

The Public Policy Preference Calculator (TriplePC): Developing a comprehensive welfare policy microsimulation

Abstract

Prospective welfare policies have often been assessed on their financial impacts, for example, their effects on net household incomes and marginal and average tax rates. However, welfare policies can have a substantial effect on population health and wellbeing. In addition, politicians must consider the electoral implications of policies that would affect large sections of the population.

In this article we describe a new microsimulation model with a public-facing user interface, the Public Policy Preference Calculator (TriplePC), which enables automated assessment of economic and health impacts as well as public preferences for particular, customisable welfare policies. The TriplePC uses data from, and regressions based on, major UK sources such as the Family Resources Survey, Understanding Society: The UK Household Longitudinal Study (UKHLS) and the Wealth and Assets Survey, alongside our own conjoint experimental surveys on public preferences. While the design of the conjoint survey necessitated relatively strong assumptions in some areas, the TriplePC's ability to simultaneously model the financial, health and political implications of a policy is, we believe, unique.

Keywords: Welfare policy, polling, public user interface, conjoint analysis

1 Introduction

In this article, we describe the Public Policy Preference Calculator (TriplePC), a new microsimulation model that seeks to extend the microsimulation art in two ways.

First, as well as modelling the outcomes of a policy in the conventional way, our model uses Conjoint Analysis to give an indication of the policy's popularity. This is novel and important. There are measures that in principle should bring benefits to almost everyone which policymakers have been unwilling to touch for fear of their electoral consequences. Perhaps the best example from UK history is the SDP/Liberal Democrat's 'Dead Parrot' merger manifesto of January 1988 (Gourley, n.d; Crewe & King, 1995), which proposed the abolition of Child Benefit and the imposition of a uniform rate of Value Added Tax (VAT) to raise money for an anti-poverty program. Although this had been modelled in detail, fear of the electoral consequences among Members of Parliament meant the manifesto was abandoned within a day. The resulting confusion and indecision arguably caused long-lasting damage to centrist politics in the UK (Crewe & King, 1995). The UK's zero-rating for food and children's clothing remains politically untouchable to this day despite the orthodox economic

arguments in favour of a uniform rate (Crawford et al., 2010). But would VAT extension really be unpopular, especially if it was part of a package that used the money raised for poverty reduction or other appealing policies? Our approach allows us to address questions like this.

Second, we integrate health outcomes into the model. There is strong evidence that welfare policies can have a substantial effect on population health (Johnson et al., 2022). A stark reminder of the real impact of worsening population health can be seen in the proportion of the UK population with a long-standing illness, disability or impairment which causes substantial difficulty with day-to-day activities. This is estimated to have risen from 19% in 2011/12 to 24% in 2021/22, an increase of 3.9 million people (Department for Work and Pensions, 2023). Indeed, the estimate increased from 14.1 million in 2019/20 to 16.0 million in 2021/22 (Department for Work and Pensions, 2023). Interestingly, the proportion among state pension age adults has remained the same between 2011/12 and 2021/22 at 45%, whereas for working-age adults it has increased from 16% to 23% and for children the figures are 6% to 11%. This suggests that increases in prevalence are not simply the effect of an ageing population (Department for Work and Pensions, 2023).

In that context, it is essential that policymakers invest real thought in realising the Government's prevention agenda (Department of Health and Social Care, 2018), which was incorporated into the 2019 NHS England Long Term Plan (NHS England, 2019). Forty-three years on from the Black Report which highlighted the role of material circumstances on health inequalities (Working Group on Inequalities in Health, 1980), 13 since the Marmot Review (Marmot et al., 2010) and three since its 10-years-on update (Marmot et al., 2020) which highlighted worsening trends in inequalities, there is good reason to examine and tackle social determinants of health.

Some of the authors of this article (Johnson et al., 2022) have called for trials of cash transfers, in particular Basic Income, as an upstream intervention to mitigate poverty, inequality and insecurity as social determinants of mental and physical ill-health. Systematic reviews of cash transfer schemes that resemble Basic Income, such as Gibson et al. (2020), have indicated positive impacts on mental and physical health, hospital attendance and health related behaviour, such as alcohol and drug use. In contrast, conditional, means- and needs-based welfare systems in high-income countries are associated with below average health outcomes (Shahidi et al., 2019) and increased psychological distress prevalence (Wickham et al., 2020). We have suggested several explanations (Johnson et al., 2022): schemes are 'insufficient to offset the negative health consequences of severe socioeconomic disadvantage' (Shahidi et al., 2019); conditionality and assessment inflicts stress (Dwyer et al., 2020) and creates perverse incentives for health-diminishing behaviour (Johnson et al., 2022); and focusing on the poorest fails to mitigate broader determinants that affect society as a whole (Marmot et al., 2010).

There are existing health simulations for the UK. Public Health Scotland's Informing Interventions to reduce health Inequalities (Triple I) tools focus on comparing the effects and costs of a range of tax-benefit (including a Basic Income) changes as well as non-economic programmes such as a lifestyle weight management service, 20-mile-per-hour speed limits or Alcohol Brief Interventions. Effects and costs modelled are based on premature deaths, years of life lost and hospital stays, with changes population health and inequalities as the key measures. It does not model the economic impacts on household types nor public preferences.

