Communities and Local Government

Options for the Future of the Household Projection Model

A final report

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A final report

Experian
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The findings in this report are those of the authors and do not necessarily represent the views of Communities and Local Government.

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Executive Summary

Aims and objectives

The Communities and Local Government 'household projection model' is used to generate household projections using the latest Office for National Statistics (ONS) sub-national population projections, with the outputs used as a key element of the evidence base for housing and planning.

The national household projections are the Government's official long term view of the future if demographic trends were to continue, and are particularly important in supporting policy development and enabling regional and local bodies to plan their housing and other services.

The current methodology has remained largely unchanged since the 1996 based household projections released in October 1999. The projections are generated by applying projected household representative rates to a projection of the private household population disaggregated by age, sex and marital/cohabitation status and summing the resulting projections of household representatives. The model includes the projection of household representative rates using the 'life cycle' approach, which takes account of changes in-household formation over time and also due to progression through the life cycle.

This project has three key objectives:

- propose changes to the methodology that would improve its usefulness while ensuring it continues to be regarded as transparent and robust

- complete the project before the release of the 2006 based sub-national population projections by the ONS in summer 2008 and the subsequent update of the household projections

- incorporate the outcomes of the November 2007 review meeting that discussed the future of the household projection model.

The approach taken to complete this project splits neatly into three components:

- conduct a thorough review of the alternative methodologies and possible refinements assessing how each would fit in with Communities and Local Government's detailed requirements

- carry out a set of interviews with experts and users focusing on the practicalities and required outputs from the projection system as well as the theoretical background

- run a number of statistical tests or small scale pilots to test the implications of varying the methodology on the results.

Methodological Recommendations

1. That the model is split into two parts, the first of which benefits from the type of time series/cohort modelling currently used by the Household Projection Service (HOPS) and the second to an add-on section that uses a more limited data set. The aim should be to keep the benefits from the time series approach while permitting the introduction of the kind of household type breakdown available in the Scottish and Northern Ireland projections.

2. That the existing household type, gender and marital status breakdown is dropped and that the main time series modelling is only applied at the age band level. Cohort modelling should only be used for the 40-44 and older age bands.

3. Labour Force Survey (LFS) data, suitably adjusted for outliers and smoothed, should be used at the age level with an equal weighting to the Census data.

4. Tables should be commissioned from the 1991 and 2001 Censuses to permit similar household type breakdown to the Scottish and Northern Ireland projections but these projections should be lined up to the aggregate projections produced using time series/cohort methods with an age breakdown. There is a requirement, in particular, to have information on the number of households with children. Models and projections for single person households could utilise longer time series as this data is already present in the current system.

5. Controlling should become an occasional exercise to permit the rapid updating of estimates and projections when new demographic data becomes available.

6. The trends-based household projections and any affordability modelling should be kept separate.

Process Recommendations

1. Whoever does the projections, whether Communities and Local Government, ONS or an external provider needs to maintain the impartiality of the household projections and provide an authoritative support service to users. Communities and Local Government staff currently lack the necessary resource and expertise to bring the production of the projections in-house. Instead projections could remain with a contractor or be transferred, with funding either on a contractual or Service Level Agreement basis, to ONS.

2. At this moment in time Communities and Local Government are not ready to bring the projections in-house, but any future external contractor should work with Communities and Local Government staff to help disseminate knowledge and build expertise.

3. Any future contractor should be required to provide a policy-led scenario facility as well as the main projections.

4. New household projections should be released as close to new population projections as possible.

1. Introduction

1.1 Aims and objectives

The Communities and Local Government 'household projection model' is used to generate household projections using the latest ONS sub-national population projections, with the outputs used as a key element of the evidence base for housing and planning.

The current methodology has remained largely unchanged since the 1996 based household projections released in October 1999. Since then Communities and Local Government have released the 2002, 2003 and 2004 based household projections. A revised set of 2004 based projections were published in February 2008.

The projections are generated by applying projected household representative rates to a projection of the private household population disaggregated by age, sex and marital/cohabitation status and summing the resulting projections of household representatives. The model includes the projection of household representative rates using the 'life cycle' approach, which takes account of changes in-household formation over time and also due to progression through the life cycle.

This project has three key objectives:

- propose changes to the methodology that would improve its usefulness while ensuring it continues to be regarded as transparent and robust

- complete the project before the release of the 2006 based sub-national population projections by the ONS in summer 2008 and the subsequent update of the household projections

- incorporate the outcomes of the November 2007 review meeting that discussed the future of the household projection model. The key points from this review are contained in Appendix B.

The methodological review should take into account the following issues:

- **portability/flexibility**: ability for Communities and Local Government to perform minor updates to the model internally rather than contracting all updates out; as such, the new methodology must be transparent and fully portable

- **simplification**: identify scope for simplification, particularly of the complex 'life cycle' modelling of household representative rates

- the review should take into account **alternate methodologies** and **data sources** (eg Integrated Household Survey and the UK Household Longitudinal Study)

- **improved sensitivity analysis**: consider how Communities and Local Government's variant household projections based on the variant ONS population projections could be incorporated in the output procedures with Communities and Local Government's separate model for producing 'econometric' variants

- **feasibility testing**: the proposals should be detailed enough to immediately feasibility test the approach alongside the existing method in 2008.

1.2 Our approach

The approach taken to complete this project splits neatly into three components:

1. conduct a thorough review of the alternative methodologies and possible refinements assessing how each would fit in with Communities and Local Government's detailed requirements and the issues listed above (portability/flexibility, simplification etc)

2. carry out a set of interviews with an agreed list of experts and users

3. run a number of statistical tests or small scale pilots to test the implications of varying the methodology on the results.

1.2.1 Interviews

Upon inception Experian met with Communities and Local Government to generate a list of appropriate people to interview. The interviews focused on the practicalities and required outputs from the projection system as well as the theoretical background. The list was designed to include a mixture of relevant experts and users alike. The list of interviewees is shown below.

Interviewees	Area of Expertise
Professor Dave King, Anglia Ruskin University	Director of the Population and Housing Research Group – responsible for the current households projection model
John Hollis, GLA	Application of Household Representative Rate method to London
Professor Geoff Meen, Reading University	Responsible for the construction and maintenance of the Communities and Local Government's Affordability Model
Professor Mike Murphy, LSE	Household transition models; micro simulation techniques
Chris Shaw, ONS	Marital Status projections
Jonathan Swan, ONS	Sub-national population projections
Greg Ball, Birmingham City Council	Birmingham Household projections
Richard Cooper, Nottingham City Council	Nottingham Household projections
Wendy Back, Communities and Local Government	Policy use of household projections

1.3 Structure of this report

This report sets out the findings of the study and takes the following shape:

- a summary of the current model
- advantages of the current system
- problems with the current system
- worked examples
- conclusions.

Rather than provide full transcripts of each interview, we have provided a summary of key points raised at each interview and included relevant detail in each part.

2. The household projection model

2.1 The current model (HOPS)

The existing system (HOPS)[1] makes use of a six stage process:

a. population projections are taken from the ONS national and sub-national population projections[2]

b. marital status projections (de-jure and de facto) at the national level are taken from ONS. Changes at the sub-national level are assumed to follow the national pattern

c. the institutional population is either assumed to stay at a constant level (for younger age groups) or at a constant share (older age groups)

d. the institutional population is deducted from the total population to give the household population

e. household representative rates (HRRs) are extrapolated at the age/sex/marital status level and the resultant projections are applied to the household population by age/sex/marital status and are then summed across age/sex/marital status groups to give total household numbers

f. this process initially takes place independently at the national, regional and sub-regional levels with regional projections being adjusted (constrained) to be in line with the national projections and the sub-regional projections being adjusted to be in line with the regional projections. This process is known as controlling.

A considerable amount of the inputs into the process are other official projections, namely the ONS population projections and the national marital status projections. Of the rest of the process the two key elements are the institutional population projections and the household membership rate projections.

The model makes use of data from four Censuses (1971 to 2001) to extrapolate Household Representative Rates (HRRs) for a detailed set of age groups (5-year age bands), relationship status (married, single, widowed or divorced together with whether cohabiting or not) and household type (cohabiting couple, lone parent, single person and multi-person) and by geography. Extrapolation is

[1] http://www.communities.gov.uk/housing/housingresearch/housingstatistics/housingstatisticsby/householdestimates/communitieslocal/

[2] National (age/gender) projections and marital status projections were formerly produced by the Government Actuary's Department. Responsibility for this work transferred to ONS in January 2006

done through a mixture of looking at changes over time (eg by comparing, say, HRRs for single non-cohabiting males aged 30-34 across the four Census points) and life cycle trends (eg by comparing, say, the HRRs of males aged 30-34 in 2001 with the HRRs of males ages 20-24 in 1991 etc). The main source of data is the Census but some Labour Force Survey (LFS) information is used to inform trends post the most recent Census. Projections also incorporate the official population and marital status projections.

2.1.1 Advantages of the current system

The main advantages of the current system are detail and consistency. They combine a large amount of official data, both historical and projections, and a projection technique that has been in use for some time (early versions predate the 1996-based projections and date back to the Building Research Establishment's work in the 1980s). Given that many, if not most, of past and projected future changes in the relationship between population and household numbers (the average household size) can be traced back to either changes in marital status or to the age profile of the population, the level of detail in HOPS is a powerful tool. It also means that the household projections are fully consistent with two other commonly used sets of official projections, namely the trend-based population projections and the marital status projections (though not with the lone-parent family projections produced by DWP).

Other changes in average household sizes are due to changes in age/sex/relationship type specific HRRs. Here the ability of HOPS to look at changes over the life cycle is a distinct asset although many of the bigger actual and projected changes in HRRs have been for younger age groups where life cycle analysis is of more limited use and where HOPS has had some problems with over-prediction in the past.

2.1.2 Problems with the current system

a. transparency/portability – although, in principle, the current system is quite straightforward, the number of households equals the sum of disaggregated household population multiplied by HRRs, the requirements for local area marital status projections, the life-cycle projection methodology and the non-linear constraining process combine to make the process quite involved

b. interpretation – HOPS is a trend-based model. This means that HRRs are extrapolated from past-trends without reference to other considerations such as affordability. The original authors of the system argued that in the long-run, it was impossible to distinguish between the underlying social, economic and housing market trends and that such trend-based analysis was appropriate. We now have a situation where the extrapolated post-

Census HRR trends from HOPS which go into the current set of estimates (as well as the projections) are well above the actual trends, particularly for younger age groups, as indicated by alternative data sources such as LFS and housing market data. This is almost certainly because of affordability problems leading to an increase in the incidence of younger people living with parents for longer (including post-university returnees) and more sharing couples with a delay in-house purchase (as evidenced by the slump in first time buyers). This makes the HOPS estimates and projections difficult to interpret. Are they estimates of what has actually happened and a "central" projection of what is to come or do the estimates refer to what would have happened had housing costs been more "normal" and are the projections of what will happen if affordability returns to historic norms or trends? It might be better to formally incorporate affordability into the main model and to explicitly tie the projections to a continuation of existing affordability levels (similar to the way that economic activity projections assume a continuation of current labour market conditions) or to explicitly assume a return to past affordability levels over a given time frame. This would also make the projections more consistent with the household numbers that are produced by the Communities and Local Government's Affordability Model developed by the University of Reading

c. level of detail – although the level of detail is often seen as the strength of the current system it is also a source of complexity. The breakdown by de-jure and de facto marital status, in particular, is an issue. At first sight, tying the projections to official projections of marital status is a considerable enhancement to the robustness of the projections (as long as the official projections of marital status are accurate). The official projections of marital status, however, are at the national not local level and the assumption that the pattern of change is the same everywhere can cause problems. Timing differences in the release dates of the ONS sub-national projections and the marital status projections has also lead to delays in the past. The current scheduled timing, however, will overcome this problem if the schedules are hit:

    - mid-year population estimates for year X produced August, year X+1
    - national population projections for year X produced in October, year X+1
    - sub-national population & marital status projections for year X produced in Summer, year X+2.

