B Introduction to Inquiry modelling

Background

B.1 This annex sets out the approach taken to the statistical modelling used to support the analysis and recommendations in the Inquiry's final report. The Inquiry team developed several detailed models to inform the analysis of options for the reform of the local government funding system over the course of the Inquiry.

B.2 The first wave of modelling work for the Inquiry examined the impact of council tax revaluation and was reported in annexes to the *Interim Report and Consultation Paper* in December 2005. It was published before the 2006-07 local government finance settlement had been finalised, and so Annex C reports results of an updated version of the extra bands reform option using figures for 2006-07.

B.3 The other annexes to this report complement that earlier work by providing details of statistical modelling of possible options for reform, including further work on council tax and other property taxes, local income tax, business rates, the assignment of revenues and grant equalisation. The material is grouped by the areas covered by Chapters 7, 8 and 9 as shown below.

Contents of the technical annexes

B.4 This annex is an introduction to the modelling of the report and covers methodology and approach used for modelling; the main data sources; the availability of data used for modelling; and the pressures scenarios used to inform Chapter 3.

B.5 Annex C explains the technical background to support Chapter 7 and covers the following:

- council tax and point value property tax;
- council tax benefit (CTB) and related changes; and
- local income tax as a full or partial replacement for council tax.

B.6 Annex D outlines the technical background to support Chapter 8 and examines:

- full relocalisation of business rates;
- supplementary business rate;
- the impact of rents on rateable values;
- estimated yield from removing the business rates exemption for agricultural land and buildings; and
- breakdown of the empty property relief.

B.7 Annex E explains the technical background to support Chapter 9 on incentives and the grant system, including:

- council tax incentives;
- business rates incentives; and
- options for assignment of national taxation.

B.8 A series of supplementary charts and tables which provide background information to the modelling work carried out by the Inquiry team is also available on the website.

METHODOLOGY AND APPROACH

B.9 The general approach taken in the technical annexes is to present the methodology used in the analysis; assumptions; data sources; and detailed findings, particularly the impact on bills and grant by local authority region and type of household. Some pieces of modelling work do not, by their nature, fully lend themselves to this approach.

General technical issues

B.10 Although every piece of modelling work involves some technical methods and terminology, a few of them are relevant for several pieces of modelling work. Those with a more general application are defined in the glossary, with the more technical details being discussed below. Further details are given as necessary in other annexes, in the descriptions of particular pieces of modelling work.

Models used

B.11 The Inquiry team has run analysis using the Department for Work and Pensions' (DWP) Policy Simulation Model (PSM) and the Inter-Governmental Tax Benefit Model (IGOTM). Both are static micro-simulation models of the Great Britain tax and income-related benefit system and can be used to estimate the impact of changes on different types of household and on the overall government budget. The Inquiry team used these simulation models to estimate the impact of policy changes on households and the overall cost of CTB to government.

B.12 Both the IGOTM and PSM simulation models are based on Family Resources Survey (FRS) data and calculate household or benefit unit liability for taxes and entitlement to benefits.[1] Although similar, the models are not identical and each has particular strengths for analysing different areas of the tax and benefit system.

B.13 Most of the council tax reform analyses were run using IGOTM, but analyses of the costs of some CTB reforms were based on PSM to check the implications for the overall government budget at full take-up of CTB. Survey data are recognised as having limitations but the Inquiry team used them as the most accurate available data, and to ensure consistency with central government's own work.

B.14 Net household income is usually defined as the income received by a household after taking account of taxes and benefits, but before deducting housing costs. The usual presentation of analyses involving net household income includes a breakdown by income decile, where each decile represents the range of incomes relating to one tenth of the number of households after sorting by income. The first decile represents the 10 per cent of people on lowest incomes, whereas those in the tenth decile are the 10 per cent with highest incomes.

B.15 The usual presentation of analyses involving household types includes a breakdown into seven categories of household: single non-pensioner; married without

[1] In IGOTM, the most recent available estimates of CTB take-up are applied to the FRS-based data in modelling where actual take-up rates are modelled, even if they relate to an earlier year in practice. In particular, the IGOTM modelling work carried out by the Inquiry team is based on estimates of take-up for 2003-04. DWP has since published some estimates for 2004-05, which are similar to those for 2003-04 for overall take-up rates.

children; married with children; one-parent families; single pensioners; married pensioners and multiple tax units with or without children.

