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Survivor Benefits and the Gender Tax-Gap in Public Pension Schemes

Work Incentives and Options for Reform

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Abstract

Since its inception, the traditional form of providing survivor benefits through public pension schemes has lost much of its legitimacy. As a result of fundamental changes in marriage behaviour and the typical division of labour between married spouses, offering non-contributory benefits of this kind can not only be seen as inequitable. Since they usually substitute for non-derived pension entitlements based on the survivant spouse's own contributions, they can also lead to incentive effects, especially for married women with some degree of labour force attachment, that appear to be far from optimal. The present paper highlights this problem based on empirical estimates regarding the wage elasticities of labour supply for German females *vs* males and shows how it could be resolved by installing a joint annuitisation of a given couple's pension entitlements.

JEL Code: H55, J16, J22.
Keywords: Public pension, survivor benefits, female labour supply, optimal taxation.

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1 Introduction

Next to old-age and disability pensions, survivor benefits form part of the traditional benefit package provided by most existing public pension schemes. In the German Statutory Pension Scheme, the earliest public pension scheme in the industrialised world, widows' and orphans' pensions were added with a small delay (in 1904, while the scheme was set up in 1889; see Frerich and Frey 1993, 114). But since the early 20$^{\text{th}}$ century, they are a standard type of benefits that spouses and young children who outlive their breadwinners are entitled to receive without any very restrictive qualifying conditions and without the insured individual having paid any other than the regular contributions. Later on, this design has been exported to many other countries. In most cases, for reasons of legal non-discrimination, widowers' pensions have been introduced more recently as an additional category of survivor benefits.[1]

The present paper mainly concentrates on widows' pensions and on the standard case where these are paid to women who have reached, or are close to, their own retirement phase. The problems it is going to highlight are relevant for pensions paid to partners, not children, of an insured individual and they relate to labour supply decisions taken by these partners during earlier stages of their life cycle. Orphans' pensions as well as pensions paid to mothers who have to take care of small children are thus out of our focus. In addition – in spite of legal entitlements that are uniform since 1986 – 92.7% of all widows' and widowers' pensions paid out by the German Statutory Pension Scheme effectively accrue to widows, their average monthly amount being about 2.5 times higher than average widowers' benefits.[2] The reasons for these strong asymmetries are that women are usually younger than their husbands; that, in any case, their life expectancy is significantly longer;[3] and that their husbands still are typically acting as primary earners, building up own pension entitlements by which their claims on widowers' pensions are reduced and often fall to zero, even if the relevant contingency arises.

In spite of what was just said, there has been a substantial change in the division of labour between women and men within a given household over the last decades, with a continuous increase in female labour force participation and a notable reduction in the gender wage gap observed earlier on. As a result of these changes that are common across most industrialised countries, providing benefits for surviving spouses has become more and more obsolete, in Germany and elsewhere, over time. Figure 1 illustrates these trends, comparing labour-force participation rates and wages for females and males in West Germany, as well as their impact on average, non-derived pension entitlements that is becoming effective, with some delay, within the German Statutory Pension Scheme.

[1] For an up-to-date survey of relevant rules for the countries of the EU-15, the US, and Switzerland, see Fenge *et al.* (2003, 61–67).

[2] See *Verband Deutscher Rentenversicherungsträger* (2003, 147f. und 165).

[3] According to the "Life table 2000–02" (*Statistisches Bundesamt* 2004), contingent life expectancy of women (in brackets: men) aged 60 is 23.8 (19.7) years.