    Further, having to model marital status rates and decomposite HRRs separately also adds considerably to the complexity of econometric models linking household formation to affordability and, as a result, composite (ie HRR for the population as a whole rather than by marital status) models have been used in a number of other studies

d. modelling approach – HOPS uses a trend-based approach to HRRs together with exogenous assumptions on a number of key variables such as population and marital status. An issue with such a model is that it is a deterministic projection model that does not easily permit any sensitivity analysis. One approach, already mentioned, that could be more flexible is to build affordability into the projection model though a drawback of this approach would be the need to rely on higher frequency but lower sample size LFS data to estimate the affordability effect (though the introduction of the new Integrated Household Survey may help to overcome some of the sample size problems in time). Another approach, much used in policy analysis, is household transition modelling. This, essentially, looks at the probability of one type of household evolving into one or more other types over the period of a year (usually). Such models are used in the official marital status projections and in DWP projections of lone parent family numbers. These models are popular when changes in transition rates (from one household state to another) can be linked to policy variables and, as micro simulation models, can be used to assess the potential impact of policy changes. Their main drawback is that they focus on transition rather than long-run steady states and that they are data hungry and, partly as a result, are not popular for large scale projection exercises such as that required by Communities and Local Government. Nonetheless, it may be possible to design a method where trend-based projections act as a constraint for detailed transition models and where policy induced shocks to transition models can be interpreted as changes in HRRs which can subsequently be fed back into the main-household projections and used as sensitivity analyses

e. trend-based or policy based – a frequently mentioned issue with Communities and Local Government's household projections is that they do not incorporate any housing constraints. The issue here, however, is really with the principles behind the population projections that feed into the HOPS projections rather than with the HOPS methodology per se but there is still an issue over whether users appreciate this distinction or not

f. coverage – HOPS identifies single person households and lone-parent households but does not say anything about the structure of other households (such as the number of two adult households, the number of two adult one child or two adult two children households etc). The methodology used for producing the Scottish Household projections, by contrast, does permit such a breakdown although there is no detail on some of the household types identified by HOPS and the projections rely on data from just two rather than four Census points. Consideration should be given to the relative merits of the Scottish system and to the possibility of combining elements of the two

g. **who should produce the projections?** – a constraint of the current system is that it is complex and that even relatively small updates have to be produced by an external organisation with implications for timing and costs. All development options need to be considered in light of the implications for future production. In other words, would it ever be feasible for Communities and Local Government to bring the system in-house, could a slimmed down version be produced more cost effectively and more quickly by an external organisation or would the involvement of another public sector body such as ONS be desirable.

2.2 Other UK household projections

The responsibility to produce household projections has been devolved to each of the home countries in the UK, and the recommendations in this report will be considered by Communities and Local Government and applied to England. To provide some additional context to the methodological review of HOPS presented in this report, a brief overview of the approaches taken to produce household projections in each of the other home countries in the UK is presented in this section.

2.2.1 Household Projections for Scotland, 2004-based[3]

Household projections are based on the population projections produced by the General Register Office for Scotland (GROS). To estimate the number of households of each type, information on household type and age group is projected forward from the 1991 and 2001 Censuses, for each household type, age group and local authority area. This information is applied to private household population produced by the General Register Office for Scotland (GROS) to produce the basic household projections.

Recent estimates are adjusted to keep them in line with aggregate estimates based on Council Tax data (unlike the corresponding estimates for England, however reliance on administrative data could mean that the methodology is at risk if the revenue system is changed).

Household projections are produced for each local authority area, broken down into seven household types (based on the number of adults and children living in the household) and ten age groups, as shown overleaf.

The Scottish methodology identifies most of the household types identified in HOPS. The exception that HOPS distinguishes between married couple, co-habiting non-married couple and non-cohabiting (other multi-person) households whilst the Scottish method does not. On the other hand, the

[3] http://www.gro-scotland.gov.uk/statistics/publications-and-data/household-projections-statistics/household-projections-for-scotland-2004-based/annex-a-houshold-projections-methodology.html

Scottish method has considerable detail on the number of children in a household while HOPS only identifies lone parent households.

Table 2.1: Household types and age groups used in the household projections

Household types	Age of head of household
One person households:	16-24
one adult: male	25-29
one adult: female	30-34
Two person households:	35-44
two adults	45-54
one adult, one child	55-59
Three plus person households:	60-64
one adult, two plus children	65-74
two plus adults, one plus children	75-84
three plus adults	85+

The proportions of households by local authority area, household type, and age group of the head of household are known from the 1991 Census and the 2001 Census. The proportions of each household type sum to one within each age group within each local authority area. Headship rates are projected forward and applied to the population projections (by age group and local authority area) to give the household projections. The headship (and non-headship) rates are projected forward using the modified two-point exponential model.

2.2.2 2002-based Household Projections for Northern Ireland

Northern Ireland Statistical Research Agency (NISRA) produce their own household projections for Northern Ireland using the 2002 based population projections.

Various projection methodologies and data sources were tested and the two-point exponential model used by the Scottish Executive (see above), applied to 1991 and 2001 Census data, was found to be the most robust for Northern Ireland. Household propensities were used instead of the more commonly used 'headship' rates to avoid some of the weaknesses NISRA associate with the headship approach. Other methodologies have also been used to produce high and low variant projections.

The two-point exponential model for 1991 and 2001 household propensities emerged as the most sensible and robust projections technique for three reasons as identified by NISRA. Firstly, the two-point exponential model constrains the projections by slowing down the linear trend as probabilities approach 1 or 0 and is therefore more in keeping with reality than a linear regression model that allows projected negative probabilities or trends to reach a floor or ceiling too quickly. Secondly, the use of 1991 and 2001 Census data ensures that projections are based on the latest household formation trends (ie trends between 1981 and 1991 may not be relevant). Thirdly, the use of household propensities takes account of all household members and avoids the older male bias that is inherent in the traditional 'headship' method.

NISRA feel that although the two-point exponential model only uses two data points (1991 and 2001 Census data) on which to base the projections, the two points are more reliable than a larger number of points taken from survey data (which would contain sampling errors that are not present with census data).

2.2.3 Wales

The latest (2003-based) regional household projections for Wales were produced by Anglia Ruskin University which was part of work commissioned by Communities and Local Government, the contract for which has now ended.

Local authority population projections are planned to be published by the Welsh Assembly Government this summer, which will in turn allow the production of household projections for local authorities. The Welsh Assembly Government is currently working to develop and publish household estimates and projections for local authorities in Wales.

Welsh Assembly Government are currently researching methods used in other countries and investigating software for this task and will be drafting a discussion document outlining the methods used and recommending a way forward which will be put to a consultative group comprising of local authority representatives and other key customers who have experience of using household projections. One of the aims of this project is to produce a projection method that is simple, easy to update and easy for users to understand.

3. Is the complexity and level of detail in HOPS necessary?

The level of disaggregation together with the non-linear cohort modelling and the top-down controlling mechanisms make the current version of HOPS quite cumbersome and time intensive to operate. The detail and complexity have been incorporated for good reasons (to make the household projections consistent with other official demographic projections, to incorporate genuine cohort[4] effects in-household formation behaviour and to allow the incorporation of more aggregated control totals) but the complexity of the model used in England now stands in sharp contrast to the relatively simple models used in Scotland and Northern Ireland which, arguably, provide a more useful breakdown by household type.

This section shows the results of a number of exercises that look at what alternative methods of extrapolating household representative rates would have meant for household numbers or the aggregate household representative rate for England as a whole in 2001. These are then compared to the 2004-based estimates to get an idea on the likely gains or losses in accuracy to be had by using different techniques. All of the methods illustrated in this section are trend-based and do not take account of affordability.

3.1 Disaggregated projections

The first set of comparisons retains some age/sex disaggregation. The approaches considered are:

TEST1 – A modified version of HOPS where no cohort effects are incorporated for the age groups up to and including 30-34[5] and where a simpler cohort methodology[6] (where the household representative rate for an age band is only affected by that for the ten years younger age band, ten year previously). Apart from this, the full age/sex/marital status/household type breakdown of HOPS is used.

TEST2 – As with "1" above except with no breakdown by household type.

[4] Although the term "cohort" is used, we are not able to measure true cohort effects as in the ability to track a group of individuals over time. What we have are pseudo-cohorts where individuals in a certain demographic group are compared with individuals in the same demographic group ten years later even though the group may well contain a different group of individuals by then

[5] Although HOPS incorporates cohorts effects for most age groups, experiments indicate that they are not important below the 35-39 age group

[6] Where there is "no cohort" effect, the models look at the changes in HHRs for a particular age band over time, eg trends in the HRR for 30-34 year olds. Where there is a cohort effect, the models look at changes over time for the same age group, eg trends in the difference between the HRR for 40-44 year olds at for one Census and that for 30-34 year olds for the previous census

TEST3 – As with "1" above except with no marital status/household type breakdown.

TEST4 – As with "3" above except with no sex split.

TEST5 – The application of the 2-point Exponential projection or "Scottish Method" to a simple age/sex breakdown (ie the same breakdown as "2" above).

TEST6 – The application of the "Scottish Methodology" to a simple age breakdown (ie the same breakdown as "4" above).

TEST7 – The aggregate "Scottish Methodology" where the 2-point exponential approach is applied directly to the aggregate headship rate.

These are then compared to:

HOPS96 – The 1996-based trend-based projections and:

HOPS04 – The 2004-based based household estimates.

All of the tests are carried out only using data up to 1991 and then projections are made for 2001 and their accuracy is compared. The exercise is done at the England level only although it could be repeated for any level of geography.

The time series extrapolation methods (Tests 1-4) are estimated using logistic functions or "S-curves" for both simple extrapolation (15-34 year olds) and cohort models (ages 35+). The point of inflection is constrained to be no later than 1981. This means that the curves are always flattening off in the forecast period (and, indeed before). The decision on this parameter may, it could be argued, be unduly influenced by what we now know actually happened between 1991 and 2001 but the results are not unlike those of the 1996-based HOPS projections and such dampened projections are usually employed in practice.

The results are expressed by looking at the predicted change between 1991 and 2001 rather than the absolute level. This is because revised estimates for earlier years in the 2004-based trend-based estimates make levels difficult to compare. The results are summarised in Figure 1, Figure 2 and Table 3.1.

Figure 1: Estimated and Projected Changes in the Aggregate HRR for England, 1991-2001

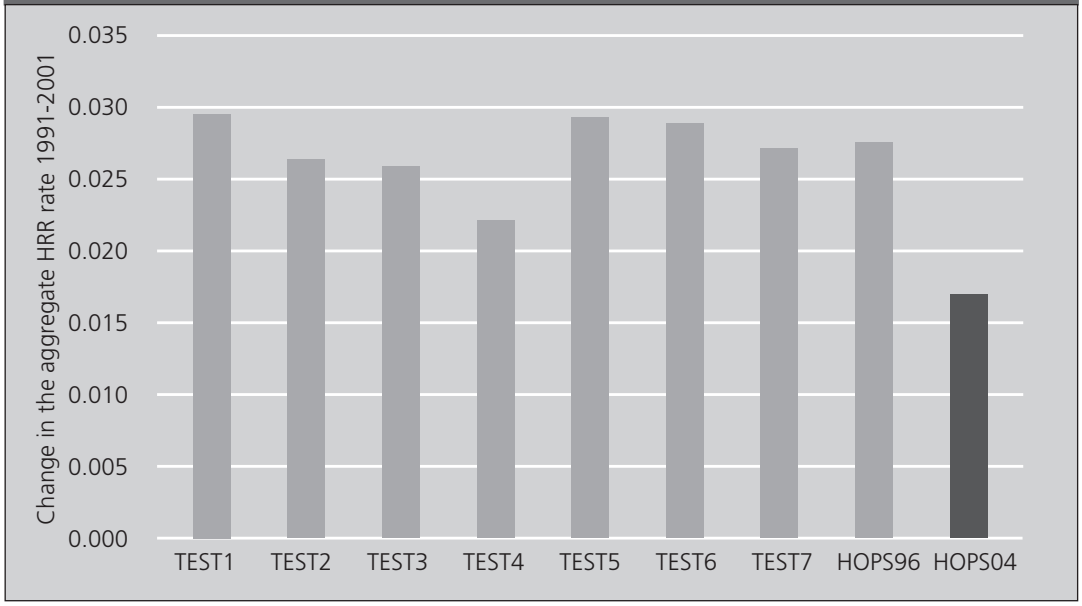


Figure 1 illustrates a number of key features:

1. All of the projection methods exaggerate the actual change in the aggregate HRR between 1991 and 2001 as measured by the 2004-based estimates (HOPS04).

