

## OPTIMAL DESIGN OF MEANS TESTED RETIREMENT BENEFITS\*

*James Sefton and Justin van de Ven*

Design of welfare benefits is a tricky business. In this regard, James Meade believed that it is important to avoid excessive distortions to the price of labour. He also recognised that means testing is a useful way of limiting the ‘hideously expensive’ cost of universal benefits provision; he conjectured that a 50% claw-back rate might be appropriate. We use a rational agent model to explore the welfare effects of alternative retirement benefits arrangements in the UK. Our analysis supports an extensive role for means testing, consistent with Meade’s conjecture, and highlights the distortions associated with alternative methods of benefits financing.

Every citizen, rich or poor, receives the same tax-free Basic Income but the Surcharge on the first slice of other income is the equivalent of a withdrawal of part of the Basic Income, not pound for pound but, say, one pound for every two pounds earned. The Surcharge may weaken but will not eliminate the incentive to earn more income; it can however, enormously reduce the cost of the Basic Income. “Can we learn a ‘third way’ from the Agathotopians?”  
Meade (1993, p. 94).

Controversy has surrounded the role of means testing in the provision of state benefits ever since the concept was first introduced in the UK in the 1930s.<sup>1</sup> That the recent debate regarding retirement benefits in the UK should be concerned about the distortions associated with rates of benefits withdrawal is understandable, given the perceived need to encourage higher savings. In fact, and almost entirely in response to this concern, the 2007 Pensions Act will move the structure of retirement benefits away from the present framework with its substantial reliance on means testing, to one that will eventually be close to flat rate. However, this solution possibly over compensates. As noted by Meade (1993, p. 94), universal welfare benefits can be ‘hideously expensive’ to provide, and means testing is a tool for limiting that fiscal burden. Here we take a fresh look at means testing of retirement benefits, examining the conflict between Meade’s suggested structure of benefits provision (as cited above) and the direction of recent pensions policy reforms.

Our analysis focuses on two key questions. First, what does a rational agent model that is designed to approximate prevailing circumstances in the UK imply regarding the preferred structure of state retirement benefits, and the role of means testing in particular? And second, how does the evaluation of alternative pension schemes depend upon the assumed method of financing and the wider tax and benefits system more generally? We believe that these questions would have appealed to James Meade, who was intimately

\* An earlier version of this article was presented at the conference in honour of James Meade, held at the Bank of England, July 2007. The current paper is a revision of National Institute Discussion Paper No. 299.

<sup>1</sup> For an entertaining historical account, see ‘There is nothing mean about a means test’, by L. Purves, published in *The Times*, November 7, 2008.

concerned with the design of the welfare state. But more than that, these questions are now of growing concern in the wake of the on-going global economic crisis, which has placed both public and private finances under unforeseen strain, creating uncertainty over existing plans for funding future retirement incomes.<sup>2</sup>

We explore these issues in the spirit of the optimal tax literature, following the seminal paper by Mirrlees (1971). Our basic economic unit is the household, with preferences modelled by a standard intertemporal utility function. Household savings and work decisions are considered to be made to maximise expected lifetime utility, given preferences, circumstances and beliefs regarding the future. Importantly, our analytical framework includes uncertainty over future labour incomes, which – given the assumption of risk aversion – has an important influence on preferences regarding the size and structure of the welfare state. We carefully calibrate our framework to reflect the existing tax and benefits structure, and to statistics estimated from UK survey data. We use the calibrated framework to explore the implications of alternative retirement benefits arrangements, taking the remainder of the tax and benefits system as given. In this way, we constrain ourselves to the mandate of the Pensions Commission, which delivered the recommendations upon which the recent Pensions Acts are based (see Pensions Commission, 2005, for details). We assess the implications of alternative pension arrangements in terms of aggregate savings, aggregate labour supply and household welfare.

Our analysis produces answers to both of the questions that we pose above. First, given the current tax and benefits system, we find a strict preference for means testing over universal benefits provision. This finding is consistent with the recommendation made by Meade (1993). We find very little evidence that a 50% marginal tax rate on the first tranche of pension income would represent a strong disincentive to private savings for retirement. It does, however, substantially reduce the cost of public pension provision. In fact – in striking contrast to much of the contemporary pensions debate in the UK – we find that a sizeable universal basic pension crowds out private savings, due to the accompanying income effect.

Second, our results highlight the fact that it is impossible to divorce analysis of pension benefits from the structure of the wider tax and benefits system. Put another way, the choice of the pension system is necessarily conditional on the remainder of the redistributive system. For example, if the wider tax and benefits system is only weakly redistributive, then this will be balanced by a desire for greater redistribution in the pension system and *vice versa*. Our analysis suggests a strong demand for greater social insurance; increasing the targeting of pension benefits raises expected lifetime utility. This finding is relevant, given the current crisis, as it suggests alternative options that the government might consider if it wishes to reduce its fiscal

<sup>2</sup> Public sector net borrowing requirements (PSNBR) are forecast to rise to 8% of GDP in 2009–10, with public debt rising to 57% of GDP by 2012 – and these forecasts assume that the government sticks to its ambitious target of reining in the PSNBR within 3 years, HM Treasury (2008). Equally private pension provision is under similar pressures – in the 10 months to January 2009, the aggregate deficit of private sector defined benefit (DB) pension funds has grown from £67bn to £190bn (Pension Protection Fund, 2009). Existing pension policy reforms are forecast to increase expenditure on state pensions by around 2.6% of GDP by 2050, despite a rise in the state retirement age from 65 to 68, DWP (2006).

deficit. It could cut expenditure by increasing the targeting of pension benefits, or alternatively it could raise revenue by increasing the progressivity of the income tax system. An implication of this second option – seen through the lens of our analytical framework – would be to enhance popular support for a universal basic pension, consistent with current legislation.

The article is structured as follows. Section 1 begins with a brief review of the considerations that underlie the analytical framework that is used to conduct our analysis. We then describe the analytical approach that we adopt, followed by a description of the results obtained. Section 4 concludes.

## 1. The Analytical Context

Means testing of pension benefits can be interpreted as a form of non-linear capital income taxation, because it reduces the effective return to private retirement savings for people who remain eligible for benefits, relative to those who are not. Banks and Diamond (2008) summarise the current literature on the design of capital income taxes. They take as their starting point the Atkinson and Stiglitz (1976) theorem, which states that, if

- (i) there is no uncertainty,
- (ii) people do not face liquidity constraints,
- (iii) there are no restrictions on the way in which labour income can be taxed,
- (iv) preferences are separable between consumption and leisure, and
- (v) all consumers have the same preferences,

then there is no role for (non-linear) capital income taxes in the design of an optimal tax system. The intuition behind this result is that, if preferences on consumption are identical and separable from labour, non-linear capital income taxes impose a wedge between the marginal rates of substitution and transformation. This results in a loss of efficiency, without any offsetting redistributive gain. In such an economy, taxes are levied on labour income and there is no role for taxing pension income. However, many of these assumptions are unlikely to hold in practice, and it is interesting to consider the likely implications of relaxing each one in turn.

