HM Treasury

SAS Forum UK 2015

Using SAS to model the distributional impact of government policies

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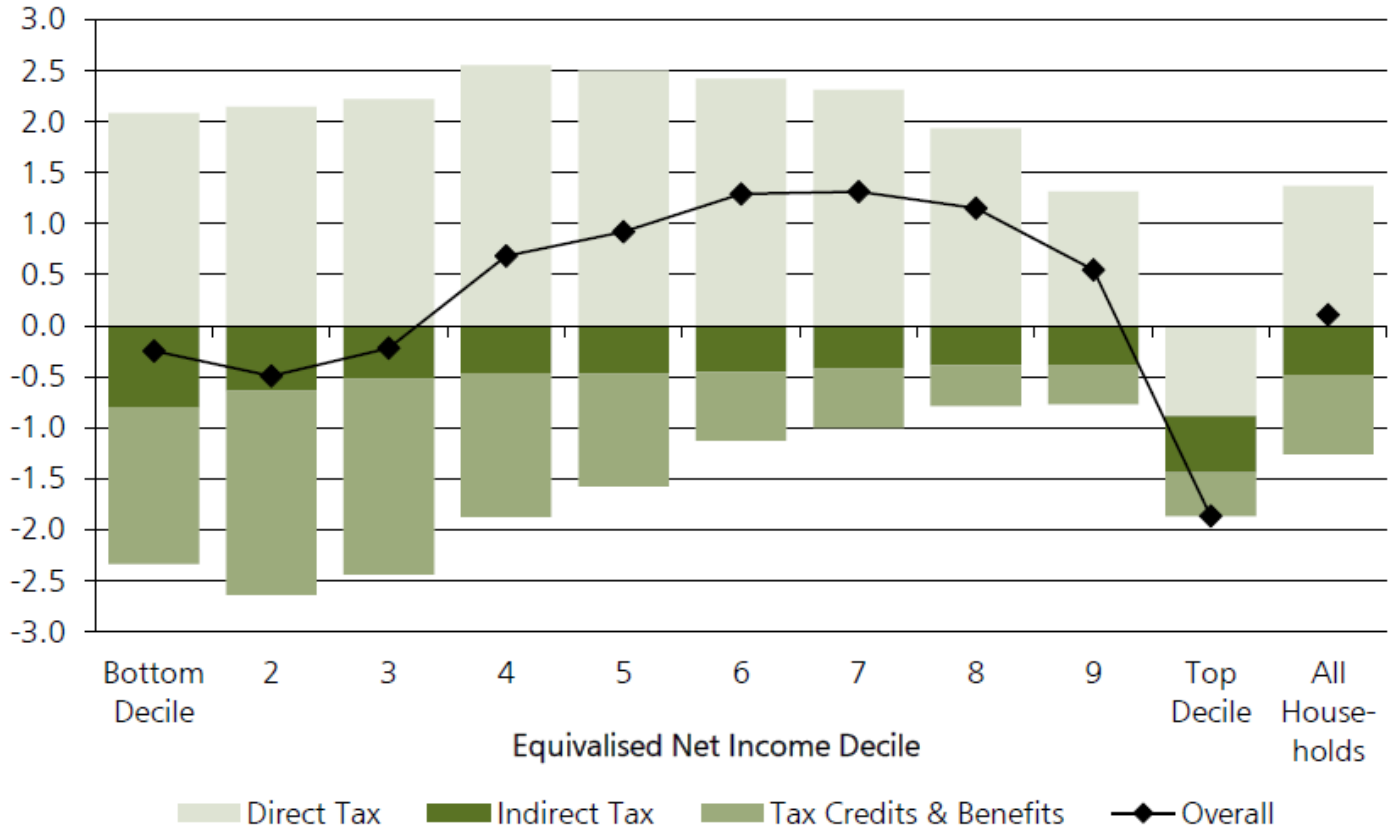
About us

- Labour Markets and Distributional Analysis team in HM Treasury
- Advises ministers on the distributional implications of tax and public spending policies.
    - How would a cut in income tax benefit households at different points across the income distribution? What about different household types?
- Since 2010, we have also published regular analysis of the cumulative impact of the government's policies (e.g. fiscal consolidation) on households, across the income and expenditure distributions.
    - First analysis of tax and welfare measures published in the June 2010 Budget, then updated at biannual fiscal events (March Budget and Autumn Statement) and the less frequent Spending Reviews

