Andrew, Mark, Allmendinger, P., Ball, M., Cameron, G., Evans, A., Gibb, K., Goody, J., Holmans, A., Kasparova, D., Meen, G., Monk, S., Muellbauer, J., Murphy, A., Whitehead, C. & Wilson, A. (2005). Affordability targets: Implications for Housing Supply. London: The Office of the Deputy Prime Minister.

CITY UNIVERSITY LONDON

City Research Online

Office of the
Deputy Prime Minister

Creating sustainable communities

Affordability Targets: Implications for Housing Supply

housing

Office of the
Deputy Prime Minister

Creating sustainable communities

Affordability Targets: Implications for Housing Supply

December 2005

Office of the Deputy Prime Minister: London
Philip Allmendinger: The University of Reading
Mark Andrew: The University of Reading
Michael Ball: The University of Reading
Gavin Cameron: University of Oxford
Alan Evans: The University of Reading
Kenneth Gibb: University of Glasgow
Jennifer Goody: Peter Brown Partnership
Alan Holmans: University of Cambridge
Diana Kasparova: Policy Studies Institute
Geoffrey Meen: The University of Reading
Sarah Monk: University of Cambridge
John Muellbauer: University of Oxford
Anthony Murphy: University College Dublin
Christine Whitehead: London School of Economics
Alan Wilson: Oxford Economic Forecasting

This research has been carried out on abstract scenarios for additional housing supply, based on those assumed in Kate Barker's Review of Housing Supply, published in 2004.

ODPM has considered more realistic housing supply scenarios, whereby the rate of housing supply builds up over time. This report does not give results for the additional housing supply needed to reach the Government's ambition of 200,000 annual net delivery. This will involve fewer net housing additions by 2016 than the levels in all the additional housing supply scenarios modelled in the research.

The Office of the Deputy Prime Minister
Eland House
Bressenden Place
London SW1E 5DU
Telephone 020 7944 4400
Web site www.odpm.gov.uk

Further copies of this publication are available from:
ODPM Publications
PO Box 236
Wetherby
West Yorkshire
LS23 7NB
Tel: 0870 1226 236
Fax: 0870 1226 237
Textphone: 0870 120 7405
E mail: odpm@twoten.press.net
or online via the Office of the Deputy Prime Minister's web site.

ISBN: 1851127992

Printed in Great Britain on material containing 75% post-consumer waste and 25% ECF pulp.

December 2005

Product code: 05 HC 03499(a)

CONTENTS

Preface

This report presents the results of an econometric modelling project, concerned with regional housing affordability, conducted for the ODPM between November 2004 and April 2005. The key outputs of the project are not just this report, but the model itself, the details of which are set out in the accompanying Technical Appendix, available via the ODPM website: www.odpm.gov.uk/housing. The team for the project was large, including fifteen individuals from nine organisations. The project was directed from the University of Reading. In addition to the team, the work was improved by help from an advisory group and a user group, consisting of members drawn from both central government and from the wider academic and policy communities. The team would particularly like to thank Andrew Amerasekera, Paul Chamberlain, Michael Kell, Andrew Morrison and Andrew Parfitt from the ODPM for their contributions and support during the project. The external reviewers also made valuable comments on an earlier draft of the report.

Geoff Meen
(Project Director)
The University of Reading

Introduction

The Barker Review of Housing Supply, (Barker 2004), has become one of the most important documents for housing policy in recent years and the Government has quickly adopted many of its recommendations (see HM Treasury 2005). The setting of national and regional affordability targets, as proposed by Barker, is central to ODPM's response to the Review. Nevertheless, the use of affordability targets gives rise to considerable technical difficulties and it puts economists and their models at the forefront of policy analysis. But the type of models that are required for the analysis have never been fully developed. Although national econometric models have been used within government since the late sixties, comprehensive regional and local housing models that are required for affordability analysis simply do not exist at the current time. Although the academic literature provides valuable insights into part of the jigsaw, the components have never been brought together into an integrated whole. This is the challenge faced in this Report.

ODPM has asked our team to derive an appropriate methodology whereby affordability targets can be translated into regional housing targets. This methodology has to be consistent across the regions. Therefore, regional targets have to add up to the national target and changes in house prices and migration flows in one region, for example, have to be consistent with changes in other regions.

The aim of the project is not to derive affordability targets – the Government will be consulting on this issue, using the model developed here as an aid. The central indicator of affordability – the ratio of lower quartile house prices to incomes – is given to our team, although we discuss additions to this central indicator. The exercise described here is, therefore, a modelling project designed to quantify, at a regional scale, the relationship between affordability and construction. Moreover, it is not the intention of the project to look at the wider environmental impacts of additional housing. These are clearly very important, but the wider social costs of development have been considered in a companion project. As such, our remit is tightly defined, i.e. if we want to reduce house prices in order to improve affordability, how much extra construction is necessary? However, the modelling project has been extended by a requirement to ensure consistency, on the one hand, between "traditional" household projections and estimates of housing need based on demographics and, on the other hand, estimates of housing demand derived from affordability projections. The concepts underlying the two are not the same.

The spatial scale of analysis is the Government Office Region. Most housing economists would probably argue that this is not the most appropriate scale, since regions typically do not correspond with conventional notions of housing market areas. However, the need to model at the regional level arises from the nature of the planning system. Since the regions have statutory planning responsibilities, the aim is to provide a tool that will help them with those responsibilities. It should be stressed that the aim of the model is not to usurp any powers. No model can ever do that; nor is it desirable. The model is simply an aid to decision making, providing an additional tool that has never before been available to policy makers. An appropriate analogy is the macro econometric model that has been operated by the Treasury since the late sixties. This has been a useful tool, but has never taken away any power from the Chancellor. Indeed, one of the external reviewers of the project has pointed out strongly that the model is of secondary importance to the need for more direct research, aimed at identifying actions that can improve the responsiveness of the housing market, such as the regulatory framework and taxation.

At first sight, the key outputs of the project appear straightforward. At the simplest level, the model needs to assess the required level of housing construction in each region in order to meet affordability targets. Indeed, the simplicity of the basic concept is one of its attractions from a policy perspective. The model should also be able to assess the sensitivity of the outcomes to different target values and to the model parameters. But, although the Barker Review produced estimates of the required increase in housing construction to meet a particular house price target, it did not consider affordability targets; nor did the Review attempt to produce regional estimates of requirements. Although the national estimates are consistent on their own terms, the method used to produce them cannot be used at a regional or sub-regional level. In particular the calculations become more difficult because of the need to consider migration flows, which, in principle, might themselves be sensitive to the availability of housing.

Interactions between housing, demographics and labour markets are central to the project. We cannot assume that the labour market is unaffected by the housing market. The model, therefore, has three interconnected modules, (i) a housing module, (ii) a labour market module (iii) a demographic module. The three modules are the minimum that meet the requirements.

In summary, the key elements that are required from the model are:

- The ability to translate national and regional affordability targets into housing requirements. Furthermore the national and regional pictures need to be consistent.

- The affordability targets are concerned with long-run trends rather than short-run cyclical movements.

- The model should be readily usable by non-specialists. This suggests that the structure ought to be as simple as possible subject to producing the required outputs. Furthermore, the model should run in Excel so that specialist knowledge of model simulation software is not required. The model has to run over a 30 year period under a variety of alternative assumptions and parameters, so that its sensitivity can be tested.

- The model should be able to deal with lower quartiles in house prices and incomes, rather than the more usual means.

- It needs to be able to incorporate baseline government household projections (which are based on demographic trends, implicitly assuming that past trends in incomes and house prices continue in the future) and Regional Planning Guidance supply assumptions. Furthermore, the model should reconcile its estimates, based on affordability targets, with household projections currently used in planning.

Therefore, in this report, the final results of the project are presented. In addition to discussing the central features of the econometric model and its properties,[1] the implications for targets are drawn out through the use of simulations. We consider the impact of different levels of housing construction for regional affordability. The scenarios examined are consistent with those discussed by Barker at the national level.

1 A Technical Appendix accompanies the report with full details of the equations.

The final report of the Barker Review presented a range of estimates of the required extra increase in housing construction, necessary to reduce long-run house price growth to the European average. The headlines suggested a figure of an extra 120,000 dwellings per annum in England alone in order to meet the target, although the report made it clear that the outcome was subject to a significant margin of error and depended on certain estimated key elasticities. Unsurprisingly, the large numbers were subject to criticism from some quarters (although welcomed by others). But perhaps intellectually the two most telling lines of attack came from those who believed:

- The effect of any increase in housing supply on prices would be larger than suggested in the Review. Therefore, relatively small changes in supply would be needed to meet any given price target. This is known as the "stock versus flow" debate.

- There is insufficient demand to meet the 120,000 extra homes. In other words who would live in these homes? This line of attack has come particularly from the more traditional planning approach to modelling housing requirements.

Both of these important points are discussed below since they have a central bearing on the conclusions of the project team.

The project has been intensive over a six-month period from November 2004 to April 2005. In that time, a large number of meetings have been held. In addition to numerous meetings between individual members of the team, two technical workshops have been run, two end-user group meetings, three Advisory Group meetings, two Steering Group meetings, and attendance at the Barker Steering Committee Away-Day. The model has also been reviewed by three international housing economists, but no model ever remains constant over time and we would expect the model to evolve as it is further reviewed and experience of its use is obtained within the context of the proposed National Advice Unit.

The second section examines the model structure, beginning with an overview and then focussing in more detail on the key equations that are responsible for the model's simulation properties. The third section concentrates on a number of central issues that have arisen during the project that affect our main conclusions. Stock versus flow and the source of demand are amongst these. The fourth section considers the base case that is used for the simulation work presented in the fifth section. The sixth section is rather different and discusses issues that, strictly, lie outside our terms of reference, i.e. the sub-regional aspects of affordability targets. The final section draws conclusions and brings out the key findings. Appendices discuss in detail the nature of the affordability targets and alternative household projections. Although the target set in terms of the ratio of lower quartile house prices to incomes is given, some of the problems are discussed and alternatives considered.

CHAPTER 1

Model Structure

An Overview

The model consists of three interrelated modules:

- a demographic module;
- a housing module;
- a labour market module.

The modules are constructed for each of the nine English Government Office Regions. The regions are all linked, primarily through migration flows and through relative house price movements. But, in addition, the model takes into account spatial contiguity. Therefore, for example, earnings in any region are related to earnings in contiguous regions. Commuting flows, for example, would be expected to produce earnings contiguity even in the absence of migration. In the context of the house price equations, the well-known ripple effect provides another example of spatial relationships between areas that can be captured by including contiguity terms into the equations.

A novel feature of the model is that, for some central equations, two versions are included. This is particularly the case for the house price and the migration equations. The idea is to test the robustness of the simulation results to different equation sets. Broadly, one set of equations is relatively simple and the other more complex, although the theory underlying the two sets is not fundamentally different. In fact, some of the most important properties of the model are determined by a fairly small number of elasticities[2] – for example, the price elasticity of housing demand. But both house price equations provide estimates of this parameter. The question is, therefore, whether excluding the additional terms from the more complex house price equation biases the key elasticity. If not, then we can use the simpler version and not worry too much about the complications.

Therefore, in terms of answering the limited set of questions required by the project (rather than answering wider questions on the full workings of the housing market), a relatively small number of parameters matter. Indeed by using the simpler versions of the equations, it is sometimes easier to highlight the central issues as long as they are not seriously biased by

2 Elasticities measure the responsiveness of one variable with respect to changes in another variable. For example, if the price elasticity of housing demand is –0.5, this means that if house prices rise by 1%, demand falls by 0.5%. Note that these are percentage changes.

the omission of other factors. The comparisons between the two equation sets can help. The key elasticities turn out to be:[3]

- the elasticity of real house prices with respect to housing supply (both the stock and new supply);
- the price elasticity of demand for housing;
- the elasticity of household formation with respect to real house prices;
- the elasticities of earnings and employment with respect to real house prices[4];
- the elasticities of gross inter-regional migration flows with respect to relative regional house prices.

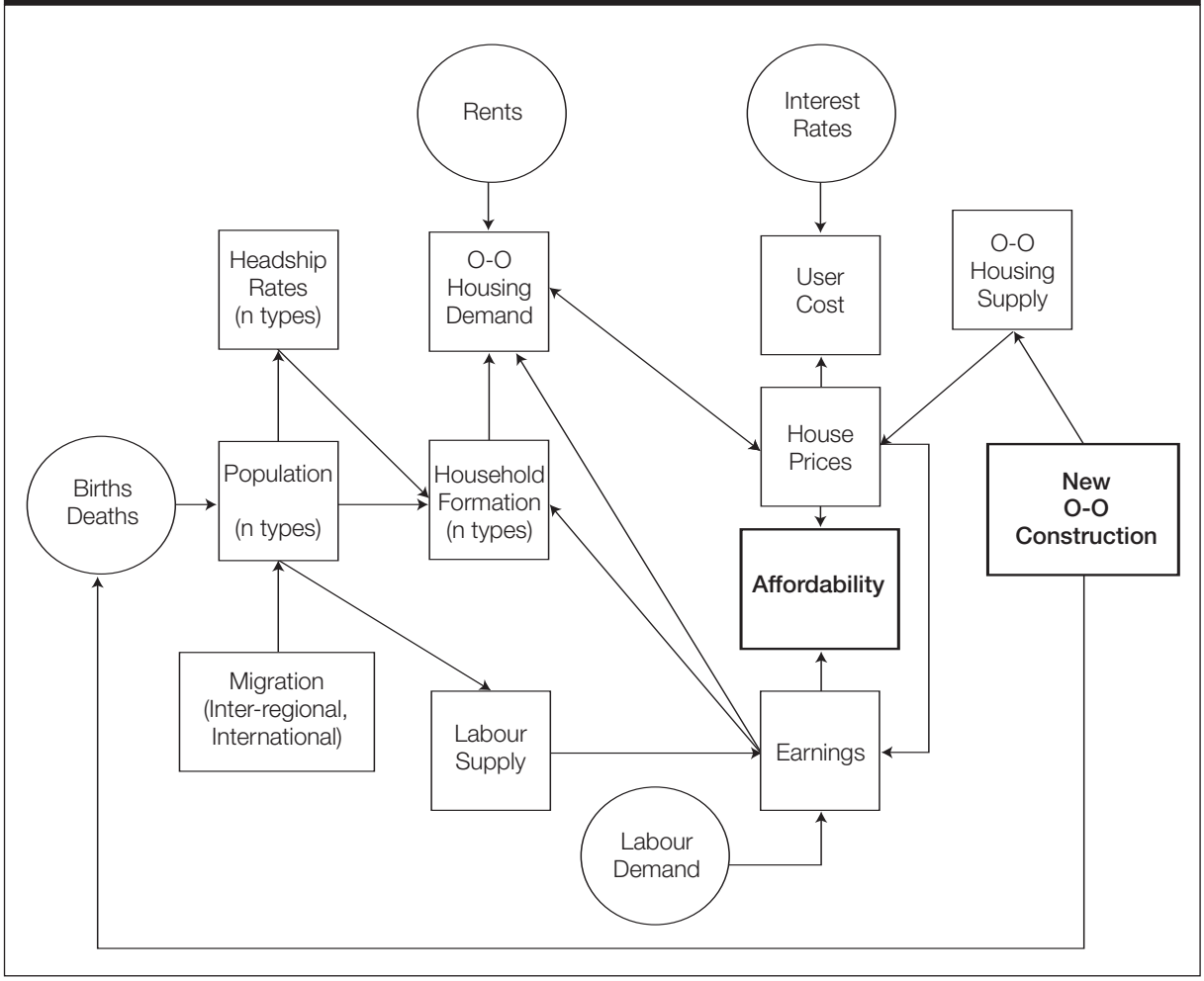
The flow chart, given as Figure 1, sets out the key interactions between the modules. However, the chart is only illustrative and omits many of the subtleties of the model. It concentrates on how increases in new housing supply affect affordability. Affordability, as defined by the target, is the ratio of two variables – house prices and earnings – but since the housing market can affect the labour market, the latter has to be determined within the structure of the model. Earnings and employment, for example, cannot be treated as exogenous. Increases in real house prices can affect earnings both directly and indirectly through their influence on migration patterns. Furthermore, the availability of new housing supply affects migration. Therefore, the effect of an increase in new construction on affordability could be mitigated by increased housing demand generated by migrants.