- 1 The assumption of no uncertainty is clearly at odds with the practical reality, where decisions regarding saving for retirement must usually be made well before an individual can be certain about their financial circumstances in old age. Banks and Diamond (2008) argue that uncertainty in future labour income increases the desire for some form of capital taxation. This is because capital taxation can increase the cost of intertemporal consumption smoothing for people with positive wage surprises, thereby increasing incentives to provide labour.
- 2 Borrowing constraints are likely to have an influence on policy design that is very similar to that described for uncertainty. This is because such constraints tend to imply that people on lower incomes – who are more likely to encounter constraints on borrowing – have shorter planning horizons than those on higher incomes.

- 3 Although a completely open choice of tax and benefits arrangements might be desirable, it is rarely possible in practice.
- 4 Econometric studies by Browning and Meghir (1991) and Ziliak and Kniesner (2005) have found that the assumption of additive separability of consumption and leisure in utility is strongly rejected by the data. Similarly Banks *et al.* (1998) observe a significant fall in mean household consumption at retirement in UK data, and estimate that a large proportion of this fall can be explained by the substitution of leisure (or home production) for consumption goods – a proposition that is at odds with the separability of preferences. It follows from Atkinson and Stiglitz (1976, equation 21)<sup>3</sup> that later consumption be taxed more heavily, providing a role for capital income taxation.
- 5 Saez (2002) assumes that those on high incomes have a greater propensity to save (lower discount rates) than those on lower incomes and finds a significant role for capital income taxes.

The analytical framework that we assume is informed by the above observations. Our analysis is structured to explicitly account for the effects on behaviour and welfare of uncertainty over future wages and longevity. We base our analysis on a structural model of behaviour, so that it is possible to resolve incentive effects, subject to both uncertainty and borrowing constraints. In selecting the wider tax and benefits context with which to conduct our analysis, we have been guided by the terms of reference of the Pensions Commission, as is discussed at length in the following subsection. And the preferences that we assume for analysis do not impose additive separability between consumption and leisure, consistent with empirical findings. In contrast to the analysis of Saez (2002), however, we assume – like most of the related literature – that preferences are the same throughout the population.

The importance that is attached to uncertainty relates this study to the optimal tax literature that is concerned with the *social insurance–efficiency* trade-off, rather than the larger literature that is concerned with the *equity–efficiency* trade-off.<sup>4</sup> In the social insurance–efficiency context, taxation serves the role of hedging individuals against some form of uninsurable risk. As noted by Varian (1980, p. 51), ‘The motive for redistribution here is not a desire for equity *per se*, but rather a desire for *social insurance*’ (emphasis in the original). A methodological advantage of this approach is that it makes inter-personal welfare comparisons – and the exogenous specification of a social welfare function – unnecessary.

Focusing upon the social insurance–efficiency trade-off has generally been found to result in higher marginal rates of taxation than those reported in the equity–efficiency literature and to provide a motive for a progressive rate structure. Regarding some of the technicalities of the approach, Varian (1980) and Low and Maldoom (2004)

<sup>3</sup> Given our specification of preferences, this result can be derived by substituting in for the marginal utilities in (21). The resulting expression for the taxes on later consumption relative to earlier consumption will be positive if leisure and consumption are substitutes.

<sup>4</sup> The literature that explores optimal taxation in the context of uncertainty stems from Mirrlees (1974). Examples from the literature include Diamond and Mirrlees (1978), Varian (1980), Tuomala (1984), Low and Maldoom (2004) and Pirttilä and Tuomala (2007).

suggest that the optimal progressivity of the tax structure is increasing in risk aversion and uncertainty, and decreasing in prudence.<sup>5</sup> The first of these effects is intuitive enough. On the negative relation between prudence and preferences for progressivity, we note that both Varian (1980) and Low and Maldoom (2004) consider analytical contexts in which precautionary behavioural responses tend to augment the tax base, and Low and Maldoom (2004) cite this as the driving mechanism behind the result. In the context of intertemporal consumption and labour supply decisions, however, it is not clear that this relationship between prudence and the tax base will continue to hold. Attanasio *et al.* (2005), for example, report that precautionary behaviour tends to motivate increased labour supply and saving at the beginning of the working lifetime, and earlier retirement. If the tax base is more sensitive to variations in labour supply later in life, then the results of Attanasio *et al.* (2005) suggest that prudence may actually reduce the tax base, with consequences for the welfare maximising design of taxation. Although we do not explore this issue further here, it is an effect that would appear to warrant further research.

The policy debate accompanying recent reforms has raised a number of additional considerations that may be of practical importance but are beyond the scope of the current study. One of the most frequently cited is that means tested benefits tend to suffer from poor rates of take-up – potentially due to a social stigma that is attached to their receipt – and therefore fail to provide assistance to those that they are designed to help. Furthermore, as Atkinson (1996, p. 68) states, means testing is most naturally adapted for application to benefits that are provided at the family or household level, which runs counter to the political trend toward welfare provision at the level of the individual. Finally it is argued that means testing encourages tax-evasion, setting ‘the interest and the duty of individuals at variance’, Slemrod (2007). To the extent that these concerns are important, our analysis will overstate the case in favour of means tested retirement benefits.

## 2. The Analytical Approach

The policies that are explored were chosen to reflect the contemporary debate regarding the structure of retirement benefits in the UK. This Section begins by describing the policies with which we are concerned, placing them in context of contemporary reforms to the retirement benefits system. We then describe details of the structural framework that we use to evaluate and compare alternative policy counterfactuals.

### 2.1. A Decade of Pension Reform

It has been a declared objective of recent government policy in the UK to improve the living standards of poorer pensioners.

<sup>5</sup> Risk aversion is defined in the usual way ( $-u''/u'$ ). Preferences are described as exhibiting ‘prudence’ if the sign on the third derivative is positive ( $u''' > 0$ ), which implies decreasing risk aversion with consumption. In the context of additively separable utility, Leland (1968) proves that individuals will only undertake precautionary saving if their preferences exhibit prudence.

The Government's first priority has been to help those in greatest need. . . . Too many pensioners have not shared in the rising prosperity of the country.

HM Treasury (2001, Section 5.42: Tackling Pensioner Poverty)

In context of rising life expectancy and falling birth rates, however, the government has also been concerned to encourage 'tomorrow's pensioners to save for their retirement', Department for Work and Pensions (2002*a*). To this end, the government have introduced a series of policy initiatives that have significantly altered retirement benefits provision during the last decade. These initiatives reveal considerable uncertainty about how to achieve the dual objectives of social and private provision for retirement. To illustrate the degree of uncertainty, we shall briefly contrast the various initiatives that have been employed.