Most other health microsimulations tend to model the economic effects of health, rather than the other way round (Schofield et al., 2017). There are some that model the effects of, potentially economic, interventions on health, particularly with regard to extrapolating from childhood and adolescence, for example, the University of York's LifeSim (Skarda et al., 2021).

We therefore decided to create microsimulation with a public-facing user interface – the Public Policy Preference Calculator (TriplePC) – that would enable automated assessment of economic and health impacts as well as public preferences between different welfare and tax policies. The TriplePC model project therefore had three strands:

1. Estimating the likely electoral popularity of possible policies
2. Deriving relationships between income and health, in a form suitable for use in a microsimulation
3. The integration of strands 1 and 2 into a microsimulation tax-benefit model

We discuss these in turn.

2 Public preferences: Conjoint analysis

Conjoint analysis (Hainmueller et al., 2013) is a survey-based technique originally developed as a market research tool, to examine how consumers value characteristics (sweetness, colour, alcohol content, etc.) of goods. Recently, the technique has become popular as a method for discovering the public's relative valuations of competing economic or social policies (Bremer & Bürgisser, 2023). Research comparing conjoint survey experiments to actual votes has shown that the conjoint results are good predictors of voting outcomes (Bansak et al., 2023).

For our study, we recruited 800 UK resident adults through the Prolific online platform. Participants were told they would be asked, repeatedly, to choose their preferred welfare policy from sets of two. Each time, the two policies contained the same input (design) and outcome (health and distributional) attributes but with randomised levels in each (e.g. payment sizes of £63 per child, £145 per adult and £190 per pensioner; poverty decreased by 25% etc.). Table 1 shows the full list of

10 attributes with between three and nine levels each. All options were fully randomly generated from the possible combinations. Instructions in the survey explained that participants might prefer some features in one policy and some in the other, but they needed to consider which policy they preferred overall. The attributes on which the policies varied were explained in greater depth prior to the first choice task, and then described just with brief phrases during the choice tasks themselves.

We simultaneously estimated the average impact of preference or dis-preference for particular feature attribute-value on preference for policies overall using comparable scales through computation of Average Marginal Component Effects (AMCEs) (Hainmueller et al., 2013) from linear probability models. The AMCE for a given level of an attribute can be interpreted as the marginal effect on the probability of choice of the attribute being at that level compared to the reference level, averaging across the possible levels of all other attributes. Through randomization and a high number of pairwise comparisons, this allows us to quantify the causal effect of including specific levels of individual reform elements on the support for the entire reform package, compared with the support for a reform package that contains the baseline level (status quo) of this particular reform element (Nettle et al., 2023).

Table 1: Conjoint experiment attributes and levels used as TriplePC inputs and outcomes

Attribute	Levels
Payment size	<ul style="list-style-type: none"> • Child - £0; Adult - £63; Pensioner - £190 • Child - £41; Adult - £63; Pensioner - £190 • Child - £0; Adult - £145; Pensioner - £190 • Child - £41; Adult - £145; Pensioner - £190 • Child - £63; Adult - £145; Pensioner - £190 • Child - £63; Adult - £190; Pensioner - £190 • Child - £95; Adult - £190; Pensioner - £230 • Child - £41; Adult - £230; Pensioner - £230 • Child - £95; Adult - £230; Pensioner - £230
Income tax	<ul style="list-style-type: none"> • Basic rate - 20%; Higher rate - 40%; Additional rate - 45% • Basic rate - 30%; Higher rate - 50%; Additional rate - 60% • Basic rate - 40%; Higher rate - 60%; Additional rate - 70% • Basic rate - 48%; Higher rate - 68%; Additional rate - 78% • Basic rate - 50%; Higher rate - 70%; Additional rate - 80% • Basic rate - 65%; Higher rate - 85%; Additional rate - 95%
Other funding	<ul style="list-style-type: none"> • Removal of income tax-free personal allowance • Increased government borrowing • Corporation tax increase • Tax for businesses based on carbon emissions • Tax for individuals based on carbon emissions • Tax on wealth • VAT increase

Poverty	<ul style="list-style-type: none"> • Decreased by 100% • Decreased by 75% • Decreased by 50% • Decreased by 25% • Decreased by 10% • Decreased by 5% • Increased by 5% • Increased by 10% • Increased by 25% • Increased by 50%
Inequality	<ul style="list-style-type: none"> • Decreased by 50% • Decreased by 25% • Decreased by 10% • Decreased by 5% • Increased by 5% • Increased by 10% • Increased by 25% • Increased by 50%
Life expectancy	<ul style="list-style-type: none"> • 0 more or less years on average • 5 fewer years on average • 3 fewer years on average • 1 less year on average • 1 more year on average • 3 more years on average • 5 more years on average

Anxiety and depression	<ul style="list-style-type: none"> • Same number of cases • 50% fewer cases • 25% fewer cases • 10% fewer cases • 5% fewer cases • 5% more cases • 10% more cases • 25% more cases • 50% more cases
Conditionality	<ul style="list-style-type: none"> • People in and out of work are entitled • People who are not disabled are required to look for work • Only people in work are entitled • Only people out of work are entitled
Means testing	<ul style="list-style-type: none"> • People with any or no amount of income are entitled to the full benefit • Only those with incomes less than £20k are entitled to the full benefit • Only those with incomes less than £50k are entitled to the full benefit • Only those with incomes less than £125k are entitled to the full benefit
Universality	<ul style="list-style-type: none"> • Anyone residing in the UK for more than six months are entitled • Only citizens and permanent residents are entitled • Only citizens are entitled

Note that only one option from each group could be chosen. This is a problem for the ‘other funding’ group, where a respondent might prefer a mix of policies, but can only choose one. Note also that tax and benefit levels are grouped as single choices, limiting the customisation of policies possible within the TriplePC.

