UKMOD Behaviour (BVR) Add-on

technical note

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1 Background

The total effects of a change to fiscal policy can typically be disaggregated into two components:

1. Effects that would be observed if all individual characteristics upon which tax and benefit payments depend remained invariant – referred to as "direct", "static", or "first-order" effects.
2. Effects associated with behavioural responses to the change in fiscal policy – referred to as "indirect", "behavioural" or "second-order" effects.

First-order effects are often a prime focus of interest in public policy debate. This focus reflects the relative transparency of definition of first-order effects, and prevailing uncertainty concerning forecasts of behavioural responses underlying second-order effects. Nevertheless, the potential importance of accounting for behavioural responses when analysing the likely effects of fiscal policy reform scenarios has not gone unnoticed, and indirect effects often feature prominently in the public debate (see for instance the supply-side argument in favour of tax reductions).

An extensive economic literature has sought to improve our understanding of behavioural responses to policy change. The simplest approach considered by this literature involves econometric estimation of functions that describe behaviour in terms of policy parameters. This "reduced form" approach provides an intelligible connection between the subjects of interest (policy parameters) and the issues of concern (behaviour). Yet there are substantial risks associated with assuming that such stylised relationships will continue to hold into the future, as Lucas' critique and the hyper-inflation episode of the 1970s made clear. An appreciation of the limitations of reduced form methods has motivated interest in identifying "structural descriptions" of behaviour that are (conceptually) invariant to changes in the policy environment.

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Nevertheless, most work that seeks to account for second-order effects in UK government studies of changes to tax and benefits policy adopts a reduced form approach to project behavioural responses. A popular method is to base analyses on assumed elasticities, which relate changes in policy parameters to (percentage) changes in (hours of) employment. This focus reflects both the relative transparency of the approach, and the ease of conducting associated sensitivity analyses.

In the case of Department for Work and Pensions (DWP) and HM Treasury modelling, for example, elasticities for labour supply responses draw upon related empirical studies conducted by the Institute for Fiscal Studies (2013, 2008). A similar approach has been applied to taxable income by the Scottish Government (2020) and Scottish Fiscal Commission (2021, 2018).

The method implement in UKMOD follows the approach documented by the Scottish Fiscal Commission, which has the advantage of being transparent and publicly documented.

1.1 Scottish Fiscal Commission assumptions

The Scottish Fiscal Commission (SFC) models behavioural responses over four domains[1]:

- Intensive margin responses to changes in marginal effective tax rates
- Extensive margin responses to changes in average effective tax rates
- Additional intra-UK migration responses[2]
- Short-term forestalling responses[3]

UKMOD is adapted to project the "intensive margin" and "extensive margin" effects listed above, noting that "intra-UK migration" and "short-term forestalling" responses remain outside the scope of the model. It is important here to avoid mis-interpretation of terminology. The "extensive margin" in economic studies often refers to incidence, whereas the "intensive margin" refers to quantum given incidence. Hence, in studies of employment, the extensive margin refers to whether people are in or out of work, whereas the intensive margin refers to the number of hours worked among those who are working.

In contrast, the SFC behavioural assumptions interpret the "intensive margin" as the subset of individuals who experience a change in marginal effective tax rates as the result of a reform, and the "extensive margin" as the subset of individuals who experience a change in average effective tax rates. For example, a 5% increase in the basic rate of income tax will affect the intensive margin only of basic rate taxpayers, but will affect the extensive margin for all people with taxable incomes in excess of the minimum threshold to pay the basic rate.

[1] Scottish Fiscal Commission (2021), 5.13.
[2] For example, migration between Scotland and England in response to differences in fiscal rules.
[3] Behavioural responses in anticipation of changes to fiscal rules.

This document uses the SFC's terminology throughout – the reader could as well interpret 'intensive' and 'extensive' as 'marginal' and 'average', respectively

Individuals who experience a change in marginal effective tax rate will (usually) also experience a change in average effective tax rate; in this case SFC behavioural responses are limited to consideration of the intensive margin.

The BVR add-on focusses exclusively on the intensive and extensive behavioural responses outlined above. Each of these responses is described at further length below.

1.1.1 Intensive margin responses to changes in marginal effective tax rates

In this case, SFC analyses "account for behavioural responses to changes in a taxpayer's marginal rate of tax primarily through the use of Taxable Income Elasticities (TIEs). TIEs estimate the percentage change in total taxable incomes in response to a one per cent change in the net-of-tax rate" (p. 16).

The "net of tax rate" defines the proportion of income that is left after taxes are deducted, so that a "one per cent change in the net of tax rate" is generally equal to one minus an individual's marginal effective tax rate. Assumed TIES considered for analysis in SFC (2021) are reported in Table 1.

Consider the case of an individual earning £200,000, with an assumed TIE of 0.5, whose (top) marginal tax rate increases from 40% to 45%. This policy change represents an 8.33% (0.55 / 0.6 - 1) reduction in the "net-of-tax rate". In this case, a reduction in total taxable income of 4.17% (0.5 x 8.33%) would be projected, equal to £8,333 (200,000 x 4.17%). The increase in tax revenue generated by the rise in marginal tax rate would consequently be reduced by £3,750 (8,333 x 0.45) due to projected behavioural responses.

Table 1: Scottish Fiscal Commission's assumed taxable income elasticities for 2020/21 budget forecasts

Taxable income start (£)	Taxable income end (£)	Taxable income elasticity
Low	Basic rate limit	0.015
Basic rate limit	80,000	0.1
80,001	150,000	0.2
150,001	300,000	0.35
300,001	500,000	0.55
500,001	High	0.75

Source: Scottish Fiscal Commission (2021), Figure 5.3.

1.1.2 Extensive margin responses to changes in average effective tax rates

The SFC adopts a more stylised approach for simulating behavioural responses at the extensive than the intensive margin, which (ostensibly) reflects the relatively thin evidence base for informing the associated approach (see IFS, 2008).

Here, the SFC projects extensive margin effects by multiplying the change in total net transfer payments of an individual affected by a considered policy reform by an assumed factor. Factors underlying the 2020/21 Scottish budget forecast are reported in Table 2.

Consider the case of an individual paying the top rate of tax, whose net tax liability would increase by £500 in 2020/21 following an increase in the basic rate of tax. In this case, if the average effective tax rate factor was 0.2, then the increase in tax liability projected after behavioural responses would be £400 (500 x (1 – 0.2)).

Table 2: Scottish Fiscal Commission's assumed average effective tax rate factors for 2020/21 budget forecasts

Taxable income start (£)	Taxable income end (£)	Extensive AETR factors
Low	Basic rate limit	0
Basic rate limit	80,000	0.06
80,001	150,000	0.06
150,001	300,000	0.25
300,001	500,000	0.25
500,001	High	0.25

Source: Scottish Fiscal Commission (2021), Figure 5.4.

The intuition why factors are assumed to increase with income is that people at the bottom of the income distribution are more likely to be constrained, while people at the top have both stronger (absolute) incentives to optimize their tax burden and more flexibility to do so. The evidence however, as discussed above, is rather thin.

2 Methods

Following the approach outlined above for projecting behavioural responses at the intensive and extensive margins requires the following information:

- Intensive margin:
    - Taxable Income Elasticities (TIEs)
    - Taxable Income under baseline scenario
    - Marginal Effective Tax Rates (METRs) under baseline and reform scenarios
- Extensive margin:
    - Average Effective Tax Rate factors (AETR factors)

- Net tax liability under baseline and reform scenarios

UKMOD addresses these requirements by:

- including TIEs and AETR factors in the model spine from the 2016 system year;
- checking for METRs and net tax liabilities for a baseline combination of policy and input data when input data are imported.

Given this information:

- the "Behavioural Responses" (BVR) add-on is designed to evaluate second-order effects; and
- the "Behavioural responses" statistics template is designed to analyse the impact of behavioural responses on UKMOD projections.

Each of the above points is addressed in turn.

2.1 Assumed behavioural parameters

The SFC's modelling approach was first documented in 2018, with an updated description provided in 2021. Both descriptions are identical, comprising the same TIEs and AETR factors across the same income bands. Furthermore, income band thresholds are reportedly fixed in nominal terms, except for the upper income threshold of the lowest band, which evolves with the basic rate (of tax) limit. These details are included in policy *ConstDef_uk* of UKMOD; see parameters *TIERate*, *TIEThresh*, *AETRFactor*, and *AETRThresh*.

2.2 Extended input data

Use of the BVR add-on involves extending the model input data. The steps to achieve this are described in Section 4.

2.3 The Behavioural Responses (BVR) add-on

The MTR add-on that is described in the UKMOD documentation was taken as the starting point for the BVR add-on. The MTR add-on evaluates marginal effective tax rates (METRs) implied by a policy system for everyone in the input data with non-zero labour income. The BVR add-on extends upon the MTR add-on in four ways:

1) METRs are evaluated for the entire population described by the input data;
2) routines to evaluate behavioural responses to the intensive margin are included;
3) routines to evaluate behavioural responses to the extensive margin are included; and
4) adjustments to income and employment to reflect the intensive and extensive behavioural responses are included.

