IS THERE A SOCIAL SECURITY TAX WEDGE?

ALESSANDRO CIGNO

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Abstract

A Beveridgean pension scheme invariably reduces the marginal return to labour, and will thus discourage labour. A Bismarckian scheme can do so only if it is not actuarially fair, or in the presence of credit rationing. In any case, the same pension contribution will discourage labour less if the scheme is Bismarckian than if it is Beveridgean. A Bismarckian scheme may even encourage labour.

JEL Code: H31, H55, J38.

Keywords: tax wedge, labour, public pensions, Bismarck, Beveridge, implicit pension tax.

Alessandro Cigno
University of Florence
Via delle Pandette, 21
50127 Florence
Italy
cigno@unifi.it

1 Introduction

The political discussion on the effects of pension policy appears to take it for granted that a pension contribution is a tax on labour income, and will thus discourage labour. Indeed, a series of empirical studies finds a negative effect of pension contributions on either 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, because individual pension benefits are then unrelated to individual contributions, and the latter are thus effectively an earmarked tax (the *social security tax*). Not so, however, 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 thus regard them as a tax only if, and to the extent that, they are higher than would be required to obtain the same amount of retirement income by other means.

The concept of an implicit pension tax dates back to Lüdeke (1988) and Sinn (1990). More recently, Murphy and Welch (1998) and Orszag and Stiglitz (2000) also 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 estimate the labour effects of the tax and the mandatory saving components of pension contributions. The author finds that, if composition 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 female participation (male participation appears to be insensitive to either).

If the age of retirement is an object of choice, the existence of a public pension system may affect both the length of a person's working life, and the amount of labour that he will supply over a working life of any given duration. Although there are analogies between the two decisions, the issues involved and the way of dealing with them are actually quite different. The present note has the limited objective of analytically deriving the labour distortion associated with compulsory participation in a public pension scheme, assuming that the age of retirement is fixed.[1]

[1] For a theoretical analysis of the retirement decision, see Sheshinski (1978) and, more recently, Cremer *et al.* (2004).

We find that, while a Beveridgean scheme will always discourage labour, a Bismarckian one need not do so, and may even have the opposite effect. In any case, the same pension contribution will discourage labour less if the scheme is Bismarckian, than if it is Beveridgean.

2 Individual decisions in the absence of a public pension system

Let l^i denote the labour, c_1^i the working-age consumption, and c_2^i the retirement-age consumption of agent i. His utility is assumed to be given by

$$U^i = u_1\left(c_1^i - v\left(l^i\right)\right) + u_2\left(c_2^i\right), \tag{1}$$

where $v\left(l^i\right)$ is the money-equivalent of the disutility of labour. The functions $u_t\left(.\right)$ are assumed increasing and concave, and the function $v\left(.\right)$ increasing and convex. The agent chooses (c_1^i, c_2^i, l^i, s^i) to maximize (1), subject to

$$c_1^i + s^i = w^i l^i, \tag{2}$$

$$c_2^i = s^i r \tag{3}$$

and

$$s^i \geq -b^i, \tag{4}$$

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

$$v'\left(l^i\right) = w^i. \tag{5}$$

and

$$\frac{u_1'(w^i l^i - v\left(l^i\right) - s^i) - \lambda}{u_2'\left(rs^i\right)} = r, \tag{6}$$

where λ is the Lagrange-multiplier of (4). The marginal disutility of labour is thus equated to the wage rate. The MRS will be set equal to r if the credit ration is not binding, higher if it is.

3 Stylized pension systems

Let us now introduce a compulsory pension system. This will reduce i's disposable income by the contribution θ^i while he is of working age, and increase it by the benefit η^i when he 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,

$$\theta^i = \theta\left(w^i l^i\right),\ 0 < \theta'\left(w^i l^i\right) < 1. \tag{7}$$

If the system 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

$$\eta^i = \eta \tag{8}$$

for all i. By contrast, if the system is Bismarckian in nature, individual benefits increase with individual contributions,

$$\eta^i = \eta\left(\theta^i\right),\ \eta'\left(\theta^i\right) > 0. \tag{9}$$

The treatment of agent i is said to be *actuarially fair* if, at the time of retirement, the expected value of his future benefits is equal to the capitalized value of the contributions made.[2] This definition is different from the one used in the literature, mentioned in footnote 1, that deals with the choice of retirement age.[3] In our two-period framework without uncertainty, actuarial fairness simply means $\eta^i = \theta^i r$. If i's treatment is *more than actuarially fair*, $\eta^i > \theta^i r$, this agent 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 somebody, or the scheme is badly run.

If the system is Beveridgean, it redistributes from high to low earners. If the system is Bismarckian, the function $\eta(.)$ can be defined so that the system redistributes from the rich to the poor, does not redistribute at all, or even redistributes from the poor to the rich.