Further detail on the design and analysis of the conjoint experiment is available in a working paper (Nettle et al., 2023). That study found:

- preference for more generous payments than less generous ones.
- strong preference for decreases in poverty (compared to the status quo).
- preferences on tax rates depended on the broad effects of the policy package. Increasing personal income tax rates were popular if the package they were part of also decreased poverty, and unpopular otherwise.
- preference for a wealth tax, carbon taxes, and increased corporation tax, as opposed to increased government borrowing.
- significant positive effect of a large reduction in inequality, and a significant negative effect of a large increase in inequality. However, the effects for inequality were weaker than for poverty.
- other health and wellbeing consequences also had some significant marginal effects above and beyond those of poverty and inequality. An increase in life expectancy of five years was significantly preferred to the status quo, and a decrease in life expectancy of five years significantly dis-preferred.
- dis-preference for increased rates of anxiety and depression relative to the status quo, and there was a slight preference for policies that decreased them sharply.
- no strong preference for or against means-testing or other restrictions on eligibility.
- Mild differences between left- and right- supporting participants, in the expected directions.
- no significant variation by gender or between rich and poor.
- older people were significantly less keen on high income tax schemes and, curiously, less concerned with health consequences.

The conjoint analysis was conducted ahead of the construction of the microsimulation model. As we discuss below, some of the measures in Table 1 (income tax, payment sizes, poverty and inequality rates) are reasonably straightforward to model (though there are issues around definitions). Others, such as the 'other funding' options and the relationship between income and health, are harder.

3 Modelling health outcomes

We model two health measures: mental health and life expectancy. We build a model relating SF-12 scores (Ware, 2002) to income and demographic characteristics. SF-12 is a widely used measure of an individual's health-related quality of life, with two summary scores: the Physical Component Summary (PCS-12) and the Mental Component Summary (MCS-12). The model is estimated over 12

waves (2009/11-2020/22) of Understanding Society: The UK Household Longitudinal Study (UKHLS) (Institute for Social and Economic Research, 2023) panel data. Another companion article (Reed et al., 2023a) discusses this modelling in detail.

3.1 Health modelling strategy

Our health model is estimated using the ‘between’ individual coefficient from a fixed effects ‘within-between’ model, which combines the effect on physical and mental health of both an individual’s income in one wave vs their average across waves, and their average across waves compared with the sample average.

The model is a reformulation of the standard Mundlak model and has a significant advantage in being able to retain the flexibility of random effects models while reducing concerns about bias that fixed effects models address (Bell et al., 2019; Bell & Jones, 2015). The within-between model, conceptually, captures several key income-based drivers of health, including:

- temporary income shocks (within component), which see individuals’ income increase or decrease in one wave compared to their average.
- permanent income shocks (between component), which see an individual’s average income either be closer to or further away from the population average.
- objective inequality (between component), which see differences between individuals’ average income, which is calculated over a longer, enduring, period.
- subjective social status inequality (between component), which is the psychological phenomenon driven, in part, by income inequality.

It does not, however, capture what we anticipate through our model of impact (Johnson et al., 2022) to be very substantial benefits from systems such as Basic Income of increased security of income and protection from destitution for a very large proportion of the population in even relatively highly paid jobs. We use the between-individual coefficient in our modelling because changes to the welfare system are more likely to reflect permanent income shocks.

The SF-12 regression are available in a working paper (Reed et al., 2023a) available at <https://doi.org/10.17605/OSF.IO/SKPYB>.

3.2 Mental health

We create a binary variable for cases of depressive disorder which takes the value of 1 if the individual’s imputed MCS-12 score is ≤ 45.6 and 0 otherwise (Vilagut et al., 2013).

3.3 Life expectancy

We impute life expectancy from SF-12 in three steps:

1. Convert SF-12 scores to SF-6D (Brazier et al., 2002), using software from QualityMetric (QualityMetric, 2022). SF-6D is a preference-based measure of health.
2. Use SF-6D score to calculate quality-adjusted life years (QALYs). QALYs are a widely recognized standardised measure of health outcomes commonly used in health economics (Drummond et al., 2015; Kaplan & Hays, 2022).
3. Calculate life expectancy from QALYs using multipliers conditional on gender and age. The multipliers are derived from McNamara et al. (2023).

4 Microsimulation: The TriplePC model

As discussed in Section 2, respondents have preferences over inputs (income tax rates, payment sizes, etc.) and outcomes (poverty and inequality levels, numbers of mental health cases, etc.). We use microsimulation to bridge between them.

The analysis uses a heavily adapted version of Scotben (Stark 2023a), an open-source microsimulation model of Scotland written in the Julia programming language. Scotben is a conventionally structured static tax-benefit model, in the family of models branching out from the Institute for Fiscal Studies' TAXBEN (Johnson et al., 1990) of which two of this article's authors (Reed and Stark) were developers. For this project, we extended the scope of the model to Great Britain¹ using a single 2021/22 wave of Family Resources Survey (FRS) data (Department for Work and Pensions, 2019).

