Seminar 4: 'Bridging the Gaps; Setting the Agenda'
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Microsimulation at HM Treasury: methods and challenges
David Roe and Doug Rendle

[EDITED TRANSCRIPT]

David Roe: Good morning everybody, my name is David Roe and my colleague over there is Doug Rendle, we're both from the Treasury in London, and we're very pleased to be kicking off this morning's session. I look forward to an interesting and productive discussion.

Our short presentation will be just to give you a bit of a flavour of some of our modelling experiences in the Treasury, some of the challenges we face, and also very quickly again maybe a few of the areas we might want to explore in the future. We were going to speak for 15 minutes and take questions at the end, but with more time available now, maybe there'll just be more questions at the end or we can talk a bit more. It seems a bit odd but we're both going to speak, I know it's only a short session but if only just to say hello to everybody, there's a few people that know us here, but not very many.

And first just a few words about our unit and our interests and the work that we do.

We're located in the Budget, Tax and Welfare Directorate in the Treasury, Her Majesty's Treasury which for anybody who doesn't know is the UK Economics and Finance Ministry. The Budget, Tax and Welfare Directorate sort of does what it says on the tin and as part of all that myself, Doug and Stephen Slater whose name is on the slide here, we look at microsimulation modelling of UK tax and benefit policies.

The models arecentral to the work we do, that is microsimulation models. We're the only unit in the Treasury that does microsimulation modelling, though needless to say a lot of our colleagues have, there's a lot more of our colleagues who have a great interest in the outputs of such models, and of course not just the stuff we do in house, all the work that's done out of house as well.

So the slide tells you very briefly who does what, so do come and stop us for a chat today or get in touch, you're very welcome.

In terms of our key outputs, the sort of stuff we're doing on a day to day basis, the work we do with the models is a key plank in the policy advice that goes to Treasury ministers, in particular to pursue objectives of promoting a fair and efficient tax and benefits system, and promoting employment opportunities for all. We're looking at reforms, actual or possible reforms across a sort of wide range of personal tax and benefits. The sort of stuff we're really interested in, and the focus for that sort of analysis as you might expect are impacts on household incomes, winners and losers of course, and looking at changes in the income distribution including summary measures of poverty and household income inequality.

We do use the models for policy costings, though there are limitations of survey-based models for that question, but unsurprisingly as in other organisations they do get used in this way, at least in the early stages of policy development.

In terms of what we're doing, looking at reforms, in principle analysing tax and benefit reforms at a point in time is straightforward given a base populationSo for example that might be analysis of all the measures in a particular Budget or Pre -Budget Report. If you're interested in comparing tax and benefit systems that are separated in time you do need to put further assumptions into the models which we use mostly to separate what you might think of genuine policy reforms from changes that reflect normal or what we call policy neutral annual uprating of tax and benefit parameters.

The other area which is on the slide here that we are interested in particular is analysis of work incentives inherent in any tax benefit system and possible labour supply responses to changes in such systems.

In terms of the methods employed, we have one of the several static tax and benefitmicrosimulation models that are owned and maintained by different groups in the UK, ours is just one of those.It was born in the 1980s as a collaboration between the Treasury and our National Statistical Office. It came to the Treasury in the mid 1990s. There's been several user interfaces since then, but I think it's probably fair to say that the underlying structure of that model and the code modules, which are written in SAS if you're interested, has probably not changed a great deal, we just keep it up to date with changes in the tax benefit system.

Like all the other models, you know PSM at DWP or TAXBEN at the IFS, it's a static model, so evaluating first round or direct impacts on household incomes of possible reforms.

In terms of the benefits that are covered in there, we focus very much on the main means-tested benefits in the UK, so that's Income Support and related out of work benefits, tax credits, and the housing benefits . We do model other flows but we certainly don't model all benefits in the UK, so some of those are effectively feeding into our simulation as reported in the underlying data with just a little bit of uprating for price changes. The model takes one or other of the major UK household surveys as input, either the Expenditure and Food Survey or the Family Resources Survey, and if you do take data from the first of those of course that opens up the possibility of modelling indirect taxes using the data on household spending that's there.