In 1998, a single adult aged 65 or over in the UK, and with a full work history, was eligible to a flat rate benefit (the basic pension), equal to £64.70 per week, 21% of the median wage of all full-time employees (Table 34 of the *Labour Force Survey (LFS) Quarterly Supplement*, Office for National Statistics). In addition, they were eligible to a means tested benefit (income support) equal to £5.75 per week. This means tested benefit was subject to a 100% withdrawal rate, so that it was reduced by £1 for every £1 of private income until it was exhausted. At that time, the recently elected labour government set about expanding the role of the means testing in the provision of retirement benefits (re-branding income support to retirees as the Minimum Income Guarantee). Between 1998 and 2003 – while the flat rate benefit as a percentage of the median full-time wage was approximately constant – the surplus of the means tested benefit measured as a percentage of the flat rate benefit increased from 9% to 32% for single retirees, and from 6% to 26% for retired couples. Over this period, opposition to means testing of retirement benefits gathered momentum, primarily focusing upon the argument that means testing discouraged individuals to save for their retirement.<sup>6</sup> This prompted the government, in October 2003, to reduce the withdrawal rate on means tested retirement benefits from 100% to 40% (re-branding the Minimum Income Guarantee as the Pension Credit). Nevertheless, the value of means tested benefits has continued to grow, so that they are now worth an additional 37% on top of the flat rate benefit to single retirees and an additional 31% to retired couples at the time of writing (April 2008).

A parallel set of reforms concerns the question of earnings-related benefits; see Hills (2003) for a review. Originally both contributions and benefits were independent of employment earnings. In 1961 earnings-related contributions and benefits were introduced for the first time, with the Graduated Pension Scheme financed by Graduated Contributions. This was replaced by the State Earnings Related Pension Scheme (SERPS) from 1978. In April 2002 the government reformed SERPS, which thereafter became known as the State Second Pension (S2P). This last reform partly reversed the general trend towards earnings related benefits.

<sup>6</sup> For example, Mary Francis, Director General of the Association of British Insurers stated 'Our concern is that as means testing is extended . . . too many people will conclude that it doesn't pay to save' (March 2003, ABI Press Release). Similarly, Frank Field, Minister for Welfare Reform 1997–8 stated that "the Government's . . . emphasis on means tests now seems misplaced. It is quite clear that the message has gone out . . . that savings can damage their retirement income" (Hansard, 4th June 2003).

However, the government was concerned about both the prospective costs of state pensions and the problems that were starting to emerge with private-sector pension schemes. As a response to these concerns, in 2002 it established the Pensions Commission led by Adair Turner to carry out an exhaustive review of the United Kingdom pensions system. The final report of that Commission was published in April 2006 and the recommendations were largely implemented in the 2007 and 2008 Pensions Acts. Based on the Pensions Commission's premise that means testing discourages private saving, these Acts will eventually establish a flat rate benefit (but with graduated contribution rates) that is greater in value than the thresholds associated with means tested benefits, effectively doing away with means testing entirely. These reforms consequently reverse policy changes implemented in the late 1990s, re-establishing a retirement benefits system that is both flat-rate and relatively generous.

## 2.2. *Analysis of Means Testing*

We work from the structure of pensions as it was in April 2003 to explore the desirability of means testing and thus whether the Pensions Commission was correct to propose a move to flat-rate benefits, or whether Meade's alternative would offer a better way of supporting incomes in old age. We carry out our analysis using a dynamic stochastic partial equilibrium model of the UK economy and assess different pension frameworks in the light of their effects on the expected life-time utility of people as calculated at the time that they enter the labour market. We begin by describing briefly the model that we use and then set out the framework in which we conduct our analysis. The model is described more fully in the Appendix with a complete specification provided in Sefton *et al.* (2008).

### 2.2.1. *A behavioural model of the United Kingdom economy*

Our results are derived using a dynamic stochastic partial equilibrium (DSPE) model of the UK economy. The model is dynamic in the sense that households are forward looking and plan their consumption and labour supply decisions for the rest of their respective lives; stochastic in the sense that households face uncertainty about both their future income and longevity; and partial equilibrium in the sense that we treat the UK as a small open economy, where the aggregate wage level and interest rates are set by the world economy.

Our unit of analysis is the household, which is assumed to have a maximum economic life of 90 years that are designed to span the age band from 20 to 110. Households are considered to be familiar with their economic environment; that is, they are considered to know their current wage and the dynamic process governing intertemporal wage variation, they understand the tax and benefit system (the function describing take-home income as a function of their pre-tax wage, demographics and capital income) and know the risk-free interest rate. They are also assumed to know their age dependant probabilities of death but not their actual date of death. Households are assumed to die when all adult members are deceased. We abstract from household demographics, assuming that the intertemporal evolution of marriage and child rearing are both certain and understood.

Each year, households decide how much labour to supply and how much to consume; these are chosen to maximise expected lifetime utility, subject to the constraint that there is no credit market (so that each household cannot have negative net worth). Preferences over labour/leisure and consumption/saving are described by a standard time-separable constant elasticity utility function:

$$U_{i,t} = \frac{1}{(1-1/\gamma)} E_t \sum_{j=t}^{110} u\left(\frac{c_{i,j}}{\theta_{i,j}}, l_{i,j}\right)^{1-1/\gamma} \delta^{j-t} \phi_{j-t,t} \quad (1)$$

$$u\left(\frac{c_{i,j}}{\theta_{i,j}}, l_{i,t}\right) = \left[ \left(\frac{c_{i,j}}{\theta_{i,j}}\right)^{(1-1/\varepsilon)} + \alpha^{1/\varepsilon} l_{i,t}^{(1-1/\varepsilon)} \right]^{\frac{1}{1-1/\varepsilon}} \quad (2)$$

where  $E_t$  is the expectations operator,  $c_{i,t}$  is consumption of household  $i$  at age  $t$ ,  $l_{i,t}$  is leisure,  $\phi_{j-t,t}$  is the probability of living to age  $j$ , given survival to age  $t$ , and  $\delta$  is the discount factor, which is assumed to be the same for all households and time independent.  $\theta_{i,t} \in R^+$  is adult equivalent size based upon the McClements' scale,<sup>7</sup> which (as implied above) is considered to evolve deterministically. Labour supply is considered to be made between discrete alternatives between ages 20 and 64, with all households forced to retire by age 65 (although they may choose to retire sooner).

The model was calibrated to provide a close approximation to the UK economy as it stood in 2003. In this regard, the tax and benefits system was specified to reflect the April 2003 edition of the *Tax Benefit Model Tables* (TBMT), which are issued by the Department for Work and Pensions (see <http://www.dwp.gov.uk/asd/tbmt.asp>). Interest rates were set to 4% and probabilities of mortality were derived from the UK life tables that are published by the ONS. The remaining parameters of the model were adjusted to match moments calculated for a simulated cohort to moments that were estimated from Family Expenditure Survey data covering the period 1971Q1 to 2001Q1 (adjusting sample moments by age for time and cohort effects via the procedure described by Deaton (1997)). The preference parameters derived from this calibration are consistent with estimates reported in the econometric literature. Specifically, the intertemporal elasticity (of total expenditure) was set to  $\gamma = 0.2$  and the (period specific) elasticity of substitution between equalised consumption  $c_{i,t}/\theta_{i,t}$  and  $l_{i,t}$  was set to  $\varepsilon = 0.58$ . The constant  $\alpha = 1.63$  is referred to as the utility price of leisure and the discount factor,  $\delta = 0.97$ .