The outcome questions are phrased as changes (e.g. '50% fewer cases of anxiety and depression', 'Poverty increased by 50%'). A particularly tricky question arising from this is how to establish a baseline for comparison. The conjoint experiment survey had no 'keep things as they are' option for the tax and benefit inputs, so there were two options for the TriplePC:

1. Using a tax-benefit system some way from the current one as baseline and assuming that the outcome changes represent changes in poverty, health, etc. from that point, rather than changes from the actual current situation.
2. Using the current system as the baseline, but then the default output will have significant deviations for the outcome variables.

¹ We exclude Northern Ireland here because of lack of time to adequately model Northern Irish local taxation: 'Rates' and 'Rate Rebates'.

We selected option 1 on the grounds that it makes the conjoint popularity output much easier to understand. The result, however, is that the model starts some distance from the actual existing system.

4.1 Income tax rates

The conjoint experimental survey had six income tax rate options with a basic, higher and additional rate in each (see Table 1). The first of these options is the current non-Scottish UK income tax rates, which we take as the base.² All other options represent rate increases. We assume the corresponding thresholds are as present. Since we have to remain consistent with the conjoint analysis, only the six rate groups in Table 1 are presented to the user, though the model can handle any combination of rates and thresholds. We assume no behavioural responses to changing tax rates and make no corrections for underreporting of incomes beyond that embodied in the FRS sample weights.

4.2 Benefits

The payment size question in the conjoint survey was about a hypothetical system of payments that most closely reflects the simplicity of Basic Income (Reed et al., 2023b). There were also questions about eligibility, means-testing and citizenship (see Table 1, above). It is not clear how this proposed system of cash transfers should interact with the existing tax and benefit system, especially bearing in mind that the question is not how an expert believes they should interact, but what was most likely in the mind of the conjoint respondents. We follow our recent analysis (Reed et al., 2023b) and assume:

1. means-tested benefits are retained.³
2. most other benefits, including the State Pension and Child Benefit, are abolished and replaced by the cash transfers.
3. Needs-based benefits such as those based on sickness or disability, like Personal Independence Payment (PIP), are retained.

² Scotland has its own five-rate system. Because of the need to impose a uniform base case, we impose the ‘Rest of UK’ three-rate system as the baseline in Scotland too, so we start from a position where Scottish low earners pay slightly more than in reality, and high earners less.

³ A wrinkle here is that the UK has two means-tested benefit systems operating: the ‘legacy’ tax credit-based system and the new Universal Credit (UC) that is gradually supplanting it (House of Commons Library, 2020). For simplicity, in our modelling we assume all households have been transitioned to UC.

The least generous set of options (Child - £0; Adult - £63; Pensioner - £190) are taken as the base values. Compared to the actual system, this means that we're starting from a social security system that's considerably more expensive (because of the adult payments), but where pensioners are usually slightly worse off (£190 vs £203.85 for the new State Pension) and families with large numbers of children not on means-tested benefits are worse off, since the cash transfer to children is zero in the default case and the payments to adults are not always enough to compensate. We do not adjust taxes to meet these extra base costs. For eligibility, means-testing and citizenship options, it seemed plausible that at least some of the respondents might be aware of the means and eligibility tests from existing benefits. Consequently, we model the eligibility rules that apply to the 'legacy' UK benefits: Working Tax Credit and Income Support/Employment Support that are in the process of being phased out, and the means-tests are taken from the new Universal Credit (Child Poverty Action Group, 2022).

4.3 Modelling other funding options

Table 1 includes a number of 'other funding' options that are worth discussing briefly.

There is ambiguity in some of these options. A wealth tax or carbon levy could be implemented in many ways, for instance; we make what we hope are reasonable assumptions for these cases, but for the microsimulation to be fully consistent with the conjoint survey we would have to know what was in the mind of the respondents. This section discusses how we tackled modelling three of these options.

4.3.1 'Increase in VAT' (Value Added Tax)

Our Family Resources Survey (FRS) dataset has no expenditure data. The main UK source of household expenditure data is the Living Costs and Food Survey (LCF) (Office for National Statistics, 2019a). To model the complex set of VAT exemptions and zero-rated goods⁴, we therefore have three choices:

1. Switching the primary dataset to be the LCF. LCF⁵ was the primary dataset of all UK Tax Benefit Models until it was supplanted by the FRS. LCF remains the source used in the Treasury's IGOTM model (Brice, 2015). But to model other options such as wealth taxes, we would need still other datasets. Switching between multiple different datasets, and hence slightly different base outcomes, depending on which options were being modelled could be confusing.

⁴ See HM Revenue & Customs (2022); for general discussions of consumption in microsimulation models, see Crawford et al. (2010 and Capéau et al. (2014).

⁵ Then the Family Expenditure Survey (FES)

2. Imputing expenditure data onto the FRS via a demand system. This seems appealing as the model would be consistent with economic theory, expenditure could vary with tax rates, and, in principle, we could use the demand system to calculate changes in economic welfare rather than just estimate cash changes. But it is infeasible to build a demand system with fine enough detail to adequately model the complex set of exemptions and zero-rated goods.
3. Assigning LCF records to our primary FRS dataset using data matching, which is the option we chose. Since it is important to capture the relationship between income and expenditure, we performed the matching in two steps. We selected a candidate group of LCF donors in the conventional way (matching on age, sex, tenure, etc) and then ranked among those candidates by income.