Our other area of interest is in labour supply modelling, and we obviously have a particular interest here in that we work in the work incentives and poverty analysis team. You can look at distributions and changes in distributions of intermediate measures of work incentives inherent in the system, whether that's ratios of in and out of work incomes or effective marginal tax rates, and they will give you a feel for direction of travel, where you're heading under a particular policy reform. In terms of assessing possible magnitudes, that is the overall response of UK labour supply to reforms, we have benefited from delivery in 2003 of a model put together for us by researchers then based at the Institute of Fiscal Studies. This looks at labour market entry and exit conditional on in and out of work incomes that are simulated using our static model, and also conditional on other things like personal or family characteristics. There's a reference there on the slide for people who want to read more.

This model at the time was innovative I suppose in that it had an explicit focus on actual movements in and out of employment, tracked through the panel aspect of the Labour Force Survey. But that did mean that you had to do a bit of mixing and matching of datasets, linking movements in and out of work of in the Labour Force Survey with modelled incentives which of course we can only really estimate using one of the detailed household income surveys, the FRS in this case. The model looks only at participation effects, entries in and out of work only. Likely in work wages and hours are fixed in the model. And because it estimates transitions using Labour Force Survey data, we're not able to feed back what the model's saying about changing behaviours to our main tax benefit model, or at least it would take a great deal of effort to do so. There is a new behavioural model of hours worked under development at the Treasury which Doug will say a little bit more about later.

Finally, I was going to say just a few words about model maintenance. We've had a period of about 5 years where maintenance and development of our model has been conducted largely out of house. Our main tax benefit model has been maintained for us by colleagues in Her Majesty's Revenue and Customs, and of course you now know we have this labour supply model put together and indeed updated for us by people in the IFS. Now the reason for doing that I suppose is practical. We are a relatively small unit, and cannot spend all our time working with microsimulation models. So you know there's clear advantages to us in having others look after the models. I guess in terms of the challenges in maintaining these models, for a static tax benefit model, it's not so complicated in theory, rather the rules of the tax benefit system are complicated and so it takes time to keep such models up to date. I suppose in terms of the labour supply modelling, that's more genuinely a challenge, where some of the expertise required certainly to estimate those models is probably in shorter supply in our Treasury.

But there were knock ons for our unit. I think probably progressively over time we are likely to become rather less critical users of these models, as I think the development of models, or maintenance certainly informs your policy analysis, it goes hand in hand with it. And so there's something of a slight warning there, particularly with staff turnover it's quite easy to lose some of the knowledge of the, say the sensitivities and the particular limitations of models that you're using.

I guess the other thing we have found sometimes is that ready to use simulation programmes or suites for reporting on policy reforms are not always flexible to particular questions that come up. So for example in our case, users of our particular tax benefit model, and it's not the same elsewhere, have very little choice over the vintage of input data that is put into the model, and that's a real constraint for analysis of trends.

I'll let Doug take over at this stage.

Doug Rendle: Thanks David, for this part of the presentation I'm going to start off by running through a couple of examples of analysis we've used and how that's contributed to policy development, before then turning to talk about a few of the challenges we've faced in doing our analysis. And then finally I'll say a few words about some areas we might want to focus on for future development.

Just before I get into this, it's just worth saying that the focus of this discussion is on the contribution modelling has made to policy development; as for the policies themselves I'll leave it to you to judge on their success or otherwise.

So let's start here by looking at financial support for families with children. The Govt adopted the first in a series of targets to reduce child poverty in 2000 and is currently legislating on a commitment to eradicate child poverty by 2020. Whilst it's clear that such goals won't be achieved by financial transfers alone, modelling is useful in that it helps us highlight the scale of any potential challenge that we face, and also identify what kinds of policies may or may not have the greatest impact in achieving those goals.

As an example microsimulation models can tell us which sort of levers in the tax and benefit system might be more effective than others, as well as illustrating possible impacts of changes to the system.

Unsurprisingly these kinds of models really excel where the interactions between taxes and benefits are of key importance. They played a role for example in promoting an upcoming change that we're making to the way the Child Benefit income is treated in Housing and Council Tax Benefit, a change which provides additional support for those on lowest incomes whilst also, and to some extent slightly unusually, simultaneously boosting incentives as well to enter the labour market.

One thing that is worth probably mentioning is the treatment that we currently use for incomplete take up of benefits is at the moment fairly incomplete. Adoption of standard techniques to take account of take up across the range of means tested benefits which has been long practised by other groups is probably something that may be overdue.

And whilst our focus tends to be on changes in poverty outcomes following reforms, it's important that we don't lose sight of the importance of having a good level of understanding and confidence in the modelled starting points as well.

