

Is there a social security tax wedge?*

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Abstract

A Beveridgean pension scheme discourages labour, and is bad for efficiency. A Bismarckian one may encourage labour, and be good for efficiency. In any case, the same contribution level will discourage labour and reduce efficiency less if the scheme is Bismarckian, than if it is Beveridgean.

Key words: tax wedge, labour, public pensions, Bismarck, Beveridge, credit rationing, implicit pension taxes and subsidies.

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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, and will consequently reduce employment. 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.¹ In such countries, pension contributions are a mandatory form of saving. There will be an element of tax only if these contributions are higher than would be required to obtain the same amount of retirement income by other means. If they are lower, labour is being subsidized.

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 element in pension contributions; see, for example, Börsch-Supan and Reil-Held (2001), and Fenge and Werding (2004). Disney (2004) takes the empirical analysis further by estimating the effects of the tax component of pension contributions on labour participation by age and sex. He finds that, if composition is not controlled for, pension contributions reduce participation as in the earlier empirical studies mentioned. If it is, pension contributions have either no significant effect, or a significantly positive one. The tax component has a significantly negative effect on female participation, but little or no effect on male participation.

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 this person 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 however quite different.² The present paper has the limited objective

¹On this criterion, Disney (2004) classifies Austria, Belgium, Finland, France, Germany, Greece, Italy, Luxembourg, Norway, Portugal, Spain, and Sweden as "Bismarckian". The countries classified as "Beveridgean" are Australia, Canada, Denmark, Ireland, Japan, The Netherlands, New Zealand, Switzerland, UK, and USA.

²See Sheshinski (1978) and, more recently, Cremer *et al.* (2004).

of analytically deriving the labour distortion associated with compulsory participation in a public pension scheme, assuming that the age of retirement is fixed.

We find that a Beveridgean scheme will always impose an implicit tax on labour. By contrast, a Bismarckian scheme may tax some workers, and subsidize other. An implicit pension tax tends to discourage labour, an implicit pension subsidy to encourage it. We also find that credit market imperfection does not affect the size of the labour distortion caused by a Beveridgean pension system. By contrast, if the system is Bismarckian, credit rationing reinforces the distortionary effect of any implicit pension tax, and weakens that of any implicit pension subsidy. If it is actuarially fair, a Bismarckian system can distort labour behaviour only if the worker is credit rationed. These interactions do not appear to have been pointed out before.

These findings have important policy implications. Cutting back a Beveridgean system will definitely encourage labour, and improve efficiency, but will also raise inequality. Cutting back a Bismarckian one *may* do the very opposite. A country with a Bismarckian pension system should thus be double careful before reaching for the axe.

Sections 2 to 4 of the paper set out the theory. Section 5 briefly reviews the empirical evidence, and suggests ways of going forward on that front. Section 6 summarizes and discusses the findings.

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

$$U^i = u_1(c_1^i - v(l^i)) + u_2(c_2^i), \quad (1)$$

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

$$c_1^i + s^i = w^i l^i, \quad (2)$$

$$c_2^i = s^i r \quad (3)$$

and

$$s^i \geq -b^i, \quad (4)$$

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

$$v'(l^i) = w^i. \quad (5)$$

and

$$\frac{u'_1(w^i l^i - v(l^i) - s^i) - \lambda}{u'_2(r s^i)} = r, \quad (6)$$

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,

$$\theta^i = \theta(w^i l^i), \quad 0 < \theta'(w^i l^i) < 1. \quad (7)$$

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

$$\eta^i = \eta \quad (8)$$

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

$$\eta^i = \eta(\theta^i), \quad \eta'(\theta^i) > 0. \quad (9)$$

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.³ This definition is different from the one used in the literature, mentioned in footnote 1, that deals with the choice of retirement age.⁴ In our two-period framework without

³This 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.

⁴In 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.