Real house prices are determined by the interactions of demand and supply. In response to shocks, the market returns to equilibrium, although not immediately and disequilibrium may persist for a number of years. But one of the key econometric questions is the effect of new construction on house prices. As discussed below, the central point is whether new supply has a direct effect on house prices or only indirectly through the housing stock. If the first exists, then relatively modest increases in new construction are likely to be necessary to meet affordability targets, but the required increases are likely to be much greater if only stock effects occur.

3 In addition, in empirical studies, income is typically found to be an important determinant of both housing demand and household formation. These effects turn out to be less important in our model because, in practice, housing supply, via house prices, has only a limited impact on incomes.

4 This is not the same as the previous bullet point, i.e. the price elasticity of housing demand. This is because a change in prices affects not only newly forming households, but also existing households.

Figure 1: Model Flow Chart



The flow chart also stresses the interactions between demographics and housing and labour markets. At one level the linkages are straightforward. In any region, the change in population is determined by natural increase and migration (both regional and international). Both demographic and economic factors determine headship rates[5] and the number of households. New household formation and demand from existing households determine total housing demand. Housing demand (relative to supply) then impacts on house prices. An increase in housing supply also has implications for the level of housing vacancies and implicitly for renovations and demolitions. This issue is discussed in more depth in the next section of the report.

Because of the questions posed, inevitably concentration is primarily on the owner-occupied sector. But it should be noted that, although the model implies that demand and supply are brought into equilibrium through house price changes, the main driver of owner-occupancy rates in the model is the supply of housing. This is the policy variable to be changed in the simulations. Therefore, if new owner-occupancy housing supply is increased in the future, ownership rates must by definition rise, with prices falling to restore market equilibrium. In reverse, this is consistent with the observation that owner-occupancy rates have risen only slowly in recent years (due to weak supply) with the excess demand being choked off by rapid increases in prices.

5 The flow chart simplifies by only showing a link from population to headship rates. In fact, headship rates are determined at a very detailed level, varying by types of individuals. These headship rates are related both to demographic factors, e.g. age, marital status, as well as economic factors, e.g. incomes and house prices.

This, of course, has implications for the rental sector. At the simplest level, by definition, a rising owner-occupier share implies a falling rental share. However, at this stage of development, the rental sector is only treated in a cursory manner. For example, the model does not distinguish the social and private rental sectors, nor consider the question of what percentage of new owners will transfer from the social sector as opposed to the private rental sector. A resolution to this issue requires a full model of tenure choice. This issue is further complicated by the growth of the Buy-to-Let market, which is a closer substitute to owner-occupation than the "traditional" rental market. But analysis is difficult because this is a new market with inadequate data for modelling. For our narrow focus, the failure to model the rental sector in detail is not a key constraint. For this reason, the flow chart simplifies by treating rents as exogenous, whereas the non-administered parts of the market will, in practice, respond to market conditions. But for wider questions, we would recommend that further work concentrates on modelling tenure choice.

The demographic module is one of the most complex in the model. The problems arise because the analysis is conducted at the micro level, using BHPS data for estimation. This has two advantages. First, it becomes easier to obtain more precise estimates of the key elasticities, e.g. house price and income elasticities of household formation. Second, we were required to reconcile our household estimates with those produced by traditional means. This is easier using a disaggregated approach. We can show the number of households that would occur in the absence of the need to meet affordability targets. These should be close to traditional estimates, but the need to meet the targets generates a divergence since the price trends will differ from those observed historically. In practice, the model determines household formation probabilities for a wide range of different household types. These are multiplied by the number of individuals in each demographic group in order to obtain total households in each group.

In the flow chart, certain variables are in circles; these are the exogenous variables in the model, i.e. those not determined within the model structure. Birth, death and marriage rates do not vary with affordability in the model. Although there is evidence in the literature that these vary with economic conditions, we took the view that the elasticities are probably quite small and their influence on the simulation results would be second order. But this is a potential area for further work. Birth and death rate projections in the model are, therefore, taken from official sources. Perhaps, more important is the assumption that international immigration is unresponsive to changes in UK house prices. The factors underlying international migration are complex. It is unlikely that housing availability is the only (or even main) factor driving in-migration. The UK labour market is another "pull" factor in addition to "push" factors from other countries, but the tight time frame for the project did not allow these issues to be examined. We would suggest that this is a more important area for further work, although we do not under-estimate the modelling difficulties.

Labour demand is shown as exogenous in the flow chart, although housing market factors have some impact. The employment and earnings equations have a set of regionally varying industrial structure variables, designed to capture long-run trends. However, given the concentration of the model on the medium to longer term, where an assumption of approximate full employment is reasonable, the model implies that primarily the population of working age determines the long-run growth of any region. This is discussed further below.

The Demographic Module

Flow charts are useful in setting out the basic model interactions, but they are insufficiently detailed to provide a full understanding of the workings of the model. Therefore, this and the next two sub-sections provide more details.[6]

As noted above, considerable effort has been devoted to the modelling of the demographic module and particularly household formation at an individual level. The model takes the following steps:

- Population at age (r) in year (i) is determined (by identity) as population of age (r-1) in year (i-1) plus net interregional migration plus net international migration minus deaths (plus births for age group 0). Since birth and death rates and international migration are exogenous, the only reason why population differs from official projections is because of inter-regional migration. As explained below, migration depends on relative housing and labour market conditions. Therefore, as housing construction is varied, the migration flows also change, generating different population projections from official publications.

- The population identities also require the migration flows to be distributed by age. For both the endogenous inter-regional flows and the exogenous international flows estimates are, first, made in terms of totals and, then, a fixed weight age distribution is applied to each of the gross flows. The younger age groups have the largest weights since they are the most mobile.

- The important step is to move from population estimates to the number of households. This requires estimates of headship rates. The model of household formation is based on work by Andrew and Meen (2003), updated to use BHPS data to 2001[7]. This micro work indicates that the probability that any individual will form a separate household depends on:

    - income;
    - housing costs (but not the availability of new housing);
    - marital status;
    - age;
    - gender;
    - number of children[8].

6 This paper does not set out the formal econometric equations and their associated diagnostic statistics. These appear in the Technical Appendix.

7 This modelling work is based on the population up to the age of 35. This concentration on the young is common in the literature, since this is the group where headship rates are changing most. Simpler projections are used for the older groups.

8 Other variables are included in estimation, but for the model we concentrated on disaggregating headship by these variables. Adding further variables increases the number of household types in the model considerably.

- This disaggregation means that the model distinguishes 256 household types – far more than could be identified from aggregate time-series data on headship rates. But this degree of disaggregation helps the reconciliation with traditional household projections. In fact, the demographic factors are quantitatively more important than the economic factors (incomes and housing costs). This accords with most of the literature, which suggests that the income and price elasticities of household formation are low. Our estimates, obtained by aggregating over the household types, suggest that the price elasticity is in the range –0.1 to –0.15. This has an important implication. If any increase in housing supply had to be matched by an increase in the number of households, to produce equilibrium, the fall in house prices would have to be very large indeed. Modest increases in housing supply would meet the affordability target. However, as explained in the next section, this is an inadequate representation of the workings of the market. The model also has to take into account the effect of house price changes on the demand for housing by households already in existence.

- Given the population and headship rate break down, disaggregated household projections are obtained. These are, then, compared with the "traditional" demographic-based projections and are aggregated for use in the house price equations. The household numbers are one important factor that determines housing demand.

As an illustration, Table 1 shows the probability that any individual will be in an independent household in 2001 in London. As might be expected, the probabilities are much higher for an individual who is already in a separate household (second part of the table) as opposed to an individual who is living with a parent and is considering setting up a new household. Therefore, a single female aged 25-29, without children, but with an income in the fourth (top) quartile had a 3.5% probability of forming an independent household in 2001 if she was living with a parent in 2000. But a male aged 30-34 with a partner and children had an 70% probability. This rises to almost 100% if the male was already in an independent household in 2000.

It should be noted that these values are not held constant over the projection period. The probabilities change with the underlying regional economic conditions – housing costs, incomes and unemployment. Typically the probabilities of household formation rise, although relatively slowly, over the medium term and level off over the longer term.

As noted above, inter-regional migration is also endogenous in the model. In this case, two versions of gross inflows and outflows equations have been estimated. The literature generally suggests that both housing and labour market variables are important in determining flows but, although a simplification, housing market factors e.g. the desire for better housing or neighbourhood are more important in determining short-distance moves, whereas relative labour market opportunities are more important for longer-distance moves. But it should be remembered that the greatest proportion of moves are very short-distance. Most are within local authorities and travel-to-work areas. Therefore, contiguity effects are expected to be important. But, in general, the estimated model includes both housing and labour market effects, since both long and short distance moves are included in the data.

Table 1: Probabilities of Household Formation (London, 2001)	
	Probability (%)
Previously living with parent a year earlier	
Female, 25-29, single, no children, income quartile 4	3.5
Male, 30-34, single, no children, income quartile 4	10.6
Male, 30-34, partner, children, income quartile 4	69.9
Previously not living with parent a year earlier	
Female, 25-29, single, no children, income quartile 4	60.3
Male, 30-34, single, no children, income quartile 4	68.6
Male, 30-34, partner, children, income quartile 4	98.8

The simpler set of equations includes four classes of variable:

- relative house prices – in general these are the own region prices relative to those in the South East. This generates a form of ripple effect;
- relative unemployment rates – expressed in terms of deviations from the national average. Both the level and change have an influence;
- the availability of new housing – although this effect has been tested for all regions, in practice, it turned out to be significant only in the southern regions. This is, perhaps, unsurprising since supply shortages are more severe in the South. It might be noted that it is not inconsistent to include both house price and availability terms in the equation as some models of rationed behaviour would suggest, because of the aggregation over spatially distinct markets, where some may experience shortages and some may not;
- the nominal mortgage interest rate.

In this system, an increase in new construction raises inflows both by reducing relative housing costs and by increasing availability . This gives rise to an important issue that is demonstrated in our simulations. Unbalanced increases in construction, i.e. concentrated on a single region, generate relative price changes and migration, offsetting partly any improvement in affordability.[9] The model is estimated as a panel across the regions. The weakness of the system is that it only uses data since the early nineties.

Although not fundamentally different in concept, the second set of equations is more complex. The equations are based on the work of Cameron and Muellbauer (1998). The main variables determining migration are:

- working age population relative to the size of the housing stock – this acts as an availability of housing indicator;
- the change in and level of relative unemployment rates – this places particular emphasis on unemployment in contiguous regions;
- earnings relative to those in contiguous regions;

9 Note that it is much more likely that new construction will be significant in a migration equation than a house price equation since new construction and migration are both flow variables.

- relative proportions of employment in the production sector – high proportions deter migrants;
- the level of house prices relative to contiguous regions and their expected rate of change. Migrants are deterred from an area by high relative prices but are attracted by the prospect of a capital gain;
- housing turnover – migration is high at times of high turnover;
- the cube of relative house price growth. The use of such terms has a history in national house price models (see Muellbauer and Murphy 1997) and captures housing market "frenzies" that might also be reflected in migration flows;
- housing market downside risk.

In terms of model properties and theory, the additional expected capital gains and the relative earnings terms are the most important differences between the two sets.

The Housing Module

The most important equation in this module (and the model as a whole) is the house price equation. Although the final affordability indicator is in terms of lower quartile house prices, the main econometric modelling is conducted in terms of mean mix-adjusted house prices. Long time-series of quality-adjusted median and lower quartile prices are not available. As explained below, an important assumption of the model is that the relationship between mean, median and lower quartile house prices remains constant over the future.

In the UK, large numbers of empirical studies of national house prices have been published. The studies of Muellbauer and Murphy (1997) and Meen and Andrew (1998) have had a particular influence on the specifications here. However, as Meen (2001) has argued, at the theoretical level, there has been little distinction between the specification of national and regional house price models. Regional price models have been a simple extension of national models with an allowance for spatial spill-over. Explaining the ripple effect has been a topic of particular interest in the literature. Typically, regional house price equations in each region have been related to prices in either the South East or London – a form of spatial contiguity. However regional price models suffer from data inadequacies compared with their national counterparts. For example national models may include wealth indicators, which are not available at the regional level.

Again two versions of the price equations have been estimated, but, in both cases, the key principle is that house prices clear the market, although market clearing does not necessarily occur in all periods. It might, in fact, be argued that we do not need to estimate complex econometric equations. Given supply (from both the stock and new supply), if the price and income elasticities of housing demand are known, the required change in prices to clear the market can be calculated. The central issues, therefore, are the long-run house price and income elasticities and there is considerable evidence on these parameters in the literature.

Each set of equations models the log change in real house prices in each region (approximately equal to the percentage change in real prices). The long-run solution to the more complex equations implies that real prices depend on:

- Real non-property income. All regions are influenced not only by own region income, but also incomes in Britain as a whole.

- The stock of dwellings relative to the number of households. In this specification owner-occupied dwellings have a larger effect on prices than social housing. A socially rented house added to the stock has approximately 30% of the effect on prices as owner-occupied housing.[10] Also, the housing stock in Britain as a whole influences prices as well as the region specific stock. The long-run elasticity of house prices with respect to income is estimated to be two and with respect to the housing stock, is estimated as minus two. The fact that the former is not one sometimes causes surprise since this would imply a constant long-run price to income ratio. In fact, this is not a requirement as a systems property. The elasticity with respect to the housing stock is the same as that used in the national Barker study. Therefore, this equation is consistent. This long-run elasticity is common to all regions.

- Each regional equation contains a region specific intercept and time trend. In all regions, these trends have positive coefficients of the order of one per cent per annum in the long run. This may reflect trends in quality, for example, through conversions and improvements.

- Other levels effects in the long-run solution include the log tax adjusted nominal mortgage rate, an index of credit conditions, which measures credit supply to UK households, which has greatly expanded since 1980; and the interaction of this index with the real mortgage rate. The combination of a log level nominal effect and the credit weighted real interest rate effect is consistent with findings for mortgage demand by Fernandez-Corugedo and Muellbauer (2004). The log nominal effect means that a reduction of rates from 5% to 4% has a stronger effect on house prices than a reduction from 10% to 9%. The short run nominal interest rate effects are stronger in London and the South East.

- Another important levels effect is the log price of house prices in London relative to GB, which is allowed to vary by region. This has a positive effect in the regions adjoining Greater London, capturing some of the role of London as a driver of UK house prices.

- As an indicator of downside risk in the housing market, the average value over the previous 4 years of the negative return in the region's housing market, is incorporated. If the return is positive, the variable is set to zero.

- In the dynamics, the persistence of the previous year's house price growth rate is measured through a coefficient common to all regions. However, the relative weight attached to the own region and other regions growth varies by region.

10 Much empirical work assumes that only owner-occupied supply is relevant for the determination of house prices. But Muellbauer and Murphy (1997) estimated this effect to be approximately 30% rather than zero. In the current context, the hypothesis of 30% can be accepted. However the variable can also pick up correlations with any omitted trending effects, so the model has been calibrated to this plausible value.

- As highlighted earlier, an important hypothesis concerns the question of stock and flow equilibrium effects on house price determination. To recap, if the flow of new housing affects prices directly, then an increase in new housing is likely to have a strong effect on house prices. But if the effect is only indirect through the housing stock, then the effects are expected to be more modest. The model tests both stock and flow effects; the latter is approximated by the percentage change in the housing stock relative to population changes. The idea is that short-term increases in the housing stock (through new construction) relative to population lead to short-term local excess supply, with downward pressure on local prices. Conceivably, this could also reflect an expectations effect in that market participants may believe that a higher rate of house building relative to population growth could have an impact on future house price changes. We found a significant effect, suggesting that a 1 percent rise in working age population relative to the housing stock has a short run effect of the order of 1.5 to 2 percent on the region's house price index. In summary, both stock and flow effects are found to be significant.

- We investigated whether the growth in the regional proportion of households in the main ages for first time buyers (20 to 39) had any effect. The estimated effect of this variable is statistically significant and positive.

- Income dynamics turn out to be important. Both current and the previous year's income growth rates are significant.

- It is often thought that the stock market, or financial wealth more generally, has an effect on the housing market. The rate of growth of the FTSE index in real terms has significant positive effects, especially in London and the South East. It is sometimes suggested that relative returns or relative risks in housing and shares influence the allocation of investment between the two sectors. A simple measure of downside risk for the stock market is included. Again this takes a zero value when the index is rising. This effect is important in London and the South East, where share ownership and active portfolio investors are most likely to be concentrated, but irrelevant outside these regions.