I'll just turn now to look at the second case study here on personal tax reforms, and the slide here provides a reminder of the fairly wide ranging package of reforms to the personal taxation system announced in Budget 07. Some commentators welcomed the simplification these changes brought to the tax system, but not everyone agreed and further tax changes were announced in 2008. And while the average impacts were relatively small of these changes, to give you a context, roughly around a net £2 ½ billion transferred to some 25 million households, the distributional effects were more complex which was unsurprising I guess given the mix of changes to personal tax and Family Tax Credits that were introduced.

Static models here played a key role in assessing the impact across different groups, where for example the number of earners in a family, earnings, age, eligibility for Tax Credits and number of children all played a part in determining outcomes. And particularly in assessing options helped those on lower incomes where tax changes were averse. Evidence provided by the Treasury and others to the House of Commons Treasury Select Committee's enquiry into these matters, which was published in June last year, provides further details if you're interested.

Though the microsimulation contribution was important here, it did highlight certain issues for modellers. These include for example questions about what is the appropriate level of analysis for tax and benefits modelling. Shouldhould this be done at an individual level, or should we be focusing on the benefit unit or family level, or should this be done at a

household? This has led us to a growing interest in the work others are doing on trying to gain a greater understanding of intra household income allocation, and intra household flows.

Just moving on to talk about some of the challenges we face, following the recent transfer of maintenance and development of the model back to Treasury, which David talked about, we've instigated a comprehensive review of the model.I It's not a particularly innovative thing to do but it is something which we regard at least of significant importance. It includes an audit of the model against the 2009/10 system rules, examines the coverage the model has of benefits and seeks to provide a better structure for the code and improved documentation for the model. In terms of progress, full re-writes of important areas in the model have been successfully completed, including modules on direct and indirect taxation, and the major out of work benefits. Most of the remainder of the model has been rationalised, optimised and better documented.

And the final strand of this work is to review the way the model and some key public statistics measure income, in particular against DWP's Households Below Average Income publication. The aim here is to ensure the approaches are consistent and any differences between them are well understood. This is clearly particularly important for poverty analysis to which I'll turn.

So next year is the point at which the Goverment has sought to halve UK child poverty from a 1998 base, a goal which has helped shape the modelling efforts that we've focused on for a number of years. With the Govt now legislating to eradicate child poverty by 2020, the focus is shifting to the longer term and this brings its own particular challenges for us.

As noted earlier, analysis to date has been largely focused on likely changes due to policy reforms using base data fixing today's, or probably more accurately yesterday's population. Other groups, particularly IFS have contributed much to the likely poverty developments conditioned on particular announced policies. But moving our analysis to the longer term and longer term forecasting with income distribution, poverty and pretty much anything is an area which is potentially fraught with uncertainty and difficulty, but it's clearly an area also which is crucially important. Given the sensitivity of policy analysis to simulation bases we need to be careful to anchor our future analyses on a realistic assessment of the likely future world that we may be in and whilst also recognising uncertainty through the development of effective scenarios. For example we might want to look at scenarios on parental employment or take up of benefits amongst many other things.

We've started turning now to labour supply modelling. David mentioned earlier the ongoing work to develop a new model for labour supply, a model focused on the likely choices for hours worked amongst a restricted set of commonly observed, alternative hour choices. Alan Duncan at Nottingham University is providing oversight, and leading the estimation of this model. The theoretical underpinnings for these models is something that Alan discussed at one of the previous sessions in this series of seminars.

The development has posed a number of challenges for us, for example how to estimate a continuous maximisation model with market data which shows that in practice choices are highly concentrated, at least for certain groups. And also there's a classic modelling trade off between the development of a system architectureand model which can take account of the likely wide range of variation in individual responses, against the need to deliver a model which runs in reasonable time while remaining suitable for policy analysis.

To just finish off I will just say a few words about possible future directions we might want to focus our development on. Our interest in the longer-term modelling just generalises here, just generalises my earlier comments on poverty analysis, that our model's reliance on the demography and real economic variables fixed by the most recent household survey data does limit the sorts of questions that we can analyse and the full answers that we can provide.

So related to this, shifting the focus of our distributional analysis from the immediate impact of particular tax and benefit forms to the distributional impacts of wider economic trends, and including those sort of effects in our models will generally be of interest and value.

Earlier I mentioned as well our interest in the allocation of resources within households, this is clearly of relevance in terms of for example measures to tackle child poverty, so is an area of interest, and I know it's an active area of research for some groups.