2. The simplified HOPS methodology (TEST1) does not perform quite as well as HOPS (HOPS96). This could be because of slight differences in the modelling approach and/or because HOPS96 had the advantage of the use of a number of years of post-1991 LFS data.

3. The time series extrapolation methods tend to get more accurate the simpler they are. ie dropping household type makes the projections more accurate; dropping marital status makes them no less accurate still, and dropping the gender breakdown and focussing simply of the age bands produces the most accurate projections of all.

4. The two-point Exponential or "Scottish Methods" do not tend to do as well as the time series extrapolation methods but their results are not that much worse than HOPS96.

Figure 2: Aggregate Headship Rates

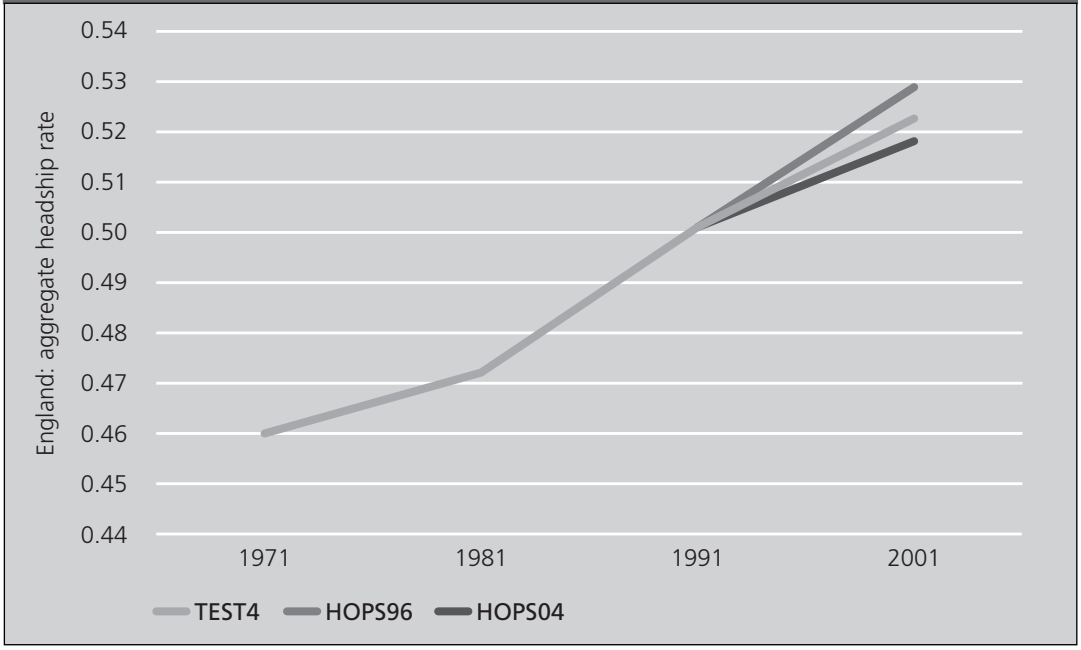


Figure 2 compares the results from HOPS96 with TEST4 and the out-turn as measured by the 2004-based estimates and puts these in the context of past changes.

To put some of these results in terms of actual households and to give a better feel for the meaning of these numbers, the 2004-based estimates show an increase in-household numbers of 1.357m in England between 1991 and 2001 compared to a projected figure in HOPS96 of 1.779m. Part of this over-forecast was due to errors in the population projections. However, using the 2004-based population estimates and information on the institutional population from the 2001 Census that would not have been available when the 1996-based projections were produced only reduces the projected change to 1.712m. In other words, although population projections obviously matter, error in the 1996-based population projections, marital status and institutional population assumptions only accounted for around 16 per cent of the total projection error in HOPS96 or 67,000 out of a total error of 422,000.

The equivalent figures to the aggregate projection error of 422,000 in HOPS96 for the time series model with no age or sex split (TEST4) was 206,000 and that for the "Scottish Method" with an age/sex breakdown, to give the two extremes, were 489,000. The aggregate time series model is clearly more accurate than HOPS. The inferiority of the "Scottish Method" with an age/sex breakdown is not that marked, however and the aggregate Scottish model actually does marginally better than HOPS96.

Table 3.1 gives an age breakdown of the results. As can be seen, all of the projections benefit from a number of off-setting errors, in particular TEST4. This shows up in the comparison of mean absolute errors[7] (by age band) where TEST4 still shows up as being better than the other methods but the gap is not as wide as for the aggregate HRRs.

Table 3.1 also shows that the bigger errors tended to be for the younger age groups – ie the age groups for which cohort modelling is not really possible or appropriate.

Table 3.1: Estimated and Projected Changes in the Aggregate HRR for England, 1991-2001 – differences from 2004-based estimates

Errors	TEST1	TEST2	TEST3	TEST4	TEST5	TEST6	HOPS96
15-19	0.004	0.002	-0.002	0.000	0.004	0.008	0.004
20-24	0.015	0.012	0.013	0.018	0.022	0.034	0.022
25-29	0.054	0.053	0.033	0.034	0.054	0.049	0.054
30-34	0.021	0.019	0.015	0.003	0.025	0.023	0.025
35-39	0.012	0.009	-0.003	-0.019	0.008	-0.002	0.008
40-44	0.012	0.011	0.020	0.006	0.005	-0.006	0.005
45-49	0.015	0.014	0.021	0.009	0.006	0.003	0.006
50-54	0.014	0.008	0.014	0.007	0.004	0.009	0.004
55-59	0.004	0.002	0.003	0.008	0.001	0.011	0.001
60-64	0.000	-0.005	0.004	0.011	-0.002	0.007	-0.002
65-69	-0.001	-0.007	0.004	0.007	-0.003	0.003	-0.003
70-74	-0.003	-0.008	0.000	0.002	-0.003	0.000	-0.003
75-79	0.000	-0.005	-0.006	-0.002	0.002	0.010	0.002
80-84	0.009	0.005	-0.001	0.000	0.013	0.024	0.013
85+	-0.001	-0.010	-0.024	-0.016	0.003	0.018	0.003
Total	**0.013**	**0.010**	**0.009**	**0.005**	**0.012**	**0.012**	**0.011**
Mean absolute error	**0.011**	**0.011**	**0.011**	**0.009**	**0.010**	**0.014**	**0.010**

[7] The mean absolute error measure of predictive accuracy prevents offsetting errors from improving the results

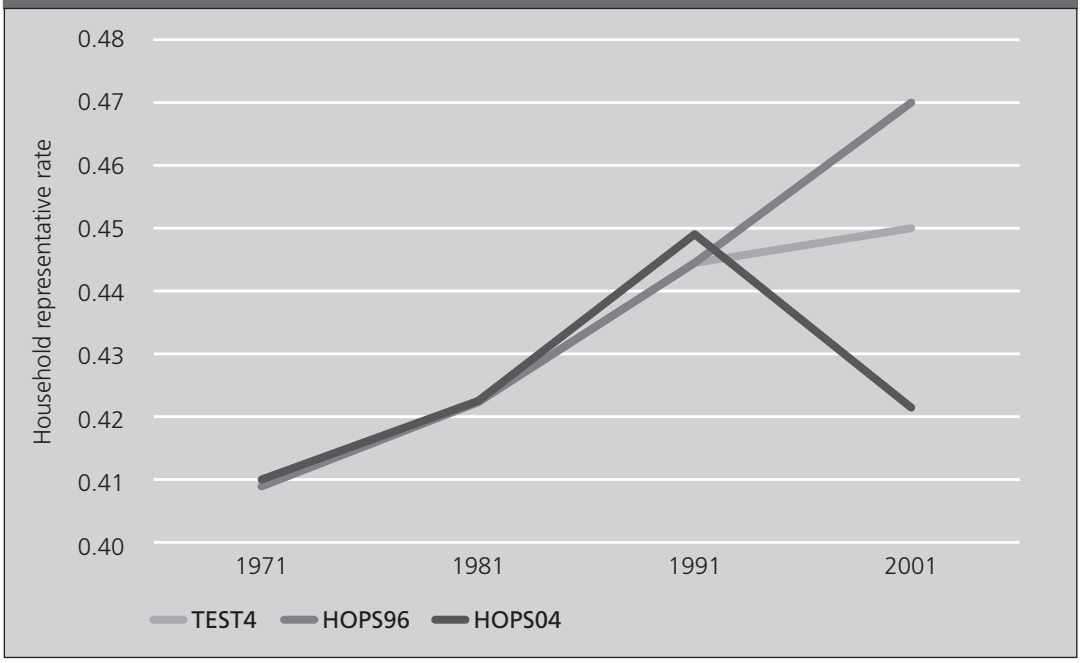
3.2 Further examples

This section looks at two of the age breakdowns in further detail and concentrates on the predictive accuracy of the 1996-based projections (HOPS96) and the aggregate time series model by age (TEST4). The biggest error of any age band for every model in table 3.1 is for 25-29 year olds. This is further illustrated in Figure 3 and further examined below. The second example looks at 40-44 year olds which was an age group where most of the projection methods tested did rather better.

3.2.1 25-29 year olds

The change in the HHR for 25-29 year olds accelerated between 1981 and 1991 and the 1996-based projections (HOPS96) extrapolated this change to 2001. The assumptions behind the shape of the S-curve in TEST4 means that the TEST4 projection shows some levelling off of the increase after 1991. Neither of these comes close to the latest, 2004-based estimates (HOPS04). These estimates show a sharp reversal of the trend between 1991 and 2001, something that any trend-based model would find impossible to reproduce (as shown by the scale of the errors in the 25-29 column in table 3.1).

Figure 3: Household Representative Rates – All 25-29 year olds in England



This begs the question of what did cause the reversal of trends in the HRR for 25-29 year olds. There are a number of possibilities:

1. affordability problems – increasing housing costs could have led to the postponement of household formation. Housing costs relative to earnings, however, were actually lower in 2001 than in 1991 so this is unlikely to be the explanation

2. increase in student numbers – could also have led to a change in behaviour and the postponement of household formation but 25-29 is beyond the age at which most people complete full-time studies

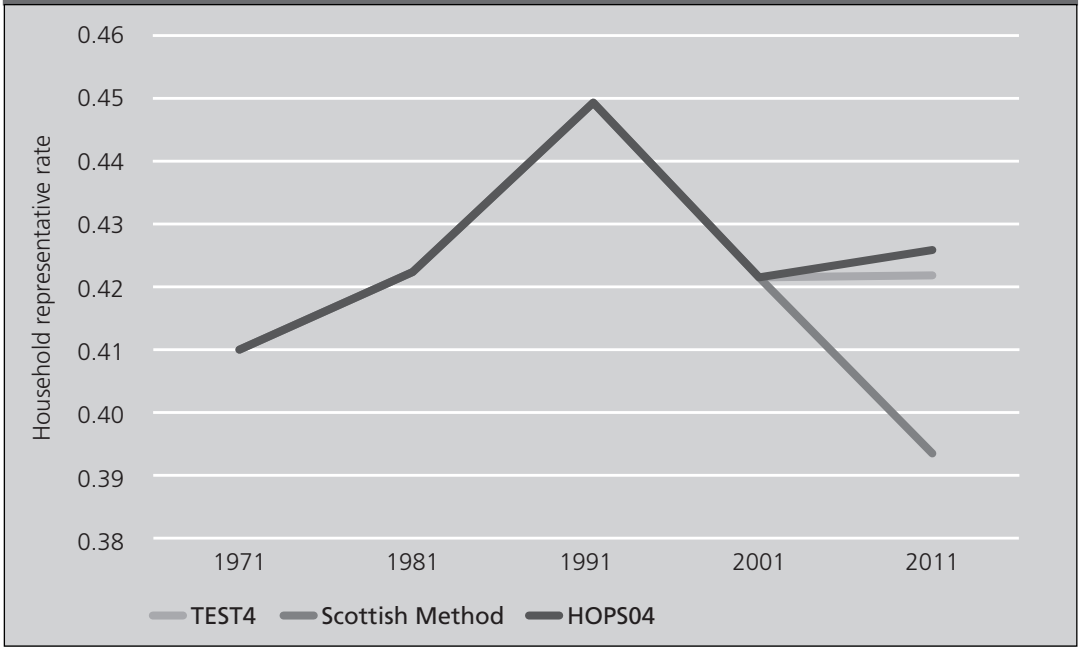
3. changing marital status mix – as we have focused on composite HRRs, changes over time could have been due to changes in the marital status mix but the pattern shown in figure 3 is common to most of the male marital status and household type groups (but not to females)

4. data errors – cannot be ruled out as a possible cause of difficult to explain data movements. The data comes from commissioned Census tables rather than standard Census output and we know that there were problems with some of the initial tables produced for HOPS from the 2001 Census. The data errors in the Census tables might explain some of the difference in-household representative rates, although they could just as equally have been in 1991 as in 2001, and we have no hard evidence of data errors in either.