The revised add-on loops over the UKMOD spine seven times. The first loop conducts a standard UKMOD simulation, as would be run without the add-on. This loop permits net

tax burdens to be evaluated for the considered policy system for all observations in the input data. The second to sixth loops re-evaluate tax and benefit payments that would apply if selected sources of income increased slightly from their observed values, commencing with labour income (yem and yse), before proceeding to private pension income (ypp), taxable property income (yprtx), taxable investment income (yiytx), and other income (yprnt, yiynt, yptmp, yot01, yptot).

Comparisons between projected transfer payments in the first and subsequent loops are used to evaluate observation-specific marginal effective tax rates for each respective measure of income under the considered policy system, in common with the MTR add-on. The final loop uses the net tax burdens evaluated from the first loop, and the effective marginal tax rates to calculate intensive and extensive behavioural responses as described in Section 1.1. These behavioural responses are assumed for the final loop of the BVR add-on.

Each of the amendments to the MTR add-on referred to above is described in turn below.

2.3.1 Evaluation of METRs for the entire population

The MTR add-on was devised to explore policy implications for employment incentives, which limited consideration of the MTR add-on to marginal variation of labour incomes. Consistency with the modelling approach described in Section 1.1, however, requires all sources of taxable income to be taken into consideration.

The METR of individual i, mtr_i, with original (pre-tax and benefit) income x_i, and disposable (post-tax and benefit) income y_i is given by:

$$mtr_i = 1 - \frac{\Delta y_i}{\Delta x_i}$$

where Δ denotes a small perturbation of original income: $\Delta x_i = x_i' - x_i$. The MTR add-on considers projections for a small deviation of employment income to evaluate METRs for the employed population. This approach has been extended for the BVR add-on to consider a more complete description of original income for the population with positive original income.

Specifically, as discussed above, five separate sources of original income are considered by the BVR add-on: employment income, private pension income, taxable property income, taxable investment income, and a residual "other" income. METRs for each of these sources of income are evaluated for any individual reported in the input dataset aged 18 and over and with income from the respective source exceeding a minimum threshold. These METRs are evaluated by increasing the reported measures of income by 5 percentage points.

2.3.2 Evaluating behavioural responses at the intensive margin

Behavioural responses at the intensive margin are projected in the form of changes to taxable income, following the approach adopted by the SFC as described in Section 1.1.1. This involves first calculating METRs of the considered policy system for all observations in the input data set, as discussed above (Section 2.3.1). The add-on then evaluates, for each income source, the ratio of the calculated METRs to METRs reported in the input data for the default system/input data combination (see Section 2.2). These ratios are then combined with Taxable Income Elasticities provided as parameters to the model (see Section 2.1) to evaluate the change in income associated with the considered policy system.

The calculations outlined above are evaluated separately for earnings (yem, yse), private pensions (ypp), taxable property income (yprtx), taxable investment income (yiytx) and other income (yprnt, yiynt, yptmp, yot01, yptot). This allows each measure of income to be adjusted individually. Hence, a policy reform that affects the marginal rate of earnings income but not of investment income will be associated with behavioural responses only in terms of earning income.

Note that the ratio of METRs mentioned above can only sensibly be obtained where the METRs reported in the input data are less than 100%. Where METRs reported in the input data exceed 95%, then behavioural responses at the intensive margin are ignored. Although a substantial share of the population may be subject to a METR above 95% in practice, the respective population is predominantly comprised of individuals on very low incomes, for whom behavioural responses are anticipated to be small.

2.3.3 Evaluating behavioural responses at the extensive margin

Behavioural responses at the extensive margin are also projected in the form of changes to income, in common with responses at the intensive margin. In this case, the total net transfer payments of the considered system are deducted from the associated statistic reported in the input data for the reference system/input data (see Section 2.2). These values are then multiplied by the respective Average Effective Tax Rate (AETR) factor described in the expanded model parameters (see Section 2.1) to obtain the projected impact of behaviour on net transfer payments under the considered system. Income changes due to extensive margin behavioural responses are then obtained by dividing the change in net transfer payments by the respective METR under the considered system.

Extensive margin behavioural responses are evaluated distinguishing between the same five income sources as considered for the intensive margin. Furthermore, as for the intensive margin behavioural responses, the ratio noted above can only be sensibly obtained where the METR is greater than zero. Hence extensive margin behavioural responses are only considered for observations where the METR exceeds 5%.

2.3.4 Identifying behavioural adjustments

Having identified the intensive and extensive behavioural responses as described above, the model proceeds by assuming the intensive margin where this is non-zero and the extensive margin otherwise. This is consistent with the SFC's approach, as described in Section 1.1, and reflects the greater precision generally associated with empirical measures of intensive margin effects.

2.4 Statistics Presenter template

Statistics Presenter includes a template entitled "UKMOD Statistics – Behavioural responses". As behavioural responses are understood as arising due to a change in the policy environment, the associated template is an adaptation of the "Baseline/Reform" template. The "Behavioural responses" template is structured around three projected scenarios.

The "base" scenario reflects policy prior to a considered reform. The "static reform" scenario reports statistics that omit behavioural responses. Comparisons between the "base" and "static reform" scenarios replicate a standard analysis of a reform scenario, commonly explored using the "Baseline/Reform" template. "Static effects" (Section 1) of the considered reform that omit behavioural responses are obtained by subtracting statistics evaluated under the "base" from the "static reform" scenario.

The third scenario is referred to as the "behavioural reform", and incorporates the behavioural responses evaluated by the BVR add-on. "Behavioural effects" of the considered reform are evaluated by subtracting "static reform" from "behavioural reform" statistics. These statistics provide a measure of the impact of behavioural responses to the reform. Finally, the "total effects" of the reform are obtained by subtracting statistics evaluated under the "base" from those evaluated from the "behavioural reform", so that total effects are the sum of static and behavioural effects.

3 Structure of the BVR Add-on

The BVR add-on is comprised of 10 policies, each of which is briefly described in turn.

3.1 Policy: oa_control_bvr

The *oa_control_bvr* policy, in common with other add-ons, defines which systems the add-on is designed for use with and controls associated integrations with the respective policy spines. Each of the subsequent policies of the BVR add-on is associated with a separate function in the *oa_control_bvr* policy identifying where in an existing policy spine it should be injected. The last function of the *oa_control_bvr* policy is designed to facilitate consideration of full benefits take-up for analysis.

3.2 Policy: prep_bvr

The *prep_bvr* policy manages the loops upon which the BVR add-on depends. The seven principal loops around which analysis is organised are defined by a "Loop" function with loop_id *prim* (for primary). As noted in Section 2.3, the first primary loop conducts a standard UKMOD simulation of the targeted system. In primary loops 2 to 6, UnitLoops are used to adjust specific measures of income, which are used to evaluate associated marginal effective tax rates. The seventh (and final) primary loop uses detail gathered in preceding loops to evaluate behavioural responses to the targeted policy system.

The loops of the BVR add-on are inserted into the policy spine after all inputs have been initialised (following policy *neg_uk*) and continue until just prior to where outputs are saved (*output_std_uk*).

3.3 Policy: init_bvr

The *init_bvr* policy defines loop-specific adjustments. These adjustments are defined at the top of the add-on loops, adjusting income (for unit loops in primary loops 2 to 6), and behaviour (loop 7).

3.4 Policy: store_bvr

Policy *store_bvr* is added just above the standard output policy in the policy spine (*output_std_uk*). The policy is designed to store targeted results for subsequent processing and model output.

3.5 Policy: calc_bvr

The *calc_bvr* policy evaluates the net tax burden of each simulated individual at the end of the first primary loop. These calculations are evaluated prior to *store_bvr*¸ for use as intermediate inputs in later calculations.

3.6 Policy: earns_bvr

The *earns_bvr* policy is inserted just after *calc_bvr*. This policy evaluates marginal effective tax rates on earnings after primary loop 2, and associated behavioural responses considered in loop 7.

3.7 Policy: ypp_bvr

The *ypp_bvr* policy is inserted just after *earns_bvr*, and performs a similar role to that policy but for private pensions rather than earnings.

3.8 Policy: yprtx_bvr

The *yprtx_bvr* policy follows the same pattern as outlined above for taxable property income.

3.9 Policy: yiytx_bvr

The *yprtx_bvr* policy follows the same pattern as outlined above for taxable investment income.

3.10 Policy: other_bvr

The *yprtx_bvr* policy follows the same pattern as outlined above for "other" income.

3.11 Policy: dummy_bvr

The *dummy_bvr* policy is included to ensure that variables of interest are reported by the EUROMOD software.