B.16 When interpreting figures for the average local tax as a percentage of household income produced using IGOTM, it should be noted that they are calculated on a 'democratic' (or unweighted), rather than 'plutocratic' (or weighted) basis. This helps to explain the findings that show increased average tax bills, but decreased average percentage burdens, which arise in some of the analyses. Details are given below:

Plutocratic and democratic averages

Suppose there are three people whose tax bills are £5, £10 and £15 per week, with incomes of £50, £150 and £400 per week respectively. For both plutocratic and democratic averages, the average bill is calculated in the 'normal way', as (£5+£10+£15)/3 = £10.

For plutocratic averages, the average burden is the sum of all bills divided by the sum of all incomes; (£5+£10+£15)/(£50+£150+£400) x 100% = 5%.

For democratic averages (as calculated in IGOTM), the average burden is the unweighted average of the individual burdens: (£5/£50+£10/£150+£15/£400)/3 x 100% = 7%.

The plutocratic average gives more weight to the taxpayer who is contributing more to the total pot, who here has a lower burden. Democratic averages are not weighted like this.

This explains some instances where the results seem counter-intuitive. For example, calculating, the average tax bill in the 'normal' way can result in an increase in average bill at the same time as the percentage burden appears to reduce. This is because the burden is calculated using an unweighted democratic average, which does not give more weight to those taxpayers contributing more to the pot whose burdens have increased.

Terminology and definitions

B.17 This section explains some of the key terms used in the modelling. The local authorities included in this modelling work are billing authorities and major precepting authorities. The modelling has not included separate figures for parish and town councils – which are known as local precepting authorities – although aggregate amounts of council tax precepted by them have been included in the council tax figures for the relevant billing authority where appropriate to the modelling.

B.18 The precise definition of 'budget requirement' includes adjustments for collection fund surpluses and deficits. It also includes expenditure funded from certain other items for particular authorities, such as GLA General Grant for the Greater London Authority, and the business rate yield from the City of London's own multiplier.

B.19 There are two different definitions of 'tax base'. The 'tax-setting tax base' for a local authority, is used in practice when calculating the average band D council tax for a local authority, whereas the 'tax base for Formula Grant purposes' is used in the calculation of Formula Grant. They differ in respect of the treatment of second home discounts. In addition, the former reflects a billing authority's estimate of its council tax collection rate, whereas the latter assumes 100 per cent collection for all billing authorities.

Common assumptions

B.20 The Formula Grant figures used in the modelling work usually exclude the effects of floor damping, in order to identify the effects of using the underlying grant figures.[2]

B.21 When calculating the impact on council tax bills of changes to grant distribution (for example in revaluation modelling), the modelling generally assumed that a local authority's budget requirement remains the same. Calculation of average council tax bills was therefore carried out by using the recalculated grant figures in place of the actual 2006-07 Formula Grant figures. The resulting required council tax yield was then divided by the tax-setting tax base figure to give a revised band D council tax figure for each local authority.[3] These were then added up to give a revised figure for the band D area council tax – the average band D bill – for each billing authority area. These figures were used in conjunction with data based on the Family Resources Survey to model the effects at a household level.

B.22 Unless otherwise stated, each analysis relates to England as a whole.

MAIN DATA SOURCES

B.23 The main data sources used were:

Council tax

- figures relating to numbers of dwellings, council tax discounts and council tax exemptions, broken down by band, submitted by billing authorities to the department for Communities and Local Government (CLG) on council tax base (CTB1) returns for October 2005;[4]
- figures relating to 2006-07 budget requirements and council tax requirements and council tax bases, submitted by local authorities to CLG on Budget Requirement (BR) returns;[5] and
- figures for amounts of Formula Grant for 2006-07, as calculated by CLG, and subsequently reported on BR returns.[6]

Business rates

- figures relating to forecast and actual yields from business rates and associated information on rateable values and reliefs submitted by billing authorities to CLG on NNDR returns.

[2] Floor damping occurs as the final block of the four-block model. It involves constraining the figures calculated for each authority to guarantee a minimum year-on-year percentage increase in grant for each class of authority. More details are given in Annex A.

[3] Tax bases were revised where necessary, for example to reflect new band ratios or the introduction of extra bands.

[4] Figures from CTB returns for October 2006 are available at the time of publication of the final report, but were not available at the time of modelling.

[5] Figures from BR returns for 2007-08 are expected to become available at about the time of publication of the final report, but were not available at the time of modelling.

[6] Although provisional Formula Grant figures for 2007-08 were available at the time of modelling, final figures were not available, and neither council taxes nor budget requirements for 2007-08 had been set, so that any 2007-08-based modelling would have been incomplete.