A key property of this equation is that, for all regions, the implied long-run price elasticity of housing demand is – 0.5, whereas the income elasticity is 1.0. These values can be calculated from the estimated long-run elasticities of house prices with respect to income and the housing stock (i.e. the values of two and minus two given above).

The second version contains a heavily restricted set of regressors. The key variables are:

- Regional real per household consumers' expenditure. This is a proxy for permanent income. Although there is evidence, at least at the national level, that house prices affect consumers' expenditure, in simulation, we allow per capita consumption to fluctuate only with changes in average earnings, in effect keeping the marginal propensity to consume constant.

- The housing stock, but there is no term from new housing supply.

- The number of households.

- The nominal mortgage interest rate.[11]

- Contiguity effects from prices in other regions. The key driver is prices in the South East, which appear in all regions outside the South.

- In estimation, the nine English regions are divided into three meta-regions – the South, Midlands and North. The estimated coefficients within the meta regions are common but not across the meta regions. This distinction was found to be valid in earlier regional work by Meen (1999).

As noted earlier, as long as they are not biased, these sets of coefficients are sufficient to answer the project questions. Furthermore, the equations are set up to ensure market clearing in the long run. As a check, the model includes an explicit measure of excess demand or supply in each time period, since market clearing does not occur in all time periods. As noted above, the more complex price equations include price (-0.5) and income (1.0) elasticities of housing demand that are common to each region. The alternative versions have somewhat lower price and income elasticities of housing demand, i.e. -0.34 and 0.87 But these are still well within the range suggested in the literature.

The Labour Market Module

The central equations in this module are for full-time average earnings, total employment and unemployment in each region. These are based on the work of Muellbauer and Cameron (2001) and only one version of each equation has been estimated. In each case, the equations are expressed in terms of deviations from the GB averages with the national averages imposed from outside the model.[12]

Average earnings are related to:

- Expected house price changes.

- The level of relative house prices.

- The growth of employment in own and contiguous regions.

- The mortgage interest rate (real and nominal).

- The growth in stock market prices.

- The proportions of working age population in different age bands.

- The proportion of employment in the financial services sector. High percentages raise earnings, but the effect is interacted with a house price term. A boom enhances the effect.

- The proportion of employment in the government sector.

---

11 Arguably real interest rates should be included as well as nominal rates and, indeed, both are included in the more complex version. But our earlier national work has stressed the importance of nominal rates because of front-end loading. We have been critical of studies that only include real rates without testing for the statistical significance of nominal rates.

12 The model requires some form of nominal and real anchor. These are provided by exogenous national projections.

The dependent variable in the employment equation is the number of employees divided by the working age population i.e. the employment share. This is related to:

- Employment in contiguous regions.
- Relative expected house price appreciation.
- The level of relative house prices, interacted with the owner-occupation rate.
- Earnings in own and contiguous regions.
- The proportion of employment in the production sector, interacted with the mortgage rate. Separate terms also interact production with the real exchange rate.
- The growth in the stock market index.
- The age distribution, proxying demographic effects on the working population.
- The proportion of employment in the financial services sector, again interacted with the house price term.
- The proportion of employment in the government sector.

Unemployment is related to:

- Real relative wages. The effect is positive.
- The real exchange rate, scaled by the proportion of employment in the production sector (positive).
- Real house price appreciation scaled by the proportion of employment in the financial services sector (negative).
- Expected relative appreciation of house prices (negative).

Therefore, the three equations are determined by very similar variables and can be considered as a reduced form labour market model. The model is clearly complex, but, in practice, most of the non-housing market variables are extrapolated according to simple trends over the future and have little if any effect on the model properties. But this does imply that if the trends changed – for example, if industrial structure began to favour the North – then housing demand would also change geographically.

In terms of the housing market influences, expectations of capital gains clearly play a central role. In the wage equation; higher expected capital gains reduce wage claims. This can be considered as a form of user cost effect. This improves the ability of firms to hire workers more cheaply. However the level of relative house prices has a positive effect on earnings since higher house prices reduce the real wage. In the employment equation expected capital gains increase employment (although the coefficient is insignificantly different from zero), whereas the level of relative house prices reduces employment. This suggests that higher land and housing costs in any area limit the location of firms and jobs in that region.

Other Modelling Issues

Although the sections above discuss the main equations of the model, which determine its properties, the model also includes a large number of other relationships. These are partly identities (adding up relationships) and simple linking equations between different parts of the model, which have minimal effects on its overall properties. However, there are some simplifying assumptions, which are possibly slightly more controversial, but allow us to concentrate on the main issues.

The relationship between prices and incomes at the different quartiles

The equations described above relate to average house prices and incomes. But the target is in terms of the ratio of lower quartile house prices to incomes. The absence of long runs of data for the lower quartiles makes it difficult to model the quartiles explicitly. In fact, the main difference between mean and lower quartile ratios, historically, arises from the denominator – earnings. This reflects major changes in the income distribution over time. Changes between the growth in mean and lower quartile house prices have been more modest. Therefore an important assumption is that the income distribution does not change further over the projection period. Clearly if lower quartile earnings grow at a slower rate than the average over the future, the affordability projections for low income households in the base will be worse than we have shown. But modelling changes in the income distribution is a major exercise in itself and outside our remit. Although less crucial to the results, we also assume that mean, median and lower quartile house prices all grow at the same rate from 2005 onwards.

The treatment of second homes

Second homes are clearly more important in some parts of the country than others, notably the South West. However it is not feasible to model this market formally as a separate set of estimates. The data are insufficient for this. However, second homes are implicit in the price equations for the South West, particularly in terms of the estimated income elasticities. Furthermore, since in the more complex equation set, house prices in the South West are related to those in London, there are spill-over effects from the London market to the South West. Therefore an increase in London prices provides additional equity for the purchase of second homes in the South West.

The consistency with demographic projections of household formation

Traditionally, household projections are obtained by applying headship rates to detailed population projections. But the headship rates are extrapolations of past trends and do not respond to changes in economic conditions. Clearly, this is not valid in the current context, where we simulate significant changes in affordability and we wish to examine the effect of price changes on household formation. However, regional representatives have told us (through the User Group) that it would be highly confusing to work to different baseline estimates of the number of households, i.e. projections that differ from the official figures. It is possible to constrain the model's baseline figures to the official values without difficulty. However the latest official household projections are based on 1996 population figures, although interim 2002-based projections were published in 2004. The 2002 based figures, in fact, use the same headship rates as in the 1996 projections and will be superseded by estimates using headship rates derived from the 2001 census. The estimates are discussed in detail in Appendix 2.

Given that the model is heavily census based, it would have been inconsistent simply to apply the latest 2002-based estimates. Therefore, Alan Holmans of Cambridge University was asked to derive household projections consistent with the census and the latest 2003 based population projections, but using the traditional methodology for headship rates. Again details are given in Appendix 2.

Importantly, the 1996-based household projections for 2001 were significantly higher than the outturn shown in the census and the overestimates were heavily concentrated on the South. Alan Holmans has suggested two possible reasons:

(i) the effects of higher house prices, constraining household formation (which is consistent with the model);

(ii)the impact of higher levels of immigrants with larger average household size (our model includes some ethnicity indicators).

The cause of the over-estimate obviously affects future projections. Alan Holmans has assumed that in the first half of the 1991-2001 decade, the full explanation is in terms of immigration, whereas in the second half, the two factors have equal weight. The results of the household projections under these assumptions are given in Table 2 and are compared with the official 1996-based projections.[13]

Table 2: Alternative Household Projections (000s)

	2001	Official 1996-Based		2003-Based Revision	
		2011	2021	2011	2021
North East	1,081	1135	1167	1,108	1,141
North West	2,833	2997	3110	2,991	3,156
Yorkshire and Humber	2,087	2260	2372	2,224	2,360
East Midlands	1,738	1904	2033	1,902	2,068
West Midlands	2,157	2299	2398	2,312	2,464
East of England	2,238	2494	2701	2,465	2,722
London	3,091	3377	3645	3,527	3,941
South East	3,303	3735	4060	3,609	3,951
South West	2,091	2317	2515	2,310	2,543
England	**20,619**	**22,519**	**24,000**	**22,448**	**24,346**

Software

The project requires that the model should be solved as an Excel spreadsheet. It is fair to say that we were sceptical that this was achievable at all and, even if it were achievable, solution speeds would be unacceptably slow. Most econometric models use specialist solution software. The advantage of Excel is that it is widely used by non-specialists and, therefore, requires limited investment in human capital. We attempted to build nine fully linked regional models in Excel and, to our surprise, the model can be solved and there are no problems in terms of solution speed. As required by the project, the model has been solved to 2031, with particular attention being paid to 2016. A switch controls the version of the model to be used. Details are given in the Technical Appendix.

13 Holmans also produced estimates extrapolating past trends (see Appendix 2).

Check list of issues

During the course of the project, the Advisory and End User Groups raised a large number of detailed questions concerning the model structure and its features. These are summarised in Table 3, compiled primarily by Andrew Amerasekera of the ODPM.[14]

Table 3: Frequently Asked Questions

Interpreting the headline outputs, including caveats	
Does the model consider housing characteristics/attributes?	The model does not consider different housing attributes/characteristics; rather it focuses on housing numbers. Nevertheless the next section discusses some major issues that arise from the heterogeneity of the housing stock. The model focuses on lower quartile house prices, although the formal econometrics concentrates on average mix-adjusted prices. An ODPM *New Horizons* project, entitled "Which House Price? Finding the Right Measure of House Price Inflation for Housing Policy", will consider the issue of bias in house price indices.
What about demolitions, conversions and vacancies?	The model allows the user to derive net additions to the housing stock that are consistent with various levels of an affordability goal. The net addition comprises a combination of new starts, conversions and demolitions, although the model does not provide separate estimates of each. Similarly, the model implicitly assumes that vacancies vary with the level of affordability.
Does the model capture the impact of second homes?	Second-home ownership is not explicitly modelled, although it will be picked up to the extent that it contributes to the ripple effect in house prices across regions.
Does the model capture the impact of changes in pensioner incomes?	The model considers earnings, not incomes – this is a requirement of the study, driven by data availability. Thus, the modelling does not explicitly reflect the impact of changes in pensioners' incomes.

14 Although the authors bear responsibility for the views expressed in the table.

Issues of spatial scale	
The model deals with national and regional spatial scales. Many regions comprise a mixture of buoyant and depressed housing markets. Is not some sub-regional modelling necessary to inform the setting of regional affordability targets?	The model focuses on the relationship between housing affordability and housing numbers. The allocation of additional housing between regions is important in the model, but not the allocation within regions. Implicitly, the model assumes that the distribution of housing within the region is similar to the past.
Also, regional planning bodies are interested in the allocation – or sub-regional distribution – of additional housing.	Further work is required to better understand housing markets at local level. ODPM will be commissioning research that will add to the evidence base.
How does the model treat inter-regional migration?	The model developed in the accompanying *Sustainability Project* will seek to establish the wider environmental impacts of increasing housing supply.
	Given that many of the impacts of additional housebuilding would be experienced at local level, it will be necessary for the model to provide some sub-regional analysis. However, it is recognised that there is a danger of detailed sub-regional modelling being too prescriptive as regards the location of housing, which is a matter for the regions to decide.
	The model includes explicit equations for inter-regional migration. These take into account possible population flows induced by extra house building in some regions.
Why not set affordability targets at sub-regional level?	It might be possible in future to develop the affordability model to the sub-regional level. However, technical difficulties, including non-linearities and spillover effects, might detract from the usefulness of sub-regional simulations.
	Work recently completed by some of the team for the Joseph Rowntree Foundation on local markets suggests that increasing housing supply is associated with strong population inflows at the local level, negating some of the improvement in affordability. This would suggest that sub-regional affordability targets might be extremely difficult to employ in a meaningful way.

Non owner-occupier sectors	
How does the model incorporate private and social rental sectors?	The core model considers two housing sectors: owner-occupied and rented. The core model does not distinguish between social and private rentals, as this is not thought to have a significant bearing on the long-run relationship between housing supply and the affordability of market housing. However, as noted above, one version of the price equations makes an allowance for the impact of additions to the social housing stock on the affordability of market housing.
Does the modelling inform analysis of impacts of the range of 'affordable housing' initiatives?	The model is primarily a tool for assessing the impact of increasing housing supply on market affordability, and not for explicitly assessing 'affordable housing' issues. In principle, the equations might be adjusted to take account of the impacts of recent 'affordable housing' initiatives on affordability of market housing, although there is clearly a lack of historical evidence on these impacts.
Will the model account for the impact of Right-to-Buy type initiatives?	The impact of Right-to-Buy is likely to be of secondary importance to our central questions. Transfer of stock from social to private sector via Right-to-Buy is likely to have quite a small impact on overall affordability of market housing in the long-run.
Other technical issues	
Does the model consider earnings based on place of work, or on place of residence?	The model considers earnings based on place of work – this is again driven by data availability. This raises some challenges in interpreting regional price-earnings affordability indicators where commuting across regions is prevalent (e.g. London and surrounding regions – many of the people in London's earnings distribution show up in the house price distribution for non-London regions).
Does the model adopt a 'stock' or 'flow' approach to determination of house prices?	Both approaches have been considered in the research. One version of the price equations includes both stock and flow variables, whereas the second (simpler) version only includes stock effects. Note, however, that in an equation that includes both terms, the stock determines the long-run equilibrium and the flow primarily influences the speed of adjustment. The headline analysis in the Barker Review adopted a 'stock' approach – the implication being that new construction takes a relatively long time to induce improvements in affordability.
How will the model be validated?	Whilst it will be possible to validate regularly the individual demographic, housing and labour market modules, robust validation of the overall model will need to wait a few years until the data extends over a suitable length of time.
End user issues	
How can it be ensured that the model is easy to use by non-specialists?	The model runs in Excel, which is useful from an end user perspective. The Technical Appendix details its operation.
Does the model inform policy in Scotland and Wales?	The emphasis in this project is to inform policy in England. Scotland and Wales are only included to the extent necessary for modelling the English regions.

CHAPTER 2

Key Issues

In this section, some of the main model properties and features are highlighted. These determine the outcomes in both the base case and the simulations in the two following sections.

What are we trying to achieve?

The target – the ratio of lower quartile house prices to incomes – has been given to us and the problems associated with this target (and possible alternatives) are discussed in Appendix 1. But it is important to realise that the policy goal appears to have shifted over time. The original simulations in the Barker Review were concerned with reducing house price inflation to the European average in order to prepare Britain for EMU entry. Therefore, the target was in terms of house price growth. Subsequently, concern has shifted towards broader social objectives of adequate housing, initially for key workers, but now more generally through wider home-ownership. Affordability targets are more applicable to these wider objectives, but the model is not designed to answer all the wider issues concerned, for example, with tenure, which are currently high on the policy agenda. As noted in the last section, additional work would be required to extend the model.

Point targets versus ranges

Our view is that, whatever the merits and demerits of point targets, they are inconsistent with the current (and likely future) state of housing market modelling. All econometric models have significant errors associated with them, which generally increase over time. It is most unlikely that the market can be fine-tuned sufficiently, based on any model, to achieve a point target in 2016. The simulations below indicate that different equation sets produce different projections. As further work, it would be valuable to derive more formally the error bands associated with any set of projections. Furthermore, the last year has shown that forecasts of house prices even over a one year period can be problematic.

Stocks versus flows

The conclusion reached in the Barker Review that up to 120,000 extra houses per annum would be needed to reduce house price growth to the European average produced considerable controversy. Some pressure groups and academics have taken the view that the required increase to meet the target, in fact, only needs to be much smaller. Part of the argument is technical concerning the nature of house price equations. As noted earlier, if house prices are only affected by the housing stock, then increases in new housing supply have only a modest impact on house prices, particularly in the short run. This is because annual housing production is only approximately one percent of the existing stock. However, if there is a direct effect from the new flow of housing, then the change in prices is expected to be much larger. Consequently, the additional housing required to meet the target is limited. The case that smaller increases in construction are required to meet the target is put forward in Bramley and Leishman (2005), who argue that an increase of 40% is sufficient to reduce house price growth to the European average.