4 Practical Use of the BVR Add-on

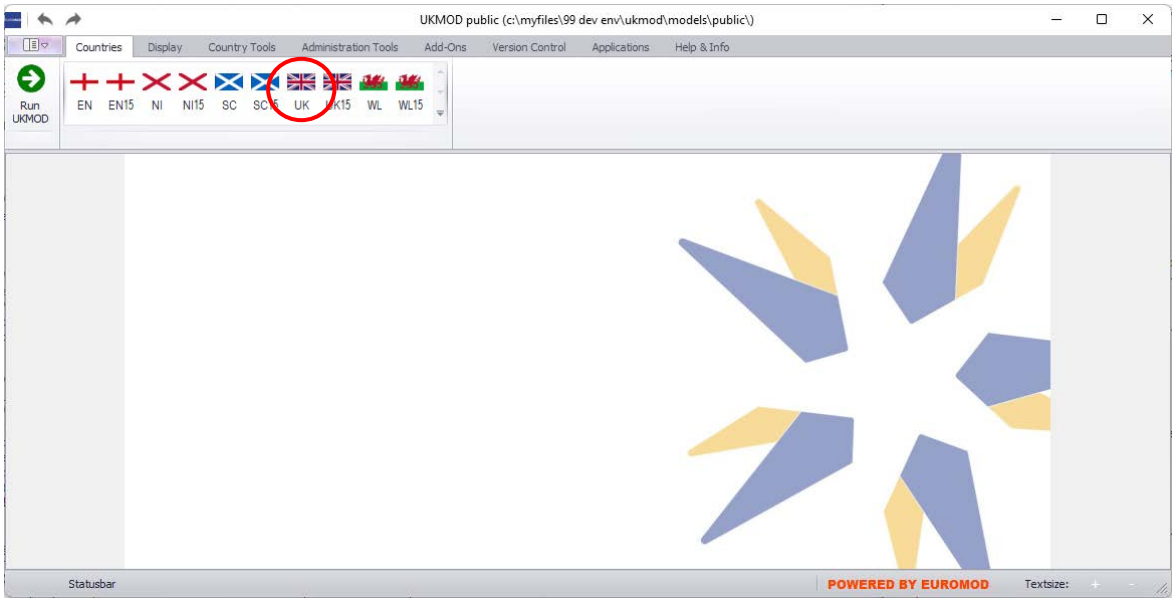
This section describes how to use the BVR add-on for the first time, with the aid of a practical example. Note that using the BVR add-on is slightly more involved when analysing regions rather than the UK as a whole. We consequently begin by describing analysis for a simple reform for the UK, before finishing with additional points to address when modelling results a constituent nation.

Suppose we are interested in analysing a 5-percentage point increase in the basic rate of tax for people residing throughout the UK except in Scotland, starting from the 2029 system.

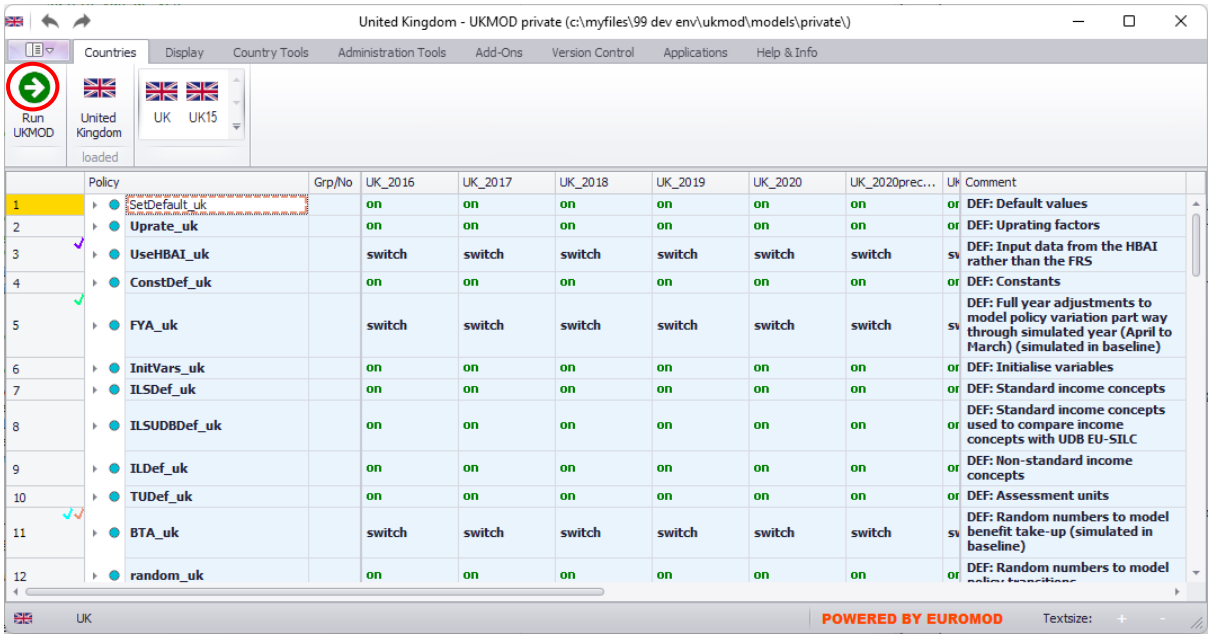
4.1 Baseline statistics

We begin by generating results for the default combination of system and input data.

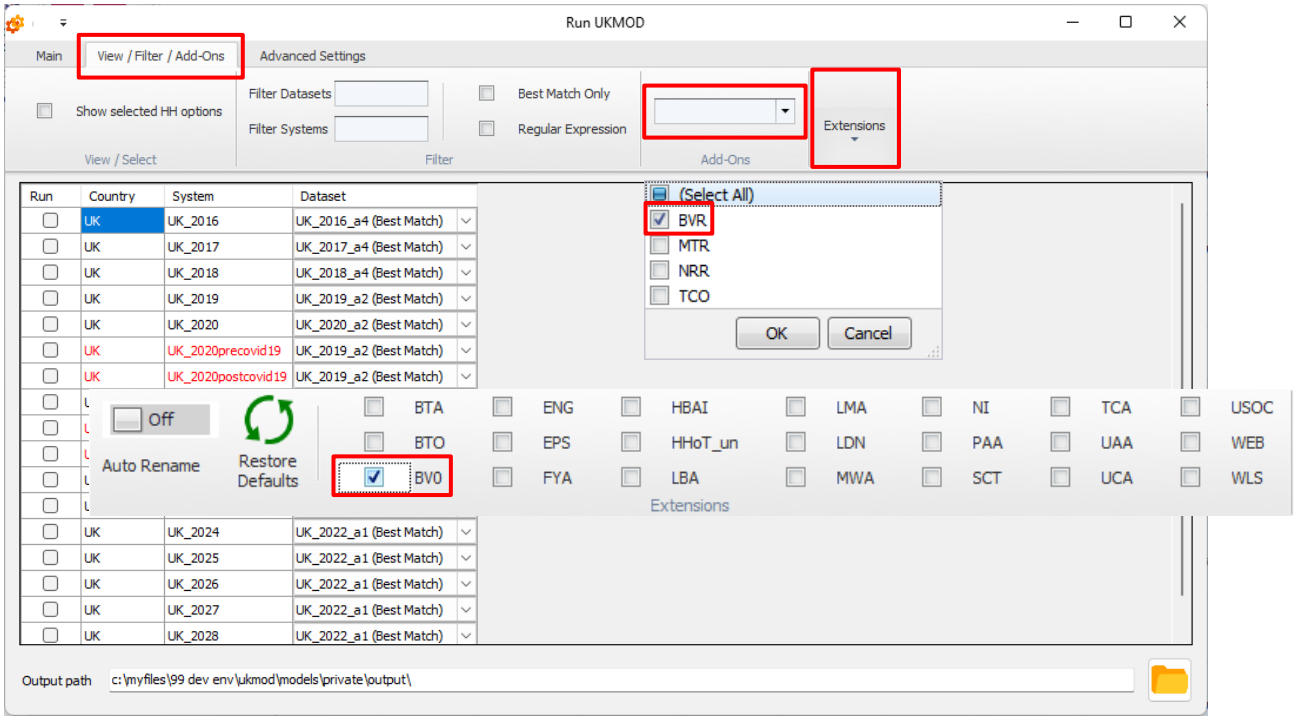
Open UKMOD, and open the country of interest:



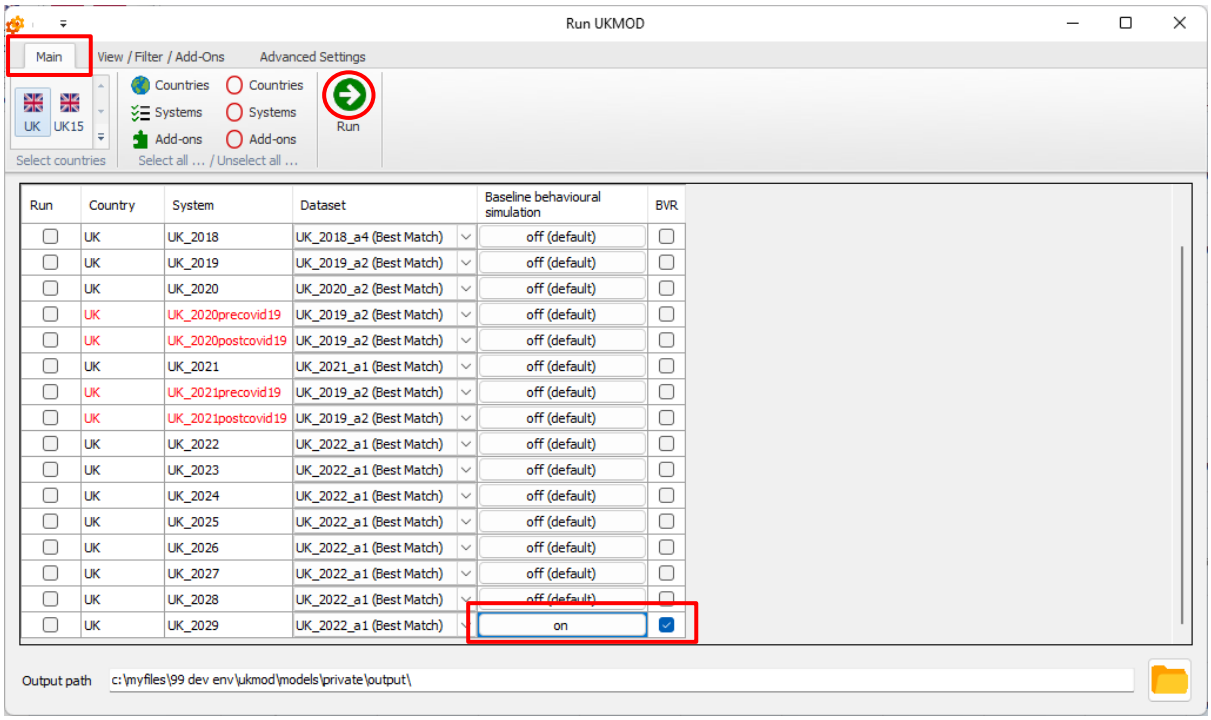
Press the "Run UKMOD" button to access the run window:

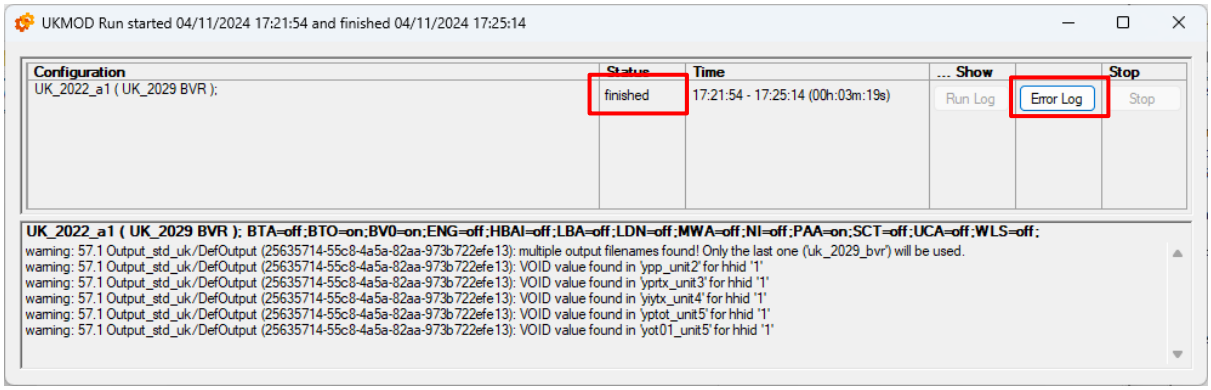


Access the "View / Filter / Add-Ons" menu, and enable both the BVR add-on and the BV0 extension:



Turn on the switch to indicate a "behavioural baseline simulation" and run the BVR add-on:





4.2 Augment input data

The baseline simulation described above generates working statistics that need to be copied to the input data. These statistics are reported in a dedicated output file named "additional_inputs.txt". The additional statistics can be copied manually to the baseline input file by opening both files with Excel and copying columns of data reported in additional_inputs.txt to the input file. Alternatively, a Stata program is provided with the model to facilitate copying the required data – see "data processing\BVR_compile_input_data.do". We describe the automated approach before outlining how to implement the changes manually.

4.2.1 Using Stata file "BVR_compile_input_data.do"

After opening the Stata do file, follow the directions below (which are also provided in the comments at the top of the file):

1. Set global variable "model_dir" to indicate the directory where UKMOD is saved.
2. Set global variable "input_file" to match the input file for the baseline simulation.
3. Run the Stata program, which will append data to the model inputs.

4.2.2 Manual adjustments

Use Excel to import the output file "additional_inputs.txt" obtained as described in Section 4.1, and the input file considered for the associated simulation. In the output file (additional_inputs.txt), copy all columns except for the first ("idperson"). Paste the columns just after the right-most column of the input data.[4] Check that the new data include the same number of rows as the initial input data. If the new variables report a different number of rows to the initial data, then verify that you have accessed the same input data as analysed using the BVR add-on, and that you have directed the model to generate results for the

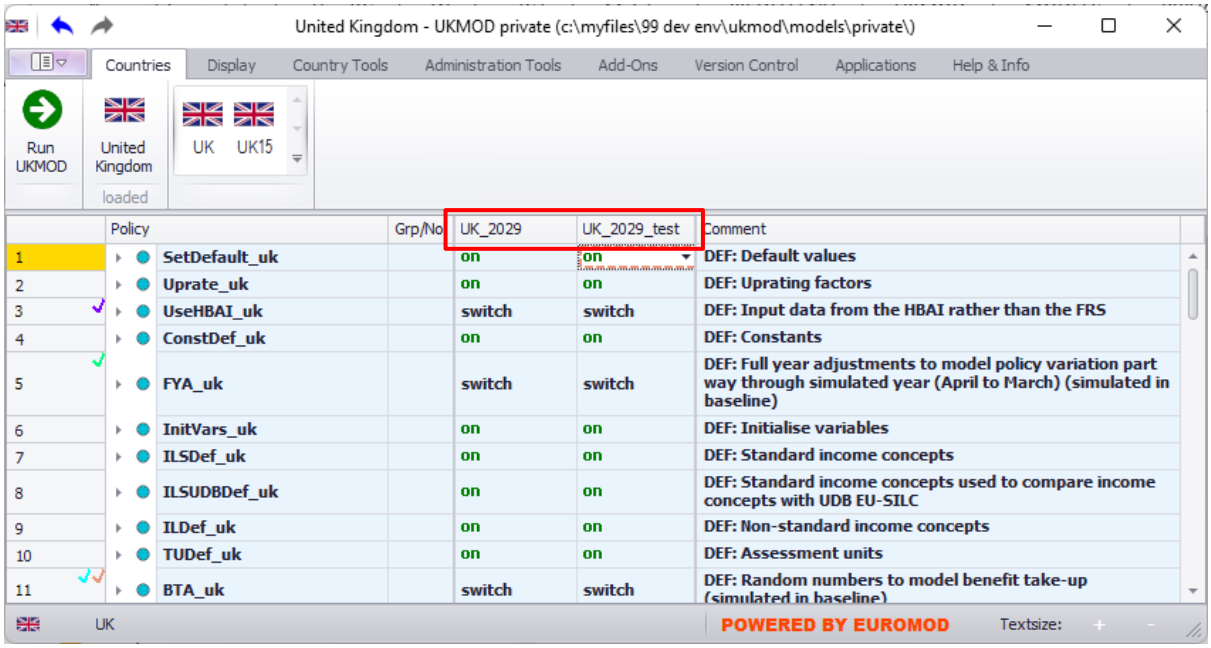
[4] If behavioural simulations have been run previously using the input data, then you should copy over the existing columns starting with "ntax".

whole of the UK. Also, ensure that the name of variable "dec02" is not auto-corrected by Excel to "Dec-02".[5] Save the input data file, and close Excel.

4.3 Run the counterfactual simulation

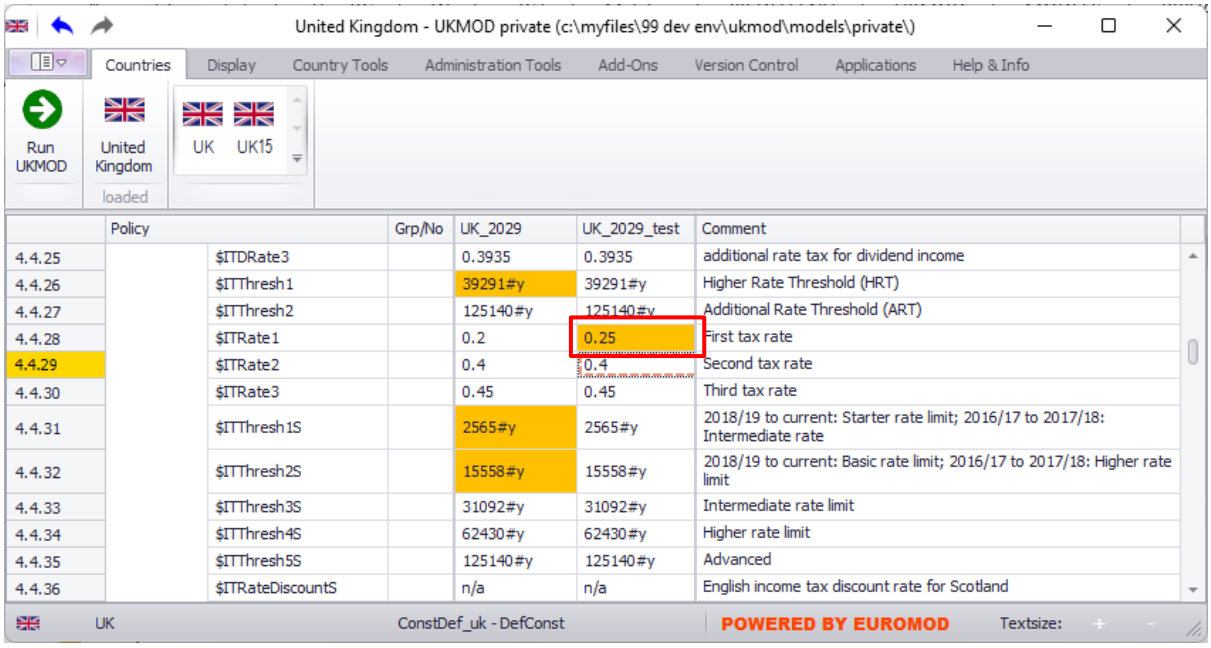
The model has now been set-up to analyse behavioural reforms to changes in the 2029 system. Note that this process needs to be repeated for any change to the desired behavioural baseline simulation (including data and model parameters).