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 $\eta(\cdot)$ 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,

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

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 $\vartheta'(\theta^i)$ can be negative, zero or positive according to whether the scheme is less than actuarially fair, actuarially fair or more than actuarially fair to i . In any case, however, $\vartheta'(\theta^i)$ 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,

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

is always positive, but may be lower than, equal to, or higher than r depending on 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,

$$c_1^i + s^i = w^i l^i - \theta^i \quad (12)$$

and

$$c_2^i = s^i r + \eta^i. \quad (13)$$

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,

$$v'(l^i) = [1 - \theta'(w^i l^i)] w^i. \quad (14)$$

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.⁵ Therefore, a Beveridgean scheme will always discourage labour.⁶

The effect of a Bismarckian system is less straightforward, 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 formula is *actuarially fair* to i . This agent will then supply labour to the point where

$$v'(l^i) = \left[1 - \left(1 - \frac{r}{u'_1(w^i l^i - v(l^i) - s^i - \theta(w^i l^i)) / u'_2(s^i r + \eta(\theta(w^i l^i)))} \right) \theta'(w^i l^i) \right] w^i. \quad (15)$$

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, 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 $(1 - \theta') w^i$. Therefore, an actuarially fair Bismarckian system does not discourage labour decisions directly, but may do so indirectly if saving decisions are distorted by credit rationing. If anyone is induced to supply less labour, it is then credit rationed workers.

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

$$v'(l^i) = \left[1 - \left(1 - \frac{1 - \vartheta'(\theta(w^i l^i))}{u'_1(w^i l^i - v(l^i) - s^i - \theta(w^i l^i)) / u'_2(s^i r + \eta(\theta(w^i l^i)))} r \right) \theta'(w^i l^i) \right] w^i. \quad (16)$$

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

$$v'(l^i) = [1 - \vartheta'(\theta^i) \theta'(w^i l^i)] w^i. \quad (17)$$

⁵It the scheme does not redistribute *between* cohorts, this will be true of persons in the middle of the earnings distribution.

⁶Strictly 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 an income-effect, 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.

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, $[1 - \vartheta'(\theta(w^i l^i))]r$, is smaller than r . As the product between the expression in the large round brackets on the right-hand side of (16) and $\theta'(w^i l^i)$ 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 $\theta'(w^i l^i)$ is not a tax wedge, but a *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 a Bismarckian system, credit rationing has thus the effect of reinforcing the negative labour effect of any implicit pension tax, and of weakening (possibly to the point of changing its sign) the positive one of any implicit pension subsidy. This does not happen in a Beveridgean system, where pension contributions are not a form of saving, and credit rationing neither increases nor decreases the distortion caused by pension policy. In any case, the tax wedge and thus the labour distortion associated with any given contribution rate is smaller if the system is Bismarckian, than if it is Beveridgean.

The effects of the two types of pension system are illustrated in Figure 1 under the assumption that i 's pension contribution is a constant share of his earnings, and his pension benefit a constant multiple of the 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