None of these arguments are conclusive or even plausible in most cases, so the movement of the aggregate HRR for 25-29 year olds remains a mystery for the time being, but it serves to remind us of the unpredictability of some HRRs and the difficulty in making projections whatever method is used.

The unpredictability of the HRR for 25-29 year olds still has some lessons for the most suitable projection method for the future. Figure 4 shows the alternative projections for the HRR for 25-29 year olds produced using three different methods. The difference between TEST4 and HOPS04, on the one hand, and the two-point exponential or "Scottish Method" on the other are clear.

Figure 4: Household Representative Rates – All 25-29 year olds in England – Alternative Projections for 2011



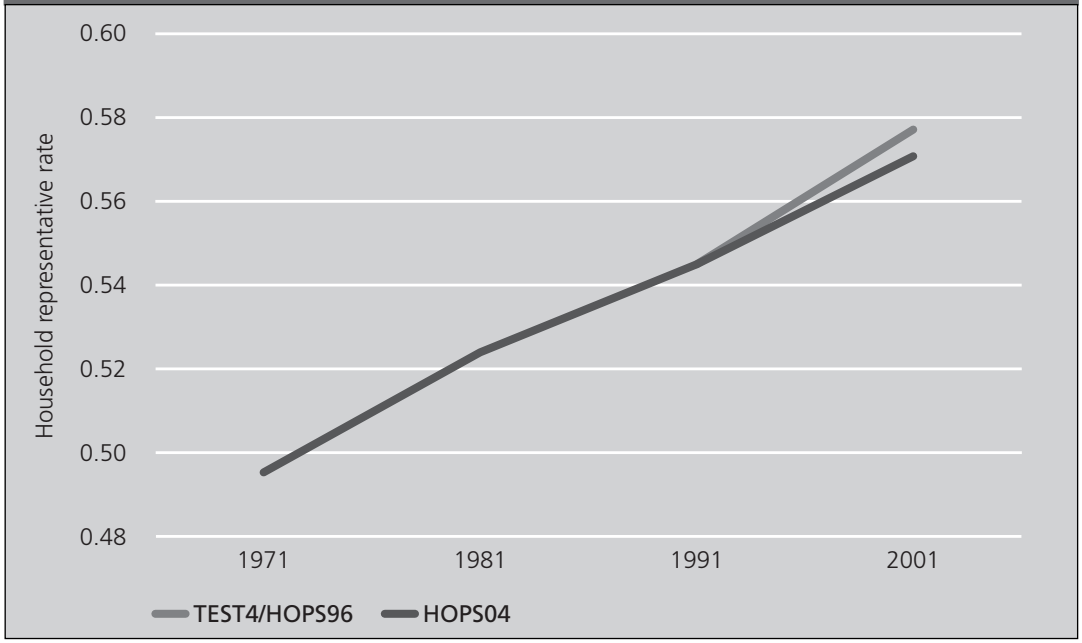
The first two projections show either a levelling off or a slight return to the earlier increasing trend while the "Scottish Method" extrapolates the 1991-2001 change to show another sharp fall (and this continues beyond 2011). If there is confidence in the data and a belief that the change in trend observed between1981-91 and 1991-2001 is permanent then the projection produced using the "Scottish Method" is plausible. If not, then one of the other two projections are to be preferred. Although hard evidence is lacking, we suspect that there are data problems with this series and this would lead us to be wary of extrapolating between just two data points (as with the "Scottish Method").

In summary, the experiments for the 25-29 age band offer two lessons. One is that if there is a reversal of trend, no trend-based method will pick it up (Figure 3). The other is that if there are data errors, some methods may be more prone to producing implausible forecasts than others (Figure 4).

3.2.2 40-44 year olds

In contrast to the projections for 25-29 year olds, most of the projections for the 40-44 age band were reasonably accurate. Figure 5 shows the projection for 2001 made by HOPS96 and by TEST4 (both give the same figure) together with what the 2004-based estimates show. HOPS96 and TEST4 exaggerated the increase but not by very much.

Figure 5: Household Representative Rates – All 40-44 year olds in England



The 40-44 age band is a good example of the benefits to be had from modelling cohort changes rather than simple time series extrapolation. The rate of increase in the HRR for 40-44 year olds was slower between 1981 and 1991 than it had been between 1971 and 1981. Any logistics/s-curve estimate would have produced a further deceleration between 1991 and 2001 yet both the projections and the estimates show an acceleration rather than a slowdown. The reason for this is that the cohort change (the change between the 30-34 age and band in one census and the 40-44 in the next) was still increasing between 1981 and 1991 rather than slowing down.

This is illustrated in Table 2. In the data available for the HOPS96 projections and TEST4, the aggregate HRR for 40-44 year olds had increased by .029 between 1971 and 1981 and by .021 between 1981 and 1991 (Row 3). Given this pattern, the change over the next decade could have been expected to have been less than .021. The cohort change (Row 4), however, was increasing and both HOPS96 and TEST4 projected that this would rise further to .058 in 2001 making the 2001 projection for the HRR for 40-44 year olds equal to .577 (ie equal to the HRR for 30-34 year olds in 1991 plus the .058 extrapolated cohort change).

The 2004-based estimate show an HRR for 40-44 year olds of .571, so both HOPS96 and TEST4 exaggerated the out-turn by .006. Note, however, that half of this is due to a revision to the estimates of 1991 HRR for 30-34 year olds, which shows that the cohort method can suffer from data revisions just as much as simple extrapolation.

Table 2: HRR for 30-34 and 40-44 year olds and the "Cohort Change"

	1971	1981	1991	2001
HOPS96/TEST4				
1. 40-44	0.495	0.524	0.545	0.577
2. 30-34	0.472	0.488	0.519	0.550
3. simple change (40-44)		0.029	0.021	0.032
4. cohort change		0.052	0.057	0.058
HOPS04				
5. 40-44	0.495	0.524	0.545	0.571
6. 30-34	0.472	0.488	0.516	0.522
7. simple change (40-44)		0.029	0.021	0.026
8. cohort change		0.052	0.057	0.055

This and other experiments tend to show that cohort extrapolation is worth persevering over simple time series extrapolation for the older age groups. That said, the two-point extrapolation or "Scottish method" when applied to an age breakdown also appears to work quite well on a number of the older age groups although it was considerably less accurate for the over 74s.

3.3 Conclusion

The tests and example presented above are not intended as a thorough evaluation of HOPS and alternative projection methods but rather to give a broad feel for the likely loss or gain in accuracy from different methods. The conclusions are that all methods suffer from inaccuracies and that any accuracy gains are likely be modest. On the other hand, there is no evidence that the more sophisticated and disaggregated models perform that much better than the simpler models. At the extreme the aggregate "Scottish Method" with no age breakdown marginally out-performs HOPS96. We would caution, however, against such a simple approach as the age profile of the population did not change all that radically between 1981 and 2001 but this might not be the case in the future when the ageing population really takes hold. Consequently, there is a good argument for retaining the age breakdown in any model (as is the case with the actual methodology used in Scotland and Northern Ireland). There is little evidence, however, that the marital status or household type breakdown in HOPS helps to improve its predictive accuracy.

4 Recommendations

4.1 Is there still a need for household projections?

All of the interviewees were very keen that official household projections continue to be produced. The projections are seen as an essential reference point in the planning process and their disappearance after so many years would leave a considerable void.

Even Professor Geoff Meen, who has been more critical than most, of the current methodology and its interpretation said that they were a valuable comparator for the outputs of Communities and Local Government's Affordability Model.

4.2 Is there a need to clarify interpretation?

The biggest single confusion surrounding the household projections concerns their links to the ONS population projections. Almost all of the criticisms of the projections made by general users and even by a few expert users are really criticisms of the population projections rather than the household representative rates (HRRs). Whoever is responsible for producing the projections in the future needs to take action to minimise this confusion. The best ways to do this are:

1. release the household projections as soon as possible after the population projections. Ideally they would be released simultaneously to emphasise the dependence of the household projections on the population projections. This would only really be possible if ONS were to take over responsibility for producing the household projections and use end to end planning and processing with the population projections, or if Communities and Local Government enters a data sharing agreement with ONS to use their data before release. However, simultaneous release might delay release of other data and might therefore not be possible. If the projections were to stay with a third party or to be brought in-house by Communities and Local Government there should be a target of releasing the household projections within a month of the population projections being released. This should apply to both the national and sub-national projections and estimate

2. make sure that there is adequate documentation supplied with the projections and that this clearly emphasises the link with the population projections. There is a general feeling that the documentation supplied with the 1996-based projections was superior to that provided with the 2003-based projections

3. provide tables that decompose the national and, possibly, regional level projections into the demographic effect (including changes to the age structure of the population) and the HRR effect. This should emphasise the importance of the demographic input to the projection

4.3 Simplifying the model

4.3.1 Cohort modelling

The current model looks at changes in HRRs for different cohorts over time rather than changes for the same age/sex/marital status group over time. There is evidence that cohort modelling does improve accuracy for some age groups and there is a good argument that it should be retained.

Strictly speaking, however, the cohort approach can only be used for older age groups if all of the available data points are to be used. For example, the latest set of projections should only really use the cohort approach for 50-54 year olds and older age groups. This is because it is only for these older age cohorts that we have valid comparisons going all the way back to 1971 (45 years olds would only have been 15 in 1971 etc). HOPS actually does use the cohort approach for younger age groups by extrapolating changes from older cohorts to the younger cohorts. The fact that this had to be replaced in the 2004-based projections for some younger age groups indicates that this caused some problems (over-prediction). An alternative would be to extrapolate based on a shorter time period but this too could produce problems.

Despite the loss of data involved, experiments suggest that cohort modelling may add accuracy to the modelling of HRRs for some younger age groups (Table 3 and Section 3.3.3) but that it has little to add to the pre 40-year age groups. Consequently, if retained, cohort modelling should only be used for the 40-44 year and older age bands.

4.4 Marital status

Although there are clear differences in-household formation behaviour by de-jure and de-facto marital status, experiments indicate, perhaps surprisingly, that the marital status breakdown adds little to predictive accuracy, at least at the England level. There are also issues with using national projections of changing marital status at the sub-national level.

As a result, we recommend that marital status is dropped as a level of disaggregation in future household projections.

4.5 Gender breakdown

An issue with having a gender breakdown is that it necessitates an arbitrary decision on who should be the head, or household representative, of a household in a married or cohabiting couple household. The usual way that this is done is to make the male the household representative. While this need not cause serious modelling problems, experiments show that it adds surprisingly little to predictive accuracy. This means that any projection model could be further simplified by dropping the gender split unless Communities and Local Government or other key stakeholders need to keep it for policy development at national or regional level.

4.6 Household structure

A recurring request from the interviews was for some kind of household structure breakdown that at least identifies the number of children in the household. The system currently in place in Scotland gives considerable detail on household structure using a very simple extrapolation technique (although a full-time series exists to permit a more sophisticated approach for single person households). This could be introduced in England as long as the relevant commissioned Census tables used in Scotland were available for England but fully integrating it into the existing model framework would be almost impossible.

The only option if the detail and structure of the current system are to be preserved is to carry out a "Scottish-style" procedure as a separate exercise and then to constrain the results to the main-household projections. This is recommended for future projections.

4.7 Projection method

The HRRs are currently projected using a maximum likelihood technique. This seems a little over the top for a trend-based projection that has so few observations. If the trend-based approach is to be persisted with, a much simpler and easier to understand extrapolation method should be considered. Experiments show that equally good results can be achieved using simpler methods.

4.8 Controlling methods

The need to control or constrain the regional results to the national results and the sub-regional results to regional results introduces a degree of complexity into the process as it involves a non-linear iterative procedure. This cannot be avoided but modern computing techniques have, however, made this a simpler process and this could be achieved using a combination of Excel and VBA and run on a standard PC.