And finally, better integration of any new behavioural model that we develop with our existing tax and benefits tool will hopefully enable us to undertake some dynamic distributional analysis, rather than from a static framework, which will be, as an example, helpful in considering a fuller range of options to alleviate poverty for working families.

I think that concludes everything I wanted to say there, so thanks for listening and I think David and I would happy to take any questions anyone has.

QUESTIONS

Questioner 1 – A very quick one. Who are your users? Are your users other colleagues in HM Treasury or does your team support other users?

David Roe – In terms of what goes on in the Treasury, just a few of us run the model on our colleagues' behalf, very much, though there's different ways of doing it. At DWP by contrast there is a wide community of users within the department, and you have a central team supplying expert services such as model maintenance, but it's quite different in the Treasury, with very few users, the 3 people on the slide, and only a few more have access. I think I failed to mention as I went along actually, there are users of our model in other Government departments, including HMRC still, Communities and Local Government, the Office for National Statistics, and the Scottish Executive. So there are users elsewhere, but I'm guessing probably no users quite so frequent and heavy as us. So the model we have adopted is a select few as it were trying to provide services to the many!

Paul Williamson – I have 2 questions, one is about flexibility of IGOTM in terms of if you want to change some rules you have to re-write SAS or do you just tweak some parameters on a spread sheet a bit more in DWP?

David Roe – It depends a bit what you're doing, I mean if you're changing those tax and benefit parameters which sit very much in the context of the existing tax benefit system then this is all very easy. We have a user interface to our model, like other UK groups, just a standard Windows approach, depicting parameters in different areas, so for example changing the tax rates in a system of X taxes and tax bands that already exist is easy. Whenever you want to change the rules of the tax benefit system then you must amend the underlying code of the model, which can be easy or it can be jolly difficult. For example, it is straightforward to say add new bits to the Tax Credits system, but if somebody wanders along and says well you know wouldn't it be interesting to have a joint system of income taxation in the UK rather than an independent one, then clearly I would imagine that that's a bit more of a challenge.My main views on flexibility of IGOTM is more going back to what I said about how it's a ready to use model with pre-prepared bases, but I sometimes find that a bit, rather constraining. I know from talking to people like Mike Brewer at the IFSthat their model clearly is much more amenable to analysis of trends over time with better choice for example over the base population dataset employed.

Paul Williamson – My other question was, you mentioned TAXBEN and you had on your list another large static tax benefit model, what's the difference between the three? I mean what's distinctive about IGOTM, why wouldn't you use one of the other two instead?

David – Well it come first, but I suppose the question is why do we all continue to maintain our own models given the reasons for their creation are now partly historical. I think this relates to my comment about model maintenance going hand in hand with policy analysis, and I think the staff do lose something if they disengage from maintaining models, I think they lose important knowledge. In addition I think a bit of competition between the modelling groups is really no bad thing, you know either within Government say with DWP or between the Treasury and the IFS. I think it keeps people on their toes a bit in terms of their methods, or at least those who are behind can learn from the others, I think also that it encourages sensible interpretation of model results as well, I think it's helpful that there's people breathing down our necks, I think it encourages sensible analysis and results with for example reference to the limits of these models. So it's hard to know which way you should go with these things but I do see benefits in there being several UK models. But if you know, why not go to the IFS rather than us or DWP? In most cases, there is no reason not to go to the IFS rather than us is the simple answer to your question.

Questioner 2 – Could you please say something more about plans for long term modelling or distribution or forecasting?

David Roe – It's very, very early days for us, the interest is in distributional forecasting. This is more just an acknowledgement that the sort of analysis we do is very much focussed on what is the impact of this particular tax and benefit change? It's not analysis of well who will be the gainers and the losers this year as a result of wider economic developments. And it's not something we have developed yet, so I couldn't really tell you exactly how we plan to do it, but, unsurprisingly in the middle of a downturn you know these questions are important and people have done the analysis. But I just think that we could be tweaking the models, building on the models in some way so that you can answer such questions within a slightly more structured and organised distributional framework, then that would be very useful.

Doug Rendle – Yes that's right, and certainly I think an econometric panel approach to try and understand how the changes relate to changes going forward is helpful, but you still have to have a view on what is the likely initial trajectory of certain variables which is difficult in itself I guess.

David Roe – I was more thinking, you know somebody tells you that this is the way the world is likely to evolve at the macro level, can our models tell us what this would mean distributionally, that's what I'm thinking of.

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