We now return to UKMOD to define our policy reform of interest. Create a copy of the 2029 system (by right-clicking "UK_2029" at the top of the display window and selecting copy/paste system). Call this copy "UK_2029_test".

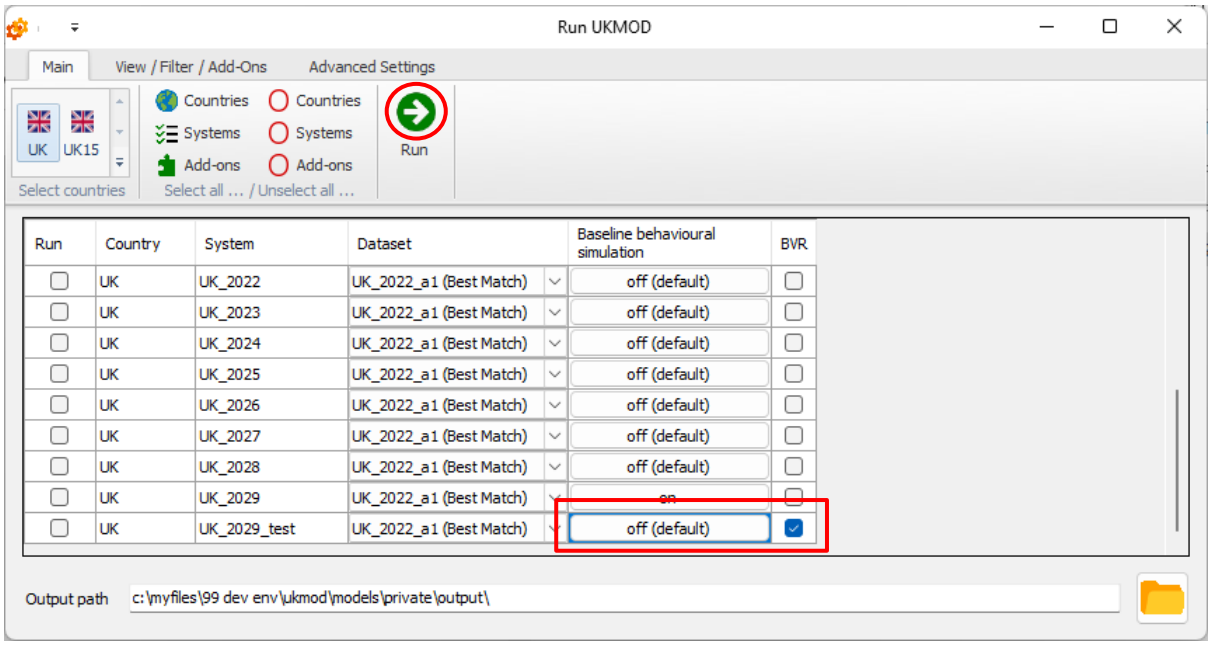


Navigate to the income tax parameters of the UK_2029_test system and increase the value of parameter $ITRate1 from 0.2 to 0.25 (as shown).

[5] This can be done by typing `'dec02` into the respective cell (include the apostrophe).

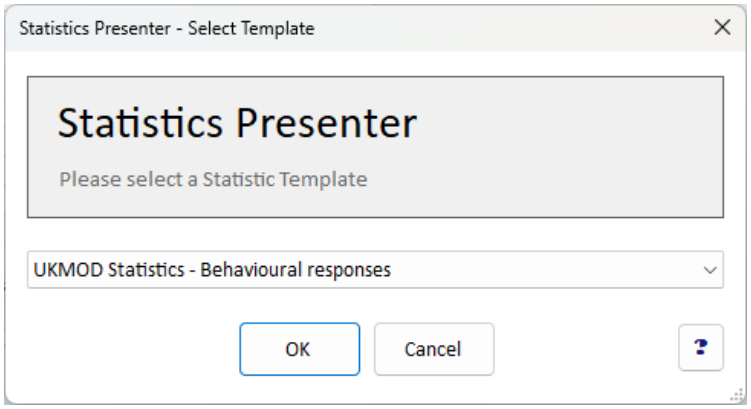


Save the model (CNTRL + s), and re-run the BVR add-on for the new system "UK_2029_test", accepting the default "off" setting for the "Baseline behavioural simulation" extension.

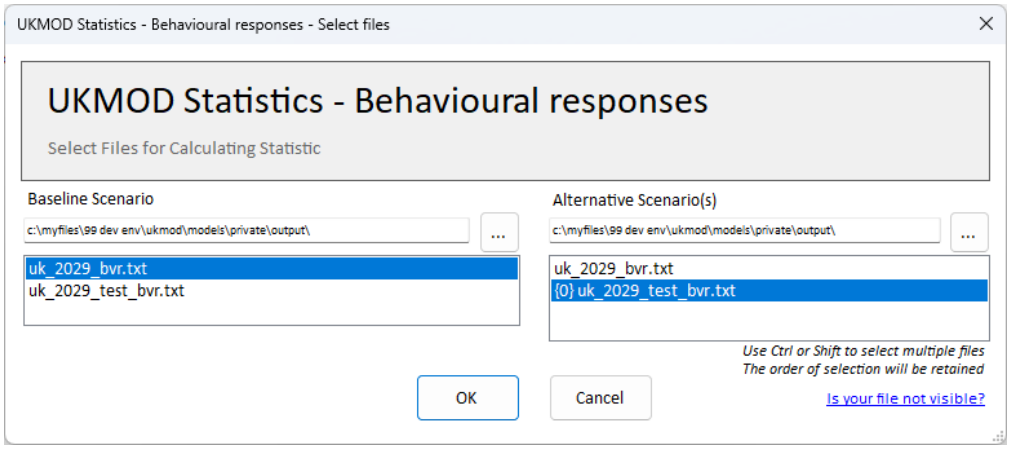


The add-on should run through, this time evaluating behavioural responses to the reform. When the model is complete, we can analyse results using Statistics Presenter.

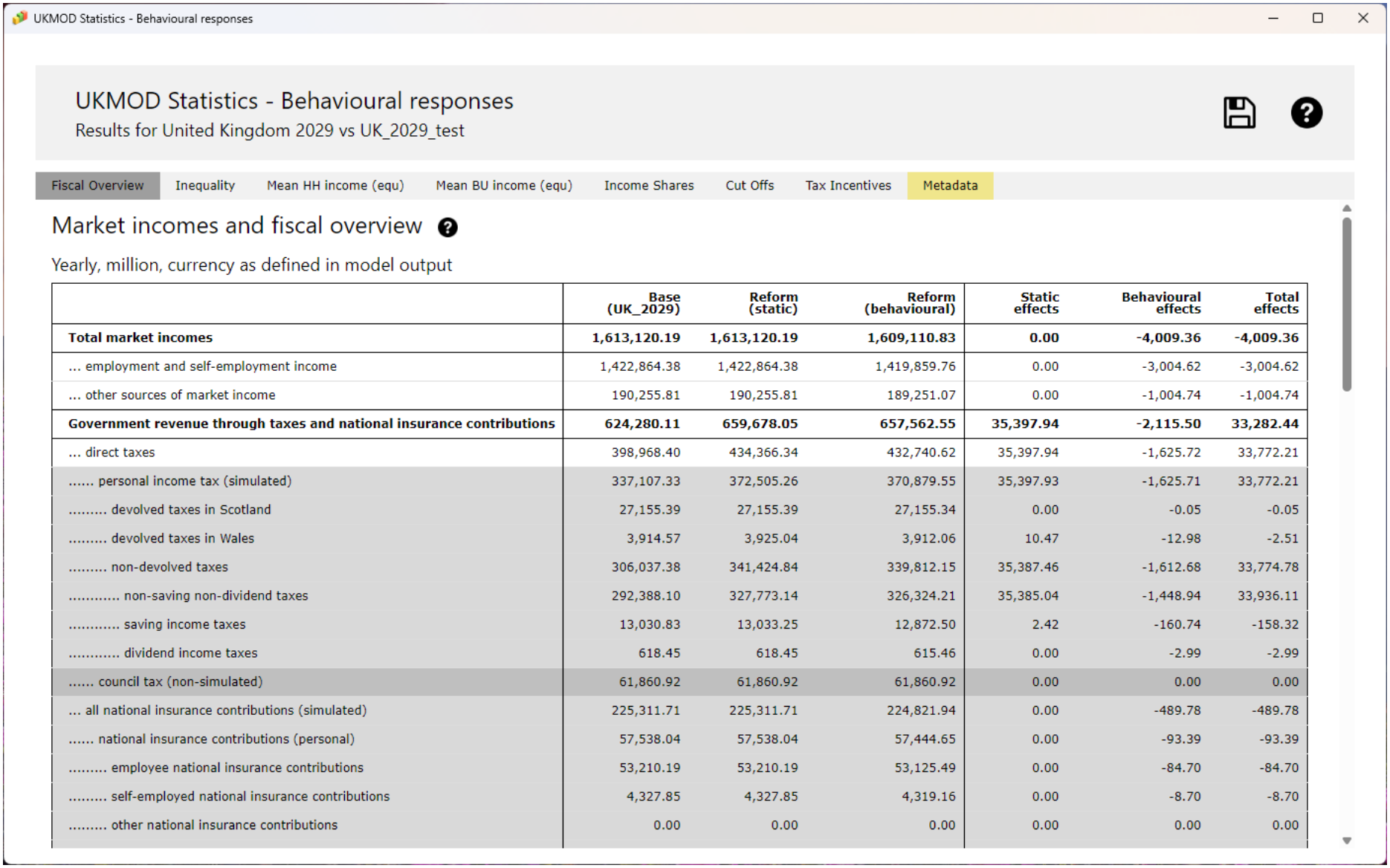
Open the "Statistics Presenter" selection window, and select "UKMOD Statistics – Behavioural responses" from the drop-down menu.