Strictly speaking, the controlling mechanism needs to be re-run whenever there is any change to the underlying demographic data. The improvement to accuracy from doing this are, however, only marginal unless there are major changes to the underlying demographics or if new LFS data are introduced. An obvious easy gain would be to only run the controlling mechanism occasionally and not to produce routine HRR updates. This would make updating the household projections into a trivial exercise with the new demographics simply being applied to earlier estimates of HRRs at the local authority level rather than going through the full top-down controlling process every time. If it was deemed desirable to include recent LFS data the final production process could still be speeded up considerably by producing a new set of HRRs which incorporated the latest LFS data but which used the old population data in the controlling procedure.

4.9 Summary methodological recommendations

To summarise the above, we recommend:

1. that the model is split is into a part that benefits from the type of time series/cohort modelling currently used by HOPS and to an add-on section that uses a more limited data set. The aim should be to keep the benefits from the time series approach while permitting the introduction of the kind of household type breakdown available in the Scottish and Northern Ireland projections

2. that the existing household type (with the exception of single person households), gender and marital status breakdown could be dropped depending on further user consultation and that the main time series modelling is only applied at the age band level. Cohort modelling should only be used for the 40-44 and older age bands

3. LFS data, suitably smoothed, should be used at the age level with an equal weighting to the Census data

4. tables should be commissioned from the 1991 and 2001 Censuses to permit similar household type breakdown to the Scottish and Northern Ireland projections but these projections should be lined up to the aggregate projections produced using time series/cohort methods with an age breakdown. There is a requirement, in particular, for information on the number of households with children. Models and projections for single person households could utilise longer time series as this data is already present in the current system

5. controlling should become either an occasional exercise or one that is done in advance of the release of the sub-national population projections in order to permit the rapid updating of estimates and projections when new demographic data becomes available.

4.10 Who should produce the projections?

4.10.1 Bringing the model in-house

Bringing the whole process in-house would be a considerable undertaking for Communities and Local Government. Although the model could be simplified and made easier to understand and could be put into a more accessible software system (maybe even something as commonly available as Excel), there are other considerations:

1. support of the model requires considerable data expertise and appreciation and not just technical ability. The definitions used in the Census sometimes change and the commissioned tables from the Census can contain errors which require an expert eye to spot

2. the release of the projections produces a large number of follow-up questions from users which the Department would have to be happy to handle and would have to be willing to commit senior expert resource to

3. there needs to be some guarantee of continuity of resource and expertise within the Department. This can often be jeopardised by staff turnover

4. the household projections would require expert technical resource but they might not be a full-time commitment (depending on the release frequency). Other tasks of a similar level would have to be available for the members of staff involved

5. some users value the services of the Chelmer Model which enables users to reverse engineer the process and produce population projections given a housing supply constraint and do not really distinguish between the HOPS and Chelmer models. The department would have to decide if it wanted to undertake this work as well or to encourage and facilitate the continued supply by external organisations.

4.10.2 Moving the model and projections to ONS

In many ways, it would be simpler if the projections transferred to ONS, the main benefits would be:

1. ONS produce the key inputs and could be better placed to organise timetabling (see 4.2 above)

2. ONS have the breadth of staff and expertise in producing projections, so should be able to take on household projections and other demography work in-house

3. ONS could take over responsibility for the majority of the work itself in conjunction with an independent contractor, probably an academic

4. the creation of one coherent National Statistics Centre for Demography with a consistent set of outputs

5. a service level agreement could be specified that commits ONS to promoting the openness and transparency of the process, leaving open the option of transfer to a contractor at a future date

The main drawbacks of transfer to ONS would be:

1. ONS would require a resource transfer before they undertook responsibility for the projections, although funding is also required to commission an external contractor

2. Communities and Local Government could lose direct control over the timetabling, but should retain an input to the timetable. Although one of the reasons for transferring production to ONS would be to facilitate a shorter delay between release of population and household projections, there would be no guarantee that this would take place, and Communities and Local Government could produce the projections quicker with earlier access to ONS data. Further, any decision over the long run continuance of the projections would ultimately belong to ONS

3. any link between the projections and the affordability model could not be solely conducted within the ONS Centre for Demography and would require the assistance from other parts of the ONS or an outside contractor as has been undertaken successfully previously

4. point 5 above (regarding the Chelmer Model) is equally applicable to ONS although the way forward may be influenced by the results of the recent consultation on the possibility of ONS producing a sub-national projection variant constrained to housing availability. Indeed, this development, further raises the question of the relationship between ONS and household projections as, presumably, average household size would be needed as an input into the process.

4.10.3 Continuing with an external provider

The main drawback of the external consultant route is a loss of expertise to the department, and the possibility of lack of control and ownership of the intellectual process, cost and issues with timetabling and responsiveness. On the other hand, there are a number of advantages of retaining an external supplier link:

1. the projections are perceived by many to be more independent than Communities and Local Government

2. continuity of supply and expert input – a supplier outside Communities and Local Government may be in a better position to deal with staff turnover and to maintain the required level of expertise over time

3. a contractual relationship could be specified that commits a contractor to promoting the openness and transparency of the process so that the contractor could be changed if necessary and so that Department staff also develop a reasonable level of technical expertise

4. an external contractor could be required to deliver a workable model (rather than just a data delivery system) to the Department for in-house use. This could be a pre-cursor to the projections eventually coming in-house (if desired)

5. an external supplier could maintain a Chelmer-style planning-led population projection service.

In summary, we are not convinced that the Department is currently in a position to take the projections in-house. At the very least, there would need to be a substantial re-working and simplification of the existing system either by an external contractor or an in-house team before this could happen and, longer term, there would be an ongoing risk of loss of expertise due to staff turnover. ONS might be able to take on the process with an adequate (as defined by ONS) resource transfer, but moving the projections to ONS would involve inevitable loss of influence and control by Communities and Local Government and the implications of this for policy development would need to be considered.

The continuance of a relationship with an external contractor would be a good solution as long as this was accompanied by a program to make the modelling and projection process simpler and more transparent and which made the model available for in-house use. This could be a precursor to eventually bringing the work in-house.

4.11 Use of recent LFS data

Although the estimates make some use of post-Census LFS data, the weighting system means that its influence on the estimates (and projections) is limited. Although there are reservations on the accuracy of movements in LFS HRR data, we believe that recent movements in the LFS data are consistent with other anecdotal evidence and that they should be taken seriously. Apart from concern over bias, the main reservation regarding use of LFS data is the relatively small sample size. This will become less of an issue once the new IHS becomes available but there would still have to be some reliance on LFS data (to bridge the gap between the 2001 Census and the first IHS point) until after the release of the 2011 Census data. In any case, we think that problems with erratic data movements caused by a small sample size can be overcome by an appropriate use of smoothing techniques (such as outlier adjustment and Henderson moving averages).

A further issue with using LFS data in historical estimates concerns the link between the estimates and projections (this is also touched upon in 4.12 below). Many users view the projections as some kind of long-run steady state which is not affected by housing affordability issues or, alternatively, what the number of households would be given population and given that affordability stayed at its 2001 level (although a better interpretation might be what HRRs would be if past trends in affordability persistent a similar rate after 2001). Simply using the current system with an up-weighted LFS would produce a set of projections that, to some extent, extrapolated to be post 2001 decline in affordability which may be equally inappropriate.

4.12 Should estimates be produced?

One source of confusion in the current system is related to the release of Household Estimates. The estimates are a product of multiplying recent population estimates by HRR projections which are largely Census-based extrapolations (the LFS having only a small weight in the process). This leads to confusion as the estimates are not estimates in the sense that they are not in any way the Department's best "estimate" of what has actually happened in the recent past but are a strange mix of estimate (population) and projections (HRRs) which are often, as at present, at odds with other evidence.

We consider that if estimates are to be produced they should take into account actual evidence of HRRs, be it from LFS or from dwelling numbers or a combination of the two. To describe something as an estimate when it is not really so in the way that ONS usually uses the term only adds to confusion and to the distrust of the whole process.

This leads to the question of the relationship between the estimates and the projections. Having estimates that actually reflect what has been going on and projections that relate to some underlying steady state is problematic. Unless the link with affordability can be tackled head on (see below), it might be better to have projections that do not take on board any post-Census LFS data (ie the projections would only need to be produced every 10 years) and estimates produced annually which fully incorporate recent LFS (and other appropriate) data produced annually and to explain why the two have diverged. Alternatively, recent LFS data should be given equal weight to the census data in the extrapolation process.

4.13 Relationship with the Affordability Model/ incorporating affordability

The fundamental conceptual problem surrounding the current system of household projections is the relationship with affordability. If affordability affects HRRs, and there is plenty of evidence that it does, at least for some younger age groups, just because the projections are trend-based it does not mean that there is no relationship with affordability unless, by some chance, affordability at each of the Census points is the same as for all of the other census points and the problem would get worse if recent LFS data were to be more fully incorporated in the estimates.

One way around this would be to merge the HOPS and Affordability models both of which are Communities and Local Government funded. The leader of the Affordability research team, however, is very much against this idea on the ground that it would seriously complicate their work. Another option would be to introduce affordability directly into the existing modelling framework possibly in a simplified structure that does not include marital status. This would mean that the projections could be made to be consistent with the sub-national population projections. The sub-national population projections assume that migration levels stay at their recent levels. An affordability-based HRR model could assume that affordability stays at similar levels. It would also permit alternative scenarios at least at the national level (at the regional level changes in relative affordability would be as likely to change population as HRRs and Communities and Local Government would be wary of being seen to produce alternative projections).

That said, we found little enthusiasm for the introduction of any affordability effects into the model so we recommend that no development along these lines takes place.

4.14 Introducing expert judgement

Most of the current projections are trend-based and they incorporate no natural limit to HRRs other then a maximum of one and a minimum of zero. The same would be true of an econometric approach that included affordability considerations if it still needed trends as a proxy for non-economic change (which it almost certainly would).

The most recent set of projections have had to introduce some judgemental adjustments for some HRRs because the initial results were not thought to be plausible. This raises the possibility of introducing judgemental inputs for all HRRs which would set a maximum and minimum HRR for all sub-groups. These could be based on international evidence or other academic research. The main advantage of this approach is that it would help stabilise future projections (ie limit the degree of change between one projection and another). The main downside, apart from the work involved, would be that the process could be subject to allegations of fixing but this could be avoided by choosing a suitable independent panel to advise on the limits.

A sensible middle course would be to have an expert panel to review the projections at a reasonably high level and to make observations and suggestions on the values of long-run HRRs when the model outputs are not thought to be plausible.

4.15 Model and data delivery

The current model is hosted by Anglia Ruskin University with only a data interrogation programme being available to Communities and Local Government. An aim of any new system should be to simplify or adapt it sufficiently that it could fit into easy to use software within Communities and Local Government. This could be a new bespoke software product but it might be better if it could be written in a package that Communities and Local Government staff are likely to be very familiar with such as Excel with any necessary VBA add-ons.

4.16 Relationship with Chelmer and similar models

The Chelmer Model, or similar, which uses the average household size projections from the household projections to estimate population given a housing constraint is at least as much used by planning bodies as the projections themselves and now ONS appear to be contemplating something similar. This process is, strictly speaking not the concern of Communities and Local Government but we consider that Communities and Local Government should take an active interest in the process and the caveats that surround it.

The issue is that the technique relies on a) the average household size projection in the base being accurate and b) the population/household structure not being sensitive to the size and mix of the housing stock. This is clearly not the case if planning policy intends to change the housing mix. This would not necessarily invalidate the basic idea as long as account was taken of the changes (the average household size implied by a one bedroom flat is likely to be much lower than that associated with a four bedroom house). Communities and Local Government should be actively involved in policing these calculations.

4.17 Relationship with household transition models

Household transition models that look at the probability of one household structure metamorphosising into one or more different structures are commonly used in micro-simulation models and are very different to the trend-based approach used to produce the Communities and Local Government projections. Household transition models are popular for policy analysis as the transition rates can be linked to economic and policy variables.

Data needs and computational complexity means that it would not be feasible to re-construct the household projection system along the lines of household transition models. One option worth considering, however, would be to sponsor a national level household transition model that would act as a comparator for the outputs of both the Household Projection System and the Affordability Model.