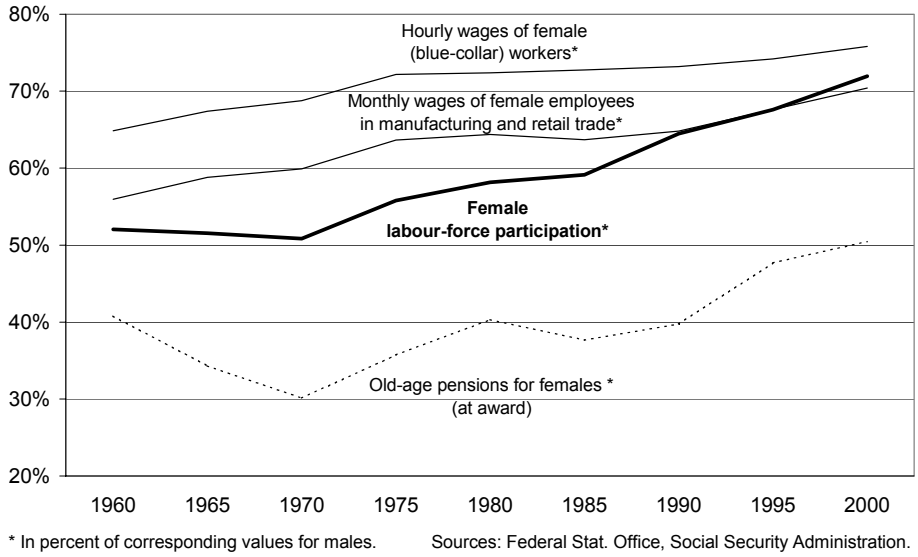

Fig. 1: Labour-force participation, wages and pension benefits of women (West-Germany, 1960–2000)

The main objections to how survivor benefits are currently being assessed are (*a*) that they can lead to over-provision in cases of married individuals where both partners have built up some amount of pension entitlements based on own contributions; (*b*) that they do not really substitute for rules addressing a sufficient level of benefits for parents, especially mothers, who spent a lot of time and other resources on rearing children, thus contributing to the future funding of pay-as-you-go public pension schemes; (*c*) that they have ceased to be a fair insurance against the risk of leaving behind dependant family members and instead have become a mechanism for redistributing resources from those who never marry to married couples with wives who are not working (Kolb 1985; Wagner 1985; Rolf and Wagner 1990).

If the traditional form of providing survivor benefits has come under attack because of its redistributive features, their incentive effects should have become problematic as well. This is what the present paper mainly looks at, concentrating on how pension entitlements typically collected in the German Statutory Pension Scheme affect the work incentives for married females *vs* males. An important intermediate result is that the "implicit wage tax" that is effectively involved in any unfunded pension scheme is usually higher for married women than for their husbands. Using a simple theoretical model and simulations regarding the implicit tax rates in the German public pension scheme, section 2 explains that this "gender tax gap" is mainly due to the way how, in this scheme, survivor benefits are being assessed.[4] In the light of empirical

[4] If survivor benefits were absent, implicit tax rates falling on women should, *ceteris paribus*, be lower than those for males. At least, with uniform contribution rates and a uniform way

estimates regarding the wage elasticity of labour supply for women and men, section 3 investigates whether this particular tax structure could be in line with the fundamental rules of an optimal taxation of wage earnings. As the result is negative, section 4 discusses a possible solution that would make the incentive problem disappear but still provides an option for married couples to secure a level of pension benefits for the surviving spouse which may exceed his or her own, non-derived benefit entitlements.

2 Survivor benefits and the tax implied in public pay-as-you-go pensions: a simple model

In a stylised model that concentrates on what is essential for the following discussion, average households are considered to be composed by two individuals (married to each other), one a male(m) and the other a female (f). The two types of individuals are differentiated by their life expectancy while in retirement. In each case, the expected lenght of the retirement period is measured as a fraction a of the (fixed) length of the active period of life. It is assumed that $\alpha^f > \alpha^m$ and, in any case, that $0 < \alpha^i < 1$, $i \in \{m, f\}$. In other words, the contingent life expectancy of a women entering retirement is higher than that of her husband. For simplicity, mortality risks while still being active are entirely neglected here; differences between the two spouses regarding their age or the timing of their retirement could be reflected, up to a point, in the differentiation of α.