4.3.2 'Tax on wealth'

Modelling wealth is tricky for three reasons:

1. Our primary FRS dataset has limited information on wealth, mainly intended to help model benefit eligibility tests, so, as with VAT simulation, we need to augment our dataset.
2. The form this wealth tax should take is not specified.
3. Wealth taxes are held to be particularly easy to evade or avoid (Scheuer & Slemrod, 2021).

To solve 1., we impute data from the Wealth and Assets Survey (WAS) (Office for National Statistics, 2019b) onto the FRS households. We chose to do this using a simple linear regression of three categories of wealth (pensions, housing, and financial and other assets) against household characteristics that are both in the FRS and WAS. A regression was chosen over data matching because we believed it would be useful for modelling evasion. In reality, we lacked both time and a good theoretical model of avoidance/evasion, so no modelling of evasion was implemented. In retrospect, therefore, matching might have been a better solution.

For the form of the tax, we were guided by the Wealth Tax Commission (Advani et al., 2020). We followed their recommendations of excluding pension wealth, having an allowance of £500,000, and having the tax payable over five years, though we deviated from the Commission in applying the tax to aggregate household wealth rather than individual wealth (Chamberlain, 2020).

To ensure that the tax is set at the right level to meet the costs of any benefit increases, a simple root finding module⁶ was integrated into the model. This searches for the rate that sets the net cost of the scheme to zero. In practice this is overkill. In the absence of evasion, a simple division

⁶ <https://github.com/grahamstark/ScottishTaxBenefitModel.jl/blob/master/src/TheEqualiser.jl>

of the wealth tax base by the required revenue would produce the right value, but many other use cases of this module are non-linear, for example adjustments of tax allowances, or changes in rates where there is a behavioural response.

Even when payable over five years, the payments from wealth taxes needed to fund some of the more generous benefit schemes can exceed net income for many families, especially elderly families who have high housing wealth. Most likely the scheme would need to be augmented by an income-related rebate scheme, or some scheme to defer until death.

4.3.3 'Corporation tax increases'

Building a plausible micro-data based model of Corporation Tax is difficult and not something that could be contemplated for this project. In any case, for a household-based microsimulation model, what matters is the incidence of the tax on the households. This could be on profits, or passed on in price increases or real wage reductions (Harberger, 1962; Atkinson & Stiglitz, 2015). If we make a simple 'small country' assumption – that the rate of return on capital and the price of tradeable goods are set exogenously on world markets – then Corporation Tax is ultimately incident on (private sector) wages and self-employment income. Therefore, we calculate the tax increase needed to meet the costs of the benefit increase and reduce the wage bill by that amount. Note that as the wage bill falls, direct tax revenues also fall, but in a non-linear way because of the tax allowance and progressive tax rate structures, so finding the correct Corporation Tax increase requires the use of our root-finder. In practice the rates needed for the more generous benefit increases can be implausibly large, exceeding in some cases total UK Corporation's Gross Profits.


5 Model flow

Putting all this together, a model run has five main stages:


1. The user selects from the Payment size, Income tax, Other funding, Conditionality, Means testing, Universality options from Table 1.
2. The model then calculates net incomes for each person in the FRS households given these choices.
3. These net incomes are in turn plugged in to the equations discussed in Section 2 to give us estimates of changes to the prevalence of depressive disorders and mortality.
4. The model next calculates gainers and losers, revenues and costs, and changes in poverty and inequality.
5. Finally, the model calculates conjoint public preferences based on 1 to 4 above and displays the results.

The model has a simple single page web interface, publicly available at <https://triplepc.northumbria.ac.uk/>. Figure 1, below, shows this in action. The user has selected a relatively generous benefit increase (top left panel), partially paid for by income tax increases (top centre). The bottom half of the screen shows the results, relative to the base discussed in section 3 above. Health results are in the bottom row, showing small mental health improvements. The net cost of this scheme is £118bn (right middle panel). Poverty and inequality are both reduced (centre left panel). The Conjoint analysis is in the centre: the scheme is more popular by 4.7 points than the baseline due to the popularity of the poverty and inequality reductions and the benefit increases, though this is partly offset by unpopular tax increases.

Figure 1: TriplePC interface example scenario



Public Policy Preference Calculator (TriplePC)



Note: some features are not yet implemented

Benefit Levels - How much?