Budget 2015 chart

Chart 2.D: Cumulative impact of modelled tax and welfare changes on households in 2015-16 as a percentage of 2015-16 net income, by income decile



Source: HM Treasury microsimulation model

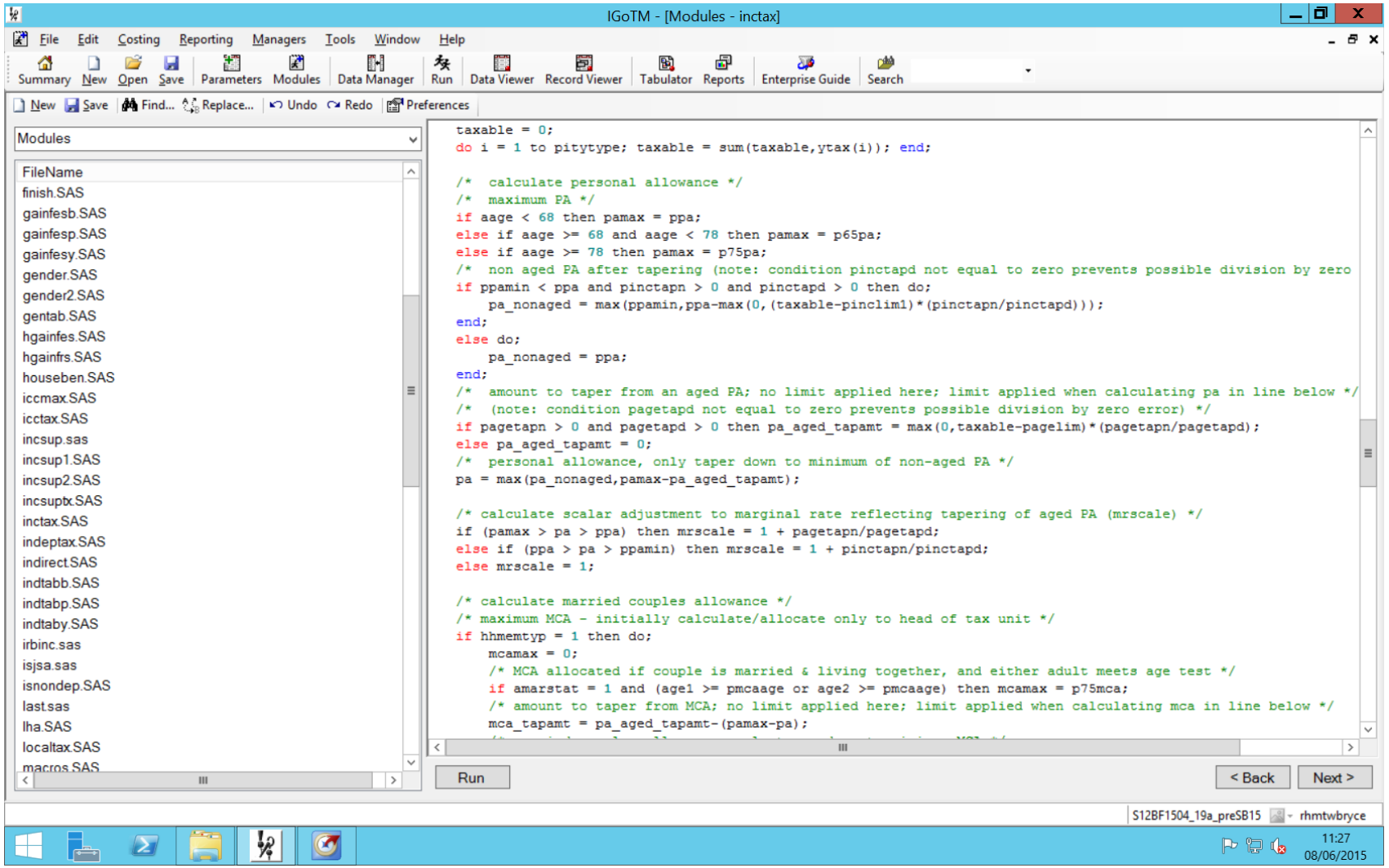
30 years of microsimulation modelling of the tax and benefit system

- The team uses HM Treasury's **I**ntra-**Go**vernmental **T**ax and Benefit **M**odel (IGOTM) – a non-behavioural, static microsimulation model in use since the 1980s. The current version (IGOTM2) has been in use since 2001 and successive governments have been using it to inform key policy decisions since.
- One of a number of government microsimulation models, such as DWP's Policy Simulation Model (PSM), though only IGOTM can model the impact of indirect taxes (e.g. VAT, duties) and benefits in kind (e.g. spending on the NHS).
- Model used to be jointly owned with several other government departments e.g. HMRC and the Department for Communities and Local Government, but now sits solely within HMT.