Analysis is undertaken by solving the decision problem that is described above for a wide range of household characteristics. The behavioural solutions so obtained are used to generate data for a simulated cohort via Monte Carlo methods. The analysis is based upon the data that are generated for this simulated cohort. Note that this approach ensures that the analysis captures the incentive and welfare effects of households strung out over the income-wealth distribution, rather than focusing upon stylised 'case studies'. This is important in an analysis of means tested retirement

<sup>7</sup> See McClements (1977) on the McClements' equivalence scale and Balcer and Sadka (1986) and Muellbauer and van de Ven (2004) on the use of this form of adjustment for household size in the utility function.

benefits, where the implications of alternative policy assumptions depend crucially upon household specific circumstances.

### 2.2.2. *Policy choices, welfare and the budget constraint*

Our analysis is designed to examine the desirability of a move to flat-rate pensions without means-testing. We start by assuming a structure that is designed to reflect the UK policy environment as it stood in 2003, just prior to the reduction in the withdrawal rate of means tested retirement benefits (introduction of the Pensions Credit). We assume that all households aged 65 or over are eligible to the full flat-rate retirement benefit (basic pension) that was payable at that time; equal to £77.45 per week for a single pensioner and £123.80 per week for a couple (when the median weekly wage of full-time employees was £356). From this basis, we consider preferences (described at length below) over both the value of means tested benefits and the associated withdrawal rates.

When undertaking an analysis of the type that is considered here, it is important to recognise that any increase in the generosity of the pension system must be paid for. To avoid dynamic effects associated with inter-cohort redistribution, we require that alternative pension policies be budgetary neutral from the perspective of the generational account of the youngest cohort (as we assume that marriages are between partners of the same age, there is no ambiguity here). The generational account is defined as the value of all taxes paid minus the value of all benefits received by a given cohort over its entire life, discounted to the start of the economic life of the cohort, which we take to be age 20. In expressing the government budget constraint in this fashion, we ensure that any changes to the pension system are fiscally neutral with respect to each cohort. We can therefore compare the expected welfare of a household over their lifetime in the presence of the different pension regimes.

The mandate of the Pensions Commission required that its recommendations be made in context of the wider tax and benefits system, and we structure our analysis to reflect this. We therefore look at design of the UK public pensions system, where compensating tax adjustments that ensure budget neutrality are specified to leave the remainder of the tax and benefits system broadly intact. Sensitivity analysis is conducted with regard to three alternative tax adjustments that ensure budget balance, by altering the budgetary burden during the working lifetime.

- Imposing a 'poll tax'. This is a vertical translation of the tax schedule, which takes the same fixed value in every period of a household's working life (ages 20–64). Thus, if £ $x$  of tax were paid on an income of £ $y$  in the base economic environment, then £ $(x + d)$  would be paid following the application of a poll tax of £ $d$ , where the value  $d$  is independent of income  $y$ . Although we acknowledge that a poll tax is unlikely to be politically sustainable, it is included here because it provides a reasonable approximation to an increase in retirement age when retirement benefits are flat-rate, as was implemented by the 2007 Pensions Act. This tax adjustment has the added advantage that it does not distort relative prices (so that the returns to labour and to saving are unchanged). It is, however, a regressive method of balancing the government's budget.

- Imposing a ‘proportional tax’. This adjustment applies a change to the marginal tax rates that is independent of income, resulting in a flattening (or a steepening) of the tax schedule in every period of a household’s working life. We note, however, that care was taken to omit the possibility of marginal tax rates in excess of 100% (poverty traps). Tax and benefits schedules during the working lifetime are modelled as four discrete (though connected) linear segments, with parameters that depend upon household age and demographics. To omit the possibility of poverty traps, we applied the proportional tax to the upper three segments of each tax function. We chose this to be our second case, as it is approximately distributionally neutral (in terms of relative incomes). It does, however, affect relative prices during the working lifetime.
- Adjusting the ‘basic rate of tax’. This involved adjusting the effective tax rate associated with the second highest segment of the tax functions used to model the tax and benefits system during the working lifetime. Our focus on this aspect of the policy environment reflects the fact that, historically, the basic rate of tax is one of the most commonly adjusted parameters of the UK tax and benefits system. Over the last 30 years it has varied between 33% and 20%, which gives the impression that it is arguably the easiest adjustment to implement in practice.

The tax adjustments necessary to ensure budget balance for each pension policy counterfactual were calculated using numerical gradient methods.

The simulation model calculates expected lifetime utility at age 20, as a function of a household’s initial wealth and wage endowment. Given a joint probability distribution over these two characteristics (estimated from survey data), we can calculate expected household welfare for the population taken as a whole. We refer to measures of expected lifetime utility that are calculated in this way parsimoniously as measures of ‘average welfare’. A policy combination, *A*, that generates a higher measure of average welfare than some other policy combination, *B*, is then said to be preferred to policy *B*. We perform a search based upon this criterion over the value of a means tested retirement benefit and its associated withdrawal rate, conditional on the approach adopted to balance the government budget (as described above). Although the search that is conducted is fairly intensive, we provide no formal proof that our policy design problem is well-behaved. Nevertheless, the numerical results that we report here suggest that the objective function with which we are concerned is well-behaved, in the sense that it does not exhibit substantial discontinuities, nor does it appear to possess multiple peaks. This is an advantage, as our problem is numerically demanding, even within the stylised context that is considered here.

### 3. Results

To restate our objectives, we are interested in two key questions: what does a rational agent model that is designed to approximate prevailing circumstances in the UK imply regarding the preferred structure of state retirement benefits? And, how does the evaluation of alternative pension schemes depend upon the assumed method of financing? Table 1 details the policy parameters that maximise the measures of average

Table 1

*Preferred Pension System of Representative Household as a Function of the Approach Used to Balance the Government Budget Constraint*

Tax adjustment used to balance generational account	Value of means tested benefits	Rate of benefit withdrawal
Poll tax of £107.40 per year (in 2003 prices)	1.8 × Value in 2003	70%
Proportional tax increase of 2.7%	3.9 × Value in 2003	70%
Increase in the basic tax rate of 2.85%	3.0 × Value in 2003	60%

welfare that were produced by our analytical framework, under each of the three alternative tax adjustments for budget neutrality. As our analytical framework assumes that all households aged 65 and over receive a flat-rate benefit (equal in value to the basic pension as it stood in 2003), note that the ‘value of means tested benefits’ that is referred to here is a benefit paid on top of the flat-rate pension.