Actually, we so not bother to give the multi-dimensional intra-household decision problem much structure. What really matters is that we assume labour-supply decisions by each partner to correspond to a "male-chauvinist" model that appears to be largely fitting to the empirical data used in section 3. In this kind of a model, women are choosing their labour supply taking as given labour supply and net life-time earnings of their husbands. Apart from this feature, we simply assume the spouses to maximise their utilities in such a way that this can be represented by an aggregate utility function

$$u_t = u(c_t, z_{t+1}, 1 - l_t^m, 1 - l_t^f) \rightarrow \max! \tag{1}$$

Here, utility of the two household members is a function of goods consumed during the active life span and in the retirement period, c_t and z_{t+1}, respectively (both aggregated across the household), and leisure consumed individually by the husband and the wife while thy are still active, $1 - l_t^m$ and $1 - l_t^f$.

At the household-level, the intertemporal budget constraint for both the active period of life, t, and the retirement period, $t + 1$, could be written as

$$c_t + \frac{z_{t+1}}{1 + r_{t+1}} = (1 - \tau_t) \left(W_t^m l_t^m + W_t^f l_t^f \right) + \frac{p_{t+1}^m + p_{t+1}^f}{1 + r_{t+1}}. \tag{2}$$

of assessing benefits, this is what should be expected to result from the higher life expectancy of females.

I.e., goods consumption in t and $t+1$ must be nourished from net life-time earnings of both spouses that are determined by their gross wage rates, W_t^i, labour supply, l_t^i, the contribution rate of the pension scheme, τ_t, and the pension benefits accruing in the retirement period, p_{t+1}^i. To make period-$t+1$ amounts of money comparable to those in period t, they are discounted by the interest factor $1+r_{t+1}$. *Ex post* and with respect to paying for the couple's life-time consumption, equation (2) is certainly correct. But if we want to look at individual labour-supply decisions that are taken sequentially by each partner – the husband taking the lead – and see how these can be influenced by the definition of pension benefits, household-level aggregation by which important effects cancel out is effectively a bit misleading. We therefore have to separate things now a little more carefully, at least with respect to how each spouses net wages are determined.

In a pay-as-you-go pension scheme that strongly links benefits to earlier contributions, such as the German Statutory Pension Scheme, benefits can be determined based on a factor reflecting the internal rate of return on contributions, $1+\rho_{t+1}$, that should be uniform across insured individuals belonging to the same age cohort. In addition, what matters for the size of p_{t+1}^i is the length of the retirement period, hence life expectancy α^i; the definition of survivor benefits that are derived from benefit entitlements of the partner faced with shorter life expectancy; and the rules that govern what happens when own, non-derived pension entitlements for the surviving partner and survivor benefits coincide. In the following, we assume the relevant structure of benefits to be as follows:

$$p_{t+1}^m = (1+\rho_{t+1})(\alpha^m + (\alpha^f - \alpha^m)\gamma)\tau_t W_t^m l_t^m \tag{3}$$

$$p_{t+1}^f = \begin{cases} \text{case 1: } (1+\rho_{t+1})\alpha^m \tau_t W_t^f l_t^f \\ \text{case 2: } (1+\rho_{t+1})\tau_t(\alpha^m W_t^f l_t^f + (\alpha^f - \alpha^m)(W_t^f l_t^f - \gamma W_t^m l_t^m)) \end{cases} \tag{4}$$

Here, pension benefits that can be attributed to the husband's contributions, p_{t+1}^m, include his own old-age pension benefits paid for the period α^m as well as derived survivor benefits paid for another period of $\alpha^f - \alpha^m$. The latter are being assessed as a fraction of $0 < \gamma < 1$ of the original benefits – in line with the German system where current rules set a corresponding factor at 0.55. As long as the husband is still alive, his wife is entitled to receive old-age pension benefits of her own that are only linked to her own contributions. Once she is widowed, however, her own, non-derived benefit entitlements are reduced against the survivor benefits that are also becoming effective. The one-for-one reduction that is assumed in (4) overstates the actual rules applied in Germany,[5] but the results are qualitatively unaffected by this simplifaction. However, we need to distinguish two cases now: If the widow's own benefit entitlements turn out to be smaller than the survivor benefits included in (3), the former is