- Child - £0. Adult - £63. Pensioner - £190
- Child - £41. Adult - £145. Pensioner - £190
- Child - £0. Adult - £145. Pensioner - £190
- Child - £41. Adult - £145. Pensioner - £190
- Child - £63. Adult - £190. Pensioner - £190
- Child - £63. Adult - £190. Pensioner - £190
- Child - £95. Adult - £190. Pensioner - £230
- Child - £41. Adult - £230. Pensioner - £230
- Child - £95. Adult - £230. Pensioner - £230

How to pay - Income Tax Rates

- Basic rate - 20%. Higher rate - 40%. Additional rate - 45%
- Basic rate - 23%. Higher rate - 43%. Additional rate - 48%
- Basic rate - 30%. Higher rate - 50%. Additional rate - 60%
- Basic rate - 40%. Higher rate - 60%. Additional rate - 70%
- Basic rate - 48%. Higher rate - 68%. Additional rate - 78%
- Basic rate - 50%. Higher rate - 70%. Additional rate - 80%
- Basic rate - 65%. Higher rate - 85%. Additional rate - 95%

How to pay- other things

- Removal of income tax-free personal allowance
- Increased government borrowing
- Corporation tax increase
- Tax for businesses based on carbon emissions
- Tax for individuals based on carbon emissions
- Tax on wealth
- VAT increase

Who is entitled?

- People in and out of work are entitled
- Everyone is entitled but people of working age who are not disabled are required to look for work
- Only people in work are entitled
- Only people out of work are entitled

Should it be means tested?

- People with any or no amount of income are entitled to the full benefit
- Only those with incomes less than £20k are entitled to the full benefit
- Only those with incomes less than £50k are entitled to the full benefit
- Only those with incomes less than £125k are entitled to the full benefit

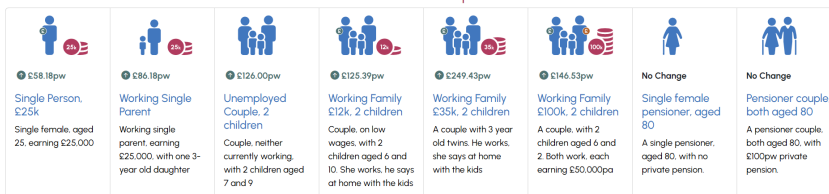
Open to non-Citizens?

- Citizens, permanent residents and anyone residing in the UK for more than six months are entitled
- Only citizens and permanent residents are entitled
- Only citizens are entitled

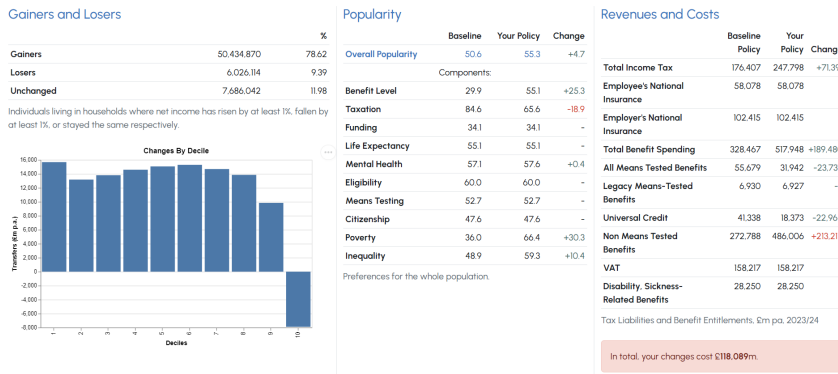
Reset
Run

Outcomes

Effects on Some Example Families



Effects on the Whole Country



6 Lessons Learned

One important lesson for similar future work is the need for good coordination between conjoint analysis and microsimulation modelling at the outset of the project.

In our case, the conjoint analysis was conducted ahead of microsimulation modelling work. Consequently, microsimulation requirements were largely fixed by the questions in the conjoint survey. This has several consequences:

- The model could present only a very limited set of options for taxes and benefits compared to the model's underlying capabilities. The survey system used for the survey – Qualtrics – had a hard limit on the number of attributes that could be included, which meant that it was not possible to ask about basic and higher tax rates individually. It might also have increased respondent load to an unacceptable level and therefore reduced the quality of the preference data.
- The meaning of options such as 'Tax on wealth' should, where possible, be made clearer in order to provide a clear direction for modelling.
- Co-development of a conjoint survey and microsimulation might have enabled respondents to see accurate consequences of their preferred policies for incomes and health.
- Some of the options in the survey, such as VAT increases, were quite burdensome to model in the time available. Very strong assumptions were therefore required for some options.
- Careful thought must be given to the definition of the base case the model is comparing against.

There are also interesting questions about how best to present results of a model with such diverse outputs. For instance, can we count payments by a household from a wealth tax in the same way as payments for income tax? And should we be imputing a monetary value to any health improvements?

7 Conclusion

We have presented the TriplePC, a new microsimulation model with novel but important features. We have established the importance and practicality of using conjoint data to provide instant analysis of the political implications of welfare packages, but also learned some important lessons on how best to conduct integrated microsimulation and conjoint analysis. We have also estimated new measures of the relationship between income and health and shown how these, too, can be integrated into the model. The TriplePC is available online at <https://triplepc.northumbria.ac.uk/> and its source code, linked on the main site, is released under an open-source licence.