What is IGOTM?

- An input dataset and series of SAS modules (called ‘costings’) modelling a wide range of taxes, benefits and benefits in kind from public services, all run through a central ‘Control’ module behind a front-end.
- Underlying dataset is the ONS’s Living Costs and Food Survey (LCF), an annual survey capturing detailed information on household incomes and expenditure. Sample size approx. 13,000 individuals (6,000 households) – we pool 3 years together to improve robustness.
- IGOTM uses this data to microsimulate direct and indirect taxes as well as means tested benefits and tax credits.
- ‘Running’ a costing requires the creation and manipulation of a large number of big datasets, which SAS allows us to do quickly. We also use SAS to produce the detailed statistical breakdowns needed for follow-up analysis.

IGOTM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isjsa.sas
isnondep.SAS
last.sas
lha.SAS
localtax.SAS
macros.SAS
taxable = 0;
do i = 1 to pitytype; taxable = sum(taxable,ytax(i)); end;
/* calculate personal allowance */
/* maximum PA */
if aage < 68 then pamax = ppa;
else if aage >= 68 and aage < 78 then pamax = p65pa;
else if aage >= 78 then pamax = p75pa;
/* non aged PA after tapering (note: condition pinctapd not equal to zero prevents possible division by zero
if ppamin < ppa and pinctapn > 0 and pinctapd > 0 then do;
pa_nonaged = max(ppamin,ppa-max(0,(taxable-pinclim1)*(pinctapn/pinctapd)));
end;
else do;
pa_nonaged = ppa;
end;
/* amount to taper from an aged PA; no limit applied here; limit applied when calculating pa in line below */
/* (note: condition pagetapd not equal to zero prevents possible division by zero error) */
if pagetapn > 0 and pagetapd > 0 then pa_aged_tapamt = max(0,taxable-pagelim)*(pagetapn/pagetapd);
else pa_aged_tapamt = 0;
/* personal allowance, only taper down to minimum of non-aged PA */
pa = max(pa_nonaged,pamax-pa_aged_tapamt);
/* calculate scalar adjustment to marginal rate reflecting tapering of aged PA (mrscale) */
if (pamax > pa > ppa) then mrscale = 1 + pagetapn/pagetapd;
else if (ppa > pa > ppamin) then mrscale = 1 + pinctapn/pinctapd;
else mrscale = 1;
/* calculate married couples allowance */
/* maximum MCA - initially calculate/allocate only to head of tax unit */
if hhmemtyp = 1 then do;
mcamax = 0;
/* MCA allocated if couple is married & living together, and either adult meets age test */
if amarstat = 1 and (age1 >= pmcaage or age2 >= pmcaage) then mcamax = p75mca;
/* amount to taper from MCA; no limit applied here; limit applied when calculating mca in line below */
mca_tapamt = pa_aged_tapamt-(pamax-pa);
Run
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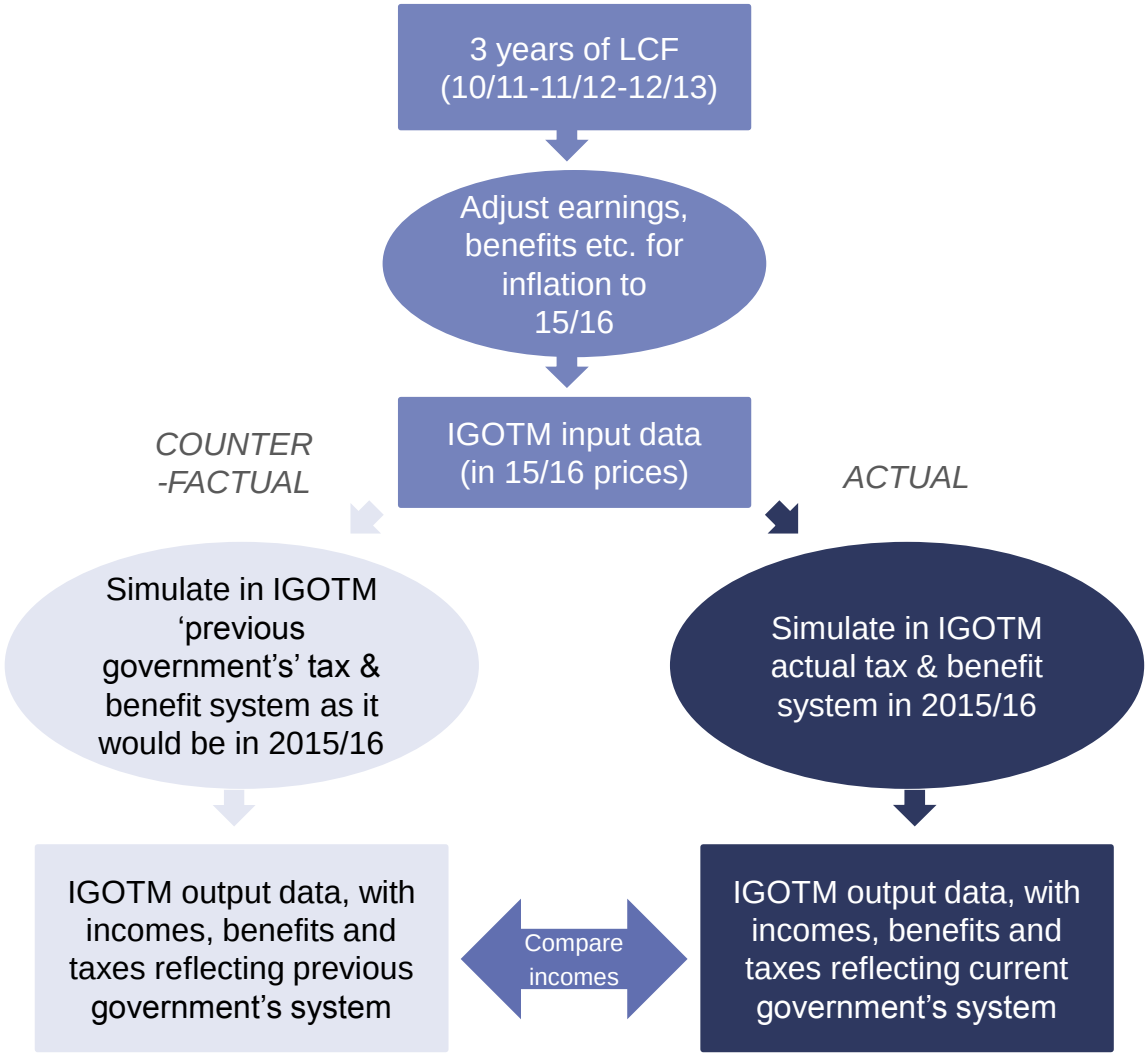
IGOTM – 'running a costing'

