FISCAL STUDIES, vol. 33, no. 1, pp. 1–37 (2012) 0143-5671

Efficient Redistribution of Lifetime Income through Welfare Accounts

A. LANS BOVENBERG, MARTIN INO HANSEN and PETER BIRCH SØRENSEN

Appendix A. Derivation of formula (9) in Section III

This appendix shows how to derive formula (9) presented in Section III and used in Section IV to estimate the effects on the public budget of introducing individual accounts.

The introduction of WAs involves a cut in τ combined with a rise in the variables s, α_e and α_m from zero to some positive numbers. Using equations (5) and (6) in Section III,[1] remembering that $s = \alpha_e = \alpha_m = 0$ initially and recalling that the proposed WA system does not involve any change in ordinary retirement benefits (i.e. $dy = 0$), we find that the revenue effect of introducing WAs amounts to

$$\text{(A1)} \qquad \begin{aligned} dR = & \overbrace{eWh \times d\tau + B_e(1-e) \times d\alpha_e + B_m m \times d\alpha_m}^{\text{mechanical effect}} \\ & + \overbrace{(\phi_e T + B_e) \times de - B_m \times dm + \phi_h \tau eW \times dh}^{\text{behavioural effect}}. \end{aligned}$$

[1]Equation (5) assumes that contributions to the WA are not deductible, that WA balances are not taxed and that only net (after-tax) benefits are debited to the WA. Alternatively, one may assume that *pre*-tax benefits are debited to the WA and that WA contributions are deductible from the personal income tax base whereas WA balances are subject to tax. In this case, by using $T = \tau Wh - I$ as in equation (6), one can show that (5) modifies to

$$\text{(i)} \qquad \begin{aligned} R = & eT - (1-\alpha_e)(1-e)B_e - (1-\alpha_m)B_m m - y \\ & + (\tau^A - \tau)seWh + \left(\frac{t^b - \tau^A}{1-t^b}\right)\left[\alpha_e(1-e)B_e + \alpha_m B_m m\right], \end{aligned}$$

where τ^A is the average tax rate on WA balances and t^b is the average tax rate on benefit income. However, in the initial pre-reform equilibrium, we have $s = \alpha_e = \alpha_m = 0$, so, to a first-order approximation, changes in e and h will have no impact on R via the last two terms on the right-hand side of (i). Hence, an analysis based on (5) still approximates the revenue effect of the reform.

The parameter ϕ_e indicates the extent to which the additional tax payments generated by additional labour force participation yield additional benefit rights. If the tax payments are actuarially fair, we have ϕ_e = 0. Similarly, the parameter ϕ_h indicates the extent to which the additional tax payments generated by additional hours worked entitle the taxpayer to additional benefits.

In modelling behavioural impacts, we abstract from income effects on labour supply, since most recent empirical studies find that these effects are quite small.[2] Income effects will be absent if utility functions take the quasi-linear form

$$\text{(A2)} \qquad U = C - D \times \left(f(h) + q \right), \qquad f' > 0, \quad f'' > 0,$$

where C is consumption, $f(h)$ is the disutility of working h hours, q is a fixed (pecuniary and/or psychological) cost of labour force participation, and D is a dummy variable taking the value of unity when the individual participates in the labour market and the value of zero when he/she does not participate. Following Immervoll et al. (2007), suppose q varies in a smooth continuous manner within a group of workers earning the same wage rate W. Given the specification of an employed worker's tax bill in (6), the participation rate of that group will then vary continuously with changes in the variable

$$\text{(A3)} \qquad Y \equiv Wh_0 \left(1 - \phi_e \tau \right) + \phi_e I - B_e \left(1 - \alpha_e \right),$$

representing the difference between net income when working and net income when not working, measured at the initial level of working hours, h_0. A marginal change in h induced by a policy reform does not affect the utility of an employed worker, since the resulting change in consumption is offset by a change in the disutility of work when the initial working hours, h_0, have been optimised (i.e. $f'\left(h_0 \right) \times dh = dC = W \left(1 - \phi_h \tau \right) \times dh$ in the initial optimum). Hence, a change in h does not affect the incentive to participate in the labour market. This is why the variable Y in (A3) is measured at the given initial level of working hours. At the intensive margin of labour supply, the absence of income effects means that the working hours of an employed worker depend exclusively on the marginal after-tax wage rate, $W \left(1 - \phi_h \tau \right)$. Hence, we define the labour supply elasticities

[2]For example, the recent empirical study by Kleven and Schultz (2012) of the elasticity of taxable income in Denmark finds almost negligible (negative) income elasticities. According to this study, the overall elasticity of taxable income in Denmark is around 0.05 for wage earners and about 0.1 for the self-employed. This is slightly higher than the elasticity assumed in the benchmark scenario in the present paper.

