Is there a social security tax wedge?

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Abstract

A Beveridgean pension scheme invariably introduces a wedge between the wage rate and the marginal take-home pay. A Bismarckian one can do so only if it is not actuarially fair, or in the presence of credit rationing. Interestingly, if the two possible sources of distortion are present at the same time, they will tend to offset each other. The distortion may even change sign (the agent may work too much). In any case, the same pension contribution will discourage labour less if the scheme is Bismarckian, than if it is Beveridgean.

1 Introduction

The public debate regarding the effects of pension policy appears to take it for granted that a pension contribution is a tax on labour income, which will discourage labour. Indeed, a series of empirical studies finds a negative effect of pension contributions on employment, or labour participation. See, for example, Alesina and Perotti (1997), Scarpetta (1996), Tullio (1987). The assumption is justified, and the empirical finding unsurprising, in countries that have given themselves a Beveridgean pension system, where individual pension benefits are unrelated to individual pension contributions, and the latter are thus effectively an earmarked tax (the social security tax). Not so in countries where the pension system is essentially Bismarckian, and thus characterized by a close link between benefits and contributions. In such countries, pension contributions are a form of mandatory saving, and we can talk of a pension tax only to the extent that pension contributions are higher than

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would be required to obtain the same amount of retirement income by other means.

The concept of an implicit pension tax appears to have been originally developed in Lüdeke (1988) and Sinn (1990). More recently, Murphy and Welch (1998) and Orszag and Stiglitz (2000) have come round to the idea. This theoretical insight has sparked-off a number of empirical studies aimed at measuring the tax component of pension contributions; see, for example, Börsch-Supan and Reil-Held (2001), and Fenge and Werding (2004). Disney (2004) takes the empirical analysis further by attempting to separate the effect of the tax from that of the mandatory saving component. The author finds that, if the tax component is not controlled for, pension contributions reduce participation as in the earlier empirical studies mentioned. But, if both the tax and the saving component are used as explanatory variables, the former has a negative, and the latter a positive, effect on participation.

The present note has the limited objective of deriving analytically the tax wedge associated with compulsory participation in a public pension scheme. It shows that, while a contribution to a Beveridgean scheme will always introduce a wedge between the wage rate and the marginal take-home pay, a Bismarckian scheme may do so only if the scheme is not actuarially fair, or in the presence of credit rationing. Interestingly, if the two possible sources of distortion are present at the same time, they will tend to offset each other. Indeed, the distortion may even change sign (the agent works too much). Irrespective of whether both distortionary factors are present at once, the same pension contribution will distort labour less if the scheme is Bismarckian, than if it is Beveridgean.

2 Individual decisions in the absence of a pension scheme

Let $l^i$ denote the labour, $c^i_1$ the working-age consumption, and $c^i_2$ the retirement-age consumption of agent $i$. His utility is assumed to be given by

$$U^i = u_1 \left(c^i_1 - v \left(l^i \right) \right) + u_2 \left(c^i_2 \right),$$

(1)

where $v \left(l^i \right)$ is the money-equivalent of the disutility of labour. The functions $u_t \left(\cdot \right)$ are assumed increasing and concave, and the function $v \left(\cdot \right)$ increasing and convex. The agent chooses $(c^i_1, c^i_2, l^i, s^i)$ to maximize (1), subject to

$$c^i_1 + s^i = w^i l^i,$$

(2)

$$c^i_2 = s^i r$$

(3)

and

$$s^i \geq -b^i,$$

(4)
where $s^i$ denotes $i$’s saving, $b^i$ his credit ration (positive or zero), $w^i$ his wage rate, and $r$ the market interest factor.

Substituting (2) – (3) directly into the maximand, we can write the first-order conditions as

$$v'(l^i) = w^i,$$

and

$$u'_1(w^i l^i - v(l^i) - s^i) - \lambda u'_2(r s^i) = r,$$

where $\lambda$ is the Lagrange-multiplier of (4).