To clarify the interpretation of the statistics that are reported in Table 1, we summarise the results obtained for the case when budget neutrality is achieved through ‘proportional taxation’. In this case, we find that the retirement benefits system that maximises average welfare raises the value of means tested benefits to 3.9 times their value in 2003. Thus, for a single pensioner [pensioner couple], this is equivalent to increasing the maximum award from £24.65 [£32.00] per week, to £96.14 [£124.80] per week. In addition, the flat rate benefit of £77.45 [£123.80] per week for single retirees [retired couples] is paid. By contrast, the median wage of all full-time employees in 2003 was £356 per week. This increase in the value of means tested retirement benefits, relative to the benefits that were payable in 2003, is augmented by a coincident fall from 100% to 70% in the rate at which the benefits are withdrawn in response to private income. To pay for the increase in the generosity of this pension system, it is necessary to raise marginal tax rates across the entire income distribution (excluding those below the lowest tax threshold) by 2.7%. The results for the other two budget rules reported in the Table can be interpreted in a similar manner.

We can immediately make two deductions from the results that are reported in Table 1, which are explored at greater length below.

- 1 Our results suggest – in direct contrast to the 2007 Pensions Act – that a significant role for means testing in the provision of benefits to the retired is preferred. Rather than decreasing the dependence of the pensions system on means tested benefits, we find that our representative household would prefer to increase the role of means testing.
- 2 The optimal pension regime is strongly conditional on the government budget rule. This highlights the complexity of the problem faced by the Pensions Commission; how to decide upon appropriate reforms to the pensions system, without also being able to recommend on how the system should be funded. The Pensions Commission side-stepped this problem by recommending coincident adjustments to the state pension age. This aspect of the problem is returned to below.

The results that are reported here indicate that our analytical framework embodies a strict preference for more social insurance (redistribution) than is currently embodied by UK tax and benefits policy. This is indicated by the large increases in the preferred retirement benefits relative to existing arrangements, and by the variation of the preferred structure in response to the method of benefits financing. Regarding this last point, note that the more progressive is the tax adjustment to ensure budget neutrality, the larger is the preferred means tested retirement benefit. This can be understood in terms of the implied impact on consumption during the working lifetime. Poll taxes interact with the liquidity constraints of our framework to produce the sharpest reductions in consumption during the working lifetime amongst low income households. This reduces the appeal of raising the retirement benefit, an effect that is off-set in the context of a proportional tax adjustment by the larger financial cost that is born by high income households.

We can now briefly comment on the approach adopted in the Pensions Acts (and the Pensions Commission's recommendations) to address the budgetary burden of pension reform. The 2007 Pensions Act addresses the funding burden that is implied by the more generous flat rate retirement benefits that are provided by raising the retirement age. Given the flat rate retirement benefits that the 2007 Pensions Act implies for the long run, this approach to funding retirement benefits is very much like a poll tax applied to people aged between the existing state pensionable age (65) and the new pensionable age (68). It is therefore very unlikely that the enacted reforms will satisfy the demand for greater social insurance that is present in our analysis.

The following subsections report in greater detail the results obtained when budget neutrality is maintained through proportional tax adjustments. These results are qualitatively the same as those that were obtained for poll tax and basic rate tax adjustments.

### 3.1. *Welfare Results in Detail*

The influence of pension parameters on the measures of average welfare derived from our analytical framework are displayed in Figure 1. Panel (a) of the Figure reports a contour map of expected lifetime utility as a function of both the value of means tested pension benefits, and the associated withdrawal rate. As the contour map indicates, the profile of welfare effects over the class of pension systems considered here is very nearly concave and reveals a clear maximum. Average welfare is reasonably insensitive to changes in the maximum benefit level between 3.5 and 4.2 times 2003 levels and withdrawal rates of between 50% and 90%. Panel (b) of the Figure consequently extends the domain, plotting the horizontal and vertical cross-sections of the surface in Panel (a) as taken through the identified maximum. In this graph, we have measured the welfare difference in terms of the compensating variation with respect to our base pension system (the pension system as it was in January 2003), so as to express differences in monetary rather than utility units. Thus our representative household would be indifferent to starting life with assets of just over £2000 and the pension system as it was in 2003, or no assets and our optimal pension system. The smooth profiles of the welfare measures that are reported in the two panels of Figure 1 give us

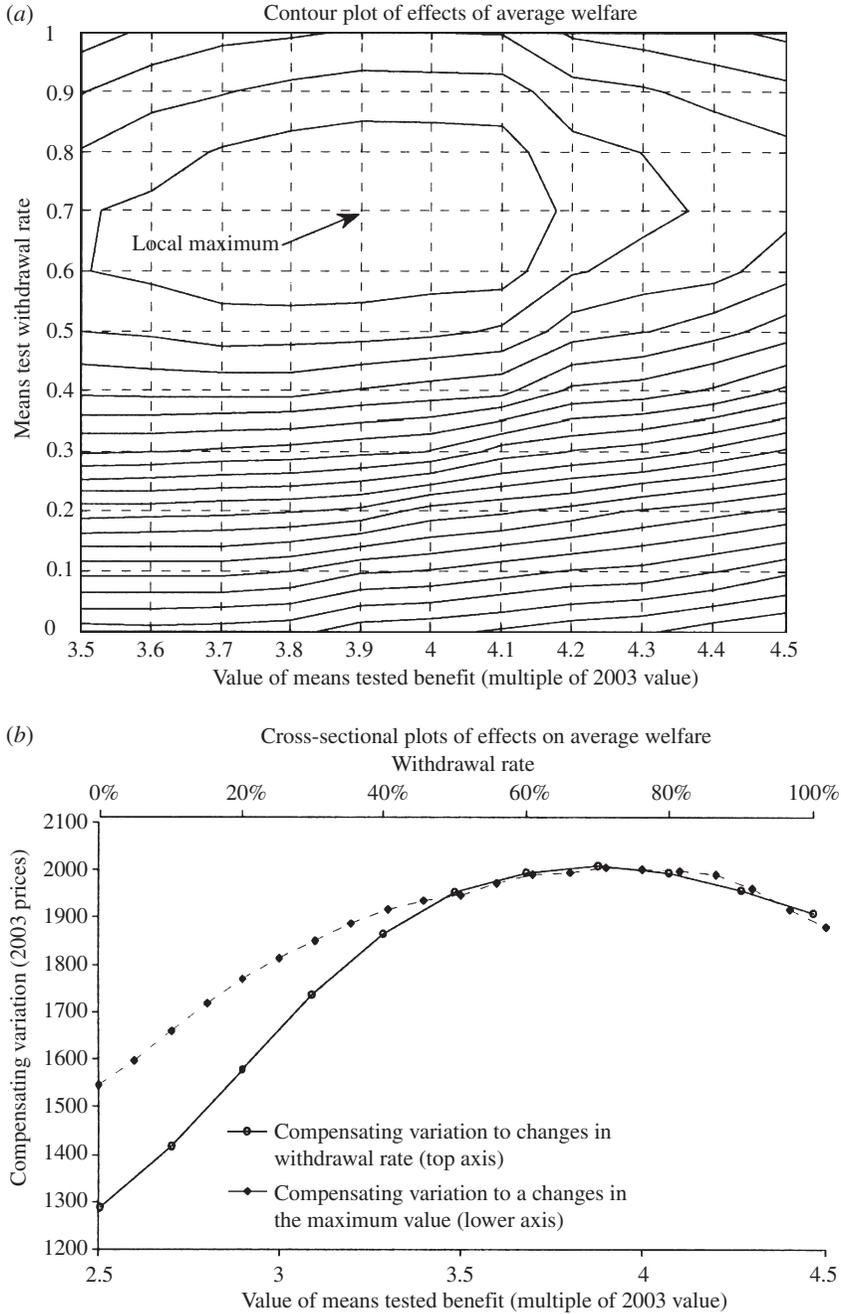


Fig. 1. *Changes in Average Welfare Under Alternative Pension Arrangements When Budget Neutrality is Maintained Through a Proportional Tax Increase*