[5] Currently, the German pension law defines a threshold amount of own, non-derived entitlements that are exempted from the reduction. This threshold amount is differentiated between West and East Germany and increases with the number of children the survivor has raised. Higher benefits are reduced by 40% per Euro of survivor benefits that the individual is entitled to receive as well.

effectively terminated in sub-period $\alpha^f - \alpha^m$ ("case 1": $W_t^f l_t^f < \gamma W_t^m l_t^m$, with the limiting case of a women who never worked in the labour market, such that $W_t^f l_t^f = 0$); if own benefit entitlements exceed the amount of survivor benefits, it is only the difference that matters ("case 2": $W_t^f l_t^f > \gamma W_t^m l_t^m$).

Using (3) and (4) to determine effective net wage rates w_t^i for both spouses, taking into account not only contributions paid to the pension scheme but also benefit entitlements that are linked to these contributions, leads to:

$$w_t^m = \left(1 - \tau_t \left(1 - (\alpha^m + (\alpha^f - \alpha^m)\gamma)\frac{1+\rho_{t+1}}{1+r_{t+1}}\right)\right) W_t^m \tag{5}$$

$$w_t^{f_1} = \left(1 - \tau_t \left(1 - \alpha^m \frac{1+\rho_{t+1}}{1+r_{t+1}}\right)\right) W_t^f \tag{6}$$

$$w_t^{f_2} = \left(1 - \tau_t \left(1 - \left(\alpha^m + (\alpha^f - \alpha^m)(1 - \tfrac{\gamma W_t^m l_t^m}{W_t^f l_t^f})\right)\frac{1+\rho_{t+1}}{1+r_{t+1}}\right)\right) W_t^f \tag{7}$$

The terms $\tau_t(1 - \ldots)$ included in (5) to (7) represent differentiated rates of an "implicit" (wage) tax that is next to automatically imposed on insured individuals through their mandatory participation in a pay-as-you-go pension scheme. In a system with earnings-related benefits, these tax rates are positive, but smaller than contribution rates, mainly because the internal rate of return, ρ_{t+1}, is usually smaller the interest rate, r_{t+1}, used for discounting. The specific formulas obtained here also incorporate a system of survivor benefits which largely corresponds to the rules sketched above.[6,7] In the following, we will call these implicit tax rates – in the order of theit appearance in the above equations – ϑ_t^m, $\vartheta_t^{f_1}$ and $\vartheta_t^{f_2}$, respectively.

Case 1 („f_1") implies that the widow's own benefit entitlements become immaterial during the period of survivorhood; for a woman falling in this category, the implicit tax rate will therefore be strictly higher than in case 2 („f_2"), where individual, non-derived benefit entitlements are not entirely off-set through survivor benefits. In this case, the implicit tax rate will decrease more and more, depending on how much the woman's own wage earnings, $W_t^f l_t^f$, exceed the amount of $\gamma W_t^m l_t^m$ that is relevant for her survivor benefits. For $W_t^f l_t^f \to \infty$, the rate converges to the implicit tax rate for an unmarried woman, the latter being only determined by her life expectancy.[8]

What is more interesting, however, is a comparison between implicit tax rates falling on married women *vs* men. While what we have just said imlies

[6] For an in-depths discussion of the concept of "implicit taxes" involved in pay-as-you-go public pension schemes, see Fenge and Werding (2003).

[7] Basically, the tax structure we are characterising here is relevent in many countries other than Germany as well. We will return to this issue at the end of this section, looking briefly at the U.S. and the UK.