Since the distinction is an empirical matter, our research for the project has been able to shed some light. The more complex house price equations described above, estimated by John Muellbauer and Anthony Murphy, found that both stock and flow effects are significant,[15] but, in fact, this turns out not to be the key distinction. In equations where both variables are important, the long-run solution is determined by the stock, whereas the speed of adjustment to the equilibrium is affected by the flow. The main difference of the Bramley and Leishman approach is not the inclusion of the flow term in stock equations, but the absence of stock terms in flow equations. There is now substantial empirical evidence that stock terms should be included.

Affordability, housing expansion and migration

The flow chart indicates links between migration and affordability. If housing supply is increased in any area, improving affordability, there are likely to be population inflows into that area to take advantage of both lower prices and greater availability. These flows are likely to be particularly important within Travel to Work Areas. Our equations support this result. A notable example is the South East. If construction is increased in the South East, a likely effect is increased population outflows from London.

This suggests the need for a "balanced" expansion in housing supply. Therefore, there are no simulations in this report in which construction is expanded in just one region. The balanced scenarios ensure that the effects on relative prices and relative availability are minimised, reducing the migration flows.

Both the Advisory and User Groups have suggested that regions are too broad for the targeting. An expansion in Manchester, for example, might have different effects on regional affordability from an expansion in Liverpool. However, the migration issue illustrates the problems associated with even finer spatial targeting. Although the Barker Review refers to sub-regional targeting, the induced migration flows within Travel to Work Areas make it very difficult to achieve targets at fine spatial scales. Areas are close substitutes. Simulations that demonstrate the issues are presented later.

Who will live in the extra homes?

Perhaps the most controversial issue that has arisen in the course of this project concerns who will live in the extra 120,000 homes suggested in the Barker Review (and in the simulations below). Full analysis requires a more complete model of tenure choice. But, even in the absence, the key issues can be brought out.

Critics point out that 120,000 extra homes per annum are inconsistent with reported demographic trends and the requirements are, in fact, much lower. More precisely, as a matter of accounting identity, the number of newly created homes must equal the number of newly forming households after taking account of migration (inter-regional and international), the change in the number of second homes, and the change in vacancies and demolitions. But, although this identity certainly must hold, in the context of affordability targets, it is incomplete.

- Housing demand is not the same as housing need and it is the former that is of relevance for meeting price and affordability targets.

15 Although the simpler equations did not test for the presence of the flow effect.

- The traditional demographic accounting approach does not take into account the induced increase in household numbers as prices fall in response to increased housing supply.

- Increased demand for housing by existing households needs to be taken into account. This is not just a question of second homes. This third point is of most importance in the reconciliation. As an extreme example, consider a large landowner who owns a mansion set in several hundred acres of parkland. If she were to move to a three-bedroom semi in the same region, the likelihood is that her satisfaction with her dwelling would fall. But, in terms of conventional arithmetic, one dwelling has been replaced with another and there is no net change in housing demand. This is clearly ridiculous, but consider the opposite case. Suppose an individual lives in a three-bedroom semi, but experiences a fall in house prices as a result of the introduction of affordability targets and an increase in housing supply. At the lower price, the household can afford a better quality dwelling and can consume more housing services. Again the trade substitutes one dwelling for another and there is no net change in demand in terms of housing units, even though the demand for housing services has risen. The problem arises because houses are heterogeneous – no two dwellings are the same (see HM Treasury, 2005 Chapter 1), but accounting in terms of housing units does not take this into account. As noted below, changing demand by existing households includes changes in tenure. At the lower prices, it is likely that more, young households would become owners rather than renters. This group is, in fact, important for helping the filtering process at the bottom end of the market.

- International migration may, itself, be sensitive to housing availability. Although this is exogenous in the model, this is potentially an additional "equilibrating" factor in the market, allowing the identity to hold.

- Housing vacancies, conversions and demolitions are all endogenous and respond to changes in the price and availability of housing.

The importance of increasing demand from existing as opposed to newly-forming households can be further illustrated by example. Suppose, initially, that all the increase in homes had to be matched by an increase in the number of households. Further assume an equilibrium in England in 2016 where the number of homes matched the number of households at the Holmans estimate of 23,397,000 (an interpolation between the 2011 and 2021 estimates in Table 2). Now if construction increased by an additional net 100,000 homes each year between 2007 and 2016, the housing stock would be 4.3% higher in 2016. If the price elasticity of household formation is –0.12 (this is consistent with our model estimates), then house prices would have to fall by 36% to restore equilibrium or by 3.1% per annum. Obviously this is a very large increase and is greater than the amount required to reduce UK house price inflation to the European average.

But, in fact, only a proportion of the increased supply of housing services is likely to go to new households. Our simulations below suggest approximately a third nationally, although there are regional variations. This partly occurs because the stock of existing households trading in the market is always greater than the number of new households being formed. This can be demonstrated, first, in terms of model arithmetic and, then in terms of the underlying concepts. The house price equations include demand from both new households and increased demand from existing households. As described earlier, the price elasticity of demand for the housing stock is –0.5 (in the more complex house price equation). Coupled with the price elasticity of new household formation of –0.12, under the same scenario as in

the last paragraph, prices would have to fall by a more modest 7% in 2016 to restore equilibrium. If the elasticity is –0.35 as in the southern regions of the alternative price equations, the fall in prices would be approximately 9%. Clearly, therefore, increased demand by existing households is of crucial importance to the calculation of price effects. But calculations of this sort, undertaken to meet affordability targets, are very different from the traditional matching of housing requirements.

It has been suggested that the model implies that "supply creates its own demand". This is not the case in any deterministic sense. Ex post demand and supply are equalised in the model, but this is brought about by price adjustment. The model only assumes that there is some price at which demand and supply are brought into equilibrium.

Conceptually,[16] consider the standard life-cycle housing model. Here, utility is defined over consumption of a composite good and consumption of housing services. As a simplification, the model generally assumes that the stock of housing services is proportional to the stock of housing units. Empirically, this is necessary since we cannot observe the stock of services directly. Often, the simplification does not matter, but here it does.[17]

From the first-order conditions, the demand for the stock of housing services is a function of the user cost (since this is the unit price of housing services in each time period), where the price index used in the definition is the price of a composite bundle of characteristics, typically defined from a hedonic regression. Services include space, accessibility (consistent with the standard monocentric model), neighbourhood as well as the characteristics of the dwelling.

Now to hit a price (affordability) target, we have to increase the supply of housing services, i.e. all or some subset of the variables that are significant in the hedonic regression. But this is where any lack of proportionality between the stock of services and units is important.

- Parts of the dwelling stock are currently unfit and provide fewer services. But, as discussed later, the expenditure required to make homes habitable is, in many cases, limited.

- For new dwellings, the average dwelling size has fallen in recent years so, unless there is compensation in terms of other characteristics (which may well be the case in some instances), service provision has fallen.

The point is that the stock of housing services, in fact, changes relative to the number of units over time, but the conventional accounting arithmetic is in terms of housing units. But an additional condition requires consistency between the stock of housing units and the stock of housing services (and the demand for and supply of housing services). The conventional approach implies that existing households cannot increase their consumption of housing services, except through buying second homes – all units are the same, but this is clearly not true.

16 This argument is necessarily somewhat more technically complex.

17 Technically, we should expect the changing structure of the housing stock to lead to parameter instability in the house price equations. In fact, the coefficient on the housing stock does appear to have gradually fallen over time.

An alternative way of looking at the point is in terms of demand and need. Need implies that if households have a decent roof over their heads, then need is met. But at lower prices the demand for housing services rises and this is not captured in the accounting relationship. Now, how can existing households increase their demand for services?

(i) By extensions to and conversions of the existing dwelling stock. Although these are clearly important, knowledge of the workings of these markets is limited.

(ii)By trading up and purchasing new dwellings with more services embodied.

Although the model does not concentrate on tenure, the delay of entry into owner-occupation amongst the youngest cohorts since the early nineties suggests that there is pent-up demand for owner-occupation that would occur at lower prices. Arguably, increases in the stamp duty threshold, and further extensions in the shared ownership programmes reduce the "hurdles" that potential first-time buyers face. Therefore, we would expect an increase in the demand for housing services amongst this group as deposit requirements become less binding, at the lower prices. Although this does not necessarily increase the demand for owner occupation per se, since owner-occupation and renting are, generally, imperfect substitutes in terms of the housing services that each tenure provides, ownership would be expected to rise.

A final important point concerns vacancies and demolitions. The model simulations imply that higher levels of demolitions and vacancies are more likely than have historically occurred as households trade up at the lower prices. These are endogenous variables. However, arguably, demolitions have been held artificially low by housing shortages in the past and greater availability allows improvements in the overall quality of the stock, generating higher levels of housing services. Ball (1996, page 12) has shown that, at the replacement rates of the nineties, the average life of a dwelling would have to be approximately 4000 years and even in the period of much higher demolitions in the sixties, the expected life was still 250 years. Ball points out that since housing, in practice, will not last this long, the calculations highlight the problems being stored up for the future. Furthermore, even if dwellings are not physically worn out, large parts of the housing stock are inappropriate to modern forms of living and are potentially technologically obsolete (see Kintrea 2005). Clearly there is scope for higher levels of demolitions and conversions.

Regional population growth and the North/South divide

Regional population growth in the model depends on natural increases in the population (births minus deaths) and migration flows, both inter-regional and international. In long-run projections (the model is solved to 2031), regional discrepancies become very evident. Regions that have relatively young population structures – London is the most extreme case – experience relatively strong natural population increases. Furthermore, the traditional pattern of inter-regional migration from the North to the South is also evident in the model simulations. London also gains disproportionately from net international inflows. Two issues arise from this:

- the labour market implications of differential population growth rates;
- the extent to which the divergences are worsened by housing market policies, i.e. the provision of extra homes in the South.

All regions suffer from the ageing of the population. At current retirement ages, the base case described in the next section suggests that the population of working age will be falling in almost all regions by the end of the solution period. Furthermore, growth becomes negative in the northern regions much earlier than in the southern regions, assuming that inter-regional migration trends broadly continue as in recent years. Although the labour market is not the focus of this report, clearly these differential growth rates contribute to a North/South divide since growth of the working population is one of the main influences on output growth.

However, the model indicates that housing market policies have, at most, a limited effect on the trends. Nor does the model suggest that housing supply increases geared towards the North can be used effectively to counter the historical trends. Inter-regional migration flows are responsive to both labour market (unemployment and earnings) and housing market variables (prices – both the level and expectations of increases – and availability). Although, in some circumstances, high house prices may exert a brake on migration flows (although expectations of capital gains appear to increase the inflows), the model does not imply that constraints on housing construction can be used as an effective way of reducing population flows to the South nor increase flows to the North. Generally, differential rates of construction are a response to different economic conditions between the regions, not a cause.[18]

18 Note, however, that in the simulations below, increases in housing construction are assumed to be "balanced". For example, in some simulations, increases are proportionate across the four southern regions. In others, increases are proportionate across all the English regions. This limits the induced migration flows.

CHAPTER 3

The Base Case

All models need a base case from which scenarios can be run. Our model is solved to 2031, using 2003 population estimates as the starting point. As required, 2016 receives particular attention with the later years being used primarily to test the model's long-run properties.

The starting point is the population projections. As indicated earlier, the main reason why the estimates differ from the official 2003-based population projections concern internal migration. In the official projections, flows are not responsive to changes in economic conditions. Table 4 conducts a comparison between the official and model projections for each of the regions. In general, the differences between the model and official estimates are modest in the years to 2026, but if required, for public consumption, the values can be brought completely in line with official estimates. However, the differences have little or no effect on the later simulations in this paper.

Table 4: Population Projections (000s)

Region	2003		2016		2026	
	Official	Model	Official	Model	Official	Model
South East	8080	8081	8669	8594	9139	9044
South West	4999	4996	5429	5443	5764	5851
London	7388	7388	8008	7937	8450	8407
East	5463	5463	5948	5957	6316	6314
E Midlands	4252	4253	4547	4527	4768	4724
W Midlands	5320	5321	5499	5505	5649	5620
Yorks & Humber	5009	5009	5202	5218	5355	5373
North West	6805	6805	6957	6995	7090	7093
North East	2539	2539	2512	2512	2495	2470
England	**49855**	**49855**	**52771**	**52688**	**55026**	**54896**

Table 5 examines the household projections, in this case, comparing the model against the Holmans estimates in Table 2. The comparative figures for 2011 are similar, but as the time horizon expands, the model-based estimates are lower, particularly in London and the South East. By definition, this implies lower headship rates. This, in turn, reflects the impact of worsening affordability on household formation. As shown below, affordability worsens in the base case in the medium term, leading to a levelling off of the headship rates, rather than a continuation of past trends.

Table 5: Household Projections (000s)						
Region	**2011**		**2016**		**2021**	
	Holmans	**Model**	**Holmans**	**Model**	**Holmans**	**Model**
North East	1,108	1,114	1,125	1,125	1,141	1,141
North West	2,991	2,985	3,074	3,057	3,156	3,085
Yorkshire and Humber	2,224	2,238	2,292	2,308	2,360	2,353
East Midlands	1,902	1,891	1,985	1,959	2,068	2,012
West Midlands	2,312	2,315	2,388	2,376	2,464	2,402
East of England	2,465	2,498	2,594	2,578	2,722	2,737
London	3,527	3,485	3,734	3,603	3,941	3,671
South East	3,609	3,633	3,780	3,744	3,951	3,869
South West	2,310	2,326	2,427	2,448	2,543	2,540
England	**22,448**	**22,485**	**23,397**	**23,198**	**24,346**	**23,810**
NB. The Holmans figures for 2016 are interpolations between 2011 and 2021						

Table 6 sets out the housing construction figures in the base case in terms of housing completions – both market and affordable. These represent net additions to the housing stock and are derived from RPG plans. They attempt to make some allowance for under-shooting between 2001 and 2004. However, this is difficult on the basis of current information, because of differences between net and gross data. Therefore, the adjustments are, at best, crude. The figures also take into account the announced 200,000 extra homes between 2007 and 2016. The assumption is also made that, in the base case, 30% of homes are affordable[19] in all regions except London, where the proportion is 50%.

Table 6: Construction: Net Additions to the Housing Stock					
	Annual Net housing Provision 2007-2016	**Allocation of Additional 200K**	**Annual Totals 2007-16**	**Annual Total, allowing for catch-up)**	**Annual Total (Market Housing)**
South East	28,050	4,389	32,439	32,759	22932
South West	20,200	–	20,200	20,045	14032
London	19,000	5,987	24,987	25,039	12520
East	20,850	6,541	27,391	27,391	19174
E Midlands	13,700	3,118	16,818	16,008	11206
W Midlands	13,055 (2007-11), 11765 (2012-2021)	–	13,055 (2007-2011) 11,765 (2012-2021)	12,846 (2007-2011) 11,556 (2012-2021)	8992 (2007-2011) 8089 (2012-2021)
Yorks & Humber	13654	–	13,654	13,034	9124
North West	12790	–	12,790	13,349	9344
North East	6000	–	6,000	5,538	3877
England	**147,299 (2007-11) 146,009 (2012-21)**	**20,035**	**167,334 (2007-11) 166,044 (2012-21)**	**166,009 (2007-11) 164,719 (2012-21)**	**111,201 (2007-11) 110,298 (2012-21)**

19 In this context, "affordable" includes social housing and all elements, which are not pure market housing, such as shared equity homes.