4.18 Dealing with immigration

The recent upsurge in international immigration has raised concern over the stability of the current model. The current model relies on the assumption that household formation behaviour only varies with age, sex and marital status. If household formation behaviour varies with ethnicity or country of birth, the procedure is no longer valid. There is evidence, although limited[8], that household formation behaviour is different for recent in-migrants, specifically that average household size is much bigger for some immigrants groups compared to the population as a whole. Complicating this further is evidence that household formation behaviour converges over time as immigrants assimilate. Equally, the housing demands of short term migrants cannot easily be accommodated in household projections.

There is insufficient data available to build these factors into the current projection system but both Communities and Local Government and ONS should be investigating this phenomenon as a matter of urgency and the model should be modified whenever sufficient data becomes available. This is particularly important given the importance of international migration to the size of the projected increase in the population.

[8] Holmans, A. & Whitehead, C. (2008) *New and higher projections of future population in England*. Town and Country Planning Tomorrow Series Paper 10. Available at http://www.dataspring.org.uk/Downloads/Households_Final_B&W.pdf

Appendix A – Interview Summaries

1. Professor Dave King, Anglia Ruskin University

1.1 Main advantages of the current system

To understand the advantages and disadvantages of the current Communities and Local Government household projection system, it is necessary to understand the original brief provided to produce household projections:

Consistency

- consistent with all official ONS population estimates and projections
- consistent with ONS marital status and cohabitation estimates and projections
- sub-national household estimates and projections need to be consistent with national ones.

The official marital status projections are generally robust and well accepted by the user community. To produce them ONS (and formerly GAD) uses marital relationship modelling methodology (LIPRO) whose output is peer reviewed. Because the marital status projections are produced sequentially after the population projections are produced, there can be a problem with the timescale of production. The demand for compliant Communities and Local Government household projections starts as soon as the relevant population projections are released. The delay necessitated by waiting for the marital status projections to be published may be seen by some users of household projections as problematic. If marital status projections were to be no longer produced, then the pressure to conform with those projections would obviously evaporate. Their loss would be felt, however, as discussed below.

Projections in the public domain

The nature of the projections means that it is necessary to use the most appropriate and most up-to-date data available, both nationally and sub-nationally, in order to justify inputs at all geographic levels. This hopefully assures users that the data being used is reliable and that therefore, hopefully, the resultant projections are also reliable. Users from different backgrounds unpick the data inputs to reveal socio-economic trends. They are also likely to be interested in exploring any differences between the trends as revealed and their own understanding of the trends, perhaps from other sources.

The projections are critical elements of the quasi-legal planning system and have an important influence, directly or indirectly, on the planned housing numbers in Regional Spatial Strategies. They are discussed and debated during public consultations and in public examinations as those strategies are being developed. Although much of the superficial focus is on the headline numbers, much of the scrutiny is on the various detailed components of change. It may well fall to the producer of the projections to explain and sometimes defend the methodology throughout the plan making and approval process. Consequently, whoever produces the projections needs to understand how the projections are used and be aware of policy context as well as the underlying data and trends. Communities and Local Government attempts to field questions about the methodology, underlying trends and projection outcomes but often does not have the resources to do this as effectively as it might wish.

Data familiarity

Preparing the historic data for the model is an involved process, not least when dealing with changes in definitions. Such changes have included changes in definition of household types between different Censuses and the introduction of new definitions part-way through a time series, as in the case of the introduction of cohabiting couples from the 1991 Census onwards. It requires a high level of familiarity with the data.

It is not simply the producers of the projections who will be familiar with the data. The wide use of these projections (or data derived from them) means that there is a user community which is also familiar with the current methodology, its data inputs and projection outputs. Any movement away from the current methodology would need to take the user community with it.

1.2 Would it help if the population and household projections were released at the same time?

As it stands, the projections are produced sequentially, and the household projection process is not an instantaneous one. Presumably, under the current system, it would require ONS to hold back the release of the population projections if simultaneity were to be achieved. That is unlikely to be acceptable. It would be an interesting prospect if ONS were to take on the simultaneous production of population and household projections, although it is worth noting that the production of marital status projections is sequential rather than simultaneous at present. It might also help users if the sub-national population and household projections were produced on an annual cycle rather than current longer cycle. This would minimise the magnitude of change between projection series and improve the currency of the projection outputs. It might also assist continuity on the production side of things, effectively allowing a team to focus fully on meeting an annual production cycle, rather than the more intermittent cycle.

1.3 Planning numbers into population projections

There is a big demand for population and household projections which are consistent with planning assumptions relating to housing numbers. Models, such as Chelmer Model, are used by Regional Assemblies and local authorities to produce demographic projections from policy-driven levels of housing provision in particular policy locations. These models are reliant on using outputs from the Communities and Local Government household projections, namely the projected age/gender-specific household representative rates. The latter provide a critical input to Chelmer and other similar models.

1.4 Marital status

The Communities and Local Government household projection model currently utilises national projections of marital status (including cohabitation). It ensures that the sub-national differences in marital composition, as exhibited at the most recent Census, are reflected in the sub-national projections of marital composition and subsequently of households.

1.5 Cohort modelling

- represents a definite improvement on the previous non-cohort-based system. It is the nature of housing careers and household lifecycles that they tend to be progressive rather than regressive. Once we have left the parental home, we tend to stay away. Once we have formed a relationship, we tend to stick with it (or if we do separate, we tend not to return to the parental home, but form a different household), once we have had a child we tend to retain and bring up a family, once we are widowed, we tend to stay widowed and live alone etc. While each generation shows some of the household characteristics of previous generations at any given age, it also brings with it differences triggered by its own household "history" at younger ages. In such circumstances, our household situation is likely to be best modelled, not just by the household characteristics of our particular age group (and the way that pattern has changed over time) but also by the evolution of our own household characteristics at younger ages in the past. The latter is known as a cohort effect

- if the data were available to support transition modelling to reflect more closely the household lifecycle, the selective use of transition rates might offer an improvement to the current modelling approach. For some household types the cohort approach may not model transitions as well as might be possible with more sophisticated data. The transition between being a lone parent with a dependant child and a lone parent with a non-dependant child, for instance, ought to be more reliably modelled using transition rates rather than via cohort modelling because it effectively represents a change of state at a potentially predictable point on the lifecycle

- any increased complexity in the current modelling approach would require significant model development and testing, even if data sources could be found to support that complexity.

1.6 Is there scope for simplifications?

The model is already fairly simple. Certainly the extrapolation technique that the model uses is sophisticated but the input data and the underlying principles used are relatively simple and transparent. They can be explained fairly readily.

Inevitably there has been some consideration of simplification over the years, particularly given the vulnerability of the household projections to the withdrawal of official marital status projections; but also given that the annual sample surveys, such as LFS, offer greater currency in data than the Census but also offer very limited prospects for supplying detailed age/gender/marital status/household composition-specific data, even at the national, let alone sub-national, level.

Eliminating marital status and household type and projecting only age/gender-specific headship rates could offer a way forward in a situation where there was no official marital status projection to conform with and where the user community was content to lose the demographic detail offered by the current projection approach. The current model could be adapted to undertake such an approach. The losses of detail would be substantial, both in terms of providing an explanation of past trends and providing an explanation of the changes implied in the projections. Previous considerations of simplification have been rejected on the grounds of loss of conformity and explanatory power.

It would also be wrong to suppose that simplified data inputs would reduce the need for familiarity with the underlying data. A depth of understanding would still be needed even when related to the simpler concept of age-gender-specific household headship. This is because the identification of the household head itself is dependent on the detailed treatment of household composition and rules relating to which individual in the household is defined as head of household in a particular household situation. Consistency of definition throughout the time series is necessary, whether the detail forms part of the projection process or not. The achievement of consistency of definition may still require considerable and complex data manipulation.

1.7 Could household size/number of children be added?

In modelling terms, they could be added with appropriate model development. They have always been "on the agenda" should model development funds become available. Data sets are not so readily available at the level required, assuming that the same 30 year time series is required. For example, it would be challenging, if not impractical, to get the required detail from the 1971 or

1981 Censuses. We would probably have to rely on accessing the one per cent Longitudinal Survey, rather than the Census datasets proper. Similarly even for 1991 Census data we might be reliant on the one per cent SARS, rather than the Census dataset proper. It would be possible to use shorter time-series for these detailed aspects of household composition. The Scottish household projections only use data from the 1991 and 2001 Censuses to establish trends in household composition, for instance. Meanwhile the enhanced sample size of the LFS will offer scope for improved currency in some aspects of household composition at the national level at least.

The Scottish household projection system is an interesting comparator. Scottish household projections do identify household size and whether there are dependant children in the household but have only accessed 1991 and 2001 Census data as the determining input to the projections. There is no national marital status projection in Scotland, so conformity to that projection is not an issue. The Scottish system produces outputs on household size but does not provide some of the detail of household type that the Communities and Local Government projections produce. For instance, there are no outputs identifying couples, including the issue of cohabitation versus marriage, or identifying concealed families of any type. There is no output identifying the marital composition of one person households, whether widowed, divorced or single. With the growth in policy interest in one person households, the dynamics of how they arise is likely to become a more significant issue.

1.8 Would it be possible to integrate HOPS and the Affordability Model?

It is possible to run the current Communities and Local Government model controlled to external projections of household representatives by age and gender. If the Affordability Model offers such projections at national or regional level, the household composition outcomes can be projected and the sub-national consequences can also be projected.

1.9 Should the post-Census estimates take more account of recent trends in LFS data?

In the current Communities and Local Government projections LFS data is down-weighted relative to Census (due to sample size). More recent LFS data is given a greater weight but the Census has a much larger sample. Prior to each projection series, considerable sensitivity testing of weights is undertaken but this has generally had little impact on the results. This is largely because the Census and LFS time series for household representative rates are broadly in step, as might be expected, for most age/gender groups. There is some evidence of stagnant HRRs among those aged under 35 in LFS data since 2001

and this evidence triggered "manual" adjustments (below the long-run trend) to household representative rates in those age groups (particularly female) in the Communities and Local Government 2003-based household projections. However, the long-run trends of age/gender-specific household representative rates in the Census and LFS for age groups over the age of 35 are very similar.

1.10 Are household projections worth producing?

Yes, household projections are needed as a policy tool to provide a clear steer to the planning system on the likely numbers of households needing to be housed in the future if trends continue, both nationally and sub-nationally. They also give a clear steer to public sector service providers and utility companies on the need for future service provision, where that need is better associated with household numbers or composition rather than population.

The projections also provide a wealth of largely untapped detail about household composition trends, both past and projected. For instance, it is pretty clear that among those aged under 35 there is evidence of a suppression of household formation in recent years and, over a longer period, relative to other age groups. And the detail contained within the household estimates and projections can be used to highlight the seriousness of the situation.

Arguably, to get the greatest benefit from this relatively rich source, there ought to be fuller analytical documentation of the sort that was made available in previous projection series.

The 1996 projection came with the "blue book" which explained in detail how the projections were derived and what they were showing. A useful by-product of such a volume is that it offers an opportunity to present answers to "frequently asked questions" which can help reduce the number of ad-hoc enquiries about what the projections are showing and why. However, given the pressure to publish the projections as soon as possible on the web, it is always likely that any interpretative volume will be published some time after the release of the projection series itself.

2. John Hollis, GLA Demographic Consultant

GLA does not use ONS sub-regional population projections as the five year trend based migration assumptions assume that what has happened in the last five years will hold true in the future – which doesn't make sense, particularly for parts of London where we know, and the government knows, that there is going to be rapid development and change. GLA and the boroughs do not necessarily subscribe to the ONS mid-year estimate base populations in all cases.

Better understanding of the population figures feeding into the household projections is key to better understanding of the results. The results from HOPS are sufficiently detailed and transparent for GLA purposes to feed into their own population model – which they use to run alternative scenarios for London at borough level. The comprehensive results from HOPS allow them to look at future housing stock change in London boroughs and determine the likely population.

There is perhaps a lack of understanding amongst local authorities about what the household projections are and this could be improved with better literature and reports to accompany the data. The household projections have become a data output rather than a service which is what was offered in the past.

ONS would be well placed to produce the household projections as it holds or produces all the data that feed into the current household projections model. ONS also has the relevant modelling skills and experience.

The GLA believes that the lifecycle approach adds to the quality of the modelling process.

John felt that the household transition modelling would be a useful exercise at the UK level but would need to be linked to migration. The Integrated Household Survey offers an opportunity to incorporate more recent data at more localised level in the inter-census years. It will mean that the relevant questions are asked every quarter. John feels that the current LFS/APS has insufficient sample size to add any real value below the national level.