3 Stylized pension schemes

Let us now introduce a compulsory pension scheme. The latter will reduce $i$’s disposable income by the contribution $\theta^i$ while he is of working age, and increases it by the benefit $\eta^i$ when the agent is retired. The pension contribution is typically an increasing function of labour income, such that the marginal contribution rate is always less than 100 percent,

$$\theta^i = \theta(w^i l^i), \ 0 < \theta' < 1.$$

If the scheme is of the Beveridgean type, individual benefits may be the same for everyone, or vary with certain personal characteristics, but are in any case unrelated to individual contributions. We shall simply assume that

$$\eta^i = \eta$$

for all $i$. By contrast, if the scheme is Bismarckian, individual benefits will increase with individual contributions,

$$\eta^i = \eta(\theta^i), \ \eta'(\cdot) > 0.$$

A pension scheme is said to be actuarially fair if, at the time of retirement, the expected value of future benefits is equal to the capitalized value of the contributions made.\footnote{In the present context, this is to interpreted as meaning that the actuarial value of future benefits is equal to the lump sum that the agent would get, at the date of retirement, if the contributions were invested in a private fund, rather than paid into the public pension scheme. This lump sum will thus be net of the costs and normal profits of the private fund manager.} In the absence of uncertainty, this simply means $\eta^i = \theta^i r$. If $i$’s treatment is more than actuarially fair, $\eta^i > \theta^i r$, $i$ is getting a present from somebody. If it is less than
actuarially fair, $\eta^i < \theta^i r$, either he is being obliged to make a present to someone, or the scheme is badly run.

The difference between the capitalized value of the contributions and the present value of the benefits constitutes an *implicit tax*,

$$\vartheta^i = \theta^i - \frac{\eta^i}{r}. \quad (10)$$

If (10) is negative, $-\vartheta^i$ is an *implicit subsidy*. In view of (7)–(8), if the scheme is Beveridgean, the implicit tax (subsidy) is increasing (decreasing) in individual earnings. The scheme is thus redistributive by nature. If the scheme is Bismarckian, by contrast, $\vartheta^i$ can in principle increase, decrease or stay constant as $w^i l^i$ increases. Assuming that the government will not deliberately set out to take from low earners and give to high earners, we shall take it for granted that the implicit tax is non-decreasing in the pension contribution,

$$\vartheta^i = \vartheta \left( \theta^i \right), \quad \vartheta' (.) \geq 0, \quad (11)$$

and thus in earnings.

The marginal return to money paid into a Beveridgean scheme is always zero. In view of (10)–(11), the marginal return to money paid into a Bismarckian one is given by

$$\frac{d\eta^i}{d\theta^i} = \left[ 1 - \vartheta' \left( \theta^i \right) \right] r,$$

equal to $r$ if the implicit tax does not vary with the amount of the contribution (in particular, if it is zero), lower (higher) if it grows faster (more slowly).

### 4 Labour effects of alternative pension schemes

If the pension scheme is Beveridgean, the agent will supply labour to the point where the money-equivalent of the marginal disutility of labour equals the marginal increase in take-home pay,

$$v' \left( l^i \right) = \left[ 1 - \vartheta' \left( w^i l^i \right) \right] w^i. \quad (12)$$

Comparing (12) with (5), it is clear that the scheme distorts labour decisions by introducing a wedge between the wage rate and the marginal take-home pay. Having assumed increasing marginal disutility of labour, and non-decreasing marginal pension contributions, $i$ will then work less than he would have done without the scheme. Therefore, a Beveridgean
pension scheme discourages labour even if the agent happens to be fairly treated.\textsuperscript{2}

Let us now see what happens to i’s life-cycle allocation of consumption. In view of (6), if either \( \theta^i \) is no greater than the amount that \( i \) would have voluntarily saved without the scheme, or \( i \) is able to borrow the excess back from the capital market, \( i \)’s marginal rate of substitution of present for future consumption will be equated to the interest factor. Otherwise, the scheme will cause \( i \) to be credit rationed. His marginal rate of substitution will in that case be larger than the interest factor, and the life-cycle allocation will consequently be distorted. This distortion can be avoided by making sure that nobody is forced to contribute more than he would have saved without the scheme (e.g., by requiring the very poor to contribute nothing or very little), but there is no way of avoiding the labour distortion. Therefore, a Beveridgean scheme can increase a person’s utility only if the implicit pension subsidy is large enough to more than compensate for the utility loss caused by the labour distortion. If the scheme has to break even, it may thus raise utility for the very poor, but will definitely lower it for everyone else.