The affordability projections are the outcome of two indicators – nominal house price and earnings growth. For the target, the denominator is defined in terms of full-time average adult earnings. Table 7 sets out the annual average growth rate of each variable between 2004 and 2016. Because there are two sets of price equations in the model, projections from each have been approximately brought into line with each other in order to ensure consistent starting bases.[20]

Table 7: Average Nominal House Prices & Average Full-Time Earnings (annual average growth rates 2004-2016)

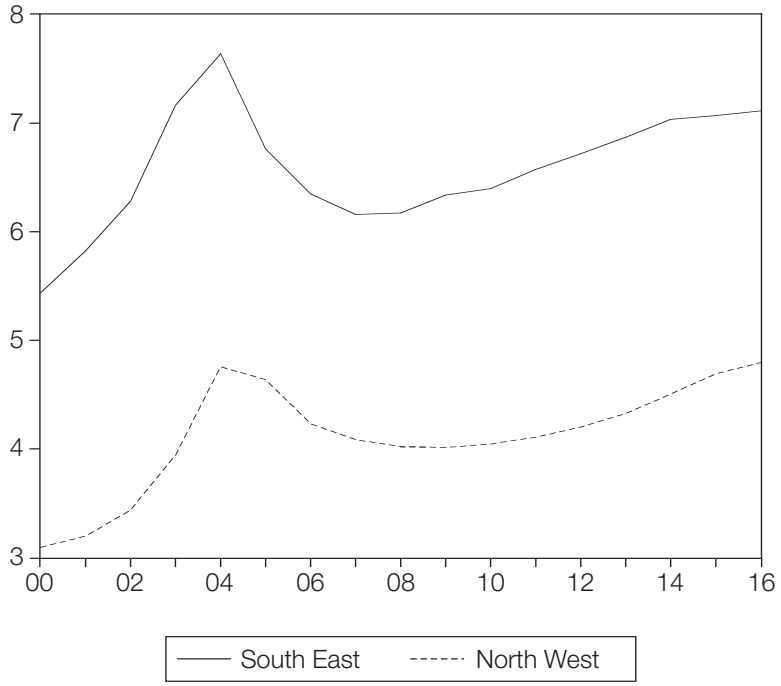
	Average House Prices	Average Earnings
South East	4.8	5.0
South West	4.8	4.7
London	5.1	5.1
East	5.7	5.1
E Midlands	4.2	5.1
W Midlands	4.5	5.1
Yorks & Humber	4.1	4.5
North West	5.1	5.1
North East	5.2	5.1
England	**5.0**	**5.1**

For England as a whole, prices and earnings grow at a similar rate between 2004 and 2016 – by approximately 5%. Therefore, the affordability ratio in 2016 is similar to that in 2004. However, the regional profiles do show some variation in house prices. This is primarily because, through the ripple effect, each region is at a different point in the cycle in the starting year of 2004. This influences the annual average growth rates over the full period.

The yearly profiles between 2000 and 2016 for median house prices relative to median earnings are presented in Figure 2 for the South East and North West. In both cases, the graphs indicate a "dip" in the short run. Most short-term forecasters expect house prices to grow more slowly than earnings in the next two to three years; the disagreement amongst forecasters is the extent of the dip, i.e. will the housing market experience a major slump in prices or will the downturn be weak? The projections are based on the view that the downturn will be modest. There are a number of factors, included in the equations, which lead to this view. First, lags in the system make it almost inevitable that price growth will weaken – prices are autocorrelated. Second, our model suggests that the market is currently not far from equilibrium and a major house price adjustment is not required. The strong growth in prices relative to incomes in recent years is a function of low levels of nominal interest rates. Although the adjustment to a low nominal interest rate environment is now probably over, unless large increases in nominal interest rates occur, there is little reason (in our view) to expect a major crash. In other words, the projections do not take the view that past house price growth is a bubble. Of course, if this view turns out to be incorrect – and house price forecasting is subject to large errors – then, perversely, meeting future affordability targets becomes easier.

20 Strictly, the values are taken from the Version 2 base.

Figure 2: Median House Price to Earnings Ratios – South East and North West



As noted above, the assumption of the model is that there is no change in the income and price distributions. Therefore, the lower quartile house price to income ratios have a similar time path to those in Figure 2. The key values for each region are given in Table 8. For comparison purposes, the table also constructs a simple measure of mortgage repayments as an alternative measure of affordability. This calculates the mortgage repayment on a median priced house, with a 100% mortgage, expressed relative to median earnings. In the current climate of low nominal interest rates, which we project to continue into the future (the base case assumes a value for the mortgage rate of 5.25% and the inflation rate to be in line with the government's target), the ratio of lower quartile house prices to incomes is unlikely to return to the historic average. Over the period 1986-2004, the average ratio for England was 4.1. At no stage in our projections does the ratio return to that level. The repayment ratio, therefore, provides an alternative indicator that takes into account the low interest rate environment.

Table 8: Ratio of Lower Quartile House Prices to Earnings & Mortgage Repayment Ratios

	Lower Quartile House Prices to Earnings		**Repayment Ratio (% of median earnings)**	
	2004	2016	2004	2016
South East	8.02	7.46	35.8	37.3
South West	8.10	8.16	36.1	40.8
London	8.21	8.22	35.7	40.2
East	7.50	7.87	33.6	39.5
E Midlands	5.99	5.39	28.1	28.3
W Midlands	5.91	5.52	28.1	29.4
Yorks & Humber	4.74	4.50	23.8	25.3
North West	4.32	4.35	22.3	25.2
North East	4.14	4.21	21.7	24.7

Two points of detail need to be borne in mind with respect to Table 8. First, the historic data for 2004 (and also for 1986-2004 in Table 11) use house prices in the first half of the respective years, rather than the whole year. This is because the earnings data from the Annual Survey of Hours and Earnings (ASHE)[21] relate to April of each year. Second, the earnings data are workplace rather than residence based, although the latter are available for the most recent years and are, arguably preferable. As Table 9 shows, for 2004, the distinction is only of major significance in the southern regions.

Table 9: Residence and Workplace Based Earnings Estimates 2004. Gross Weekly Earnings, Lower Quartiles (£ per week)

	Workplace	Residence
South East	322.7	330.8
South West	286.9	288.9
London	383.9	365.6
East	306.6	319.8
E Midlands	281.2	286.5
W Midlands	286.1	287.9
Yorks & Humber	281.6	281.1
North West	284.2	284.1
North East	268.7	268.7

21 And the New Earnings Survey for earlier years.

CHAPTER 4

Simulations of Higher Construction Levels

In the simulations, nine cases are considered in total. These consist of low, medium and high construction scenarios with different regional distributions for each. Each case is designed to relate to those analysed in the Barker Review. The "headline" scenario in the Review considered the impact of an extra 120,000 dwellings per annum. But the Review also discussed the effects 70,000 and 20,000 extra dwellings. However, our base scenario already incorporates existing government plans for an additional 20,000 homes per annum between 2007 and 2016 (see Table 6). Therefore our "high" and "medium" scenarios simulate the impact of 100,000 and 50,000 extra homes per annum. But an additional "low" scenario has been added of an extra 25,000 homes per annum. In each case, all dwellings are assumed to be in the market sector. Implicitly, this assumption lay behind the Barker projections. It should be stressed that the aim is not to look at the feasibility of achieving these higher levels of construction. The question is rather, if these higher levels of construction are achieved, what are the consequences for affordability and other housing market variables.

As argued earlier, "unbalanced" construction leads to migration inflows into regions where prices are lower and availability greater. Therefore, no simulations are run where output is increased in a single area. Instead for each output level, we assume:

- Case (I): All construction takes place in the four southern regions
- Case (II): All construction takes place in the four southern and two Midlands regions
- Case (III): Construction is spread over all nine regions

In each case, the regional allocations are based on the outturn private completions shares in 2004. The distribution of the additional house building is summarised in Table 10. The figures represent gross construction net of conversions and demolitions. The extra construction takes place (in terms of completions) between 2007 and 2016. There are, of course, issues of whether construction could be increased this quickly in practice. Although the level of housing returns to base after 2016, in fact, the effects on affordability are more long-lasting, due to lags, and continue to build up subsequently.

As noted above, the model includes two sets of equations in order to provide a range of possible outcomes. The different house price equations are particularly important to these simulations. Table 11 provides the headline affordability ratios under the alternative equation sets. Version (1) refers to the more complex equations, whilst Version (2) is the simpler set. There are slight differences between the two bases at the second decimal point in 2016, but these are technical and no significance should be attached to them.

Table 10: House building scenarios, 2007-2016 (annual house building additional to baseline)

	Scenario 1 "low" [number]			Scenario 2 (Equivalent to Barker) "medium" [number]			Scenario 3 (Equivalent to Barker) "high" [number]		
Regional distributions	**I.**	**II.**	**III.**	**I.**	**II.**	**III.**	**I.**	**II.**	**III.**
SE	7,725	5,625	4,100	15,450	11,250	8,200	30,900	22,500	16,400
L	6,125	4,450	3,225	12,250	8,900	6,450	24,500	17,800	12,900
E	6,000	3,125	3,150	12,000	8,750	6,300	24,000	17,500	12,600
SW	5,150	2,725	2,725	10,300	7,500	5,450	20,600	15,000	10,900
EM		3,650	2,650		7,300	5,300		14,600	10,600
WM		3,150	2,275		6,300	4,550		12,600	9,100
YH			2,550			5,100			10,200
NW			3,200			6,400			12,800
NE			1,125			2,250			4,500
England	**25000**	**25,000**	**25,000**	**50,000**	**50,000**	**50,000**	**100,000**	**100,000**	**100,000**

Table 11: Lower Quartile House Prices to Earnings Ratios – The Headline Figures (England), Under the Two Sets of Price Equations

		Version 1	Version 2
Average1986-2004		4.05	4.05
2004		6.23	6.23
2016	Base	6.24	6.18
2016	"low case", spread across all regions	6.01	6.04
2016	"high case", spread across the South	5.36	5.42

The table indicates that, in 2016 in the High Case, the affordability ratio would be a little less than one point lower than in the base scenario, with Version (1) and 0.75 percentage points lower with Version (2). The improvement is reduced to approximately 0.2 points in the Low Case. The range of estimates produced by the two sets of equations for England as a whole is quite narrow, which provides some degree of confidence in the outcomes. It should be remembered that Version (1) includes flow as well as stock effects, whereas Version (2) does not, but there are differences in the time paths, discussed below. These indicate that the speed of adjustment is quicker in Version (1) due to the influence of the flow effect.

Therefore, in summary, there is evidence that large increases in construction have significant effects on the affordability ratio. At first sight, these may not appear large compared with the major swings that have been experienced historically (between 1993 and 2004 the national ratio varied from 3.46 to 6.23). But it needs to be remembered that these are permanent changes to the ratio, independent of the state of the economic cycle. Cumulated over a number of years, the total effects on housing wealth, for example, are considerable.

Furthermore, the effects are even larger over a longer time horizon. In the High Case, by 2026, Version (2) indicates a fall in the ratio of approximately 1.4 points (despite the fact that the increase in construction comes to an end in 2016), reflecting the lags in the system. The response has reached an approximate equilibrium by 2026, after which the house price effects are approximately constant. However Version (1) suggests a long-run fall of approximately one point, i.e. similar to that in 2016. In other words, Version (1) reaches equilibrium more quickly, again due to the presence of the flow effect, but the long-run effects are slightly higher using model Version (2).

Figures 3: The Time Profile of the Affordability Ratio

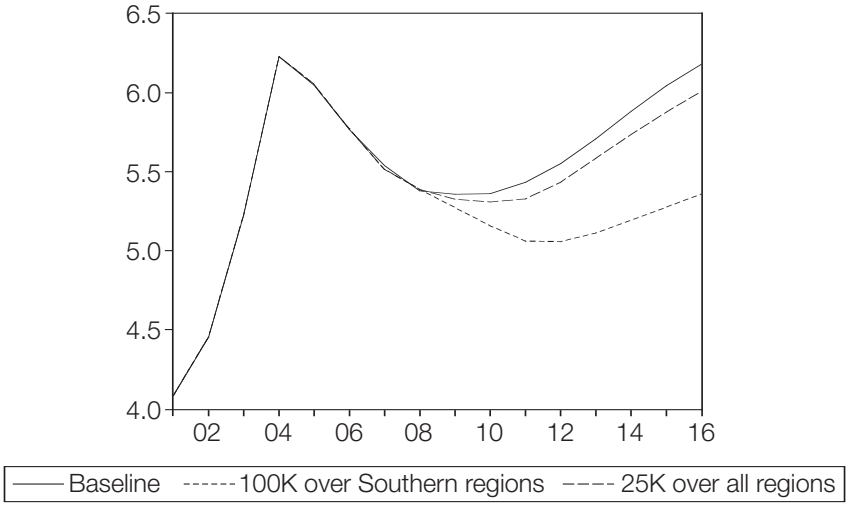


Figure 3a

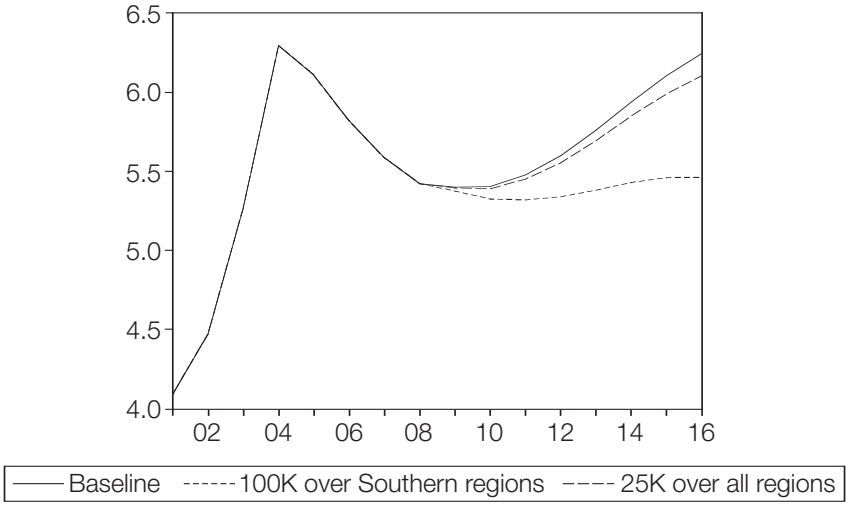


Figure 3b

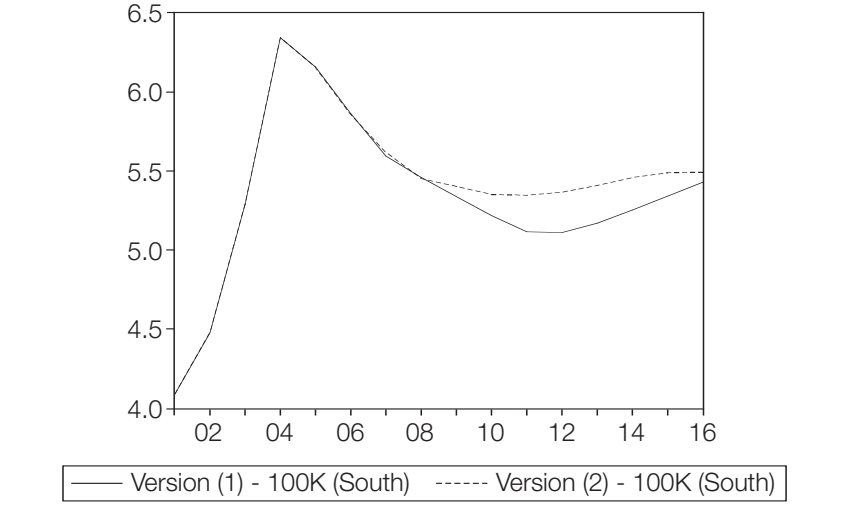


Figure 3c

Figure 3 shows the time paths for the affordability ratios. In segments (a) and (b) the base case and the high and low scenarios are shown. Segment (a) uses Version (1) of the price equations and Segment (b) uses Version (2). Segment (c) examines the high scenario using the two different price sets. Two features stand out. First, it takes time for the effects to build up. A ten-year time horizon is sufficient for significant effects to be felt, but supply policies of this form cannot be used to offset short-term variations in the affordability ratio. But it would be dangerous to target one specific year, despite the concentration on 2016. Short-run variations in the ratio are not adequately predictable and, therefore, it would be preferable to target a range of years. Yearly targets could be missed simply because of the phase of the cycle. Second, although the effects of the two price equation sets are similar in 2016, segment (c) again highlights the impact of the flow effect in Version (1) of the price equations, which speeds up the adjustment process.

More detail on all the nine cases is given in Table 12. Table 12a uses Version (1) and 12b employs (2). The tables indicate that the changes are approximately (but not exactly) linear across the different size changes. But the table demonstrates an important difference between the equation sets. Version (2) suggests that increases in construction concentrated on the South have the biggest overall effect on the national target. This provides support for the view that resources should be concentrated on the South. But this effect is less evident in Version (1). In fact, on the basis of the empirical evidence in the model, it is difficult to come to a conclusion, which is the more likely outcome. On the one hand, in terms of econometric sophistication and equation fit, Version (1) is preferable, but, on the other hand, the idea that the effects are greater in the South, where the land constraints are more severe, is intuitively plausible. It should be noted, however, that even in the cases where all the expansion takes place in the South, there is an improvement in affordability in the other regions as the ripple effect takes place. This holds in both models.

