

**International Passenger Survey
Estimates of Overseas Travel and Tourism Visits and Expenditure:
Discontinuity analysis relating to the adoption of revised methodology in 2009.**

Executive summary

This paper details the results of work conducted to assess whether the introduction of a new processing methodology and system employed in the International Passenger Survey (IPS) introduced any discontinuity in Overseas Travel and Tourism estimates. The new methodology was introduced at the start of 2009, alongside a new sample design, to address recommendations put forward by the Inter-Departmental Task Force on Migration Statistics. The process of changing the design incorporated a requirement that the quality of Travel and Tourism estimates must not suffer as a result of the revision.

It is stressed that only Travel and Tourism estimates are addressed in this work, i.e. profiling associated with visits of 12 months' duration or less. Migration estimates are not addressed.

The approach to this discontinuity work involved running 2008 data through the new processing system. The estimates produced by the new system are as follows, set out alongside those produced by the old system which were published in 'Travel Trends 2008'.

Visits (000s) and expenditure (£millions) on visits:	2008 Annual estimate (as published in Travel Trends)	2008 estimate from discontinuity run (new system)	% difference new system/previous system
To the UK by overseas residents – visits	31 888	31 318	- 1.8%
To the UK by overseas residents – earnings	16 323	15 998	- 2.0%
Abroad by UK residents – visits	69 011	67 182	- 2.7%
Abroad by UK residents – expenditure	36 838	35 250	- 4.3%

For reference, the confidence intervals associated with the original estimates (published in Travel Trends 2008) are as follows:

- Number of visits to the UK +/- 3.1%
- Earnings from visits to the UK +/- 2.8%
- Number of visits abroad by UK residents +/- 1.4%
- Expenditure on earnings abroad +/- 2.6%

The key driver of the lower estimates in the new run is traced to an improvement in the methodology employed in the Non Response weight which previously utilised interviewer estimates of the nationality of travellers who were selected for interview but failed to take part. It was ONS's opinion that this approach of estimating nationality had become unreliable and could introduce bias into estimates, and it was therefore removed in the 2009 design.

Background

As of 1st January 2009 certain elements of the International Passenger Survey design were revised to address recommendations put forward by the Inter-Departmental Task Force on Migration Statistics, December 2006.

The changes to the IPS centred on survey design and weighting and imputations methodology.

One of the core requirements when revising the survey design was that the quality of Travel and Tourism and Expenditure estimates would not be reduced. This related both to the sample coverage of respondents from whom these estimates are obtained, and to the method of processing data to produce estimates. This paper focuses on the processing methodology only, although it is pointed out in relation to the sample that the number of travel and tourism interviews has increased by over 20 per cent during the period January to September 2009 compared with a year earlier, and contacts have increased with travellers travelling to or from each of Africa, Asia, Australia, Caribbean, North America and Europe. This suggests that the quality target for the Travel and Tourism sample has been effective

Method of processing in 2009

The method of processing the survey data, to produce the IPS estimates, changed on two dimensions in 2009:

- i. A new processing system was developed, based on SAS code rather than Ingres as was the case with the legacy system.
- ii. A new methodology of weighting the data to produce estimates, and imputation of missing information, was introduced within the new system.

The remainder of this document concentrates on the weighting and imputation methodology and its effect on IPS Travel and Tourism (and not migration) estimates.

The 2009 weighting methodology

The approach to weighting data has remained broadly in line with the approach adopted pre-2009. The IPS sample data continues to be calibrated to passenger totals travelling through individual ports (with this data provided to ONS by CAA, BAA, some of the airports themselves, DfT, Eurotunnel and Eurostar). Further, the role of each individual weighting stage is broadly in line with the pre-2009 approach. However, some aspects within the individual weights have been revised.

A summary of the weighting stages employed in 2009 is provided below.

Weighting stage	Brief description	Brief overview of how the methodology employed from 2009 compares with pre-2009
Stage 1: Design weight	This weight addresses the probability of a passenger being selected for interview at a given port/route. It takes into account both the sampling interval employed and the ratio of total shifts/crossings sampled versus the total number of shifts/crossings that	Prior to 2009 this weight was applied only to 'Main airports' (Heathrow, Gatwick, Manchester, Stansted and Luton). At each of these ports an average weight was calculated and applied to all cases interviewed on all types of shift at the ports in the fieldwork period. From 2009