It would add value to the HOPS model if users (such as the GLA) could re-run the projections with different assumptions about housing market conditions. He understands that each Census year has a weighting and that housing market conditions were different at each Census point. John would like to know how the state of the housing market is reflected in weightings and would like the facility to run scenarios changing the housing market assumptions. John felt that this may be one way of dealing with the affordability issues.

Additional information on children in households would be useful. The solution offered in Scotland would take too much information away from the household types, which the GLA see as one of the strengths of the current system. However, some external analysis that attempted to link child populations with households would be a useful part of the interpretation and quality assurance of the projections.

John would be interested to know more about how national marital status change is applied to regions and sub-regions. The GLA is currently undertaking research on headship rates of ethnic populations from the 2001 Census.

Ethnicity population projections as well as levels of international migration should be monitored and considered as a long run inclusion in the household projections. It would offer acknowledgement that not all communities have the same headship rates and, as the host community becomes less dominant, the average would become less relevant and need to be adjusted. Modular extensions could offer the solution to adding additional information into HOPS without taking away from current coverage.

3. Greg Ball, Birmingham City Council

Birmingham City Council (BCC) use HOPS data through the POPGROUP/ HOUSEGROUP model. Without the use of these models they are unable to get easy access to the level of detail they require at district level. They use the output from HOPS and through POPGROUP run scenarios using alternative population assumptions.

POPGROUP produces detailed analysis and describes how much of the change in the number of households is from population and how much is from the household representative rates. Greg feels that this sort of reporting helps users understand how much change is due to population factors and how much is to do with other changes.

BCC commissioned Manchester University to produce household representative rates by ethnicity using Census 2001. Greg would be interested in how well the current system captures changing socio-economic characteristics such as ethnicity.

BCC believe that previous results from HOPS have over-predicted the fall in average household size. There are concerns about whether users or policy makers know what the projections represent. The Communities and Local Government stamp may make them appear more like government targets than trend based projections.

Greg understands the complexity of changing definitions and highlighted that the definitions of different household types in HOPS are not consistent with the Census, causing confusion. He queries the impact of the change to the recording of students between the 1991 and 2001 Census. This may make large impacts locally. Greg also questions the relevance of 1971 data.

Greg is not sure about affordability – but sees value in understanding how sensitive the projections are to different housing market conditions. BCC show increasing interest in some of the detail in HOPS. For example, Adult Services in BCC are now interested in the number of lone person elderly household to plan for future demand.

Greg is still unsure of the value of central produced policy based projections at a local level and believes that this may be a more valid exercise at regional level. He would like the model to be capable of dealing with policy based projections but to use as scenario/variant analysis rather than as a standard part of the HOPS output.

Greg believes there may be some merit to the Scottish approach and that the simplified methodology may make interpretation more straightforward. He would like the provision of information that could be used to check how accurate the household projections may be ie monitor children in schools through PLASC against children numbers in the household projections.

Greg sees ONS as a secure and independent home for the household projections but he is aware that some authorities are not convinced that ONS is independent of Government. He would want there to be some independent peer review of the projections if ONS or a commercial consultancy were to run the projections. He would also be concerned about confidentiality controls being imposed by ONS as currently Communities and Local Government provide detailed data down to district level. Finally, he asks that local authorities continue to have free access to the background technical data for their areas in formats that can be imported into their own forecasting software.

Reliable household estimates are needed for valid comparisons between local authorities on key National Performance Indicators such as the number of households living in temporary accommodation, tackling fuel poverty, residual household waste and household waste sent for refuse.

4. Mike Murphy, LSE, 21 February 2008

4.1 Household transitional models

Household transition models work in a similar way to the cohort survival approach used in population projections (which is also used to produce official overall sub-national and national-level marital status projections) in that they model the movements of people over time, in this case their household situation. Including the findings from a household transition model could provide a reality check and additional detailed information on the components of household change for the trend based forecasts at national level. Such models tend to require survey results as an input so would be unlikely to provide regional or local breakdowns but at a national level, models are capable of producing projections as a controlling target.

4.2 Regional marital status estimates and projections

Mike thought there was a lack of transparency concerning how the regional/ local marital status projections that are a requirement in the current household projection method are produced. Mike felt that it was not possible to produce regional marital status projections without a controlling target which is not available given the integrated household survey is not yet in field (and the ability of which to produce high-quality sub-national statistics is unclear).

4.3 Who should produce household projections?

Mike felt that universities with large human geography and/or demography departments and with expertise in small area analysis and projections, such as Leeds would be well-placed to produce the projections, possibly in collaboration with ONS who produce the sub-national population projections.

5. Chris Shaw and Jonathan Swan, ONS

Chris Shaw is responsible for producing the national (age and sex) projections for the UK and constituent countries and the marital status projections for England and Wales.

Jonathan Swan is responsible for producing the sub-national population projections for England (and also used to have responsibility for the marital status estimates).

Point of clarification – The gap between publication of the national projections (October) and the marital status and sub-national projections (both planned for June) was discussed. Chris clarified that any issue of timeliness causing delays to the availability of household projections is more of an issue for the sub-national projections where there is less flexibility in timing rather than the marital status projections. However, Jonathan Swan also highlighted that the June 2008 release for the latest 2006 sub-national population projections is earlier in the year than for previous equivalent releases (around October).

5.1 Marital status estimates and projections

Currently only national marital status estimates at England and Wales (combined) level, and therefore, projections are produced. The annual de-jure (legal) marital status estimates are built from data on registration of marriage, notification of divorce and deaths. Periodic estimates of de-facto marital status are also produced using survey sources on cohabitation.

Registration data on marriage excludes marriages taking place abroad. ONS have made steps to fill the data gap. A discussion of how this issue may have affected the previous 2003-based marital status projections is available on the GAD website.

http://www.gad.gov.uk/Demography_Data/Marital_status_projections/2003/marriages_abroad.asp

5.2 Regional marital status estimates and projections

The majority of data required to build regional estimates and projections of marital status are available. However there is currently no reliable information available for estimating migration by marital status. Regional marital status estimates could, in principle, be produced using the 2001 Census results and the differences applied to the projections to explore the potential impact of different marital status projections to household representative rates by region. In the future, reliable data at regional and sub-regional level may be available from the Integrated Household Survey (IHS) to plug the current data gap. To produce regional marital status estimates and projections data, ONS would require evidence of demand.

5.3 Household projections and population projections

Chris and Jonathan felt that the press coverage of household projections is typically focused on the underlying population projections and that this is due to the issue of migration. ONS provide substantial literature with their data products (National population projections for example) which explain how the data has been produced and general guidance. Chris and Jonathan felt that similar accompanying guidance material could potentially enhance the household projections and help users understand them better.

5.4 Who should produce household projections?

ONS recognises that one possibility would be for Communities and Local Government to bring the projections into Communities and Local Government, drawing on their existing expertise in the area. However ONS would also be interested in the future, in principle, in running the model. This would have some obvious attractions given that ONS also produce most of the required input data and have a breadth of staff involved with both projections and demography work. There might, however, be issues if it was felt the model should include non-demographic variables such as affordability measures. ONS also wondered whether there might be concern from users about the independence of the projections from government if they moved from Anglia Ruskin University to Communities and Local Government in-house. Such concerns might be less likely if the work moved to the independent ONS. For ONS to take over the running of the model they would require a transfer of resources.

5.5 Policy versus trend projections

ONS have recently completed a consultation on the forthcoming sub-national projections including the possibility of producing a policy constrained sub-regional population projection variant to meet the growing demand from sub-regions. The constraints could be based on housing allocations in different regional and sub-regional plans.

ONS suggested we should consult with the National Housing and Planning Advice Unit.

5.6 Sensitivity analysis

ONS understand that current sensitivity analysis in HOPS is based on running the variant population projections produced by ONS through the model. The household projections would perhaps also benefit from running variations of the household representative rates themselves.

5.7 Simplification

Jonathan Swan wondered whether we could look at projecting average household size directly and look at how closely this approach would match with the results from the HOPS model.

6. Professor Geoff Meen, University of Reading

Geoff heads the research group that produced Communities and Local Government's Affordability Model. The Affordability Model is an econometric model of household formation where household representative rates vary with incomes and housing costs and where housing costs are endogenously determined by the interaction of demand (households and incomes) and (exogenous) supply. It produces alternative forecasts of household numbers based on explicit assumptions on the future path of the economic variables and housing supply. Its main purpose is to model affordability (price-to-earnings ratios) at the bottom end of the income distribution and to give an idea of the future need for social housing.

6.1 Usefulness of Communities and Local Government household projections

Although Professor Meen has questioned the theoretical basis of the trend-based household projections in a number of articles and presentations, he also said that he found them very useful as a reference against which to compare the output of the Affordability Model and would be reluctant to see them discontinued.

6.2 Possible integration of HOPS and the Affordability Model

Given that the Affordability Model itself forecasts household numbers using explicit assumptions on the economy and on housing supply, we suggested that it might be conceptually simpler and more consistent to expand the Affordability Model so that it could also be used to produce the main set of household projections. This could be done by having the option for housing supply to "accommodate" demand growth so, for example, that house price-to-earnings ratios were fixed.

Professor Meen was not in favour of the suggestion. He was concerned not only that he would lose a comparator for the forecasts from the Affordability Model but that the possible requirement to add additional detail would detract from the main work of the Affordability Model project. In addition, he said that at a sub-national level, the endogeneity of population and migration was at least as important as the impact of income and housing costs on household representative rates and that while modelling inter-regional migration was feasible (and is actually a part of the current Affordability Model) it became a much more difficult task at greater levels of geographical detail.

6.3 Reliance on population projections

Continuing on the theme of the importance of population projections, Professor Meen re-iterated how important they were to any projection or forecast of household numbers and cautioned against over-concentration on household representative rates when population was likely to be a much bigger source of error particularly, but not solely, at the sub-national level.

7. Richard Cooper and Graham Gardner, Nottinghamshire County Council & Nottingham Council

7.1 Suitability of HOPS

Both Richard Cooper and Graham Gardner have been users of the HOPS projections for a numbers of years and had considerable faith in the quality of data, modelling technique and effort that went into their production.

They very much saw the official trend-based projections, however, as a benchmark against which to start off or compare any policy work rather than as an input into policy in their own right except possibly at the regional level.

7.2 Importance of plan-led scenarios and continuity of service

Both interviewees actually valued the plan-led/policy-led population scenario capability provided by the PHRG at Anglia Ruskin University, using the Chelmer Model rather more than the official household projections themselves. In fact they didn't really distinguish totally between the two products and saw the Official Trends-based projections as a data input into the plan-led projections from the Chelmer Model and, hence, they saw the two as complimentary services.

They said that the ability to do plan-led scenario work was essential for the development of the planning process and they were very concerned that this facility might not be available in future either because PHRG decided to discontinue the facility or because changes to, or the scrapping of, the trend-based projections meant that the necessary inputs were no longer available.

7.3 Estimates versus projections

It was thought recent estimates that paid more attention to up-to-date LFS data or other alternative estimates would be useful but that the common use of the projections was for long-term planning and that long-term projections should not be subject to fluctuations cause by short-term fluctuations.

7.4 Other requirements

There was increasing concern over the applicability of average household size or average household representative rates to changes in population where population growth was being driven by a-typical groups (such as new immigration from eastern Europe, already settled ethnic minorities and students). As there was evidence of a substantially higher average household size for these groups, using whole population averages risks significantly over-estimating or over-projecting household growth. This was particularly the case for some areas within the East Midlands and both interviewees said they would welcome further research in this area.

8. Wendy Back – Communities and Local Government

Wendy is responsible for policy on overall housing supply for Communities and Local Government and uses the current household projections for internal policy information and for briefing notes. Her work tends to be at a regional level but other teams make use of the local level detail.

8.1 Improvements

Wendy was very interested in the possibility of replicating the Scottish method and including more detail on ideally the number of children per household or, failing that, of having an indication if there are children in the household. Would also ideally like more information on the age profile of the households, beyond what is already provided on the age of head of household.

8.2 Weaknesses in the current projections

Wendy felt the current methodology would benefit from more stability arising from the improvements that have taken place in the population projections. As the population projections have changed the methodology recently, particularly concerning migration, the household projections that use population projections can subsequently be quite volatile, especially at the local level. Wendy recognised that the ONS population projections method has been subject to review and improvement but would ideally like more understanding on how any changes to the method feed through to different population projections at the local level.