Notes: Panel (b) of the Figure reports cross-sectional plots through the local maximum that is identified in Panel (a).

confidence that we have identified parameter combinations that approximately maximise the welfare measure with which we are concerned.

Figure 1*b* also gives an indication of the relative importance to welfare of adjusting the generosity of the pension, relative to the degree of targeting. The results suggest that, although targeting does improve average welfare, it is possible to achieve almost twice the associated welfare gain by increasing the generosity of the means tested retirement benefits. In this respect, our findings support the recommendations of the Pensions Commission; we find that there is a strong preference for higher retirement benefits, even in the absence of means testing.

### 3.2. *Impact on Savings and Labour Supply of Alternative Pension Arrangements*

Figure 2*a* reports the sensitivity of both simulated household savings and labour supply to changes in the generosity of means tested benefits, holding withdrawal rates constant at 70%. Savings are measured with regard to average household wealth held at age 64 (just prior to the state pensionable age), and labour supply is measured by the average number of working years of households in the simulated cohort (so that a value of 40 implies an average retirement age of 60). The Figure indicates that, as the generosity of the means tested retirement benefits is increased, simulated households on average save less and retire earlier. Hence, *ceteris paribus*, retirement benefits tend to crowd out private saving. If means tested retirement benefits were funded (so that associated payments were made from a financial account sufficient to meet all current and presently accrued claims), then the accrued wealth associated with more generous benefits would offset the coincident fall in private savings, with an ambiguous impact on the national aggregate savings rate. State retirement benefits are not funded, however, and the larger retirement benefits that are preferred in our analytical framework consequently imply a fall in national savings. Given the transparency of this effect, it is perhaps surprising how little attention it has received in the contemporary pensions debate. We do, however, recognise that the rise in the state pensionable age implied by the 2007 Pensions Act will partially offset the fall in national savings that our analysis implies.

Figure 2*b* reports the sensitivity of household savings and labour supply to changes in the withdrawal rate, keeping the maximum claim constant at the value that maximises average welfare. In contrast to the profiles reported in Panel (*a*) of the Figure, the response to means testing withdrawal rates is non-linear. This is because changing the withdrawal rate has a very different impact on households at different parts of the income distribution. At low incomes, a fall in withdrawal rates can encourage some households to save more and work longer as their savings incentives are improved. As private income levels rise, however, the income effect associated with a fall in the benefits withdrawal rate strengthens, relative to the substitution effect, until the point where the income effect starts to dominate.<sup>8</sup> This negative impact of a fall in withdrawal rates on incentives to save and to work is exaggerated by the responses of households

<sup>8</sup> This is because the elasticities of intertemporal substitution in the analysis are less than 1. Almost all empirical studies find elasticities less than 1; Grossman and Shiller (1981), Mankiw (1985) and Hall (1988) report econometric estimates between 0 and 0.4, Blundell *et al.* (1994) report an estimate of 0.75.

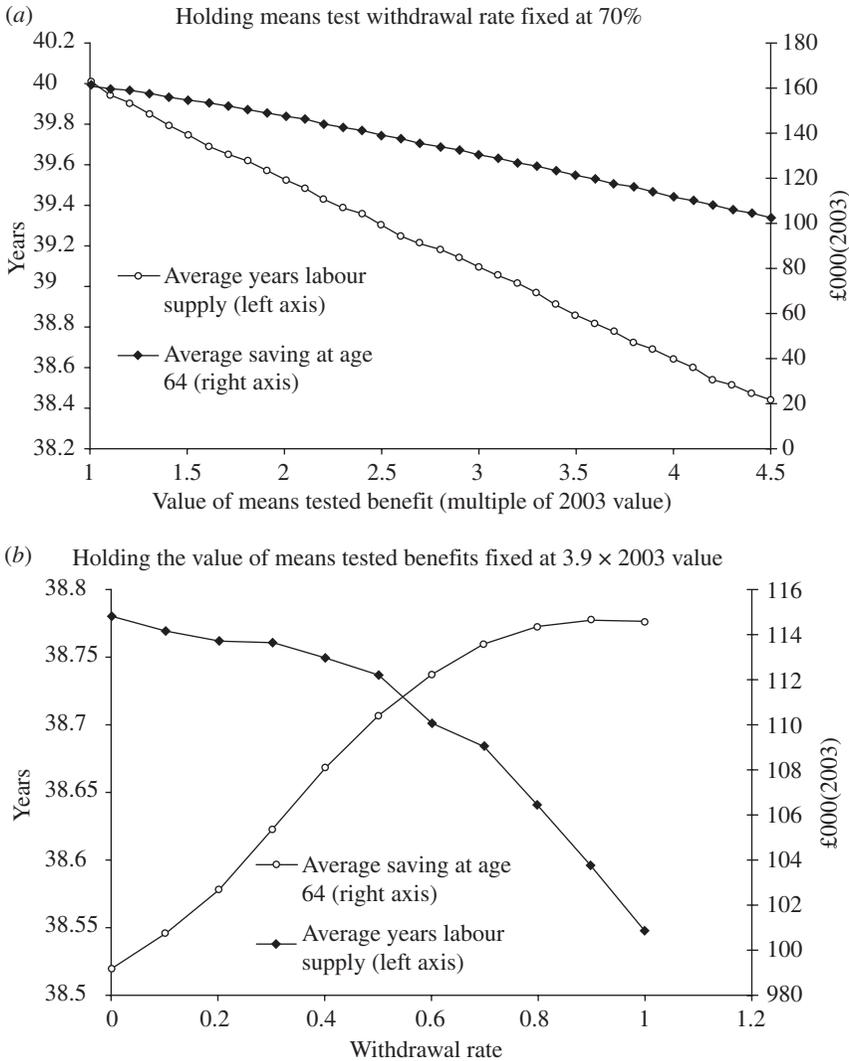


Fig. 2. Average Household Responses to Pensions Policy Counterfactuals when Budget Neutrality is Maintained Through a Proportional Tax Increase

that are made eligible to benefits by the spread of the means test up the income distribution. For these households the income and substitution effects reinforce one another, motivating households to save and work less. Sefton *et al.* (2008) explore these issues in context of an analytically tractable 2-period model.