If the scheme is Bismarckian, the marginal benefit of supplying labour is given by the increase in take-home pay, plus the increase in the current-consumption equivalent of future pension benefits. Consider first the case where the scheme is actuarially fair. The first-order condition on the choice of \( l^i \) is

\[
v' (l^i) = \left[ 1 - \left( 1 - \frac{r}{u_1' (w^i l^i - v (l^i) - s^i \theta^i)} / u_2' (s^i r + \eta (\theta^i)) \right) \right] \theta' (w^i l^i) w^i.
\]

(13)

If \( i \) is not credit rationed, his MRS is equal to \( r \), and (13) simplifies to (5). There is then no labour distortion. Intuitively, that is because the pension contribution is not a tax on labour, but a postponed wage payment. In the absence of credit rationing, the agent is then indifferent between receiving a unit of money while he is working, or \( r \) when he retires. If \( i \) is credit rationed, however, the expression in round brackets on the right-hand side of (13) is positive and lower than 1, because the agent’s MRS is higher than \( r \). The whole right-hand side of the equation is then smaller than \( w^i \), but larger than \( (1 - \theta^i) w^i \). Therefore, an actuarially fair Bismarckian scheme does not distort labour decisions

\textsuperscript{2}In the absence of forced intergenerational transfers, this would be true of persons somewhere in the middle of the earnings distribution. Such transfers would occur if, in the earlier stages of the scheme, retirees were allowed to draw benefits without having contributed for a full working life, or at all. All members of the earlier cohorts would then get an implicit pension subsidy ("inaugural gains"), and many members of later cohorts would consequently pay an implicit tax.
directly. It does, indirectly, if saving decisions are distorted by credit rationing. Even if credit is rationed, however, labour is discouraged less than it would if the scheme were Beveridgean.

If the scheme is not actuarially fair, the size of the increase in future pension benefits depends on what happens to the implicit pension tax. Using (10), the first-order condition on the choice of \( l^i \) is now

\[
v' (l^i) = \left[ 1 - \left( 1 - \frac{1 - \varphi'(\theta^i)}{u_1 (w^i l^i - v (l^i) - s^i - \theta^i) / u_2 (s^i r + \eta (\theta^i))} \right)^r \right] \theta' (w^i l^i) w^i. \tag{14}
\]

In the absence of credit rationing, (14) simplifies to

\[
v' (l^i) = \left[ 1 - \varphi'(\theta^i) \theta' (w^i l^i) \right] w^i. \tag{15}
\]

In such a case, the scheme discourages labour only if the implicit pension tax (subsidy) is increasing (decreasing) in labour income. Otherwise, there will be no labour distortion.

In the presence of credit rationing, a Bismarckian scheme may discourage labour even if the implicit tax (subsidy) does not vary with earnings. It is clear from (14), however, that the distortion in the lifecycle allocation of consumption tends to reduce the size of the wedge. The two distortions thus tend to offset each other. Indeed, if the implicit tax grew faster than the pension contribution (\( \varphi' > 1 \)), the distortion would be positive. The agent would then work too much, not too little. In any case, labour will be discouraged less than it would if the scheme were Beveridgean.

In real-life pension schemes, individual contributions are typically proportional to individual earnings,

\[
\phi^i = \tau w^i l^i, \quad 0 < \tau < 1.
\]

If the scheme is Bismarckian, individual benefits are not allowed to fall below a certain floor, or rise above a certain ceiling. Between those extremes, benefits are close to actuarial fairness,

\[
\eta^i = r \tau w^i l^i.
\]

Therefore, in such a scheme, \( \varphi' \) is equal to unity for people with either extremely low or extremely high earnings, to \( 1 - \tau \) for everyone else. For \( \tau \) sufficiently lower than the household saving rate would be in the absence of a pension scheme, the great majority of the population will not face a wedge at all. A small minority, consisting of people with very high wage rates, will only face a very small wedge. The only people facing a significant labour distortion will then be those on very low wage
rates. This raises the question whether a contributory scheme is the best way of dealing with old-age poverty. Means-tested benefits financed by general tax revenue (as in Australia) may be less distortionary.

5 References


Lüdeke, R. (1988), Staatsverschuldung, Intragonerative Redistri-