8.3 Affordability

Wendy felt that including any affordability measure would be difficult to build into the current method and that any affordability constraint could create a perceived conflict between these projections and those produced in the affordability model used by the National Housing and Planning Advice Unit (NHPAU). However Wendy would be interested in any discussions around a proposal to include affordability or any other variable in the projections in the future.

8.4 Who produces the projections?

Wendy felt that the existing system of using an academic to produce the projections helps the acceptability of the projections. Bringing the projections in-house, on the other hand, would in Wendy's opinion make it easier to produce alternative scenarios around the baseline projections.

Appendix B – Review of Household Projections Methods: Report of the Workshop on 9 November 2007 at the Department for Communities and Local Government, Eland House, London

Introduction

Bob Garland explained that the Communities and Local Government's Household Projections are a key part of the evidence base for housing and planning policy. It is important that the household projection methodology continues to be viewed as robust and transparent. This is why the methodology is being reviewed. This workshop starts this review by identifying some of the main issues that need to be addressed.

Copies of the presentations by Dave King and John Hollis are being circulated with this report. The workshop agenda is attached at Annex A and a list of attendees at Annex B.

Presentations

'Conclusions' on the current Communities and Local Government Household Projections and Estimates Model – Dave King, Anglia Ruskin University.

Dave King explained how the model works and one of its distinctive features, the 'life cycle' approach that take account of changes in household formation over time and also due to progression through the life cycle.

Another key feature is the 'top down' controlling that ensures consistency between the national, regional and district numbers.

The model show that changes in the adult population and the age distribution are particularly important drivers of household growth. This means that the model is particularly sensitive to the underlying Office for National Statistics' population projections. Trends in adult population growth can be variable due to migrations especially at more disaggregate geographies.

The relationship between adult population and household numbers is more stable with a continuing downward trend in average household size.

An important advantage of the model is the detail outputs of household formation rates by household representative types, age and gender. This enables thorough interpretation of the results that helps ensure robust projections.

Key emergent issues include the plausibility of outcomes particularly in terms of projected annual average household size and the number of one person households. International comparisons confirm the England projections in both cases.

Another issue is to what extent external controls should be applied to the 'life cycle' modelling to reflect 'expert' views of the likely limits of household formation rates for particular groups.

The top down approach can dampen particular trends that are evident in particular types of areas irrespective of region. The proportions of lone parent households, for example, show relatively high historic growth in London and other major cities. These trends are dampened in the projection due to the 'top down' controlling. A more robust geographical distribution might be achieved by modelling based on groupings of local authorities with similar demographic characteristics instead of the existing system based on administrative geography.

Q&A

Are we capturing the household formation patterns of inward migrants accurately – initially lower household representative rates?

Inward migrants are not modelled explicitly but any effects would feed into the overall trends. Evidence suggests that inward migrants tend to live initially in large households (ie low household formation rates) but over time assimilate the household formation patterns of the indigenous population.

More related to population than household estimates and projections, how can we better capture the balance of turnover of migrants in areas versus permanent residents?

This issue is being addressed in the Office for National Statistics programme to improve migration and population statistics.

'What do 'local authorities' want from Communities and Local Government household projections?' John Hollis, Greater London Authority

John described how GLA uses output from the Communities and Local Government model and made some suggestions for future development.

The Communities and Local Government model is regarded as the 'gold standard' for projection of household formation rates. It is based on 35 years of historic data and produces massive detail in terms of five year age groups, four marital statuses, and five household types.

Regional and local authorities greatly appreciate the Communities and Local Government service of providing the detailed output that can be fed into their own models.

GLA use the Communities and Local Government household formation rates in its own population projection model. This produces variant household projections in terms of different migration inputs. The population and household projections are also contained to the projected additional homes.

Some issues about the Communities and Local Government model were identified:

- projected household formation rates for particular groups in some areas move outside experience range (eg one person household and cohabitation)

- underlying population projections sometimes look 'wrong' for London (eg the balance between males and females)

- there may be uncertainty in the underlying marital status projections. For example, many marriages are conducted abroad and are therefore not recorded. There is also little information on cohabitation breakdown and the resultant single households.

Issues for the future development of the model were:

- the need for continuity which is achieved by the 'headship by type' approach

- fuller description of the projections including the limitations

- need to define households by numbers of dependent and non dependent children

- need to explicitly link the 'household with children' projection with the numbers of children in the underlying population

- need model households by number of people (rather than just having average household size), since this is important in terms of the numbers of bedrooms required in future housing supply

- need to describe how student households have an impact on household growth

- need for the model to have flexibility to provide outputs from different population projections, housing supply scenarios and various assumptions on household formation. Could this be included in a data service provided to local authorities?

Wendy Back, Housing Supply Division, Communities and Local Government

Wendy summarised the key challenges for policy users of household projections.

We need clear explanations of why the projections have changed without undermining their authority.

There is a need to raise the profile and to shorten the time between new population projections and revisions to household projections.

More interpretative detail alongside release of the projections is crucial to improve understanding and raise the profile.

More detail on the size and composition of the household (particularly children) would help in planning the type of housing required.

Key issues (not necessarily mutually compatible)

1. the projections need to be authoritative – must maintain the 'gold standard' reputation of the projections

2. need a level of transparency – the easier to explain the more impact the projections will have

3. digestibility – getting the balance right between necessary detail and a clear message

4. timetable and programme. Need a clear forward programme of when projections will be released

5. flexibility – a model that can be manipulated to test scenarios.

Q&A

Should we constrain household projections by housing supply?

No – prefer projections to be an unconstrained picture of future housing requirements rather than a reflection of the recent market.

There is a recognisable 'tension' between the model being flexible and being authoritative – producing options could undermine the main message.

Is there potential to link closer (or provide better explanation of the differences) to other models such as the 'Affordability Model' – (now with National Housing and Planning Advice Unit) or the Department for Transport's 'TEMPRO' projections?

Discussion group questions

Group 1

1. How should we project household formation? Should we be using time series data, cohort data or a mixture?

Household size and family composition are important for determining affordability and household composition.

Could there be 'core projections' together with modular extensions for more detail with less certainty?

At national level there is more potential for cohort/'transition' modelling based on panel data but much work is required to reconcile children with households.

Less clear how to model dissolution of shared (unrelated) households rather than dissolution due to divorce or death.

International in migration – difficulties of using past migrant data to project what will happen with the current wave of inward migration.

Migrants have distinct housing market behaviour of interest.

Could more than one approach at national level be utilised to compare outputs?

Consider demographic modules in other simulation exercises – eg the Department for Work and Pensions 'PenSimII' and employment forecasting models.

Take into account other countries' projection methods – not aware of any other country using micro simulation modelling.

More detailed national modelling would help explain the changes combined with more basic models at sub-national level. But be careful to maintain the credibility of the projections at local level.

2. What household types should we be projecting? What would they be useful for?

Couple households and numbers of children.

Age of eldest or youngest child/or no of dependent/non dependent children – required for assessment of size and type housing required.

Challenge – if modelling includes households with children it will need to model the transitions of leaving home – eg some multi adult households are often former lone parent households in which the children have become 'non dependant' with age.

Ethnicity – ethnic group is relevant to household formation but there are no population projections by ethnic group to draw on.

Immigration – household formation patterns vary according to duration of residence – how much driven by housing market itself?

3. How should the projections be created to be consistent with sub-national population projections? Is a 'top down' or 'bottom up' approach most suitable?

Can we go for 'clusters' of authorities according to their characteristics – move away from the traditional regional/administrative geographies?

Could London be left unconstrained as an exceptional case but everything else modelled as top down?

Conclusions from Group 1

We need a method to operate immediately for the 2006 projections.

We need more transparency and explanation of the methods on release.

We need long term and possibly 'bolt-on' enhancements for further analysis.

Group 2

4. Should we be projecting household representative rates or individual probabilities of belonging to certain-household types? Should we stick to household size only?

The 'Northern Ireland' household projection methodology uses individual probabilities of each person being in each household type. This approach appears less 'biased' than the Communities and Local Government model that gives priority to eldest male as the household representative. This means that household formation rates are sensitive to the male/female ratios in population projections.

Males shouldn't be relied on so heavily to make household projections eg a dip in the number of males in a population age group might not necessarily convert to a decrease in-households in the 'real world' as females would head the household instead. It would be better to rely solely on age rather than gender.

However – Male heads of households are a convenient way of constructing consistent time series data over several census time points.

The 'household representative' approach is perhaps not that different from the 'individual' probability approach since representative and 'non representative' rates are projected.

Another issue was that the trend all the way back to 1971 may not be the best way to base projections. Perhaps more weight should be given to the more recent trends.

5. What data sources are available? What are their strengths and weaknesses? What continuity issues could we encounter?

The censuses still provide the best benchmark data.

The Labour Force Survey (LFS) is used to calculate representative rates in the household projections but is given less weight as it is a sample survey. The census points are given more weight.

Perhaps the LFS should be given more weight.

The ONS' Integrated Household Survey (IHS) will start in April 2008. This will have a larger sample size than the LFS and could be given more weight in the household formation model.

6. How could we build in housing led variants? Should we be model variant household projections according to the number of houses planned to be built? Should we produce the back series of household estimates constrained by housing supply? Could we build in other variants, eg employment, economic growth?

There should be a clear distinction between 'projections' and 'scenarios'. Projections are based on demographic trends. They may have variants based on different demographic assumptions. Scenarios are based on different assumptions on 'non-demographic' factors such as future housing supply.

The household estimates are based the ONS population estimates put through the household projections model to produce a household numbers. This means that the household numbers can get out of step with the numbers of dwellings.

One option discussed was constraining household estimates to dwelling numbers.

Other Issues

It was suggested that population and household estimates and projections should be integrated and that household projections should transfer to ONS.

There should be a better understanding of how the household projection model compares with other models (eg the Affordability Model, the Department for Transport's TEMPRO model).

Annex A

Communities and Local Government Methodological Review of Household Projections Workshop – 9 November 2007 1pm - 4.15pm, Eland House – GJ/GK

Programme

1.00pm Lunch

PRESENTATIONS
Chair Bob Garland, Communities and Local Government

1.30pm Conclusions on the current model
Dave King, Anglia Ruskin University

2.00pm Discussant
John Hollis, GLA

2.20pm What would help housing policy development?
Wendy Back, Communities and Local Government

2.35pm Q&A

2.45pm DISCUSSION
(with tea and coffee served during discussion)

Group 1

1. How should we project household formation? Should we be using time series data, cohort data or a mixture?

2. What household types should we be projecting? What would they be useful for?

3. How should the projections be created to be consistent with sub-national population projections? Is a 'top down' or 'bottom up' approach most suitable?

Group 2

4. Should we be projecting household representative rates or individual probabilities of belonging to certain-household types? Should we stick to household size only?

5. What data sources are available? What are their strengths and weaknesses? What continuity issues could we encounter?

6. How could we build in housing supply led variance? Should we be modelling variant household projections according to the number of houses planned to be built? Should we produce the back series of household estimates constrained by housing supply?

7. Could we build in other variants, eg employment, economic growth?

3.30pm **Report by rapporteurs**

4.00pm **Next steps**
Bob Garland

4.15pm **Close**

Annex B

Attendees

Alan Holmans	University of Cambridge
Allan Cox	Communities and Local Government
Anneli Lyon	General Register Office for Scotland
Arif Al-Mahmood	National Housing and Planning Advice Unit
Ben Wilson	ONS
Bob Garland	Communities and Local Government
Chris Shaw	ONS
Dave King	Anglia Ruskin University
David Marshall	Department of Finance and Personnel – Northern Ireland
Esther Roughsedge	General Register Office for Scotland
Gilly Diggins	Communities and Local Government
Greg Ball	Birmingham City Council
Guy Goodwin	ONS
John Hollis	Greater London Authority
Jonathan Swan	ONS
Kevin Williamson	National Housing and Planning Advice Unit
Mark Auckland	National Housing and Planning Advice Unit
Neil Blake	Experian
Nia Jones	Welsh Assembly Government
Richard Cooper	Nottingham County Council
Sarah Cheeseborough	Communities and Local Government

Sarah Hawken	DWP
Stephen Morris	DWP
Steve Smallwood	ONS
Thomas Knight	ONS
Wendy Back	Communities and Local Government

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