Table 12a: Lower quartiles ratios in 2016, for various house building scenarios (as per Table 10) – Price Equations Version (1)

	Base	Scenario 1 "low"			Scenario 2 (Equivalent to Barker) "medium"			Scenario 3 (Equivalent to Barker) "high"		
Regions		**I.**	**II.**	**III.**	**I.**	**II.**	**III.**	**I.**	**II.**	**III.**
SE	7.59	7.18	7.26	7.32	6.79	6.94	7.06	6.07	6.35	6.57
L	8.10	7.78	7.83	7.87	7.48	7.57	7.64	6.91	7.09	7.22
E	7.83	7.39	7.47	7.54	6.98	7.14	7.26	6.23	6.52	6.74
SW	8.21	7.75	7.84	7.91	7.32	7.49	7.62	6.54	6.85	7.08
EM	5.44	5.31	5.17	5.22	5.19	4.92	5.01	4.94	4.45	4.62
WM	5.66	5.53	5.41	5.45	5.40	5.19	5.27	5.16	4.79	4.93
YH	4.55	4.43	4.44	4.36	4.32	4.35	4.19	4.11	4.16	3.87
NW	4.39	4.29	4.30	4.23	4.19	4.21	4.08	4.00	4.03	3.80
NE	4.31	4.22	4.23	4.17	4.13	4.15	4.03	3.95	3.99	3.78
England	**6.24**	**6.00**	**6.01**	**6.01**	**5.78**	**5.79**	**5.79**	**5.36**	**5.38**	**5.39**

Key: I refers to additional construction in the 4 southern regions
II refers to additional construction in the South and Midlands
III refers to additional construction in all regions

Table 12b: Lower quartiles ratios in 2016, for various house building scenarios (as per Table 10) – Price Equations Version (2)

	Base	Scenario 1 "low"			Scenario 2 (Equivalent to Barker) "medium"			Scenario 3 (Equivalent to Barker) "high"		
Regions		**I.**	**II.**	**III.**	**I.**	**II.**	**III.**	**I.**	**II.**	**III.**
SE	7.46	7.16	7.24	7.30	6.87	7.03	7.14	6.34	6.62	6.84
L	8.22	7.88	7.97	8.04	7.57	7.74	7.86	6.98	7.29	7.53
E	7.87	7.49	7.59	7.67	7.14	7.33	7.47	6.50	6.83	7.10
SW	8.16	7.80	7.89	7.96	7.45	7.64	7.78	6.83	7.16	7.42
EM	5.39	5.25	5.22	5.27	5.12	5.07	5.15	4.88	4.77	4.93
WM	5.52	5.38	5.36	5.40	5.25	5.22	5.30	5.00	4.95	5.09
YH	4.50	4.45	4.43	4.42	4.40	4.36	4.33	4.31	4.23	4.17
NW	4.35	4.24	4.27	4.26	4.14	4.19	4.18	3.94	4.04	4.01
NE	4.21	4.10	4.13	4.12	4.00	4.05	4.04	3.80	3.91	3.87
England	**6.18**	**5.97**	**6.01**	**6.04**	**5.78**	**5.85**	**5.91**	**5.42**	**5.55**	**5.66**

Key: I refers to additional construction in the 4 southern regions
II refers to additional construction in the South and Midlands
III refers to additional construction in all regions

Lower quartile house price to income ratios are the central target, but Appendix 1 indicates that there are problems with the indicator and there are a number of alternatives. Given the original emphasis of the Barker Review on reducing house price inflation, this is an obvious simple candidate. The high case indicates that, in 2016, house prices would be between 12% and 14% lower than in the baseline. Alternatively, the inflation rate would fall by approximately 1.3% per annum.[22] The Barker Review suggested that an increase of approximately 100,000 dwellings per annum would be necessary to reduce price inflation by approximately 1.5%. Therefore, the results presented here are broadly consistent with the earlier national findings.

A second indicator is the repayments ratio discussed earlier. Table 13 shows the effects under the high and low scenarios, again using the two price equations. However, since interest rates are assumed to be approximately constant over the projection period (the mortgage interest rate is set at 5.25% per annum), the repayments profile is similar to the affordability profile. But since house prices are sensitive to interest rate changes, this illustrates one of the problems of targets set in terms of price to income ratios. The easiest way of meeting this target is to raise interest rates. But this is hardly the required outcome.

Table 13: Repayment Ratios (England), Under the Two Sets of Price Equations

		Version 1	Version 2
2004	29.2	29.2	
2016	Base	32.7	32.4
2016	"low case", spread across all regions	31.5	31.7
2016	"high case", spread across the South	28.1	28.4

Finally an issue raised earlier is re-considered – the proportion of the increase in new dwellings that goes to new households. New household formation is shown in the first two columns of Table 14, using the high scenario, where the increase in construction only takes place in the southern regions. It is useful to compare two regions – the South East and London. In the South East, over the ten year period, 2007-2016, construction in the South East is raised by 309,000 units. But the total number of new households formed increases by a modest 64,000 using Version (2) and by 105,000 in Version (1). Therefore, the proportions of the extra construction taken by newly forming households including inter-regional migrants are 21% and 34% respectively. But, of course, inter-regional migrants will vacate properties in other areas. The two sets of equations produce rather different migration profiles. The net flows are noticeably larger in Version (1). However, this is primarily a result of the different relative house price profiles shown in Table 12. The relative regional fall in house prices in the South is greater in Version (1), inducing the extra population inflows.[23]

Abstracting from migration flows, only approximately 20% of the extra homes go to newly forming households. If the policy aim is to provide homes for new households, this is clearly controversial. It implies that the remaining 80% are taken up by pre-existing households, who are improving the quality of their housing as prices fall. Since the additional homes in the simulation are market dwellings, all are used to extend home ownership and imply a transfer of households from the rented sectors. Given the current development of the model, it would be difficult to disentangle the proportions coming from the social as opposed to the private rental sector.

22 As noted above, because of the longer lags in Version (2), the long-run inflation effect is slightly higher than 1.3%.

23 Note that no adding up constraint has been imposed. The simulation implies flows to Scotland, Ireland and Wales over the period in response to the change in construction. But these are fairly small effects over a ten year period.

However, if the aim is to improve affordability, we would argue that pre-existing households attempting to become owners for the first time would be amongst the main beneficiaries.

Table 14: New Households and Migration (High Scenario, distributed across the South)

	New Households (2016) (000s)		Net Migration (2007-16) (2007-16) (000s)		Construction (2007-16) (000s)
	Version (1)	Version (2)	Version (1)	Version (2)	
South East	105	64	54	–4	309
South West	54	36	34	4	206
London	107	115	26	39	245
East	66	41	43	–11	240
E Midlands	3	9	–25	–7	0
W Midlands	5	12	–31	–9	0
Yorks & Humber	4	2	–25	–6	0
North West	7	17	–34	–4	0
North East	1	5	–13	–1	0
England	**352**	**301**	**29**	**1**	**100**

One of the reasons that a relatively low proportion of the additional homes is taken up by newly forming households concerns the age distribution. As a caricature, households tend to migrate to the South East from London as they age. Therefore the age distribution in the South East is older than in London. But, given their age, a high proportion of the South East population will already have formed households and, therefore, will be insensitive to improvements in affordability. By contrast, in London, a higher proportion of the population will not have formed independent households and will be more sensitive to improvements in affordability. Therefore, from Table 14, (Version 2), 47% of the new homes is taken up by new households.[24] [25]

Finally, there is a caveat to these results. Arguably, the model under-predicts the proportion of homes taken up by new households and, therefore, the matching of household numbers and construction becomes easier. The Technical Appendix (page 22) indicates that the relevant price coefficient in the household formation equation is only on the borderline of significance. The appropriate specification for the housing cost term is not clear-cut and the literature adopts a variety of approaches. The model uses a fairly simple specification in which an average house price is multiplied by the mortgage interest rate. This fits in well with the rest of the model. Other (US) studies have used market rental variables, although there is a paucity of good measures in the UK. But misspecification may be biasing down the coefficient. One misspecification could arise from the omission of any capital gains term in the equation (which was found to be insignificant). However if the coefficient is biased downwards, two consequences should be noted. First, since housing costs rise over the projection period, headship rates could be even lower than projected in the baseline. We indicated earlier that our current baseline includes little growth in headship rates over the longer term. Second, if household formation is more sensitive to changes in affordability. The improvements in affordability, set out in Table 12, could be somewhat smaller, because prices would have to fall by less in order to attract the additional required demand.

24 This figure includes a relatively small contribution from inter-regional migrants.

25 As an aside, it is unsurprising that prediction errors are often greater in official projections for London than other regions – household formation is more sensitive to changes in economic conditions.

CHAPTER 5

Sub-Regional Aspects

Regions are, of course, large administrative areas and, arguably, setting targets for regions as a whole is not always helpful. The Barker Review referred to sub-regional targets. It may be that building in one part of a region has very different consequences from building in other parts. Most regions include areas of both high and low demand. But, on the other hand, there are dangers from being too prescriptive about where extra housing should be built. More fundamentally, it may be impossible, or at least very difficult to achieve targets at the sub-regional level. This is because areas (for example local authorities) may be close substitutes in terms of location for many households so that increasing construction in one or a small number of areas simply generates strong population flows to those areas with little effect on affordability. At the broader spatial scale, this is why "regionally balanced" increases in construction were examined. The issue becomes much more important *within* regions.

Our remit was to construct a model at the regional level and this model cannot examine the intra-regional questions. However, a local authority level model, with a related structure, has recently been constructed for the Joseph Rowntree Foundation. The structure is described in Meen et al (2005). It is possible to nest this model within the regional model. In principle, models for all 354 English local authorities could be added with the regional model providing control totals. But in practice, the model becomes too large to solve and as an illustration two models have been added – Reading and Knowsley. Reading is taken as an example of a wealthy town tied to a wider labour market area, including London, and facing housing shortages; Knowsley is one of the most deprived authorities in the country. Therefore, we might expect an unbalanced expansion in construction to have different effects between the two areas. In the case of Reading, the increased construction and lower prices encourages population inflows, offsetting the improvement in affordability. But, in Knowsley, the expected population flows to a deprived location are likely to be weaker, particularly if increased construction leads to more vacancies.[26]

We have chosen to examine the local impacts of the high scenario in which the additional 100,000 dwellings are spread over all the regions. A fixed percentage of the additional homes are allocated to Reading and Knowsley, based on the shares of actual construction in 2001. Table 15 sets out the key results for the two districts. Although, by coincidence, the effects on the affordability ratios are the same – the affordability ratio falls by 0.26 points, the reasons are very different. In Reading, the cumulative increase in completions is 4,050 units over the ten year period. However the number of new households arising from natural increase and migration is 3,697; most of this comes from migration.[27] Comparing this with the cumulative increase in completions, approximately 90% of the homes go to the new households and migrants. Given the strong responsiveness of migrants to the extra homes in Reading,

26 The simulation does not take account of the fact that new construction may have positive spill-over effects by raising the quality of the housing stock. This may be important.

27 Note that the net migration figure of 777 is the annual figure in 2016, not the cumulative value over the 2007-2016 simulation period. The figures refer to both inter and intra regional migration flows, although the latter dominate at the local level. In the table, migration refers to population flows not the number of households.

affordability improves by only a modest amount. Consequently the demand for housing by existing households changes little. In the absence of the migrants, the improvement in affordability in an area of housing shortage would be larger.

Table 15: Local Effects of the High Scenario Allocated Across all regions (Differences from baseline, 2016)

	Reading	Knowsley
Affordability (points)	–0.26	–0.26
In-Migration (Nos)	1151	59
Out-Migration Nos)	374	85
Net Regional Migration (Nos)	777	–26
Households (Nos)	3697	224
Completions (Nos, 2007-2016)	4050	791

By contrast, in Knowsley – an area where shortages are less pronounced – the increase in construction has little effect on net migration. Indeed the flows are slightly negative. The increase in market construction is smaller in absolute terms than in Reading (reflecting the position in 2001) and, therefore, the effect on affordability is limited. But the key difference from Reading is that, in Knowsley, approximately 70% of the new homes would have to be taken up by increased housing demand from existing households. These proportions are similar to the regional analysis in the last section.

Finally, at first sight, it might appear that the simulation illustrates different impacts between the North and South of the country and that building more homes in the North is ineffective. This is not the most appropriate conclusion. The true distinction is between areas of growth (and excess housing demand) and areas of disadvantages (and low demand). All regions contain areas of both, although it is true that the North contains more areas of low demand.

CHAPTER 6

Conclusions, Key Findings and Further Work

No model is ever complete, merely at different stages of development. Nevertheless, the model has come a long way in the six month life of the project. It is the only fully estimated, integrated nine region model of its type, incorporating both time series and micro econometric evidence. Although the academic reviewers have commented extensively on the model, it has yet to be opened up to the full academic community. But, reassuringly, the main conclusions of the study appear to be robust to the choice of equations. Two rather different approaches to house price and migration determination produce similar results. Nevertheless, there are further model validation and tracking exercises that could usefully be undertaken. Part of the exercise might be to validate the results against alternative naïve models.

Regular updating of the model will be required as new data are released. However, there are a number of areas where more major developments are required. First, formal modelling of tenure choice is desirable. At the moment, renting is treated as a residual and there is no distinction between private and social renting. This is not a trivial exercise and is made more complex by the existence of the Buy-to-Let market. Furthermore, more analysis of tenure would require greater attention to the role of mortgage markets, particularly the credit market constraints potentially faced by young, first-time purchasers. It might also be noted, however, that the introduction of a full tenure choice model, potentially, involves an identification problem since the implicit owner-occupier housing demand function lying behind the house price equation is not necessary identical to that which would emerge from the directly estimated tenure demand functions.

The model would also benefit from the endogenisation of international migration. In particular, it would be desirable to understand the extent to which the flows respond to the housing market, the labour market and other factors. Again the modelling exercise is not straightforward because of well-known deficiencies in international migration data. Nevertheless, interesting theoretical models of flows have been developed that provide a starting point.

The simulations in the previous section demonstrate that it is feasible to develop a sub-regional model, consistent with the regional model. The ODPM has also commissioned further local housing market modelling from a team at Heriot Watt University. It would be useful to develop an integrated framework for analysis of the key issues, from national to regional to local.

A further modelling issue concerns the quality of the housing stock, obsolescence, vacancies and demolitions. The model works in terms of housing units, but we have emphasised the weaknesses of this approach. In response to affordability targets, the reductions in house prices lead to an increased demand for housing services by existing households. This is different to the “traditional” policy question of how many extra homes are required to house a given number of households determined by demographic trends. In this second question, the increased demand in response to price change is less important. However, intrinsically, trading up is concerned with the heterogeneity of the housing stock and an analysis of units cannot fully take this into account. The distinction matters particularly for obsolescence, vacancies demolitions and conversions. Although a filtering of the housing stock to lower income households is likely to occur, simple adding up conditions imply that the extra construction leads to some combination of higher vacancies, conversions and demolitions,

although we have not attempted to evaluate the relative contribution of each. For example, we do not know fully how the natural vacancy rate responds to improved affordability. It is possible that a higher vacancy rate would be the norm in a less constrained market. At 3.4%, vacancy rates in Britain are low by international standards; this is to be expected, because at high property prices, the opportunity cost of leaving dwellings vacant is also high (Evans and Hartwich 2005). Indeed, Bramley and Leishman (2005) find that both house prices and new construction are highly significant determinants of vacancies. We would argue that, in a world of higher levels of construction and fewer shortages, higher vacancy rates would be the norm. This is one of the mechanisms through which the projections given in this report can be reconciled with the traditional accounting approach to housing requirements. As an illustration, Evans and Hartwich (2005) estimate that Germany has a vacancy rate of 8.2% and France 6.8%. In Italy, the rate is almost 20%. In the US, the vacancy rate for rental units is approximately 10% (although less than 2% for owner-occupied homes), US Census Bureau (2005). These are, at least, suggestive that England could operate at higher vacancy levels.