Hence, as withdrawal rates fall from 100% to 60%, we find that the increase in savings of the low income groups is of the same order as the decrease in savings of the higher income groups. But as withdrawal rates fall below 60%, we find that the net impact of the higher income group dominates, resulting in a rapid fall in average wealth accrued at age 64. These responses drive the optimal choice in relation to the withdrawal rate.

3.3. Changes in Marginal Tax Rates

The changes in marginal tax rates necessary to achieve budget balance under the different pension regimes are reported in Figure 3. Again, the changes are for cross-sections taken through the optimal pension system, as in Figure 1*b*.

The tax adjustments that are reported here and the behavioural responses that are discussed in subsection 3.2 are closely inter-related. Consider, for example, the effects of a rise in the value of means tested retirement benefits that are reported in Figures 2 and 3. In the absence of behavioural responses, a linear relationship would exist between the value of the means tested benefit and the tax adjustment required to maintain budget balance. As the value of means tested retirement benefits rise, however, simulated labour supply falls. This fall in labour supply can be understood as a response to *both* the increased generosity of the retirement benefits system and the coincident rise in taxes during the working lifetime. As the tax base falls with reduced labour supply, the increase in tax rates required to maintain budget balance increases, resulting in the convexity in the tax profile reported in Figure 3.

A similar approach can be used to interpret the effects of altering the withdrawal rate applied to means tested retirement benefits. Figure 3 indicates that the tax change to maintain budget neutrality is not monotonic with respect to changes in the withdrawal rate – tax rates actually fall (very slightly) when withdrawal rates are reduced from 100% to 90% and rise again as the withdrawal rate is reduced below that level. This is due to the offsetting behavioural effects at different points in the income distribution, as described in subsection 3.2. When withdrawal rates on retirement benefits are very

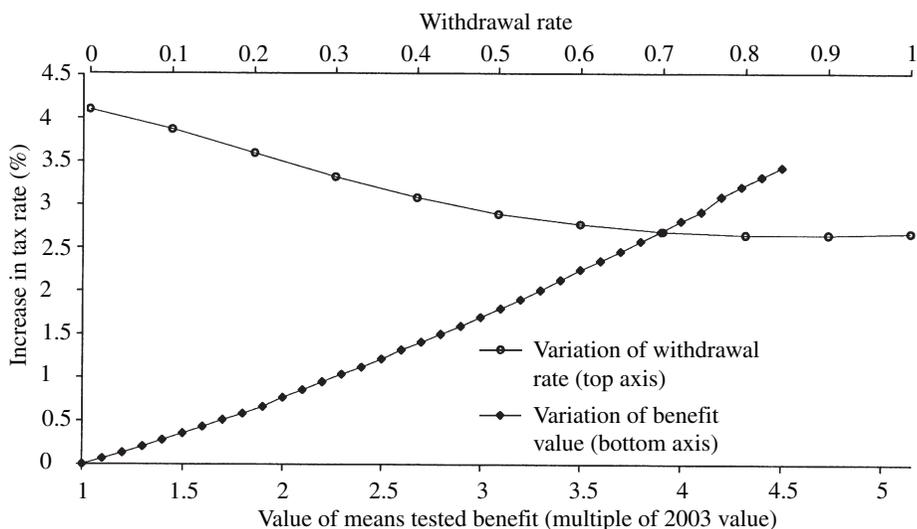


Fig. 3. *The Proportional Tax Change Required to Maintain Budget Neutrality Under Alternative Pension Arrangements*

Notes: Cross-sectional plots taken through the local maximum that is identified in Panel (a) of Figure 1

high, the aggregate response to a marginal fall in the withdrawal rate is dominated by the responses of low income households to their improved incentives to save and to work. This expands the tax base, so that the policy change effectively pays for itself. As the withdrawal rate on means tested retirement benefits is reduced below 60%, however, income effects dominate in our analytical framework, so that any further reduction in the withdrawal rate can only be purchased by imposing higher tax rates during the working lifetime.

#### 4. Conclusions

The recent debate over the future of pensions policy in the UK has crystallised around the recommendations made by the Pensions Commission (2005) in its second report and subsequently enacted through the 2007 and 2008 Pensions Acts. Current plans are to roll back means testing in the provision of retirement benefits, funded through an increase in the state pensionable age from 65 to 68.

In relation to the design of a redistributive tax and benefit system, Meade (1993) suggested that particular care should be exercised to avoid distortions to the price of labour. To avoid distortions to labour, Meade noted, redistribution must be undertaken with respect to non-labour income. He suggested three alternative approaches: a Property Owning Democracy (reduction of existing wealth inequality through effective redistribution); the Social Ownership of Property (the state takes possession of national assets by drawing down government debt); or a Welfare State (income from pay converted to income unrelated to pay through the imposition of taxes and benefits). On the third of these alternatives, Meade (1993, p. 94) suggests that the preferred method of benefits delivery is likely to be based upon a means tested framework (which he referred to as a surcharge), to offset the 'hideously expensive' cost of a flat-rate benefit.

In this article we have taken a new look at the debate regarding the structure of retirement benefits in the UK, focusing in particular on the role of means testing. Our analysis is based on a dynamic stochastic model of the UK household sector and is conducted in the spirit of the optimal tax literature. Our households are forward looking agents who plan their consumption and labour supply over their life-cycle, conditional on the prevailing pension system. Thus we are able to simulate how our households respond under different pension arrangements, and identify who gains and loses in welfare terms under the alternative regimes.

Contributors to the optimal tax literature often stress that great care must be taken when drawing implications for the practical design of tax policy. This caution is understandable in view of the strong assumptions that are necessary to permit analytical tractability. The current analysis is a clear departure from that tradition, as we have chosen to sacrifice analytical tractability to capture aspects of the practical reality that are likely to be important in determining preferences over means tested benefits policy. As such, we place emphasis on both the qualitative and quantitative results that we obtain.

On the qualitative side, our results emphasise the inter-connectedness of the tax and benefits system, and the consequent difficulties that are involved when analysing any one component of the system in isolation. The results that we have obtained

indicate that, given a general preference for social insurance (or redistribution), the nature of the tax and benefits system during the working lifetime can have a pronounced impact on the preferred design of benefits in retirement. Given the piecemeal way in which tax and benefits policy tends to evolve in practice, these observations highlight the value of periodic reviews of the tax and benefits system taken as a whole, as conducted by the Meade Review, and currently underway in the Mirrlees Review.