	could have been sampled.	the weight has been extended to all ports/routes, and the design weight is calculated for each interviewing shift, i.e. removing the system of averaging that was employed previously.
Stage 2: Non Response weight (incorporating a second design weight)	This weight takes account of passengers who were chosen for interview but who were subsequently not interviewed, due either to an interviewer not being available or the passenger refusing or not being available for interview.	As per the Design weight, this weight was previously applied to Main airports only, but is now applied to contacts from all ports and routes. Prior to 2009 an estimate of nationality was made for passengers who were unavailable for interview. This was dropped in 2009 as the ability of interviewers to estimate nationality has been reduced substantially over time, and this process was a source of possible bias in results.
Stage 3: Minimums weighting	This weight works along similar lines to the Non Response weight but relates to respondents who began an interview but gave only minimal information. These interviews are removed from the sample but the respondents' core characteristics are used to weight records from which fuller information was obtained.	The principle of this weight was retained in 2009. However, the approach employed pre-2009 was very complex. It has been simplified in the new system.
Stage 4: Weighting to sample frame	This weight uplifts records to account for the total traffic passing through the sampled ports and routes during the time periods that were sampled during the reporting period.	The approach adopted from 2009 is generally in line with that employed pre-2009 although it has been extended to include smaller airports, sea routes and tunnel ports and routes.
Stage 5: Weighting for frame undercoverage.	The IPS sample covers ports and routes through which over 95 per cent of the passenger traffic in and out of the UK passes. However, there are some ports and routes at which passenger traffic is relatively low and are not cost-effective to interview at/on. Further, interviewing is not conducted during the night at airports. This weight uplifts records to account for the traffic at ports and routes and at times of day when no fieldwork shifts were run during the reporting period.	The approach to this weight is generally in line with that employed pre-2009.
Stage 6: Imbalance weight	This weight is applied to account for an imbalance noted historically in the estimates of people starting their visit versus those ending it.	The approach to this weight is unchanged in the new design.
Stage 7: Final weight	This weight combines all of the weights described above.	The approach to this weight is unchanged in the new design.

Assessing the impact of the new weighting methodology on Overseas Travel and Tourism visits estimates

In order to estimate the impact of the new weighting methodology on Overseas Travel and Tourism estimates, survey data from the 2008 survey was run through the new system. It should be stressed that the new system and weighting methodology has been written for the new survey design and in order to conduct this process a number of changes to the 2008 data had to be made. The changes shown should give an indication of the impact without giving an exact estimate.

Further, although each of weighting Stages 2 to 7 was employed using the new design in this discontinuity work, Stage 1 (the Design weight) had to be reworked. It was our intention to employ the 2009 Design weight in the reruns while making necessary compromises to incorporate the old design. However, the extent of the survey design revision dictated that the Design weight needed to be reworked to fit with the old survey design.

Despite these re-workings, the overall process does provide useful detail to help assess whether any discontinuity in the Travel and Tourism estimates has been introduced. The estimates from the discontinuity run compared with the annual 2008 run are as follows.

Overseas Residents' visits to the UK (estimates in '000s)

Visits to UK:	2008 Annual estimate (as published in Travel Trends)	2008 estimate from discontinuity run (new methodology)	% difference: new methodology/previous methodology
Total visits, 2008	31 888	31 318	- 1.8%
- From North America	3 806	3 845	+ 1.0%
- From Europe	23 666	23 021	- 2.7%
- From EU15	18 316	17 980	- 1.8%
- From Rest of World	4 416	4 452	+ 0.8%
- Quarter 1	7 195	7 309	+ 1.6%
- Quarter 2	8 405	8 254	- 1.8%
- Quarter 3	9 358	9 112	- 2.6%
- Quarter 4	6 930	6 643	- 4.1%

UK Residents' visits abroad (estimates in '000s)

Visits to:	2008 Annual estimate (as published in Travel Trends)	2008 estimate from discontinuity run (new methodology)	% difference new methodology/previous methodology
Total visits, 2008	69 011	67 182	- 2.7%
- To North America	4 629	4 422	- 4.5%
- To Europe	54 424	53 334	- 2.0%
- To EU15	45 000	44 098	- 2.0%
- To Rest of World	9 958	9 426	- 5.3%
- Quarter 1	14 363	13 812	- 3.8%
- Quarter 2	18 549	18 120	- 2.3%
- Quarter 3	22 467	21 866	- 2.7%
- Quarter 4	13 632	13 384	- 1.8%

To set these figures in context, the confidence intervals associated with the estimates of Total visits are:

Overseas residents' visits to UK +/-3.1%
 UK residents visits abroad +/-1.4%

Most estimates of visits have reduced. In order to identify the source of the declines noted above, estimates have been calculated at three types of port, namely the 'Main' airports, 'Residual' airports and 'Sea/tunnel ports and routes'. The main focus in this work was on estimates of UK resident visits abroad due to the fact that the larger decline in estimates occurred in that direction of travel. The result of this analysis highlights that the difference in estimates of UK residents' visits abroad is much more prominent at Main airports.

