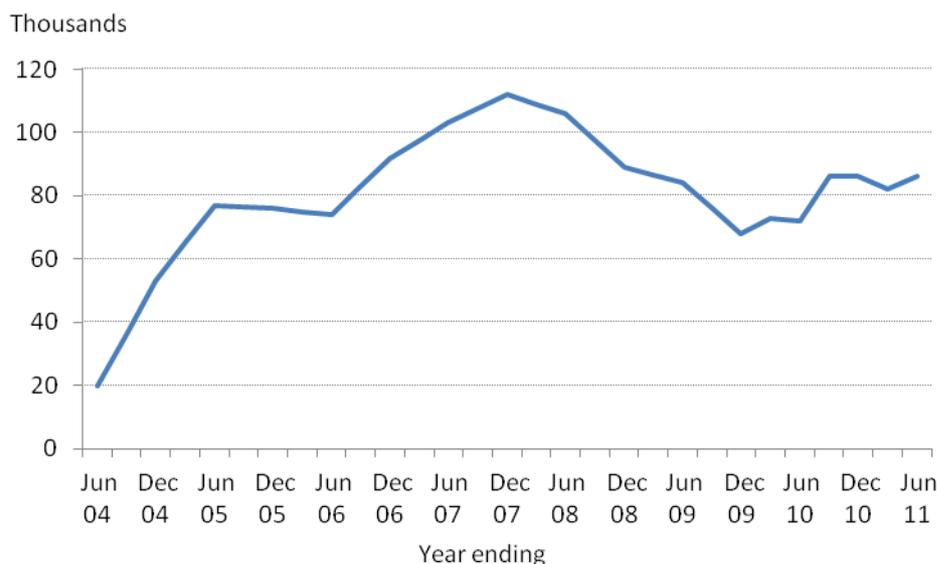
Taking all these factors into account it has been decided to allocate 250,000 of the difference to missed EU8 immigrants, and 134,500 to 'Other', reflecting all the other issues which may have contributed, including the potential for even more EU8 migrants to have been missed. This reflects the fact that the EU8 issue is the predominant but not the sole factor.

These 250,000 additional EU8 migrants are part of a total addition to net migration over the decade of 344,000 (including the additional Republic of Ireland flows and the switcher flows roll-backs). However, it should be noted that the LTIM figures for the period mid-2001 to mid-2011 have 95 per cent confidence intervals of +/- 145,000. Therefore a good proportion of the underestimate could simply reflect statistical uncertainty within these confidence intervals.

Distribution of the 250,000 missed EU-born immigrants over time

The EU8 joined the EU in May 2004. IPS figures suggest from 2001 to 2003 there was no net immigration of EU8-born citizens. LTIM data from 2004 onwards, however, suggest immigration of EU8 citizens (who have a very similar pattern to EU8-born) to the UK has been as indicated in Chart 2. The numbers going to England and Wales will be slightly lower, but with a similar distribution over time.

Chart 2: LTIM immigration of EU8 citizens, UK, year ending mid-2004 to year ending mid-2011



Another factor is that improvements made to the IPS since 2008, to both coverage and weightings, have made the uncertainty around the estimates substantially smaller.

In consequence it was decided to split the additional 250,000 immigrants as shown in Table 9. The split was broadly proportional to the distribution of EU8 immigrants in the official LTIM

figures since 2004, but lessening the share allocated to the later years in the decade due to the improved certainty for the estimates in those years.

In effect, for the latter years it is acknowledged that there may still be some missed EU8 immigrants, which may be due to underestimation of visitor switchers rather than necessarily to the IPS itself. However, it is believed that the bulk of the error occurred in the years up to mid-2008, before the IPS improvements were introduced.

Table 9: Distribution over time of missed EU8 immigrants to England and Wales

Year ending	Additional EU8 immigrants
Mid-2005	40,000
Mid-2006	40,000
Mid-2007	56,000
Mid-2008	56,000
Mid-2009	35,000
Mid-2010	13,000
Mid-2011	10,000
Total	250,000

Note: the addition of migrants to the year ending mid-2011 only covers the period up to Census Day.

The additional EU8 immigrants were split by age and sex according to the existing all immigrant age / sex distributions for each year, specifically the new ('indicative') distribution method introduced by ONS in November 2011, which covered immigration for the years ending mid-2006 onwards. For the year ending mid-2005 the breakdown for the year ending mid-2006 was applied, as no separate breakdown was available using the new method.

Distribution of the 134,500 'Other' over time

The Other difference of 134,500 has been split across the decade on a cohort basis, meaning that it takes account of the fact that individuals age as the decade progresses. An example of how this works is as follows:

1. 10 per cent of the mid-2011 difference for 35 year olds has been allocated to 35 year olds in mid-2011 (where it is already reflected in the official mid-2011 estimates).
2. 10 per cent has been allocated to 34-year-olds in mid-2010.
3. 10 per cent has been allocated to 33-year-olds in mid-2009.

and so on. For those cohorts aged under 10 in 2011 the remaining difference has been allocated evenly to the years in which those children were alive. For example, 50 per cent of the remaining difference for those aged 1 in 2011 has been allocated to those aged 0 in 2010 and 50 per cent to those aged 1 in 2011.

Appendix B: Comparison with allocation of difference in July 2012 paper

The July 2012 paper 'Explaining the Difference Between the 2011 Census Estimates and the Rolled-Forward Population Estimates' suggested that approximately 200,000 of the difference was due to inaccuracy in the mid-2001 population estimates, with the remainder being due to various aspects of international migration. This is substantially different from this paper, where no specific inaccuracy has been attributed to mid-2001.

The reason for this is that the July paper was based on initial thinking before more detailed 2011 Census data became available. The 200,000 was based on the unexplained difference between the series of population estimates that had been rolled-forward through the 1990s, compared with the mid-2001 estimates based on the 2001 Census, which were 200,000 lower. It was proposed that this difference might reflect an underestimate in the mid-2001 population.

However, it was always recognised that more detailed research would be liable to challenge that proposal, and now that 2011 Census data by country of birth are available they clearly demonstrate the extent of the underestimation of EU8 immigration over the decade. The possibility for inaccuracy in the mid-2001 population remains. However, it is not possible to reliably determine how large any such inaccuracy may be. Therefore any inaccuracy which does exist will now form part of the Other component of difference.

As there is no longer any specific inaccuracy allocated to the mid-2001 population estimates, there is no justification for revising the estimates for the years up to and including mid-2001.

References and related publications

Data:

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Papers:

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