The difference between the capitalized value of the contributions and the present value of the benefits,

$$\vartheta^i = \vartheta\left(\theta^i\right) \equiv \theta^i - \frac{\eta^i}{r}, \tag{10}$$

constitutes an *implicit tax* on individual i. If this difference is negative, $-\vartheta^i$ constitutes an *implicit subsidy*. It is clear that both ϑ^i and $\vartheta'\left(\theta^i\right)$ can be negative, zero or positive according to whether the scheme is

[2] This is to be interpreted as meaning that the actuarial value of future benefits is equal to the lump sum that the agent would have got, at the date of retirement, if he paid into into a private fund, rather than into a public pension scheme. This lump sum will thus be net of the costs and normal profits of the private fund manager.

[3] In that context, a pension system is said to be actuarially fair if it does not distort the retirement decision. In the present one, actuarial fairness cannot be defined by reference to its effect on the decision to supply labour because, as we shall see, that decision may be affected by factors extraneous to the design of the pension system.

less than actuarially fair, actuarially fair or more than actuarially fair to i. In any case, however, $\vartheta'\left(\theta^i\right)$ cannot be greater than unity, because that would imply that benefits are decreasing in contributions, and thus contradict (9).

In view of (8), the marginal return to money paid into a Beveridgean scheme is always zero. In view of (10), the marginal return to the money that i pays into a Bismarckian scheme,

$$\frac{d\eta^i}{d\theta^i} = \left[1 - \vartheta'\left(\theta^i\right)\right] r, \tag{11}$$

is always positive, but may be lower than, equal to, or higher than r depending to whether the scheme is less than actuarially fair, actuarially fair or more than actuarially fair to i.

4 Labour implications of alternative pension systems

In the presence of a pension system, the budget constraints (2) and (3) become, respectively,

$$c_1^i + s^i = w^i l^i - \theta^i \tag{12}$$

and

$$c_2^i = s^i r + \eta^i. \tag{13}$$

If the system is Beveridgean, the agent supplies labour to the point where the money equivalent of the marginal disutility of labour equals the marginal increase in take-home pay,

$$v'\left(l^i\right) = \left[1 - \theta'\left(w^i l^i\right)\right] w^i. \tag{14}$$

Comparing (14) with (5), it is clear that the scheme will introduce a wedge between the wage rate and the marginal take-home pay even if the agent *happens* to be fairly treated.[4] Therefore, a Beveridgean scheme will always discourage labour.[5]

The effect of a Bismarckian system is less straight-forward, because an increase in the amount of time worked will raise not only the take-home pay, but also the pension. Consider first the case where the benefit

[4]It the scheme does not redistribute *between* cohorts, this will be true of persons in the middle of the earnings distribution.

[5]Strictly speaking, we should be saying that the introduction of a Beveridgean scheme *without compensation* will always discourage labour. With our utility function, there are no income effects on labour, and we need not distinguish between compensated and uncompensated changes. With a more general utility function, however, there could be income effects, that would reinforce the substitution effect for agents in the lower part of the earnings distribution, but would tend to offset it for those in the upper part.

formula is *actuarially fair* to i. This agent will then supply labour to the point where

$$v'\left(l^i\right) = \left[1 - \left(1 - \frac{r}{u_1'\left(w^i l^i - v\left(l^i\right) - s^i - \theta\left(w^i l^i\right)\right)/u_2'\left(s^i r + \eta\left(\theta\left(w^i l^i\right)\right)\right)}\right)\theta'\left(w^i l^i\right)\right] w^i. \tag{15}$$

If the agent is not credit rationed, his MRS will be equal to r, and (15) will simplify to (5). There is then no tax wedge. Intuitively, that is because, in the absence of credit rationing, a worker is indifferent between receiving a unit of money now, or r when he retires.

If i is credit rationed, by contrast, his MRS is higher than r. As the expression in the large round brackets on the right-hand side of (15) is then positive and lower than unity, the whole right-hand side of the equation is smaller than w^i, but larger than $\left(1 - \theta'\right) w^i$. Therefore, an actuarially fair Bismarckian system does not discourage labour decisions directly. It may do so indirectly if saving decisions are distorted by credit rationing. In any case, however, the tax wedge and thus the labour distortion will be smaller than if the system were Beveridgean.

Consider next the case where the benefit formula is *not actuarially fair* to i. The condition on the choice of l^i is now

$$v'\left(l^i\right) = \left[1 - \left(1 - \frac{1 - \vartheta'\left(\theta\left(w^i l^i\right)\right)}{u_1'\left(w^i l^i - v\left(l^i\right) - s^i - \theta\left(w^i l^i\right)\right)/u_2'\left(s^i r + \eta\left(\theta\left(w^i l^i\right)\right)\right)} r\right)\theta'\left(w^i l^i\right)\right] w^i. \tag{16}$$

If the agent is not credit rationed, (16) simplifies to

$$v'\left(l^i\right) = \left[1 - \vartheta'\left(\theta^i\right)\theta'\left(w^i l^i\right)\right] w^i. \tag{17}$$

It is then clear that the system will discourage labour if i is paying an implicit tax ($\vartheta' > 0$), encourage it if he is getting an implicit subsidy ($\vartheta' < 0$).