(A4a) $\eta \equiv \dfrac{de/e}{dY/Y}$ (participation elasticity),

(A4b) $\varepsilon \equiv \dfrac{dh/h}{dW\left(1-\phi_h\tau\right)/W\left(1-\phi_h\tau\right)}$ (hours-of-work elasticity).

Moreover, the number of people applying for a certain benefit (and hence our variable *m*) may depend on the benefit level, and employment may in part be affected by the variable *m* (for example, the employment rate may depend on the number of people collecting education benefits). We therefore also define the elasticities

(A4c) $\chi \equiv \dfrac{dm/m}{dB_m\left(1-\alpha_m\right)/B_m\left(1-\alpha_m\right)}$ (benefit dependency elasticity),

(A4d)
$\varphi \equiv -\dfrac{de/e}{dm/m}$ ((negative) elasticity of employment with respect to *m*),

where χ could reflect a moral hazard effect. Using the elasticities in (A4), we may write (A1) as

(A5)
$$\begin{aligned} dR = {} & eWh \times d\tau + B_e\left(1-e\right)\times d\alpha_e + B_m m \times d\alpha_m \\ & + \left(\phi_e T + B_e\right)\left(\eta e\frac{dY}{Y} - \varphi\chi e\frac{dB_m(1-\alpha_m)}{B_m(1-\alpha_m)}\right) \\ & - \chi B_m m\frac{dB_m(1-\alpha_m)}{B_m(1-\alpha_m)} + \varepsilon\phi_h\tau eWh\frac{dW\left(1-\phi_h\tau\right)}{W\left(1-\phi_h\tau\right)}. \end{aligned}$$

Defining

$t \equiv \dfrac{T}{Wh_0}$ (average labour income tax rate),

$c_e \equiv \dfrac{B_e}{Wh_0}$ (replacement rate),

$c_m \equiv \dfrac{B_m}{Wh_0}$ (relative benefit rate),

$\bar{\phi}_h \equiv \dfrac{d\left(\phi_h\tau\right)}{d\tau}$ and $\bar{\phi}_e \equiv \dfrac{d\left(\phi_e\tau\right)}{d\tau}$

and using

$$dW\left(1-\phi_h\tau\right) = -W \times d(\phi_h\tau) = -W\bar{\phi}_h \times d\tau,$$

$$Y = Wh_0 - \left(\phi_e T + B_e\right),$$
$$dY = -Wh_0\overline{\phi}_e \times d\tau + B_e \times d\alpha_e,$$

as well as $d\alpha_m = \alpha_m$, $d\alpha_e = \alpha_e$ and equation (8) in the main text, we can rewrite equation (A5) as equation (9) in Section III.1.

Appendix B. Estimating the parameters ϕ_h and ϕ_e

This appendix explains how we estimated the parameters ϕ_e and ϕ_h quantifying the degree to which increases in employment and hours worked generate additional benefit rights. Since Danish public retirement benefits are unrelated to previous earnings, the discussion below refers only to transfer programmes for people of working age.

As explained in Section IV.2 of the paper, the starting point is the formulas

(B1) $\tau\phi_h = \tau - a_h u c_e, \qquad t\phi_e = t - a_e u c_e,$

where a_h is the fraction of workers who are in a position to raise their future benefits by increasing their current working hours, a_e is the fraction of people in the workforce who can increase their future benefit rights by moving from non-employment into employment, c_e is the average replacement rate (the after-tax benefit relative to pre-tax earnings) and u is the average non-employment rate. The parameters a_h, a_e, u and c_e are averages across all transfer programmes for those individuals of working age who (expect to) end up with a surplus on their welfare account.

In the Danish systems of unemployment insurance and sickness benefits, the benefit rate does, in principle, vary in proportion to previous earnings, but there is a relatively low cap on the benefit rates, implying that only about 10 per cent of full-time workers actually experience a direct link between their benefits and their previous wage income. However, for some part-time workers, a move from part-time to full-time employment may cause an increase in the rates of unemployment and sickness benefits that they may collect if they become unemployed or get sick. In recent years, the share of Danish workers working less than 30 hours per week has been slightly less than 9 per cent. Individuals working longer than that will generally not obtain additional benefit rights by increasing their hours worked. Against this background, we set a_h = 0.2 to cover that fraction of the workforce where a link between hours worked and future benefits received may reasonably be expected. This estimate will tend to understate the existing tax distortions (and hence to stack the deck against our WA proposal) because several transfer programmes offer purely flat rates of benefit with no link between benefits and earnings for any benefit recipient.