8 References

- Advani, A., Chamberlain, E., & Summers, A. (2020). Wealth Tax Commission. Retrieved August, 3, 2023.
- Bansak, K., Hainmueller, J., Hopkins, D. J., & Yamamoto, T. (2023). Using Conjoint Experiments to Analyze Election Outcomes: The Essential Role of the Average Marginal Component Effect. *Political Analysis*, 31(4), 500–518. <https://doi.org/10.1017/pan.2022.16>
- Bell, A., Fairbrother, M., & Jones, K. (2019). Fixed and random effects models: Making an informed choice. *Quality & Quantity*, 53(2), 1051–1074. <https://doi.org/10.1007/s11135-018-0802-x>
- Bell, A., & Jones, K. (2015). Explaining Fixed Effects: Random Effects Modeling of Time-Series Cross-Sectional and Panel Data*. *Political Science Research and Methods*, 3(1), 133–153. <https://doi.org/10.1017/psrm.2014.7>
- Brazier, J., Roberts, J., & Deverill, M. (2002). The estimation of a preference-based measure of health from the SF-36. *Journal of Health Economics*, 21(2), 271–292. [https://doi.org/10.1016/S0167-6296\(01\)00130-8](https://doi.org/10.1016/S0167-6296(01)00130-8)
- Bremer, B., & Bürgisser, R. (2023). Do citizens care about government debt? Evidence from survey experiments on budgetary priorities. *European Journal of Political Research*, 62(1), 239–263. <https://doi.org/10.1111/1475-6765.12505>
- Brice, W. (2015). *Using SAS to model the distributional impact of government policies*. https://www.sas.com/content/dam/SAS/en_gb/doc/other1/events/sasforum/slides/manchester-day1/W.Bryce%20SAS%20Forum%20UK%20-%20HMT%20slides.pdf
- Capéau, B., Decoster, A., & Phillips, D. (2014). Consumption and Indirect Tax Models. In *Handbook of Microsimulation Modelling* (Vol. 293, pp. 223–273). Emerald Group Publishing Limited. <https://doi.org/10.1108/S0573-855520140000293007>
- Chamberlain, E. (2020). *Defining the tax base: Design issues*. CAGE. <https://doi.org/10.47445/108>

- Child Poverty Action Group. (2022, December 21). *Welfare Benefits & Tax Credits Handbook, 2023/24*. CPAG. <https://cpag.org.uk/shop/handbook/welfare-benefits-tax-credits-handbook-202324>
- Crawford, I., Keen, M., & Smith, S. (2010, April 1). *Dimensions of Tax Design: Value added tax and excises*. Institute for Fiscal Studies. <https://ifs.org.uk/books/value-added-tax-and-excises>
- Crewe, I., & King, A. (1995). Of Merger and a Dead Parrot. In I. Crewe & A. King (Eds.), *SDP: The Birth, Life and Death of the Social Democratic Party* (p. 0). Oxford University Press. <https://doi.org/10.1093/oso/9780198280507.003.0021>
- Department for Work and Pensions. (2019). *The Family Resources Survey*. <http://research.dwp.gov.uk/asd/frs/>
- Department for Work and Pensions. (2023). *Family Resources Survey 2021/22: Disability Data Tables*. GOV.UK. <https://www.gov.uk/government/statistics/family-resources-survey-financial-year-2021-to-2022>
- Department of Health and Social Care. (2018). *Prevention is better than cure*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/753688/Prevention_is_better_than_cure_5-11.pdf
- Drummond, M. F., Sculpher, M. J., Claxton, K., Stoddart, G. L., & Torrance, G. W. (2015). *Methods for the Economic Evaluation of Health Care Programmes* (Fourth edition). Oxford University Press.
- Dwyer, P., Scullion, L., Jones, K., McNeill, J., & Stewart, A. B. R. (2020). Work, welfare, and wellbeing: The impacts of welfare conditionality on people with mental health impairments in the UK. *Social Policy & Administration*, 54(2), 311–326. <https://doi.org/10.1111/spol.12560>
- Gibson, M., Hearty, W., & Craig, P. (2020). The public health effects of interventions similar to basic income: A scoping review. *The Lancet Public Health*, 5(3), Article 3. [https://doi.org/10.1016/S2468-2667\(20\)30005-0](https://doi.org/10.1016/S2468-2667(20)30005-0)

- Gourley, D. (n.d.). The 'Dead Parrot' document. *Journal of Liberal History*. Retrieved November 20, 2023, from <https://liberalhistory.org.uk/history/dead-parrot-document/>
- Hainmueller, J., Hopkins, D. J., & Yamamoto, T. (2013). Causal Inference in Conjoint Analysis: Understanding Multidimensional Choices via Stated Preference Experiments. SSRN. <https://dspace.mit.edu/handle/1721.1/84064>
- HM Revenue & Customs. (2022, July 11). *VAT rates on different goods and services*. GOV.UK. <https://www.gov.uk/guidance/rates-of-vat-on-different-goods-and-services>
- House of Commons Library. (2020). *Constituency data: Universal Credit rollout*. <https://commonslibrary.parliament.uk/social-policy/welfare-pensions/benefits/constituency-data-universal-credit-roll-out/>
- Institute for Social and Economic Research. (2023). *Survey timeline*. Understanding Society. <https://www.understandingsociety.ac.uk/documentation/mainstage/survey-timeline>
- Johnson, M. T., Johnson, E. A., Nettle, D., & Pickett, K. E. (2022). Designing trials of Universal Basic Income for health impact: Identifying interdisciplinary questions to address. *Journal of Public Health*, 44(2), 408–416. <https://doi.org/10.1093/pubmed/fdaa255>
- Johnson, P., Stark, G., & Webb, S. (1990). *Taxben2: The New IFS Tax Benefit Model* (IFS Working Papers). Institute for Fiscal Studies.
- Kaplan, R. M., & Hays, R. D. (2022). Health-Related Quality of Life Measurement in Public Health. *Annual Review of Public Health*, 43(1), 355–373. <https://doi.org/10.1146/annurev-publhealth-052120-012811>
- Marmot, M., Allen, J., Boyce, T., Goldblatt, P., & Morrison, J. (2020). *Health equity in England: The Marmot Review 10 years on*. Institute of Health Equity. <https://www.instituteofhealthequity.org/resources-reports/marmot-review-10-years-on>
- Marmot, M., Allen, J., Goldblatt, P., Boyce, T., McNeish, D., Grady, M., & Geddes, I. (2010). *Fair society, healthy lives: The Marmot review*. The Marmot Review.