[8] In our framework, and assuming that the life expectancy of females is not affected by their marriage status, the effective net wage rate for single females ("*sf*") would be given by:

$$w_t^{sf} = \left(1 - \tau_t \left(1 - \alpha^f \frac{1+\rho_{t+1}}{1+r_{t+1}}\right)\right) W_t^f$$

that $\vartheta_t^{f_1} > \vartheta_t^{f_2}$ (since, by definition, $W_t^{f_1} l_t^{f_1} < W_t^{f_2} l_t^{f_2}$), ϑ_t^m will usually be even smaller. It is easy to see that

$$\vartheta_t^{f_2} \geq \vartheta_t^m, \quad \text{if} \quad \gamma \geq \frac{W_t^f l_t^f}{W_t^f l_t^f + W_t^m l_t^m}.$$

In other words, implicit tax rates for married women will always be higher than those for their husbands, if the survivor-benefit factor exceeds the women's share in total household income; if $\gamma = 0.55$, for instance, $W_t^f l_t^f$ would have to be $122.\overline{2}\%$ of $W_t^m l_t^m$ for this condition to become binding. Taking the current relative female–male wage rates displayed in figure 1 (75% to 70%) as a rough approximation for the ratios of earnings in an average household – still neglecting higher wage gaps observed in the past, plus typical differences in the life-time amount of labour supplied by married women and men that continue to exist – there is considerable leeway before the above condition will be violated in more than some exceptional cases.

The result that the implicit tax rate involved in public pay-as-you-go pensions is higher for married women than for their husbands – because of the existence of survivor benefits and how they interact with own, non-derived benefit entitlements – is not an artifact of our simplified model. This can be confirmed by simulations which incorporate the actual rules of how surivor benefits are being assessed in Germany. Amending earlier calculations that focused on implicit tax rates for (male) individuals who were assumed to act as "principal earners" of their households (Thum and Weizsäcker 2000; Fenge and Werding 2004),[9] we construct stylised earnings profiles for their wives reflecting on-going changes in average female labour-force participation and in the average gender wage gap for each year covered by the simulations;[10] we also take into account that married women are usually younger than their husbands (by about three years) and that they tend to live much longer (see footnote 3).

The simulation results exhibited in figure 2 add a little more detail to our theoretical observations. In particular, they show that, mainly because of their higher life expectancy, implicit tax rates for married women can be lower than those for men as long as their own benefit entitlements are so small that they are exempted, fully or to a large extent, from the reduction against survivor benefits. But as female labour-force participation increases and the gender wage gap shrinks, the reduction of own benefit entitlements during survivorhood is likely to increase implicit tax rates for married women – in the graph: for average women born starting from 1965 – beyond those for their husbands.[11]

[9] The simulations presented here also take into account the most recent pension reform enacted in 2004.

[10] For the future development of female labour-force participation, we use a scenario that is based on assumptions made for a number of long-term simulations commissioned by the German government (see *Kommission "Nachhaltigkeit in der Finanzierung der Sozialen Sicherungssysteme"* 2003; Werding and Kaltschütz 2005). Regarding the wage gap, we assume that is goes down from a current 25% (blue-collar workers in manufacturing, see figure 1) to about 15% until 2050.

[11] In our calculations, we ignore the new option of equally splitting individual pension en-