The replacement rate c_e in (B1) may be written as $B_{ep}(1-t_b)/Weh$, where B_{ep} is the average pre-tax benefit paid to people out of work and t_b is the average effective tax rate on such benefits, including direct as well as indirect taxes. The Danish Confederation of Workers (LO) recently estimated that, for the average Danish production worker, $B_{ep}/Weh \approx 0.55$ when B_{ep} is taken to represent ordinary unemployment insurance benefits. However, in other transfer programmes, the replacement rate is somewhat lower, and people with a WA surplus are likely to have lower replacement rates than the average worker because they tend to earn higher wages. Hence, we set $B_{ep}/Weh = 0.45$. The effective average tax rate on benefits is given by $t_b = (t_b^d + t^c)/(1+t^c)$. The variable t_b^d is the average direct tax rate on out-of-work benefits, which we roughly estimate to be 0.3, based on information from the Danish Ministry of Taxation. The parameter t^c is the overall effective indirect tax rate on consumption, which was taken in the paper to be 0.26. With these parameter values, we get $t_b = 0.444$ and $c_e \equiv B_{ep}(1-t_b)/Weh = 0.25$, as reported in the paper.

By definition, the parameter u in (B1) equals the non-employment rate, $1-e$. From the restriction that $\Sigma\alpha_e = 1$ across all programmes offering out-of-work benefits plus the assumption that $c_e = 0.25$, the estimate presented in the seventh row of the second column of Table 4 in the paper implies that $u \approx 0.1$.[3] For comparison, the fraction of Danes of working age receiving some kind of public transfer has tended to hover around 0.25 in recent years. Our estimate of the non-employment rate for people with a WA surplus thus has the plausible implication that these individuals tend to be less dependent on public transfers than the average worker. With these parameter values and the estimate $\tau = 0.635$ given in the paper, we can use (B1) to obtain $\phi_h = 0.992$. Thus we see that, for realistic parameter values in a Danish context, the average link between hours worked and future benefits received is so weak that our parameter ϕ_h will be close to unity.

We turn next to the estimation of ϕ_e from the formula $t\phi_e = t - a_e u c_e$, where a_e is the fraction of people in the workforce who can increase their future benefit rights by moving from non-employment into employment. In Denmark, a member of an unemployment insurance scheme is entitled to

[3]Here we make the simplifying assumptions that e and c_e are the same across benefit programmes (the assumption of roughly identical replacement rates c_e in the various out-of-work benefit programmes is not a bad approximation in the Danish context). From the seventh row of the second column of Table 4 and the fact that $\Sigma\alpha_e = 1$ and $u \equiv 1-e$, we then have

$$\sum \alpha_e c_e \left(\frac{1-e}{e}\right) = c_e \left(\frac{1-e}{e}\right) \sum \alpha_e = c_e \left(\frac{u}{1-u}\right) = 0.0283$$
$$\Rightarrow u = 0.102.$$

unemployment insurance benefits if he/she has been employed for at least one year during the latest three years. Uninsured workers are entitled to a means-tested social assistance benefit in the case of unemployment, provided they are available for work. The benefit depends on the current income and wealth of the household, but not on the previous earnings of the recipient. This means test may imply that the spouse also faces a disincentive to participate in the labour market, thus tending to increase rather than decrease our parameter ϕ_e. To be entitled to sickness benefits, a person has to have been employed only during the previous 8 weeks. Entitlement to early retirement benefits is obtained by 25 years of membership of an unemployment insurance scheme. Most other transfer programmes involve no link between employment and benefit entitlement. Estimating the 'correct' value of a_e on the basis of these benefit eligibility rules is quite difficult, but an upper bound on a_e would certainly be given by the proportion of Danes of working age (aged 18–65) who are non-employed. As already mentioned, this fraction is roughly 25 per cent, so fairly conservatively we insert $a_e = 0.2$ along with our earlier estimates $t = 0.54$, $u = 0.1$ and $c_e = 0.25$ into the formula $t\phi_e = t - a_e u c_e$ to obtain $\phi_e = 0.991$. Again, we thus conclude that in the Danish labour market, the non-distortionary fraction of the labour income tax is very low indeed.