On the quantitative side, our results support the increased generosity of retirement benefits that is implied by the 2007 Pensions Act. However, our support of the reforms embodied by the Acts is only partial. We find a strong demand for additional social insurance (redistribution) than is supplied by the flat-rate pension that is implied by existing legislation. Taking the general structure of the wider tax and benefits system as given (following the mandate of the Pensions Commission), we find that the only way to meet the demand for additional social insurance is to target retirement benefits on those with lower incomes. This finding is unlikely to be sensitive to the increased retirement age implied by the 2007 Pensions Act, which will have an impact that is similar to the poll tax adjustment we explore here. Hence, we find a significant role for a pension surcharge, as advocated by Meade. Our preferred structure would see the maximum value of means tested retirement benefits rise to between 40% and 60% of median household income, with it being withdrawn to the basic pension floor at rates not dissimilar to the 50% rate advocated by Meade.

## Appendix Details of the Model of the United Kingdom Economy

In this Appendix, we provide further details regarding the model that was used to conduct our analysis. As noted above, a full description is provided in Sefton *et al.* (2008).

### A.1 The Wealth Constraint

Equation (1) is considered to be maximised, subject to a wealth constraint,  $w_{i,t} \geq 0$  for all households  $i$  of all ages  $t$ . We define total wealth as:

$$w_{i,t} = \begin{cases} w_{i,t-1} + \tau(l_{i,t-1}, r_{i,t-1}w_{i,t-1} + x_{i,t-1}, n_{i,t-1}^a, n_{i,t-1}^c, t-1) - c_{i,t-1} & \text{if } t \leq t_{SPA} \\ (1-\eta)[w_{i,t-1} + \tau(l_{i,t-1}, r_{i,t-1}w_{i,t-1} + x_{i,t-1}, n_{i,t-1}^a, n_{i,t-1}^c, t-1) - c_{i,t-1}] & \text{if } t = t_{SPA} \end{cases} \quad (3)$$

where  $r_{i,t-1}$  is the real interest rate,  $n_{i,t}^a$  and  $n_{i,t}^c$  are respectively the numbers of adults and children in a household,  $x_{i,t}$  is private non-property income and  $\tau(\cdot)$  is the tax and benefit function. In practice, total wealth,  $w_{i,t}$ , is comprised of housing, pension wealth, safe and risky financial investments, and so on. Demand for these alternative asset classes is affected by a range of considerations, including the associated transactions costs, the uncertainty of investment returns, differential tax treatment and the consumption of housing services. We simplify the analysis by abstracting from the asset allocation problem and leave associated sensitivity analysis as an issue for further research.

At age  $t = t_{SPA}$  (=65 in the analysis), a proportion,  $\eta$ , of household wealth is annuitised at an actuarially fair rate  $\chi$ . The interest rate is assumed to be constant,  $r_{i,t} = r$ . During the working lifetime,  $t < t_{SPA}$ ,  $x_{i,t}$  defines household labour income, equal to  $\varphi(l_{i,t})h_{i,t}$  where  $\varphi(l_{i,t})$  is the

proportion of the full-time employment wage earned. This household wage is considered to evolve following a stochastic process. During retirement,  $x_{i,t}$  is equal to the annuity income generated by private pensions:

$$x_{i,t} = \begin{cases} \varphi(l_{i,t})h_{i,t} & \text{if } t < t_{SPA} \\ \eta\chi[w_{i,t-1} + \tau(l_{i,t-1}, r_{i,t}w_{i,t-1} + x_{i,t-1}, n_{i,t-1}^a, n_{i,t-1}^c, t-1) - c_{i,t-1}] & \text{if } t = t_{SPA} \\ x_{i,t-1} \frac{[0.5 + 0.5(n_{i,t}^a - 1)]}{[0.5 + 0.5(n_{i,t-1}^a - 1)]} & \text{if } t > t_{SPA} \end{cases}$$

The function  $\tau$  is a stylised representation of the UK tax and benefit system, and is described in detail in the following subsection.

A.2 The Tax Function

The function  $\tau$  is a stylised representation of the UK tax and benefit system, described as a function of the household’s pre-tax income, that is its property income  $r_i w_{i,t}$  plus non-property income  $x_{i,t}$ , its size  $n_{i,t}^a$  and  $n_{i,t}^c$ , and its age,  $t$ . The age dependency assumed for the tax function divides the lifetime into three periods: the working lifetime  $t < t_{IB} = 55$ , early retirement  $t_{IB} \leq t < t_{SPA} = 65$  and retirement  $t_{SPA} \leq t$ . During the working lifetime, the tax function is specified to reflect profiles reported in the April 2003 edition of the *Tax Benefit Model Tables* (TBMT) issued by the Department for Work and Pensions. The profiles considered take into consideration the impact of income taxes, National Insurance Contributions, the Child Benefit, the Working Tax Credit and the Child Tax Credit. Although this list omits a great deal of the detail of the UK tax and benefits system, it does include the principal schemes that affected healthy families with children during 2003.

The simulated tax function for ages  $t_{IB} \leq t < t_{spa}$  depends upon private income, employment status, age and demographic composition. Simulated households that choose to supply labour for any  $t$ ,  $t_{IB} \leq t < t_{spa}$ , are treated in the same way as during the working lifetime (described above). The tax treatment applied to a simulated household that chooses not to supply labour and is aged  $t_{IB} \leq t < t_{MIG} = 60$ , is specified to reflect the Incapacity Benefit and income taxes as they stood in 2003/4; between ages  $t_{MIG} \leq t < t_{spa}$  the tax function is specified to reflect the Pension Guarantee (identical for the alternative policy counterfactuals considered here) and income taxes.

The tax function during retirement,  $\tau(\cdot), t \geq t_{spa}$ , is specified to reflect the effect of income taxes, the basic state pension, and means tested benefits. Each of the policy counterfactuals considered for analysis hold the rates and thresholds of income taxes and the basic pension fixed, as they were applied in 2003/04. Alternative policy counterfactuals differ during retirement in the value of, and withdrawal rates applied to means tested benefits.

A.3 Income Dynamics

In the first period of the simulated lifetime, age 20, each household is allocated a wage,  $h_{i,20}$ , via a random draw from a log-normal distribution,  $\log(h_{i,20}) \sim N(\mu_{20}, \sigma_{20}^2)$ . Thereafter, wages are generated using the stochastic process described by the equation:

$$\log h_{i,t} = \beta \log h_{i,t-1} + \kappa \frac{(1 - l_{i,t-1})}{(1 - l_W)} + f(t-1) + \omega_{i,t} \tag{4}$$

where  $f(t)$  is an age-dependent wage growth term,  $\beta$  accounts for time persistence in earnings,  $\omega_{i,t} \sim N(0, \sigma_\omega^2)$  is a household specific disturbance term and  $\kappa$  is the return to another year of experience. This model is closely related to alternatives that have been developed in the literature (see Sefton and van de Ven, 2004, for discussion), and has the practical advantage that

it depends only upon variables from the immediately preceding period ( $t - 1, h_{i,t-1}, l_{i,t-1}$ ), which simplifies the endogenous simulation of household savings and labour supply. Furthermore, although the concept of an experience term in a wage regression is not new, its inclusion is an innovation for the related literature (e.g. Low, 2005 and French, 2005).

*Imperial College of London, NIESR*  
*NIESR*

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