If i is credit rationed, his MRS is greater than r. There are then two possibilities. One is that the marginal return to money paid into the pension scheme, $\left[1 - \vartheta'\left(\theta\left(w^i l^i\right)\right)\right] r$, is smaller than r. As the product between the expression in the large round brackets on the right-hand side of (16) and $\theta'\left(w^i l^i\right)$ is positive, we can interpret this product as a tax wedge. That will necessarily be the case if i is paying an implicit tax, but may be the case also if he is getting an implicit subsidy, and the marginal return to money paid into the scheme is not sufficiently large. The other possibility is that i is getting an implicit subsidy, and that the marginal return to the contributions paid is high enough to make the expression in the large round brackets on the right-hand side of (16) change sign. If the expression becomes zero, there is no tax wedge. If it becomes negative, the product between this expression and $\theta'\left(w^i l^i\right)$ is

not a tax wedge, but a labour premium. The system has then the effect of encouraging labour, rather than discouraging it. Intuitively, that is because the agent would like to equate his MRS to the marginal return to money paid into the pension scheme, which is higher than the interest factor. As he cannot borrow more from the market because his credit is rationed, however, the only way he can finance this lucrative form of investment is by working more. In the presence of credit rationing, an implicit pension tax will thus discourage labour, but an implicit pension subsidy *may* (rather than will as in the absence of rationing) encourage it.

The effects of the two types of pension system are illustrated in Figure 1 under the assumption that i's pension contribution is a fixed proportion of his earnings, and his pension benefit is a fixed proportion of his contribution. The curve labelled MC is the plot of $v'(l^i)$. The curve marked MB° plots the right-hand side of (14). Those labelled MB' and MB'' plot the right-hand side of (16) for $(1-\vartheta')\,r$ respectively "low" and "high". Since the MRS is decreasing in l^i, the expression in the large round brackets on the right-hand side of (16) gets smaller as we move from left to right. The efficient amount of labour (the amount supplied in the absence of a pension scheme, or if the benefit formula is actuarially fair, and credit is not rationed) is denoted by l^*. The amount supplied in the presence of a Beveridgean pension system is denoted by l°. That supplied in the presence of a Bismarckian one is denoted by l' if $(1-\vartheta')\,r$ is smaller than the agent's MRS, by l'' if it is larger. A Beveridgean system will induce the agent to supply an inefficiently low amount of labour. A Bismarckian one may induce the agent to supply either an inefficiently low, or an inefficiently high amount of labour. In the second case, however, the distortion is likely to be small, because the marginal disutility of labour increases with the amount worked.

5 Discussion and conclusion

We have found that public pensions will necessarily discourage labour only if the system is of the Beveridgean type. As individual pension benefits are independent of individual contributions, the marginal return to labour does in fact coincide with the marginal take-home pay, and any pension contribution will thus reduce the incentive to supply labour. If the scheme is of the Bismarckian type, by contrast, the marginal return to labour is higher than the take-home pay. The labour decision can then be distorted only if the scheme is not actuarially fair, or if the agent is credit rationed. In either case, the labour distortion may take either sign.

In the absence of credit rationing, a Bismarckian pension system will

induce the agent to supply less labour if he is paying an implicit pension tax (*i.e.*, if he is less than fairly treated), more labour if he is getting an implicit pension subsidy (*i.e.*, if he is more than fairly treated). In the presence of credit rationing, a Bismarckian system will induce a person to supply less labour if the marginal return to the money paid in contributions is lower than his marginal rate of substitution of present for retirement consumption. That will always be the case if this person is not getting an implicit pension subsidy, and may be the case even if he is. A Bismarckian system will induce a person to supply more labour if the implicit pension subsidy is large enough to make the marginal return to this person's contribution higher than his marginal rate of substitution.

It is generally assumed that pay-as-you-go pension systems, as all public ones effectively are, cannot offer returns comparable with those available in the capital market – except perhaps at the very start, when the early cohorts might be granted full pension benefits despite not having paid contributions for a full working life, or at all – and thus that participation in any such scheme inevitably entails paying an implicit tax. Available estimates indeed show that mature pension systems impose an implicit tax on the average participant.[6] Even so, it may still be the case that *some* participants are getting an implicit subsidy. These will invariably be among low paid workers if the system is Beveridgean, but not necessarily if it is Bismarckian.[7] In a Beveridgean system, however, *everybody* is discouraged from supplying labour, irrespective of whether he is taxed or subsidized. In a Bismarckian one, by contrast, those who pay an implicit tax are discouraged, but those who get an implicit subsidy may be encouraged.

Irrespective of whether the labour distortion is positive or negative, a distortionary pension system is always a source of inefficiency. If the labour distortion is positive, however, it is likely to be small, because the marginal disutility of labour increases with the amount supplied.

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[6] See Fenge and Werding (2004).

[7] In a Bismarckian system, it may happen that some of the poor pay an implicit tax, and some of the the rich get an implicit subsidy. That, however, is likely to be a historical accident (different categories of workers may have been provided with pension cover at different dates, and have kept separate pensions schemes) rather than the outcome of deliberate policy. Some recent reforms of national pension systems had as a one of their aims that of eliminating such regressive features.

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