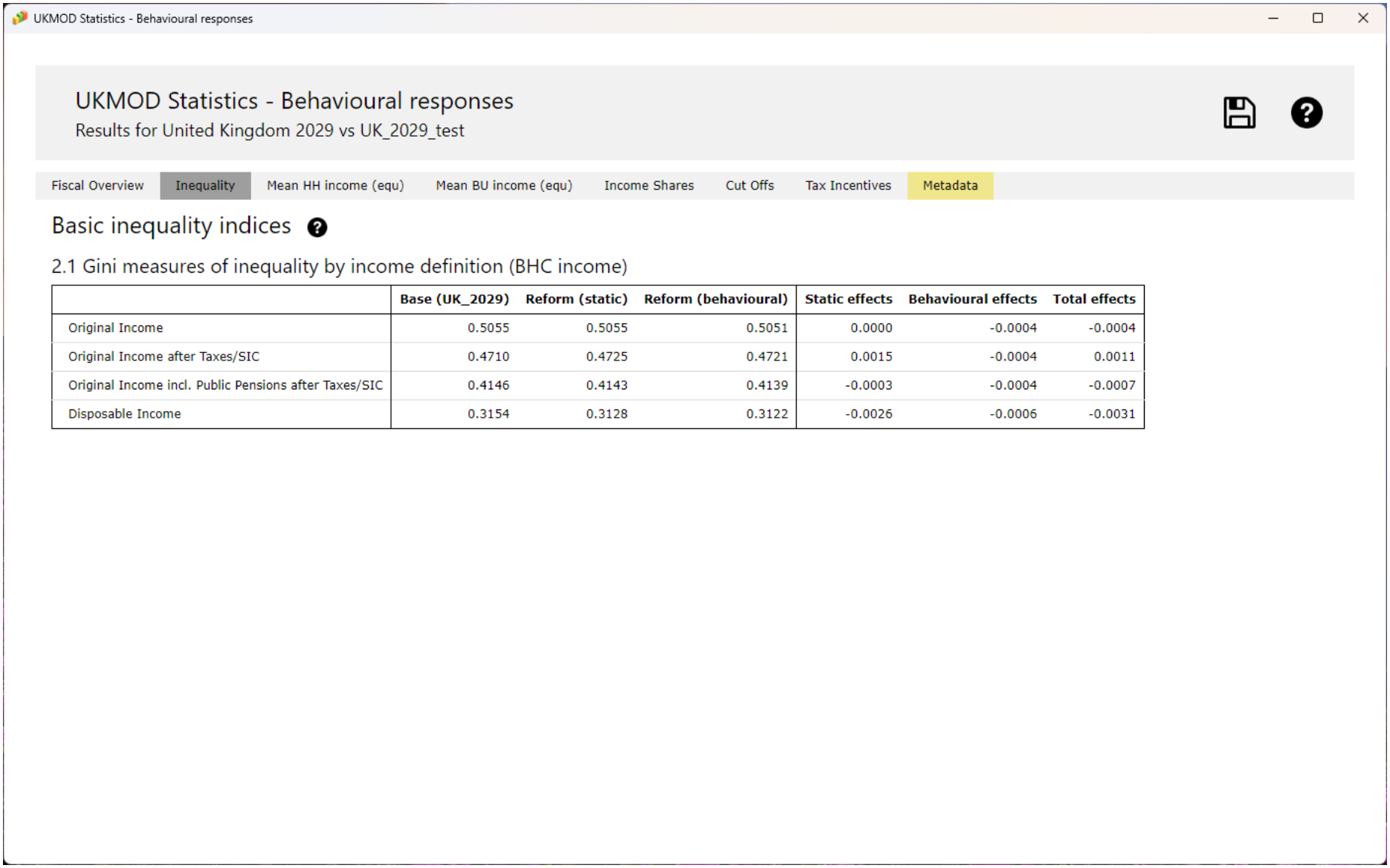
Under the Baseline Scenario, select the "uk_2029_bvr.txt" output, under the Alternative Scenario select the "uk_2029_test_bvr.txt" output, and press "OK".