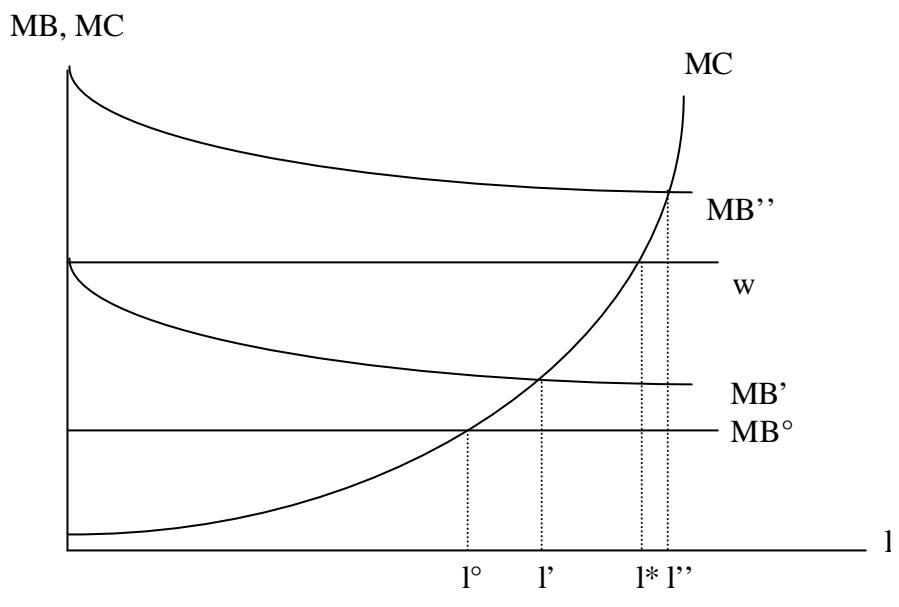


Figure 1 : Labour supply determination

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 at all employment levels, 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. The distortion is smaller in the second than in the first case, because the marginal disutility of labour rises, and the marginal benefit falls, as the amount worked increases. Credit rationing accentuates the asymmetry, because it causes the marginal benefit to fall faster (makes the relevant curve, MB' or MB'' , steeper).

5 Empirical evidence

Börsch-Supan and Reil-Held (2001), and Fenge and Werding (2004) calculate that, except at their very inception,⁷ all pension systems impose an implicit tax on the average participant. Even so, it may be the case that some categories get an implicit subsidy, paid for by other categories, even in a mature system. This is particularly true of Beveridgean systems, but a redistributive element is generally present also in Bismarckian ones.

As anticipated in the Introduction, a number of cross-country studies, including Alesina and Perotti (1997), Scarpetta (1996) and Tullio (1987), finds a negative effect of pension contributions on either employment or labour participation. These studies do not control for the possible presence of an implicit tax element. A more recent study, Disney (2004), uses a cross-country panel to estimate the effects of pension contributions, and of their implicit tax component, on labour participation by sex and age. When he does not control for the implicit tax component, the author finds, like his predecessors, that pension contributions have a negative effect on labour participation. When he does, he finds that pension contributions have zero or positive effects on female, and zero or negative effects on male participation. The implicit tax component has mostly negative effects on female, and mostly insignificant effects on male participation.

Jappelli (1990) estimates that, even in an economy with as well developed financial markets as the USA, about 20 percent of individuals are credit rationed. He also finds that the probability of being rationed is a decreasing function of age and assets. Since earnings increase with

⁷When a pension system is first introduced, the cohorts close to retirement or already retired might be granted full pension benefits despite not having paid contributions for a full working life, or at all.

age, the probability of being rationed is a decreasing function of earnings too. A number of authors, including Del Boca and Lusardi (2003), has looked for overspills between credit and labour markets, but the specific issue whether credit rationing strengthens or weakens the labour effects of implicit pension taxes or subsidies does not appear to have been directly addressed by anyone.

How does the available evidence compare with the theory? Our model predicts that a Beveridgean pension system will always discourage labour, while a Bismarckian one will discourage labour if the agent is paying an implicit pension tax, encourage it if he is receiving an implicit pension subsidy. Credit rationing does not matter if the system is Beveridgean, but will strengthen the negative effect of any implicit pension tax, and weaken the positive one of any implicit pension subsidy, if the system is Bismarckian. The aggregate labour effect of a Beveridgean system is thus negative. That of a Bismarckian pension system may be positive, negative or zero depending on who pays a tax and who gets a subsidy, who is credit rationed and who is not.

It would thus seem that such evidence as is available does not contradict the theory. But direct comparison between the two is problematic because

- (i) in real life, labour may be distorted by a host of market imperfections other than credit rationing and pension policy,
- (ii) the theoretical predictions refer to changes in individual behaviour, while the empirical findings refer to cross-country and cross-cohort differences.

Regarding (i), Alesina and Perotti (1997), and Daveri and Tabellini (2000), point out that, in a highly unionized industry, the burden of the pension contribution may be shifted on to the employer. Similar considerations apply to an economy characterized by a high degree of employment protection. However, Disney (2004) uses unionization and employment protection as controls in his participation regressions. He finds that unionization has no significant effect on either male or female participation at any age. A possible explanation is that trade union behaviour is better described by the efficient-contracting, rather than by the right-to-manage model. The former is in fact observationally equivalent to (and has the same efficiency properties as) the model of the perfectly competitive labour market. Employment protection is found to have no significant effect on the participation of women at any age, and of men up to the age of 30. The effect on the participation of older men is found to be significantly positive.