Characteristics of households

- household data based on the Family Resources Survey. A combined sample from the surveys for 2003-04 and 2004-05 was used, with the sample size in England being just over 20,000 in each year. The survey results were grossed to give results for all 21 million households in England.

B.24 Table B1 shows how the households for which figures were used in modelling can be broken down by household type and income decile.[7] The seven household types that are used in the analysis vary in size from 1.3 million households (one-parent families) to 3.9 million households (married without children).

Table B1 - breakdown of grossed household figures used in IGOTM modelling

Thousand

Equivalised Income Decile	Household type							Total
	Single non-pensioner	Couple without children	Couple with children	One-parent families	Single pensioners	Pensioner couples	Multiple tax units with or without children	
1	445	200	270	306	247	175	371	2,015
2	230	186	377	281	425	353	250	2,101
3	232	194	374	194	468	359	290	2,111
4	259	200	353	152	535	286	331	2,114
5	266	251	392	121	427	274	382	2,113
6	318	329	420	79	303	210	459	2,118
7	323	426	422	50	263	151	483	2,116
8	377	556	430	40	133	135	448	2,118
9	456	686	361	30	75	96	413	2,117
10	537	838	337	10	70	88	237	2,117
Total	**3,443**	**3,866**	**3,735**	**1,262**	**2,945**	**2,126**	**3,664**	**21,041**

Source: IGOTM

B.25 Other data sources were also used for particular pieces of work, such as income tax yields and average domestic property values. They are described in the relevant section.

THE AVAILABILITY OF DATA USED FOR MODELLING

B.26 Some of the data used for modelling are available to anyone who may wish to use them, though this varies according to the particular data sets used. Details of the availability of the main data used are given below.

Council tax and business rates

B.27 Figures taken from CTB1, BR and NNDR returns provided by local authorities to Communities and Local Government are available from the Data & Dissemination team, Local Government Finance – Capital Finance and Analysis Division, Communities and Local Government, 5th floor, Eland House, Bressenden Place, London, SW1E 5DU. Statistical releases containing national totals, and local authority level figures from BR returns, are available from http://www.local.communities.gov.uk/finance/stats/index.htm. Further information is

[7] In addition, figures for some households were excluded from modelling because they were outliers.

available from John Farrar at john.farrar@communities.gsi.gov.uk and on 020 7944 020 7944 4158.

Formula Grant

B.28 A wide range of information on the local government finance settlement for 2006-07 is available at http://www.local.communities.gov.uk/finance/0607/grant.htm. There are constraints on the dissemination of some of the data used in the settlement, placed on Communities and Local Government by the suppliers, which mean that some of the data are published authority-by-authority at http://www.local.communities.gov.uk/finance/0607/tabs067s.htm, rather than all in one place. More comprehensive databases are made available to a limited audience for the purposes of research only. Further information is available from Jo Joslin at jo.joslin@communities.gsi.gov.uk and on 020 7944 4048.

Characteristics of households

B.29 As stated above, two models were used to examine the effects of various policy options on households: the Department for Work and Pensions (DWP) Policy Simulation Model (PSM) and the Inter-Governmental Tax Benefit Model (IGOTM), both of which use datasets derived from the Family Resources Survey.

B.30 The PSM and IGOTM require access to detailed data at an individual level in order to model accurately the calculation of individual taxes and income-related benefit entitlements. Both models use datasets derived from the Family Resources Survey, which provides the detailed microdata used within the model to represent the population. An anonymised version of this dataset is deposited at the UK Data Archive at the University of Essex. Further details are available from http://www.data-archive.ac.uk/Introduction.asp.

Domestic property values

B.31 Data relating to average property values at 1 April 2005 in billing authority areas were provided by the Valuation Office Agency (VOA) and used in the modelling of extra council tax bands without revaluation and a point value property tax scenario. The particular datasets used in the modelling cannot be released because doing so would breach the VOA's statutory duty of confidentiality.

Income tax data

B.32 Estimates of the yield from 1p on the basic rate of income tax for each local authority area for 2006-07 were provided by Her Majesty's Revenue & Customs (HMRC) and used in the modelling of several options relating to a local income tax. They were produced using the Department's Personal Tax Model (PTM) and information from the Survey of Personal Incomes (SPI). The particular datasets used in the modelling cannot be released because they contain confidential taxpayer information.