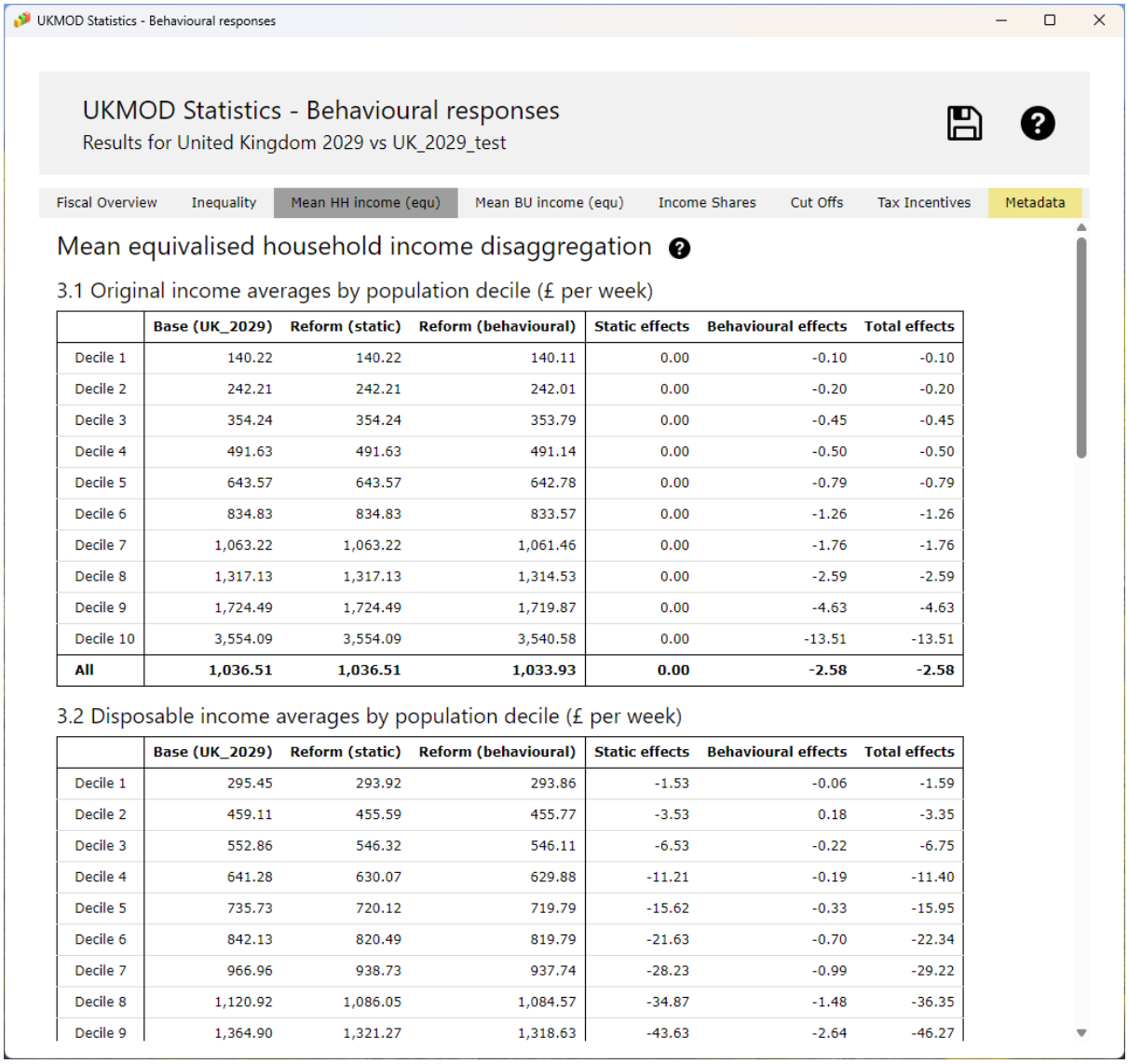


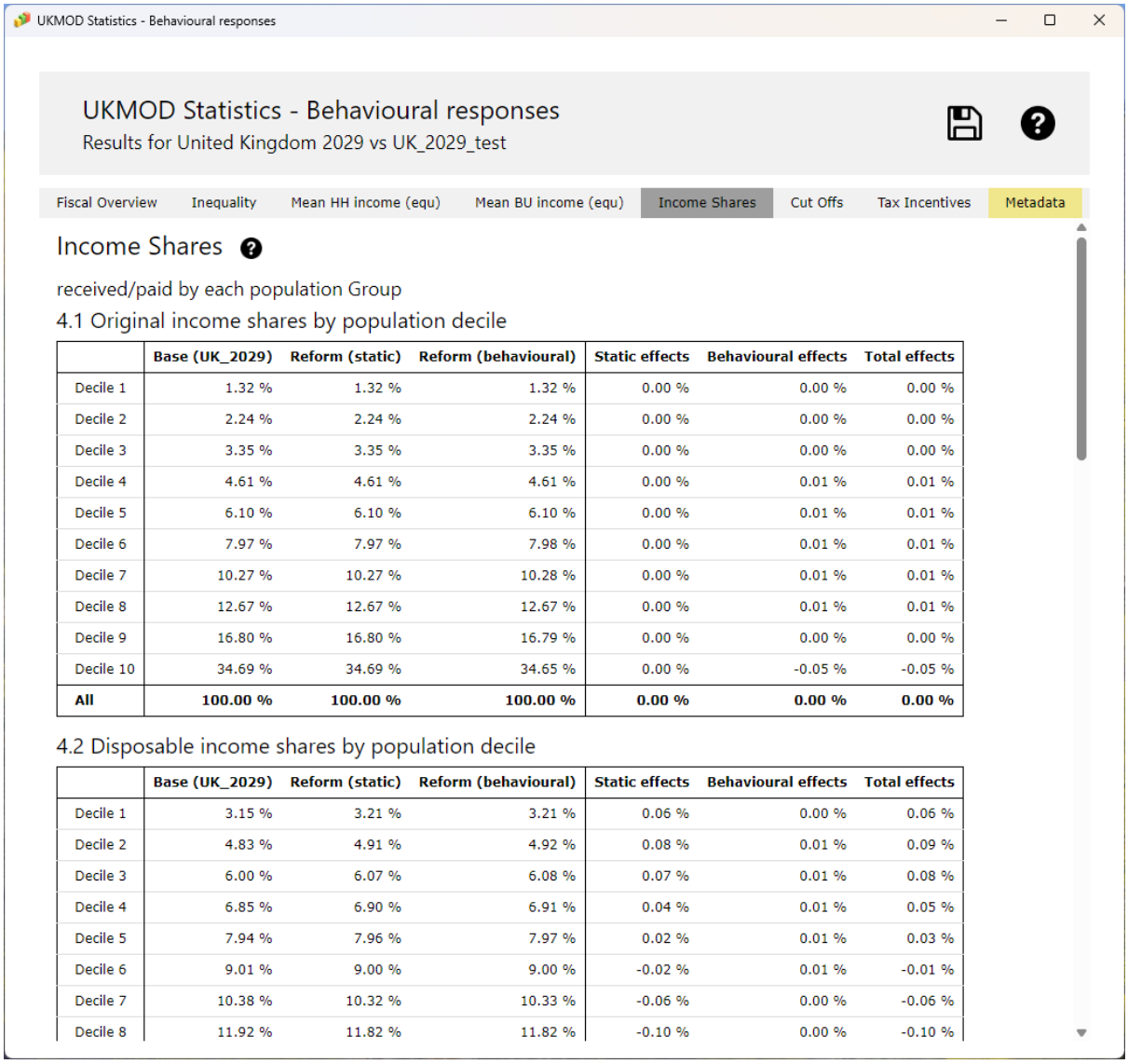
When the statistics presenter window is populated you can inspect associated results as displayed below.

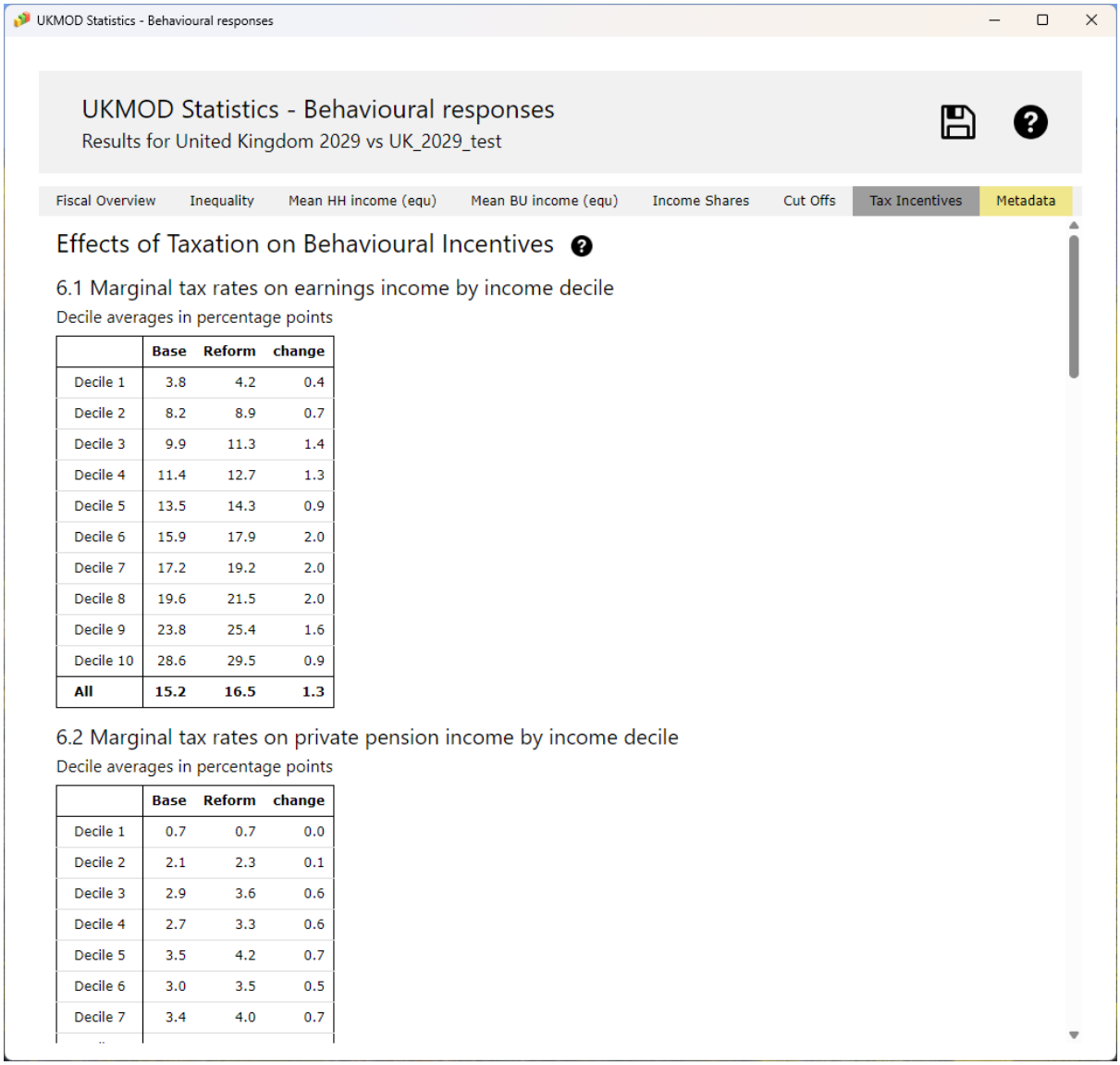


	Base (UK_2029)	Reform (static)	Reform (behavioural)	Static effects	Behavioural effects	Total effects
Total market incomes	**1,613,120.19**	**1,613,120.19**	**1,609,110.83**	**0.00**	**-4,009.36**	**-4,009.36**
... employment and self-employment income	1,422,864.38	1,422,864.38	1,419,859.76	0.00	-3,004.62	-3,004.62
... other sources of market income	190,255.81	190,255.81	189,251.07	0.00	-1,004.74	-1,004.74
Government revenue through taxes and national insurance contributions	**624,280.11**	**659,678.05**	**657,562.55**	**35,397.94**	**-2,115.50**	**33,282.44**
... direct taxes	398,968.40	434,366.34	432,740.62	35,397.94	-1,625.72	33,772.21
..... personal income tax (simulated)	337,107.33	372,505.26	370,879.55	35,397.93	-1,625.71	33,772.21
..... devolved taxes in Scotland	27,155.39	27,155.39	27,155.34	0.00	-0.05	-0.05
..... devolved taxes in Wales	3,914.57	3,925.04	3,912.06	10.47	-12.98	-2.51
..... non-devolved taxes	306,037.38	341,424.84	339,812.15	35,387.46	-1,612.68	33,774.78
..... non-saving non-dividend taxes	292,388.10	327,773.14	326,324.21	35,385.04	-1,448.94	33,936.11
..... saving income taxes	13,030.83	13,033.25	12,872.50	2.42	-160.74	-158.32
..... dividend income taxes	618.45	618.45	615.46	0.00	-2.99	-2.99
..... council tax (non-simulated)	61,860.92	61,860.92	61,860.92	0.00	0.00	0.00
... all national insurance contributions (simulated)	225,311.71	225,311.71	224,821.94	0.00	-489.78	-489.78
..... national insurance contributions (personal)	57,538.04	57,538.04	57,444.65	0.00	-93.39	-93.39
..... employee national insurance contributions	53,210.19	53,210.19	53,125.49	0.00	-84.70	-84.70
..... self-employed national insurance contributions	4,327.85	4,327.85	4,319.16	0.00	-8.70	-8.70
..... other national insurance contributions	0.00	0.00	0.00	0.00	0.00	0.00