- Three main stages:
  - Initial manipulation of the base ONS data – due to small samples we merge 3 years of LCF data, then rename, recalculate and recode data so it's ready to use.
  - Uprating earnings, rents, benefit levels etc. in the dataset to the year being modelled, using official economic forecasts.
  - We use this uprated dataset of circumstances, incomes, and expenditure to simulate the taxes paid and benefits received of households in the base data.
- Add this up for all households in the model – once for the 'counterfactual' year (e.g. 2015-16 under the previous government's policies) and once for the policy year (e.g. 2015-16 under the current government's policies) – and compare.

Tax and welfare modelling diagram



Example: income tax

- Fred appears in the Living Costs and Food Survey dataset. He is 40 (working age) and single with no children. He earns £30,000 per year from employment, and has no other income.
- We're modelling 2015-16, so the personal allowance is £10,600, the higher rate threshold is £42,385, and the basic tax rate is 20% under government policy.
- That means that Fred has £19,400 (£30,000 - £10,600) of taxable income, all taxable at 20%, so **he pays £3,880 in income tax.**
- Under the last government's rules, the (counterfactual) personal allowance would have been £7,775 in 2015-16, the higher rate threshold £52,775, and the tax rate 20%.
- So in the counterfactual Fred has £22,225 of taxable income, all taxable at 20%, **and so pays £4,445 in income tax.**
- Looking only at the change to the personal allowance, **Fred is £565 better off** in the policy world compared to the counterfactual.