A few simple calculations might illuminate the question of demolitions. First, in April 2003, there were 1.2 million unfit dwellings in England (226,000 in London and 131,000 in the South East). Although most of these could be made habitable by fairly modest expenditures, a proportion would require substantial expenditures and, consequently, provide limited housing services as they stand. Hence, some are potential candidates for demolitions. Second, over the period 1994/95 to 2003/04, the annual average level of demolitions in England was 17,795 units (0.09% of the housing stock). In the South East and London, demolitions were 1,429 and 2,100 respectively. As discussed in the report, these levels are very low. Now, from Table 14, approximately 30% of the new homes might go to new households and migrants in the South East and 50% in London. In the extreme case, this implies that 70% and 50% respectively of the new homes could be used to replace (or convert) units from the existing stock. If the medium scenario is taken as an example, this implies 7,875 homes in the South East and 4,450 in London per annum. This is equivalent to approximately twice the current level of London demolitions and five times the current level in the South East. This may appear to be an enormous increase, but note that this is only 2% of the stock of unfit dwellings in London and 6% of that in the South East. In these terms, even in the most extreme case, demolitions look more modest. In practice, some of the homes will be converted rather than demolished, vacancies are likely to be higher, additional international migrants might be attracted and, possibly the number of new households might have been under-estimated. All these reduce the implied number of demolitions. But, as discussed earlier, historically demolitions have been kept artificially low, because of housing shortages. Improved affordability offers the opportunity to relax the constraints. In the US, demolitions between 1980 and 1993 were 3.7% of the dwelling stock[28] (or 0.28% per annum), compared with 0.09% per annum in England. This is despite the fact that the age of the English housing stock is considerably older. In England, 21% of the stock was built before 1920 compared with 8.3% in the US (Williams 2004).

What are the key messages from the Report? First, large increases in construction do have significant effects on affordability, measured in terms of the ratio of lower quartile house prices to incomes. But the increases in construction have to be large. Furthermore, the improvements in affordability are permanent, reflecting the increase in supply. Many changes associated with demand shocks are temporary and cyclical, although frequently large.

28 This includes losses from natural disasters.

Second, spatial targeting presents practical problems. On the one hand, regions may be considered too large as entities since many regions contain areas of both high and low demand and expansion of construction will have a differential effect according to which is chosen. On the other hand, targets for smaller spatial areas are probably impractical because of the induced migration inflows discussed in the report. Particularly within Travel to Work Areas, migration flows offset any improvements in affordability. Nevertheless, there are good reasons for monitoring at the local scale. Therefore, there are useful synergies with other work currently being developed for ODPM at Heriot-Watt University on local housing area analysis.

Third, although we have been asked to look particularly at 2016 as a target year, we would not recommend the choice of any single year as a target. Affordability is simply too volatile over the cycle for this to be a reliable target. Supply-side policies, linked to the planning system, cannot be used to offset the short-run cycle.

Finally, there are both winners and losers from an expansion in housing supply. In general, those looking to trade up gain and those looking to trade down lose. Since those trading up are typically younger, there are clearly inter-generational transfers. Amongst the winners are existing households who are currently renting and wish to become owners and those in starter homes wishing to move up-market. The children of current owners may gain when they wish to enter the market, although this is not clear cut if the children are relying on finance from their parents, who now experience slower rates of capital gain. The construction industry is also a clear gainer and this could imply an expansion in employment opportunities.

Bibliography

Andrew, M. and G. Meen (2003). "Housing Transactions and the Changing Decisions of Young Households in Britain: The Microeconomic Evidence". *Real Estate Economics*, 31(1): 117-138.

Ball, M. (1996). *Housing and Construction: A Troubled Relationship?*. The Policy Press. Bristol.

Ball, M. (2005). *RICS European Housing Review 2005*. London.

Barker, K. (2003). *Review of Housing Supply: Interim Report* (London: HMSO)

Barker, K. (2004). *Review of Housing Supply: Final Report* (London: HMSO)

Bover, O., Muellbauer, J. and A. Murphy (1989). "Housing, Wages and UK Labour Markets." *Oxford Bulletin of Economics and Statistics* 51(2): 97-136.

Bramley, G. and C. Leishman (2005). "Planning and Housing Supply in Two-Speed Britain: Modelling Local Market Outcomes". *Forthcoming, Urban Studies*.

Cameron, G. and J. Muellbauer (1998). "The Housing Market and Regional Commuting and Migration Choices". *Scottish Journal of Political Economy*, 54: 420-446.

Cameron, G. and J. Muellbauer (2001). "Earnings, Unemployment and Housing in Britain", *Journal of Applied Econometrics*, 16(3): 203-220.

Evans, A.W. (1990). "The Assumption of Equilibrium in the Analysis of Migration and Interregional Differences: A Review of Some Recent Research". *Journal of Regional Science*, 130(4): 515-531.

Evans, A.W. and O. Hartwich (2005). *Unaffordable Housing: Fables and Myths*, Policy Exchange. London.

Evans, A.W. (2004). *Economics and Land Use Planning* (Oxford: Blackwell).

Fernandez-Corugedo, E. and J. Muellbauer (2004). "Consumer Credit Conditions in the UK", *forthcoming, Bank of England Working Paper*.

HM Treasury (2005). *Housing Policy: An Overview*. London.

Kintrea, K. (2005). "Visions of Housing Futures: Incipient Obsolescence?" *paper presented to the Housing Studies Association Conference, University of York*.

Meen, G.P. (1999). "Regional House Prices and the Ripple Effect: A New Interpretation", *Housing Studies*, 14(6): 733-753.

Meen, G. (2001). *Modelling Spatial Housing Markets: Theory, Analysis and Policy*. Kluwer Academic Publishers. Boston.

Meen, G. and M. Andrew. (1998). "On the Aggregate Housing Market Implications of Labour Market Change." *Scottish Journal of Political Economy* 45(4): 393-419.

Meen, G., Gibb, K., Goody, J., and J. MacKinnon (2005). *Economic Segregation in Britain: Causes, Consequences and Policy*. Forthcoming The Policy Press, Bristol.

Muellbauer, J. and A. Murphy (1997). "Booms and Busts in the UK Housing Market", *The Economic Journal* 107: 1701-1727.

Urban Task Force (1999). *Towards an Urban Renaissance* (London: E & FN Spon).

US Census Bureau (2005). *Housing Vacancies and Home Ownership*. www.census.gov/hhes/www/hvs.html.

Williams, B.T. (2004). *These Old Houses: 2001*. US Census Bureau.

APPENDIX 1

The Ratio of Lower Quartiles as a Measure of Affordability

Introduction

In this Appendix we discuss the ways in which affordability may be measured, with particular reference to the ratio of lowest quartile house prices to lowest quartile earnings, since this is the measure being modelled. In the first section, we discuss the characteristics of this measure. In the second section we put forward various reasons why the ratio might be expected to differ from region to region. And in the third section, we discuss alternative measures of affordability.

The ratio of lower quartiles: commentary

In the first chapter of her Final Report Kate Barker comments that 'one possible measure of market affordability is median house prices to median incomes but the emphasis on access to housing might suggest a case for focussing on lowest quartile house prices to lowest quartile incomes' (Barker, 2004, p. 26).

Characteristics of the ratio

The table below gives the figures provided by the ODPM for the ratio of lower quartiles over the last decade and a half. The denominator uses earnings data collected in April for the New Earnings Survey (now the Annual Survey of Hours and Earnings, ASHE). House prices are based on sales in the first six months of each year.

The first thing that may be noted is that some regions have similar ratios which also move together. It would over simplify very little to describe England as being divisible into three meta regions, the North (North East, North West, and Yorkshire and Humberside), the Midlands (East Midlands and West Midlands, and the South (South West, South East, Eastern, and London).

It is noticeable that ratios for the North are much less volatile than those for the Midlands and the South. In the South, the minimum was about 4 in 1995 whereas the high in 2004 was about 8. In the North, the maximum was only a little over 4 in 2004. There is also evidence of the so-called 'ripple effect' in that the North lagged the South and the Midlands in the early nineties as the ratio rose in the North whilst it was falling in the South, and as house prices were rising in the North but falling in the South.

The short run

The need is for an indicator of affordability which could be used to monitor and then influence long run trends in house prices. However it is still relevant to look at its usefulness as an indicator of short run problems. Thus one use of the ratio might be as a signal that the housing market was overheating and that land needed to be released for development so that an increased supply would damp down an incipient house price boom. This use would

accord with the view expressed in the Barker report that the housing market should be more market responsive. Could the ratio be used in this way?

The scope is limited for two reasons, but with an important caveat. The first is that it would be difficult to decide on the level of the ratio which would provide the necessary signal. In particular the variation between the regions means that there would be no single figure suitable for all regions. Thus the ratio for London is almost always higher than it is for any other region apart from the South East. But then it is probably true to say that would be little point in using the ratio as a trigger for further land release in the Greater London Region simply because there is little land to be released. Most land in the region is either already developed or designated as Green Belt or Metropolitan Open Land. The effect of high prices is anyway to stimulate the redevelopment of brownfield sites.

If a figure of 4 were chosen then the South East would appear to have a housing shortage through virtually the whole of the period. On the other hand if the higher figure of 5 were chosen then this would signal a shortage in London and the South East in 2000, in the South West in 2001, and the Eastern Region in 2002. But the two Midlands regions only reach this figure in 2004. But by then the southern ratios have reached the level of 8. As discussed below, regionally varying indicators are certainly possible, but these introduce further complications at regional boundaries, for example.

And this brings us to the second reason, the time lags involved make it extremely difficult to fine tune the housing market. Given that it takes two or three years for any houses to be built, any release of land would have to take place well before any danger signal. Thus waiting until, say, 2001 would be to leave it too late to have any chance of damping down any price boom. Thus to have any chance of success it would be necessary to predict two years ahead that a danger signal was likely, and so trigger a release of land early enough to have some effect. But such fine tuning would be difficult.

Having said this, an important reason for the indicator is the effect on expectations. An analogy is the current target for the CPI. Although monetary policy cannot maintain inflation at 2% precisely in every month, there is an expectation that it will be delivered in the future. Similarly, targets for affordability could reduce short-run volatility and speculative bubbles by providing an appropriate framework for the determination of expectations.

The long run

The main use of an indicator of affordability must therefore be as an indicator of longer run problems. Thus a prediction could be made of the long run trend in the affordability ratio, and if this were thought to be unacceptable, then some assessment could be made, using the econometric model, of the increase in the supply of housing which would be necessary to reduce the long run trend to an acceptable level.

The very long run

It should nevertheless be noted that some indicators may in the longer run mislead because they are in a sense themselves endogenous to the system. This is true of the ratio of lower quartiles. As consumers themselves adjust to the fact that housing is more expensive so the ratio is itself likely to respond, in the longer run, to long run changes and people's response to these changes. The easiest way to demonstrate the nature of the problem is to assume that the price elasticity of housing is about minus one, and that the income elasticity is about plus one. If this were true then, in the long run, any increase in the price of housing of, say, one

per cent would result in a reduction in the quantity of housing purchased of one per cent. The result would be that, in the long run, people would always spend the same amount on their housing. Unitary income elasticity would mean that since, if incomes rose by one per cent, expenditure on housing would rise by one per cent, then as incomes rose people would spend a constant proportion of their income on housing.

In practice estimates of the price elasticity of demand for housing suggest that demand is slightly price inelastic. This means that as prices rise people do reduce their consumption but not by as much as the increase in price so that their total expenditure on housing increases. On the other hand the income elasticity is slightly less than one so that as incomes rise people tend to spend a slightly smaller proportion of their income on housing. Over time, as both incomes and prices increase, the total amount spent on housing as a proportion of incomes does tend to increase.

It can be seen, however, that the effect of people's long run adaptation to price changes is that whatever short term movements might show long run changes, say from trough to trough of the cycle, will be damped down. Housing will have become more expensive but people will have responded by adjusting their expenditure and buying less.

Differences between regions

There are a number of reasons why the ratio of lower quartiles may differ between regions but which do not necessarily indicate differences in affordability. With the first two of these, differences in the size of the rented sector, and differences in the level of Council Tax, the direction of the effects is clear and would need to be taken into account in any scheme of setting indicated affordability ratios for different regions.

The rented sector

Differences in the size of the rented sector between regions will affect the ratio. It seems plausible to assume that most of those living in rented housing are lower income households. But because they are renting, the price of housing is of less relevance to them than it is to those who are in the market to buy. Nevertheless the incomes of these households are included in the income distribution and help to determine the level of its lower quartile. But the prices of their houses will not be included in the house price distribution. Thus, if our assumption is right that these are primarily lower income households occupying cheaper accommodation, then the lower quartile of the house price distribution will be higher in a region where the rented sector is larger than in one where it is smaller. So the ratio of lower quartiles will be greater, and so housing will appear to be less affordable, in regions where the rented sector is larger.

The argument also applies to changes over time. So, if the rented sector falls in size, as it did in the eighties with the Right to Buy, the ratio of lower quartiles will fall and housing will appear to be becoming more affordable. Clearly, however, no change in the level of affordability of the kind implied is actually occurring. Thus differences in the levels of the ratios between regions, and changes in level over time, may not be indicative of actual differences or changes in affordability.

The impact of the Council Tax

There is a substantial U.S. literature on the capitalisation of interregional differences into house prices and wage rates, reviewed by Evans (1990). One may not wish to follow the American economists in assuming complete interregional equilibrium, but one may still agree that systematic interregional differences will be capitalised, to a greater or a lesser extent, into differences in house prices, and that this capitalisation will affect differences in affordability ratios.

One such interregional difference results from the differential impact of the Council Tax. And, once again, American evidence is that differences in taxation levels are capitalised into house prices. In the case of the Council Tax it is known that although the absolute amounts of tax paid are to some extent equalised across regions, yet, because house prices (and incomes) are lower in the northern regions, the Council Tax represents there a greater percentage of the value of the average house. Chart 7.3 in Kate Barker's Interim Report shows Council Tax being about 0.9 per cent of the value of the average house in the north with the percentage falling to less than half of this in London and the South East. The percentage is known to be significantly higher than this for cheaper houses, and this is particularly true of the North. If the purchase of a house costs more in the North because of tax then one would expect prices to be lower. Indeed if one assumes an interest rate of about five per cent then the implication is that an extra 0.5 per cent housing cost because of Council Tax would result in house prices being some ten per cent cheaper. And the price reduction would be greatest for smaller houses in the North.

This means that one would expect the affordability ratio to be lower for the northern regions and, over all, the affordability ratio would be systematically related to the level of Council Tax as a proportion of house prices. Thus, across regions one would expect the affordability ratio to be lower in the north and higher in the south. One may hypothesise that this is what accounts for the apparently permanent differences between regions, especially in the mid-nineties when the housing market seemed to be in some kind of equilibrium. Of course it scarcely needs to be said that a lower affordability ratio in a region does not mean that housing is more affordable there if the lower ratio results from higher levels of Council Tax which make the cost of housing occupation higher there.

Note that changes in costs over time will also affect ratios over time. Thus the changes in local government taxation at the end of the eighties should have affected relative affordability ratios then. And as the level of Council Tax has increased over the past few years, in real terms, one would have expected the southern ratios to increase relative to the northern ratios.

Local living allowances

A third problem arises when differences in housing costs between regions are wholly or partially compensated by differences in income levels. This is clearest with regard to London Living Allowances, whether explicit, as is usual in the public sector, or implicit, as is more usual in the private sector. If those living in London are paid an additional allowance, and this allowance is expected to be very largely spent on housing the ratio of housing costs to incomes would tend to be lower than elsewhere.

Conversely, many commuters into London will be in receipt of allowances which, instead of paying for housing in London, they use to cover the higher travel costs resulting from living in cheaper housing some distance from the city. Again, this should result in the affordability ratio for these exurban areas being lower. In fact, despite the existence of so-called Roseland allowances (where ROSE stands for Rest Of the South East), the ratio of lower quartiles is

almost invariably higher in the South East than it is for London, and both, of course, are generally higher than elsewhere.

Adjustment in the local economy – incomes

The affordability ratio can change in the long run because the local economy adjusts over time to the fact that land and housing is expensive in the region. Thus one would expect that in regions such as London and the South East where house prices and land prices have been higher than elsewhere for some time, as have wage levels, so the industrial structure should also adapt. Because land costs and labour costs are higher one would anticipate that activities which depend on cheaper labour and/ or land to move elsewhere. Thus large scale manufacturing industry may be driven out of the region, or the country, as may the more routine clerical functions. In the latter case the UK government has actively promoted such moves in respect of its own activities. A private sector example would be call centres, deliberately located in areas (and countries), where labour is cheaper. Thus employment in the higher cost regions, particularly London and the South East, has become increasingly concentrated in more specialised activities employing more specialist, higher paid, labour. And it follows that, compared to other regions, one would expect the income distribution to be attenuated at the lower end, and so the lower quartile would be higher. Since house prices will also be higher it is, however, not absolutely clear whether the ratio of lower quartiles should be expected to be higher or lower.