<https://www.instituteofhealthequity.org/resources-reports/fair-society-healthy-lives-the-marmot-review>

McNamara, S., Schneider, P. P., Love-Koh, J., Doran, T., & Gutacker, N. (2023). Quality-Adjusted Life Expectancy Norms for the English Population. *Value in Health*, 26(2), 163–169.

<https://doi.org/10.1016/j.jval.2022.07.005>

Nettle, D., Chrisp, J., Johnson, E., & Johnson, M. T. (2023). What do British people want from a welfare system? Conjoint survey evidence on generosity, conditionality, funding, and outcomes. *SocArXiv*. <https://doi.org/10.31235/osf.io/zfnuh>

NHS England. (2019). *The NHS Long Term Plan*. NHS England.

<https://www.longtermplan.nhs.uk/publication/nhs-long-term-plan/>

Office for National Statistics. (2019a). *Living Costs and Food Survey, 2017-2018*. UK Data Service.

Office for National Statistics. (2019b). *Wealth and Assets Survey*. UK Data Service.

<http://doi.org/10.5255/UKDA-Series-2000056>

QualityMetric. (2022). *SF-6D® Health Utility*. Quality Metric. <https://www.qualitymetric.com/health-surveys/sf-6d-health-utility/>

Reed, H. R., Johnson, E.A., Parra-Mujica, F., Stark, G., Wilkinson, R., & Johnson, M. T. (2023a)

Examining the relationship between income and both mental and physical health among 18+ adults in the UK: Analysis of 12 waves (2009-2021) of Understanding Society. *Working paper*.

<https://doi.org/10.17605/OSF.IO/SKPYB>.

Reed, H. R., Johnson, M. T., Lansley, S., Johnson, E. A., Stark, G., & Pickett, K. E. (2023b). Universal

Basic Income is affordable and feasible: Evidence from UK economic microsimulation modelling1. *Journal of Poverty and Social Justice*, 31(1), 146–162.

<https://doi.org/10.1332/175982721X16702368352393>

Scheuer, F., & Slemrod, J. (2021). Taxing Our Wealth. *Journal of Economic Perspectives*, 35(1), 207–230. <https://doi.org/10.1257/jep.35.1.207>

- Schofield, D. J., Zeppel, M. J. B., Tan, O., Lymer, S., Cunich, M. M., & Shrestha, R. N. (2017). A Brief, Global History of Microsimulation Models in Health: Past Applications, Lessons Learned and Future Directions. *International Journal of Microsimulation*, 11(1), 97–142.
<https://doi.org/10.34196/ijm.00175>
- Shahidi, F. V., Ramraj, C., Sod-Erdene, O., Hildebrand, V., & Siddiqi, A. (2019). The impact of social assistance programs on population health: A systematic review of research in high-income countries. *BMC Public Health*, 19(1), 2. <https://doi.org/10.1186/s12889-018-6337-1>
- Skarda, I., Asaria, M., & Cookson, R. (2021). LifeSim: A Lifecourse Dynamic Microsimulation Model of the Millennium Birth Cohort in England. *International Journal of Microsimulation*, 14(1), 2–42. <https://doi.org/10.34196/IJM.00228>
- Vilagut, G., Forero, C. G., Pinto-Meza, A., Haro, J. M., de Graaf, R., Bruffaerts, R., Kovess, V., de Girolamo, G., Matschinger, H., Ferrer, M., & Alonso, J. (2013). The Mental Component of the Short-Form 12 Health Survey (SF-12) as a Measure of Depressive Disorders in the General Population: Results with Three Alternative Scoring Methods. *Value in Health*, 16(4), 564–573. <https://doi.org/10.1016/j.jval.2013.01.006>
- Ware, J. E. (2002). *How to Score Version 2 of the SF-12 Health Survey (with a Supplement Documenting Version 1)*. QualityMetric Incorporated. <https://books.google.co.uk/books?id=Ft4lvGAACAAJ>
- Wickham, S., Bentley, L., Rose, T., Whitehead, M., Taylor-Robinson, D., & Barr, B. (2020). Effects on mental health of a UK welfare reform, Universal Credit: A longitudinal controlled study. *The Lancet Public Health*, 5(3), e157–e164. [https://doi.org/10.1016/S2468-2667\(20\)30026-8](https://doi.org/10.1016/S2468-2667(20)30026-8)
- Working Group on Inequalities in Health. (1980). *Black Report*. Department of Health and Social Security. <https://www.sochealth.co.uk/national-health-service/public-health-and-wellbeing/poverty-and-inequality/the-black-report-1980/black-report-foreword/>