The implication of (ii) is that, for a proper test of the theory, one would have to use micro-data. Household surveys provide household

or individual level information on labour participation, wage rates (or proxies thereof), and sector of activity. In some cases, they provide also information on hours worked, and credit rationing. Information on the degree of unionization or employment protection of different sectors of activity can be derived from subsidiary sources. Individual pension contributions and entitlements – hence, the implicit tax or subsidy paid or received by each person – can be calculated using pension rules. If these rules discriminate sufficiently between workers with different earnings and other personal or family characteristics, or between workers in different sectors of activity, it may be possible to estimate the cross-sectional effects of implicit pension taxes and subsidies, and their interaction with other sources of distortion, including credit rationing. Panel data may similarly be used to estimate dynamic effects, in particular those of a change in pension policy.

6 Policy implications

The simple theoretical model outlined in the present paper predicts that public pensions distort labour if the system is Beveridgean, but not necessarily if the system is Bismarckian. In a Beveridgean scheme, individual pension benefits are in fact independent of individual contributions, and the marginal return to labour coincides with the marginal take-home pay. The whole of the pension contribution is consequently a tax on labour. In a Bismarckian system, by contrast, the marginal return to labour is higher than the marginal take-home pay, because it includes also the present value of the marginal pension benefit. If the benefit formula is actuarially fair, the contribution is a mandatory form of saving, not a tax on labour. It can then distort labour decisions only if the agent is credit rationed. If the benefit formula is less than actuarially fair to some, and more than actuarially fair to others, the former will pay an implicit tax, but the latter will receive an implicit subsidy.

In the absence of credit rationing, an implicit pension tax will induce the agent to supply less labour for the same wage rate. An implicit pension subsidy will do the opposite. Credit rationing reinforces the negative effect of an implicit pension tax, but tends to offset the positive one of an implicit pension subsidy. In any case, the same pension contribution will discourage labour less if the scheme is Bismarckian, than if it is Beveridgean. Such evidence as is available appears to be consistent with these theoretical predictions.

The model has important policy implications. Cutting a Beveridgean system back would raise aggregate labour supply, and be good for efficiency. The effects of cutting back a Bismarckian one are not so straightforward. If the system were actuarially fair to everyone, cutting it back

would affect labour decisions only for credit rationed agents. Since the policy would relax their credit constraints, these agents would be induced to work more. Aggregate labour supply would thus rise. As distortions would become smaller, efficiency would rise too. In reality, however, Bismarckian systems tend to be more than actuarially fair to the poor, and less than actuarially fair to the rich. If nobody were credit rationed, cutting such a system back would then induce the poor to work less, and the rich to work more. Distortions would still be reduced, and efficiency consequently improve, but aggregate labour supply could rise or fall. Credit rationing would not change the signs of the labour effects. Given that the probability of being effectively credit constrained is higher for poor than for the rich, however, the policy is likely to be good for efficiency only where the latter are concerned. Where the former are concerned, the cut would reduce the scope for trading-off the distortions caused by the implicit pension subsidies against those caused by credit rationing. The overall efficiency effect would thus be ambiguous.

Cutting back a pension system as redistributive as a Beveridgean one has an obvious cost in terms of higher income inequality. Cutting back a Bismarckian one need not have such an effect. If the system were actuarially fair to everyone, and provided that nobody were credit rationed, cutting it back would have no distributional effects. If some agents are credit rationed, however, cutting the system back will have distributional implications even in the case where the benefit formula is actuarially fair for everyone. Given that the poor have a higher probability of being effectively constrained than the rich, the policy would in fact induce a greater proportion of the former, than of the latter, to work more. Income inequality would consequently fall. The opposite is true if, as is generally the case, the system tends to implicitly subsidize the poor, and tax the rich. In that case, cutting the system back would raise income inequality irrespective of whether there is, or there is not, credit rationing (by more if there is not).

In conclusion, the argument that reducing the weight of a public pension system would raise aggregate labour supply, and be good for efficiency, appears to be theoretically well founded only if the system is Beveridgean. If it is Bismarckian, the policy could do the very opposite. On the other hand, however, the equity cost of the policy is higher if the system is Beveridgean, than if it is Bismarckian.

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