Adjustment in the local economy – housing

Just as the income distribution may be affected by longer run changes, so may the house price distribution. In areas such as London and the South East, where house and land prices are higher now than they once were, and where the higher prices are expected to persist, there is economic pressure to use land more intensively than it was used before. This economic pressure manifests itself in various ways. Most obviously it results in houses being demolished and replaced by blocks of flats. Here the sale of the newer houses is represented in the house price distribution. But the economic pressure to use land intensively also results in the purchase of houses which are then extended where the size of the lot makes this feasible. And where this happens the construction of the extension is not reflected in the house price distribution. And so the house price distribution is slightly distorted with prices generally lower than they should be to reflect the true market position.

This pattern of extending houses is the more likely where local planning authorities seek to discourage larger houses and to promote, by planning constraints, the construction of smaller rather than larger dwellings. One would then expect the price of larger dwellings to rise relative to the price of smaller leading to increased pressure to extend, where it is feasible, existing smaller dwellings.

Alternative Measures

What additional or alternative measures of affordability might be considered. A number of suggestions might be made. The relevant variables are the price of houses and the level of incomes or the relation between the two.

The clear choice that has already been made by the ODPM is to use a simple ratio but of lower quartile house prices and lower quartile employment based incomes. Some of the problems with that specific measure have already been raised – notably that in some localities

with large rental sectors the measure will not reflect the true position of potential first-time buyers. A further problem is the quality of the data is poorer for lower quartile than average (median) house prices. It is clear that the median price/median income ratio should also be measured and continuing differences between this and the ratio of lower quartiles should be examined to ascertain the reason.

In many ways a more appropriate measure of affordability is the proportion of income needed to purchase a lower quartile priced property – in other words the direct user cost. This measure addresses two issues of importance to affordability – first year mortgage costs and the other unavoidable costs of owning including insurance and maintenance. Such a measure more directly addresses the question of whether first time buyers are able to enter the market. However it will vary more obviously with demand and financial market factors – and could be argued to suffer even more than the price/income ratio from endogeneity – because it more directly reflects consumer decision processes.

In the context of social housing – and the view that housing has some element of a merit good for those attempting to enter the market – it is usual to measure affordability in terms of residual incomes after housing costs. This provides an assessment of whether the household is able to achieve minimum standards with respect to all necessary goods not just housing. In terms of overall government objectives this undoubtedly has resonance – although it should be recognised that it tends to show greater affordability problems in the Northern regions, not because of high house prices but because of low incomes.

A rather different measure – which would be more consistent with the need to link with sustainability and intra regional planning is to address the issue in the framework specified in the land use planning approach to defining the need for affordable housing. This starts from local housing market analyses to assess the proportion of households that cannot be expected to afford acceptable accommodation without assistance. They are also assessed at the regional level. The planning authorities are expected to use a range of measures of affordability as specified above. Linking it to the supply of housing overall would involve a decision about the long term proportion of households that might be expected to need assistance in an efficiently operating regional market – but would have the benefit of providing a direct link between the planning and economic approaches. At the least the relationship between the two types of approach will need to be transparent.

A rather different approach to measurement addresses the question of endogeneity by excluding incomes and concentrating on prices. This bears most directly on both the model and the underlying objectives.

First, since the main aim in the long run is to bring down the rate of increase of house prices it would seem evident that an index of house prices, properly adjusted for changes in size and quality would be necessary to see whether this policy target was being met. Moreover it would be advisable also to have or create such indices both at the national level and for each region. Customarily these would measure changes in median or mean house prices.

But, secondly, given that we are interested in the level of prices of smaller houses some different measure might be useful as an indicator of these prices. One possibility might be the measure of the lower quartile in the distribution used to measure the average, as outlined above. This may not be statistically possible however, since the quality adjusted index is not actually the mean point of a statistical distribution.

Thirdly, there is a way round this which would be to choose a house type or group of house types which might be regarded as representing the kind of dwellings bought by those in the lower quartile of the income distribution. This might not be possible on a national scale. The kind of dwellings bought in one region will differ from those bought in another; the terrace houses bought in, for example, Leicester will differ from the tenements bought in Glasgow. But it should be possible to construct a representative mix for each region, and track movements in prices relative to incomes and other prices.

Constructing measures such as these would pose problems but these problems would not seem to be insuperable. More generally we would expect the regions to monitor the full range of measures of affordability and house prices as well as evidence on the proportion of households in need of additional assistance to find reasonable accommodation and the tenure structure of the region. The regions would also wish to measure the same set of variables at the sub-regional and housing market levels.

Lower Quartile House Price to Earnings Ratio (selected years)

	1990	1995	2000	2001	2002	2003	2004
London	5.12	3.82	5.40	6.02	6.77	7.73	8.21
Eastern	5.17	3.85	4.42	4.77	5.55	6.68	7.50
S East	5.71	4.23	5.19	5.63	6.33	7.48	8.02
S West	5.47	4.03	4.73	5.17	5.93	7.11	8.10
W Mids	4.03	3.59	3.54	3.69	4.20	4.97	5.91
E Mids	4.06	3.36	3.43	3.56	4.02	4.88	5.99
Yorks & H	3.29	3.26	3.04	2.99	3.07	3.47	4.74
N West	3.01	3.08	2.89	2.87	2.88	3.28	4.32
N East	2.57	2.96	2.76	2.64	2.69	3.09	4.14

APPENDIX 2

Modified Projections of Households in England and Regions in 2011 and 2021

Introduction

In this second appendix, further details are presented of the household projections set out in Table 2 of the main report. In particular, it considers revisions to the official household projections, arising from more recent 2003-based population projections.

The household projections

The work reported in this appendix is based on Interim Household Projections in England to 2021 published by the Office of the Deputy Prime Minister (ODPM) in September 2004. These projections are 2002-based, in the sense of being derived from 2002-based population projections for England published by the Government Actuary's Department. The most recent definitive official household projections were 1996-based and published in Projections of Households in England to 2021 (Department of the Environment, Transport, and the Regions (DETR) 1999). They were produced from a model that comprised projections of marital status, specific for age and sex, and projections of cohabitation; and projections of household headship rates (technically "household representative rates") specific for age, sex, marital status, and cohabitation. The projections of headship rates were made from trends estimated from 1971, 1981, and 1991 census data, plus post-1991 data from the Labour Force Survey. This model, termed here "the 1996-based household projection model", was used in conjunction with the 2002-based household projections to produce the Interim Household Projections. They are "interim" in the sense that they will be superseded by (probably) 2003-based definitive projections in which the marital status and cohabitation projections, and the household headship rates are estimated from data that include the 2001 census.

It is important to emphasise that all the data in the 1996-based household projection model came from before 1996; and that in consequence the differences between the number of households given by the official 1996-based projection and the 2001-based interim projection are due entirely to the projections of the population and its age and sex structure. The 1996-based household projections showed an increase of 3.0 million households in the two decades from 2001 to 2021; and the interim 2002-based projection put the increase at slightly under 3.8 million. In annual terms the projected increase in households was raised from 150,000 a year between 2001 and 2021 to 189,000. The changes in the population projection that generated this large upward revision to the increase in the number of projected households were: (a) an assumed faster fall in mortality rates; and (b) higher inward migration from outside the United Kingdom. These changes to the assumptions were the result of experience after 1996. The more rapid fall in mortality rates is an independent influence on the future growth of the population. The migration assumption depends on a continuation of present trends and policies. Table A compares the 2002-based interim projections with the 1996-based projections. The comparison is of increases, because it is

projected increases that are of most interest in connection with estimates of future demand and need for housing.

Table A: 1996-Based and 2002-Based Household Projections from the 1996-Based Projection Model: Net Increases in 2001-11 and 2001-21 (000s)

	2001-11		2011-21		Difference between projected increases 2001-2021
	1996-based	2002-based	1996-based	2002-based	
North East	36	31	32	28	-9
North West	122	159	113	150	+74
Yorkshire and Humber	124	131	112	125	+20
East Midlands	140	161	127	156	+48
West Midlands	110	147	99	140	+78
East of England	210	233	207	258	+74
London	249	483	268	444	+410
South East	332	324	325	353	+20
South West	202	222	198	229	+51
England	**1,527**	**1,889**	**1,481**	**1,883**	**+764**

The regional population projections from which the regional household figures are derived are trend-based and therefore do not take on board possible constraints that might prevent past trends from continuing. Such constraints come into consideration when policy implications are being assessed. London is the obvious instance in Table A. The main reason why the 2002-based interim projection for London is so much higher is the much higher assumption about immigration. A high proportion of immigrants go to London in the first instance, so changes in the migration assumption for the United Kingdom as a whole have a disproportionate effect on the population projection for London. The upward revision to the projected increase in London's population is the reason for the net increase in households in London between 2001 and 2021 being over 400,000 higher in the 2002-based projection.

The household, marital status and cohabitation data from the 2001 census that are needed for new definitive household projections are not yet available. The 2001 census data do however show that the actual number of households in 2001 was lower than estimated from the 1996-based model, which shows that as far as 2001 the model over-projected households relative to population in England as a whole. The size of the over-projection is hard to assess with any precision. The census total of households was 20,451,000, which has not been officially revised, though the mid-year estimate of the population in 2001 has been revised upwards by 269,000. A review of evidence about the number of households in 2001 including survey estimates of the number of households in shared dwellings, Council Tax information, and the age composition of the revisions to the population estimates indicates that the census probably under-stated the number of households in 2001 by between 150,000 and 160,000 in England as a whole. The under-statement was concentrated in the South of England; one-half of it appears to have been in London.

Whether an over-estimate of households relative to population in 2001 by the 1996-based household projection model was symptomatic of a tendency to over-project that might run on into the future would depend on its causes. Because the over-estimate was concentrated in the South of England any likely causes would have to be specific to the south, not

nationwide in their impact. Two causes that meet this test have been suggested: very rapid increases in house prices reducing the number of people that could afford to live independently; and lower proportions of recent migrants living in separate households than in the whole population. The implications of these possible explanations (not of course mutually exclusive) are different. A lower propensity of migrants to live in separate households would be operative in future years in view of the continuing high level of net inward migration assumed in the projections. But an increase in house prices relative to income at the rate experienced in the second half of the 1991-2001 decade could not continue much further, and indeed has not done so. There is evidence of over-estimating by the model in the first half of the decade when house prices were falling in real terms in southern England, so house prices could not be the sole cause of the over-statement in 2001. There is some supporting evidence of lower proportions of inward migrants living independently from the Labour Force Survey. The assumption is made here that lower household formation by inward migrants was the sole cause of over-projection in the first half of the 1991-2001 decade; and that in the second half house prices were equally important. The effect is to treat one-third of the over-statement of households relative to population in 2001 as non-recurring, and two-thirds as running on cumulatively to 2001 and 2021. The modified household projection is shown in Table B. The projections for 2011 and 2021 for the regions of the North and Midlands are not altered. The increases between 2001 and 2011 are slightly smaller owing to revisions to households in 2001.

Table B: Modified 2002-Based Household Projection: England and Regions 2011 and 2021 (000s)

	2001	2011	2021	Increases	
				2001-11	2011-21
North East	1,081	1,104	1,132	23	28
North West	2,833	2,981	3,131	148	150
Yorkshire and Humber	2,087	2,216	2,341	129	125
East Midlands	1,738	1,896	2,052	158	156
West Midlands	2,157	2,305	2,446	148	139
East of England	2,238	2,457	2,701	219	244
London	3,091	3,513	3,901	422	388
South East	3,303	3,597	3,920	294	323
South West	2,091	2,302	2,525	211	223
England	**20,619**	**22,372**	**24,148**	**1,753**	**1,776**

Comparison with Table A shows that the downward revisions amount to 136,000 between 2001 and 2011 and a further 107,000 between 2011 and 2021. One-half of the revision is in London. But even so the projected net increase in households in London between 2001 and 2021 is 290,000 greater than in the 1996-based population projection. The Mayor of London's *Greater London Housing Requirements Study* (December 2004), however puts the net increase in households in London over the ten years from 2002 at 337,000, 34,000 a year. This is not a supply-constrained estimate; but it was made by a different method, in which neither a population projection nor a household projection was used.

The modified household projection in Table B is derived from the official 2002-based projection of the population. It has since been superseded by a 2003-based projection, which is higher because the negative "non-attributable" population change included in the 2002-based projection has been taken out. No official 2003-based household projection has been produced from it. But as it is the current official projection of the future population of England, an estimate is made here of the number of households that would be projected for

2011 and 2021 if the 2003-based projection were substituted for the 2002-based projection in Table B. Table C shows the 2003-based version. The 2002-based version is repeated from Table B for ease of comparison.

Table C: 2003-Based Version of Modified Household Projections (000s)

	2001	2002-Based		2003-Based Revision	
		2011	2021	2011	2021
North East	1,081	1,104	1,132	1,108	1,141
North West	2,833	2,981	3,131	2,991	3,156
Yorkshire and Humber	2,087	2,216	2,341	2,224	2,360
East Midlands	1,738	1,896	2,052	1,902	2,068
West Midlands	2,157	2,305	2,445	2,312	2,464
East of England	2,238	2,457	2,701	2,465	2,722
London	3,091	3,513	3,901	3,527	3,941
South East	3,303	3,597	3,920	3,609	3,951
South West	2,091	2,303	2,525	2,310	2,543
England	**20,619**	**22,372**	**24,148**	**22,448**	**24,346**

An estimated age distribution of households in the modified 2002-based projection is shown in Table D. The age distributions in the regions of the North and Midlands are as they stand in the interim projections. In the East, London, South East, and South West regions, the projections of households with heads under age 30 and 30-44 are modified, with household with heads aged 45-64 and 65 and over unchanged.

Table D: Modified 2002-Based Household Projection: Age Analysis (000s)

England	Under 30	30-34	45-64	65 and over	Total
2001	2,224	6,128	6,843	5,425	20,619
2011	2,532	5,866	7,933	6,041	22,372
2021	2,550	5,894	8,440	7,263	24,148

In view of uncertainties about the division between the effects of house prices and of lower household formation by immigrants as causes of the shortfalls of households in 2001 relative to the figure from the projection model, and indeed whether they really were the causes, an alternative set of revisions was calculated which took the shortfalls to reflect merely a time trend which could be assumed to run on to 2011 and 2021. The projections that would be produced on that basis are in Table E.

Table E: Alternative Modified Household Projections 2011 and 2021 (000s)

	2001	2011	2021
North East, North West, Yorkshire and Humber, East Midlands, West Midlands (as Table B)	9,896	10,502	11,101
East of England	2,238	2,450	2,645
London	3,091	3,485	3,845
South East	3,303	3,582	3,890
South West	2,091	2,300	2,519
England	**20,619**	**22,319**	**24,000**

That the total for England in 2021 shown in Table E is exactly the same as the official 1996-based projection is fortuitous. The time trend method brings the increase in households down to 170,000 a year in 2001-11 and 168,000 a year in 2011-21 in England as a whole, and 39,000 and 36,000 a year in London. There is though something unsatisfactory about relying purely on projecting a time trend when a behavioural explanation is on offer.

The shortfall of actual households in 2001 relative to estimates from the 1996-based household projection model cannot be fully analysed by type of household, but comparison of census information with the estimates from the model enables tentative conclusions to be drawn:

(a) Proportions of households that are one-person households as given by the census agree closely with the model estimates, both at national and regional level.

(b) Except in London, the census reported more lone-parent households with dependent children than estimated by the model.

(c) The proportion of men and women that were married, according to ONS's 2001 census-based estimate, was rather higher than in the marital status projection that is part of the 1996-based household projection model. Whether the proportion of married couple households was correspondingly higher is not known owing to different definitions.

(d) Cohabiting households were proportionally fewer in the census than in the model estimate nationally, and in the regions of the Midlands and the South of England. In London the census figure was over 100,000 lower. How far the explanation lies in more married couple and fewer cohabiting couple households than given by the projection model is not yet known.

Perhaps the most important inference from the information about household types is that the shortfall of actual households in 2001 relative to estimates from the household projection model was not caused by fewer one-person households.

This report presents the results of an econometric modelling project, concerned with regional housing affordability.

£12.00
ISBN 1851127992

ISBN 1-851127-98-4
9 781851 127986