B.33 There are two sources of publicly available material:

- HMRC publishes National Statistics on income tax and personal incomes on their website. Tables 2.1 to 2.7 can be found at http://www.hmrc.gov.uk/stats/income_tax/menu.htm, and tables 3.1 to 3.15 are available at http://www.hmrc.gov.uk/stats/income_distribution/menu.htm,

- HMRC also makes available an anonymised public usage tape of the Survey of Personal Incomes, which is deposited in the UK Data Archive at the University of Essex, http://www.data-archive.ac.uk/. The datasets can be accessed at http://www.data-archive.ac.uk/findingData/subjectResults.asp?gn=33297&subcat=VII%5CD.

B.34 Further information is available from Shahida Begum at shahida.begum@hmrc.gsi.gov.uk and on 020 7147 3045.

Rating of agricultural premises

B.35 Details of the method used to estimate the rateable values of agricultural land and buildings, based on data from the Defra Farm Business Survey (FBS), are given in Annex D. Further information on the Defra Farm Business Survey is available from the Defra website at http://statistics.defra.gov.uk/esg/asd/fbs/default.htm. More generally, a range of statistical notices and publications that use FBS data are available at http://statistics.defra.gov.uk/esg. Further information is available from Selina Matthews at selina.matthews@defra.gsi.org.uk and on 020 7238 3274.

PRESSURES SCENARIOS

Description of the methodology

B.36 The Inquiry team modelled some simplified scenarios for local spending and revenues over the next twenty years. These are purely illustrative and are not predictions, nor were they based on any specific or private information about what might actually happen. They are simply intended to give a sense of the range and scale of possible pressures, depending on trends in spending and revenues.

B.37 Data on local authority expenditure and revenues is published by CLG, as:

- net current expenditure by service; and
- revenue expenditure and financing.

B.38 The difference between projected expenditure (after efficiency savings) and projected revenues from central government was deemed to be the amount of yield required from council tax. This generated an assumed increase in council tax yield from one year to the next. The model converted this increase in yield into a percentage increase in band D bills, assuming total tax base growth of 0.8 per cent per year.[8] If income was less than forecast expenditure, council tax was assumed to increase. If income exceeded forecast expenditure, council tax bills were assumed to reduce.

B.39 All figures are expressed in cash terms. Assumptions are in some cases informed by the predicted rate of inflation, which is based on GDP growth according to HM Treasury forecasts. At the Pre-Budget Report 2006 this measure of inflation was running at 2.7 per cent.

[8] Tax base growth projections of 0.8% per year were based on advice from CLG, and reflects trend growth over recent years.

Assumptions

- Spending on waste services increases in line with the projections in the 2005 waste strategy review; [9]
- Growth in spending on social care for older people in line with the projections made in Derek Wanless' report for the King's Fund. Figures related to Wanless' baseline scenario, and do not assume any policy change;[10]
- Growth in all other service expenditure was subject to a variable assumption as part of the scenarios modelled;
- Efficiency savings across total expenditure were projected at 3 per cent year-on-year until 2010-11, in line with the commitment set out in the 2006 Pre-Budget Report. Thereafter a lower rate of 1 per cent year-on-year efficiency savings is assumed, on the basis that a stronger assumption that this might imply policy change on service provision, which is not within the scope of this model; and
- Revenues from central government were subject to variable assumptions. These were separately input for Formula Grant (business rates and Revenue Support Grant combined), and Specific and Special Grants (excluding Dedicated Schools Grant).[11]

[9] Defra, *Review of England's Waste Strategy*, 2006

[10] Derek Wanless, *Securing Good Care for Older People; taking a long term view*, King's Fund 2006. Since Wanless' projections are expressed in real terms, a GDP deflator was applied to give cash figures. The rate of growth in these, averaged over five year periods, was applied to the model.

[11] DSG growth is held constant at 5.7%, which is consistent with current growth rates. This is not assumed to have an impact on council tax since the model assumes that changes in schools funding would be mirrored in schools spending, and so made neutral overall. Grant to police and fire authorities, and to the Greater London Authority, are assumed to grow in line with Formula Grant.

Outputs

	Revenue growth	Spending growth[12]	Implied average increase in band D council tax over 20 years
Varying the rate of spending growth	Formula grant 2.7% Specific grants 5%	**3.7%** (or 1% real growth)	**-3.4% per year**
		5.2% (or 2.5% real growth)	**5.6% per year**

	Revenue growth	Spending growth[12]	Average increase in band D council tax over 20 years
Varying the rate of funding growth from central government	**Formula grant 3.7%** Specific grants 5%	5.2% (or 2.5% real growth)	**5.0% per year**
	Formula grant 5.2% Specific grants 5%		**3.5% per year**

[12] Excluding waste and social care for older people