UKMOD Statistics - Behavioural responses
UKMOD Statistics - Behavioural responses
Results for United Kingdom 2029 vs UK_2029_test
Fiscal Overview
Inequality
Mean HH income (equ)
Mean BU income (equ)
Income Shares
Cut Offs
Tax Incentives
Metadata
Basic inequality indices
2.1 Gini measures of inequality by income definition (BHC income)
Base (UK_2029)
Reform (static)
Reform (behavioural)
Static effects
Behavioural effects
Total effects
Original Income
0.5055
0.5055
0.5051
0.0000
-0.0004
-0.0004
Original Income after Taxes/SIC
0.4710
0.4725
0.4721
0.0015
-0.0004
0.0011
Original Income incl. Public Pensions after Taxes/SIC
0.4146
0.4143
0.4139
-0.0003
-0.0004
-0.0007
Disposable Income
0.3154
0.3128
0.3122
-0.0026
-0.0006
-0.0031


UKMOD Statistics - Behavioural responses
UKMOD Statistics - Behavioural responses
Results for United Kingdom 2029 vs UK_2029_test
Fiscal Overview
Inequality
Mean HH income (equ)
Mean BU income (equ)
Income Shares
Cut Offs
Tax Incentives
Metadata
Mean equivalised household income disaggregation
3.1 Original income averages by population decile (£ per week)
Base (UK_2029) Reform (static) Reform (behavioural) Static effects Behavioural effects Total effects
Decile 1 140.22 140.22 140.11 0.00 -0.10 -0.10
Decile 2 242.21 242.21 242.01 0.00 -0.20 -0.20
Decile 3 354.24 354.24 353.79 0.00 -0.45 -0.45
Decile 4 491.63 491.63 491.14 0.00 -0.50 -0.50
Decile 5 643.57 643.57 642.78 0.00 -0.79 -0.79
Decile 6 834.83 834.83 833.57 0.00 -1.26 -1.26
Decile 7 1,063.22 1,063.22 1,061.46 0.00 -1.76 -1.76
Decile 8 1,317.13 1,317.13 1,314.53 0.00 -2.59 -2.59
Decile 9 1,724.49 1,724.49 1,719.87 0.00 -4.63 -4.63
Decile 10 3,554.09 3,554.09 3,540.58 0.00 -13.51 -13.51
All 1,036.51 1,036.51 1,033.93 0.00 -2.58 -2.58
3.2 Disposable income averages by population decile (£ per week)
Base (UK_2029) Reform (static) Reform (behavioural) Static effects Behavioural effects Total effects
Decile 1 295.45 293.92 293.86 -1.53 -0.06 -1.59
Decile 2 459.11 455.59 455.77 -3.53 0.18 -3.35
Decile 3 552.86 546.32 546.11 -6.53 -0.22 -6.75
Decile 4 641.28 630.07 629.88 -11.21 -0.19 -11.40
Decile 5 735.73 720.12 719.79 -15.62 -0.33 -15.95
Decile 6 842.13 820.49 819.79 -21.63 -0.70 -22.34
Decile 7 966.96 938.73 937.74 -28.23 -0.99 -29.22
Decile 8 1,120.92 1,086.05 1,084.57 -34.87 -1.48 -36.35
Decile 9 1,364.90 1,321.27 1,318.63 -43.63 -2.64 -46.27


UKMOD Statistics - Behavioural responses
UKMOD Statistics - Behavioural responses
Results for United Kingdom 2029 vs UK_2029_test
Fiscal Overview
Inequality
Mean HH income (equ)
Mean BU income (equ)
Income Shares
Cut Offs
Tax Incentives
Metadata
Income Shares
received/paid by each population Group
4.1 Original income shares by population decile
Base (UK_2029) | Reform (static) | Reform (behavioural) | Static effects | Behavioural effects | Total effects
Decile 1 | 1.32 % | 1.32 % | 1.32 % | 0.00 % | 0.00 % | 0.00 %
Decile 2 | 2.24 % | 2.24 % | 2.24 % | 0.00 % | 0.00 % | 0.00 %
Decile 3 | 3.35 % | 3.35 % | 3.35 % | 0.00 % | 0.00 % | 0.00 %
Decile 4 | 4.61 % | 4.61 % | 4.61 % | 0.00 % | 0.01 % | 0.01 %
Decile 5 | 6.10 % | 6.10 % | 6.10 % | 0.00 % | 0.01 % | 0.01 %
Decile 6 | 7.97 % | 7.97 % | 7.98 % | 0.00 % | 0.01 % | 0.01 %
Decile 7 | 10.27 % | 10.27 % | 10.28 % | 0.00 % | 0.01 % | 0.01 %
Decile 8 | 12.67 % | 12.67 % | 12.67 % | 0.00 % | 0.01 % | 0.01 %
Decile 9 | 16.80 % | 16.80 % | 16.79 % | 0.00 % | 0.00 % | 0.00 %
Decile 10 | 34.69 % | 34.69 % | 34.65 % | 0.00 % | -0.05 % | -0.05 %
All | 100.00 % | 100.00 % | 100.00 % | 0.00 % | 0.00 % | 0.00 %
4.2 Disposable income shares by population decile
Base (UK_2029) | Reform (static) | Reform (behavioural) | Static effects | Behavioural effects | Total effects
Decile 1 | 3.15 % | 3.21 % | 3.21 % | 0.06 % | 0.00 % | 0.06 %
Decile 2 | 4.83 % | 4.91 % | 4.92 % | 0.08 % | 0.01 % | 0.09 %
Decile 3 | 6.00 % | 6.07 % | 6.08 % | 0.07 % | 0.01 % | 0.08 %
Decile 4 | 6.85 % | 6.90 % | 6.91 % | 0.04 % | 0.01 % | 0.05 %
Decile 5 | 7.94 % | 7.96 % | 7.97 % | 0.02 % | 0.01 % | 0.03 %
Decile 6 | 9.01 % | 9.00 % | 9.00 % | -0.02 % | 0.01 % | -0.01 %
Decile 7 | 10.38 % | 10.32 % | 10.33 % | -0.06 % | 0.00 % | -0.06 %
Decile 8 | 11.92 % | 11.82 % | 11.82 % | -0.10 % | 0.00 % | -0.10 %


UKMOD Statistics - Behavioural responses
UKMOD Statistics - Behavioural responses
Results for United Kingdom 2029 vs UK_2029_test
Fiscal Overview
Inequality
Mean HH income (equ)
Mean BU income (equ)
Income Shares
Cut Offs
Tax Incentives
Metadata
Effects of Taxation on Behavioural Incentives
6.1 Marginal tax rates on earnings income by income decile
Decile averages in percentage points
Base Reform change
Decile 1 3.8 4.2 0.4
Decile 2 8.2 8.9 0.7
Decile 3 9.9 11.3 1.4
Decile 4 11.4 12.7 1.3
Decile 5 13.5 14.3 0.9
Decile 6 15.9 17.9 2.0
Decile 7 17.2 19.2 2.0
Decile 8 19.6 21.5 2.0
Decile 9 23.8 25.4 1.6
Decile 10 28.6 29.5 0.9
All 15.2 16.5 1.3
6.2 Marginal tax rates on private pension income by income decile
Decile averages in percentage points
Base Reform change
Decile 1 0.7 0.7 0.0
Decile 2 2.1 2.3 0.1
Decile 3 2.9 3.6 0.6
Decile 4 2.7 3.3 0.6
Decile 5 3.5 4.2 0.7
Decile 6 3.0 3.5 0.5
Decile 7 3.4 4.0 0.7

4.4 Regional analysis

As noted at the beginning of this section, using the BVR add-on is slightly more involved when analysing reforms for one of the constituent nations. The complication arises because we require working statistics for every observation reported in the input data. By default, the model is supplied with input data for the entire UK. If interest is limited to projections for one of the constituent nations, one of two alternative methodologies can be employed.

Perhaps the simplest alternative is to limit the input file to data to describe data for the nation of interest. This can be done by opening the respective input file in Excel, and deleting any observation with a region identifier (dgn1) outside the region of interest. Saving the associated input file, analysis can proceed as set out above for the UK.

Alternatively, analysis can proceed as follows:

1. Generate baseline statistics as described in Section 4.1, allowing for input data for the whole of the UK.
2. Augment input data as described in Section 4.2.
3. Generate baseline statistics as described in Section 4.1, this time allowing only for the region of interest.
4. Generate counterfactual statistics as described in Section 4.3, allowing only for the region of interest.

References

IFS (2013), *An ex-ante analysis of the effects of the UK Government's welfare reforms on labour supply in Wales*. S. Adams and D. Phillips.

IFS (2008), *Labour supply and taxes*. C. Meghir and D. Phillips.

Scottish Government (2020), *Understanding the Behavioural Effects from Income Tax Changes*

Scottish Fiscal Commission (2021), *How we forecast income tax*

Scottish Fiscal commission (2018), *How we forecast behavioural responses to income tax policy*