Budget 2015 chart

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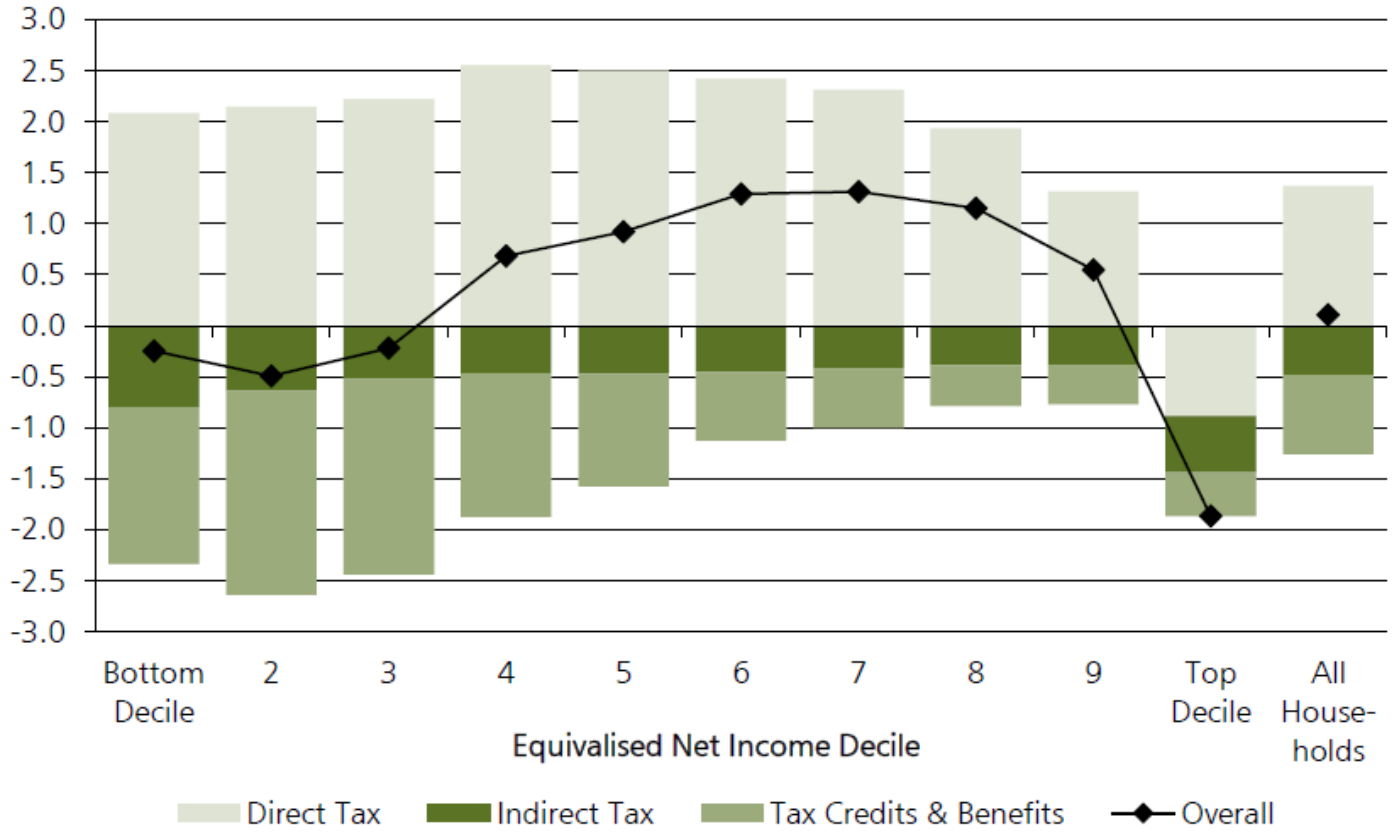

Source: HM Treasury microsimulation model

Modernising IGOTM

- Last major update to IGOTM was in 2001 – starting to show its age
- Currently working with Amadeus to bring IGOTM up to date, reflecting how its use has evolved since the previous design and to improve compatibility with our current systems:
  - Now hosted on a remote server
  - New user interface – cleaner, faster, more modern
  - Better compatibility with Windows 8
  - Moved from Base SAS v8 to Enterprise Guide
  - Additional functionality added e.g. bootstrapping to produce confidence intervals around results, and greater integration with Excel. Obsolete features removed.

Contact

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