Visits abroad estimated from interviews at:	2008 Annual estimate (as published in Travel Trends)	2008 estimate from discontinuity run (new methodology)	% difference new methodology/previous methodology
Main airports	37 787	36 053	- 4.6%
Residual airports	18 254	18 258	0%
Sea/tunnel ports and routes	12 970	12 871	- 0.8%

It is calculated that the vast majority of the difference in estimates is accounted for by the Non Response weight (which was applied only at Main airports prior to 2009). In 2009 the Non Response weight is applied equally to all cases travelling in a given direction at an individual port (within a single strata variable of weekday versus weekend shifts). Analysis of the non response weight process at main ports under the pre-2009 system, meanwhile, highlights the following weaknesses and outcomes

- The input data for this weight pre-2009 was based on those cases for which the interviewer felt able to estimate whether a non-responder was of UK nationality, European or other. In 2008 approximately 70 per cent of non responders were recorded as 'don't know' nationality, but the approach to weighting meant that a factor was applied to these records based on the estimated nationality of the minority of approximately 30 per cent.
- A higher non response weight was allocated to people ending their visit than to people starting their visit. This had the effect of uplifting the estimate of number of visits, because the estimates of number of visits are based only on people who are interviewed as they return to their country of residence at the end of their visit.
- The uplift resulted in an increased non response weight at main airports of approximately 2.9 per cent for visits from overseas residents and 6.2 per cent for visits abroad by UK residents across the year.

The conclusion from this analysis is that some (downward) discontinuity appears to have been created in estimates of number of visits, primarily by the revision to the Non response weight which was changed to remove a bias that existed pre-2009 caused by the outdated practice of estimating nationality of those people who were non-responders.

Assessing the impact of the new imputation approach on Overseas Travel and Tourism Expenditure estimates

A number of imputations are employed in the processing system, the most prominent of which occurs when calculating expenditure on visits to UK and visits abroad. The imputation for expenditure is employed when key pieces of information are not given by the respondent. In these cases the imputation references the spend on visits by respondents with similar profile, based on:

- country visiting/ resided in
- duration of stay
- purpose of visit.

The discontinuity analysis estimates the impact of this revision to the imputation country groupings as follows. Expenditure estimates are presented alongside visits estimates in order to allow a calculation of the net effect (i.e. after removing the change in number of visits) on expenditure estimates.

Visits (000s) and expenditure (£millions) on visits:	2008 Annual estimate (as published in Travel Trends)	2008 estimate from discontinuity run (new methodology)	% difference new methodology/previous methodology
To the UK – visits	31 888	31 318	- 1.8%
To the UK – earnings	16 323	15 998	Gross - 2.0% Net - 0.2%
Abroad by UK residents – visits	69 011	67 182	- 2.7%
Abroad by UK residents – expenditure	36 838	35 250	Gross - 4.3% Net - 1.6%

Thus, the estimate of earnings from overseas residents' visits to the UK in 2008 is lower in the discontinuity run by a net figure of 0.2 per cent and the estimate of expenditure abroad is lower by a net figure of 1.6 per cent.

To set these figures in context, the confidence intervals associated with expenditure estimates are as follows:

Earnings from Overseas residents' visits to UK	+/-2.8%
Expenditure on UK residents visits abroad	+/-2.6%.

Second discontinuity exercise

A second discontinuity analysis was carried out on quarters 1 and 2 of 2008 following minor corrections of imputation methods within the processing system.

The new estimates of earnings from overseas residents' visits to the UK in quarters 1 and 2 of 2008 is lower in the discontinuity run than in the original estimates by a net figure of 0.4 per cent (originally reported as 0.2 per cent lower – as above) and the estimate of expenditure abroad is lower by a net figure of 0.6 per cent (originally reported as 1.6 per cent lower – as above).

Conclusions

ONS concludes that the new processing design and methodology introduced in 2009 appears to have introduced some discontinuity in estimates of Overseas Travel and Tourism visits and expenditure.

The results presented in this paper suggest that any discontinuity involves a reduction in 'visits' estimates of less than 3 per cent, which have been driven by an improvement in the weighting process.