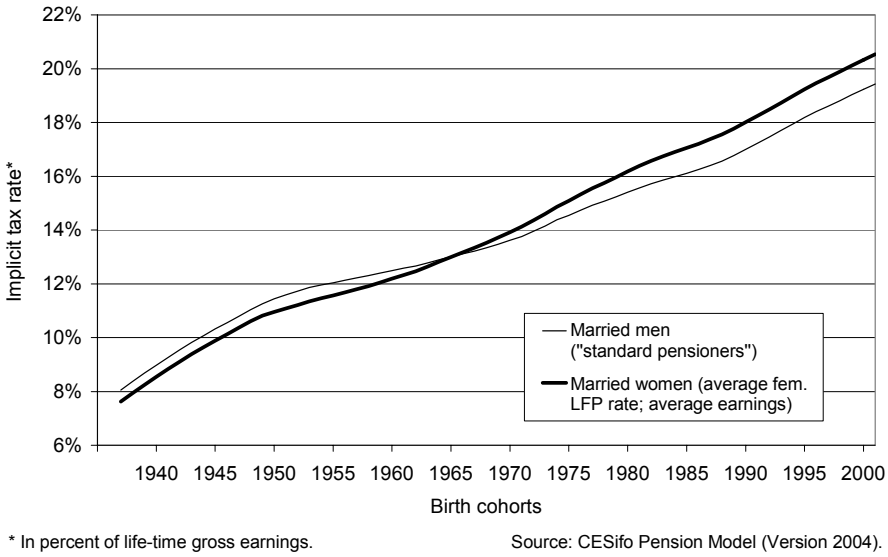

Fig. 2: Implicit taxes in the German Statutory Pension Scheme for married individuals (born 1937–2001)

The specific rules applied in other countries are different from the German ones. In most cases, however, the tax structure that they generate is similar. U.S. Social Security, for instance, with its weaker link between contributions and pension benefits (through a formula that converts a 35-years' average of indexed earnings into monthly benefit payments at degressive rates) implies that implicit tax rates vary inversely with life-time earnings. This should reduce the difference between tax rates for primary earners (whose benefit entitlements include those for survivor benefits) and secondary earners (whose benefits are set off through survivor benefits), but need not make it disappear. In addition, Social Security offers "spouse benefits" for dependant partners that are payable while the insured individual is still alive. As they also substitute for own benefit entitlements of second earners (on a one-for-one basis), they can stronly increase implicit tax rates for married women when compared to those of their husbands. Even the UK State Pension system (with earnings-related contributions, but flat-rate benefits that are only differentiated by the number of qualifying years) involves some elements of an extra-tax for married women. Paying the minimum amount of contributions for a given year to become covered may not make sense for women whose resulting benefit entitlements are too small to become effective in the presence of spouse benefits, which also exist here, and survivor benefits. Only in a pension system where benefits are entirely lump-sum, not even differentiated *pro rata temporis*, implicit tax rates were always equal to the

titlements, while giving up claims on survivor benefits, between spouses who married after January, 1st 2001. Using this option makes the incentive problems disappear that we are interested in, but it does not solve all problems of old-age provision for (married) couples; see section 4.

(explicit) contribution rates and, hence, uniform across all members of a given age cohort, including married spouses (while benefits are a pure transfer).

3 Optimal taxation and the gender tax gap

It should be noted that the existence of an implicit tax rate as such – and even its increasing time trend that shows up in the simulations run for figure 2 – is not necessarily indicating a fundamental inefficiency involved in pay-as-you-go pension schemes,[12] even if it is suited to discourage insured individuals, irrespective of their gender, from labour force participation. What is potentially problematic here, however, is the tax structure derived in the previous section, with tax rates that are systematically higher for married women who show some degree of labour force attachment than for their husbands.

Basically, implicit tax rates are an instrument required for keeping the implicit debt involved in pay-as-you-go pensions – *i.e.*, the present value of outstanding benefits that are linked to all past and present contributions – on a sustainable time path. For instance, to avoid that this debt explodes as a percentage of current GDP, the internal rate of return on contributions must fall short of the market rate of interest over the long run. By its demographic and economic fundamentals, ρ_{t+1} is generally restricted to the growth rate of the economy's aggregate payroll, or total taxable wage earnings, such that the above condition should be met.[13]

Considerations of this kind fix the implicit tax which has to be imposed on a given age cohort participating in a pay-as-you-go pension scheme as an absolute amount. In terms of our model – assuming, for simplicity, that all insured individuals are married – this gives us

$$T_t = \vartheta_t^m W_t^m + \vartheta_t^f W_t^f . \tag{8}$$

It remains an open question, though, which structure of tax rates – here: what ϑ_t^is – should ideally be chosen to yield this specified tax revenue.

This question is simply another application of the theory of optimal taxation that investigates the design of taxes and tax rates by which a given amount of tax revenue can be levied in such a way that welfare losses imposed on the individuals affected are minimised. Important standard results that are also relevant here were already provided by Sandmo (1974; 1987) or Atkinson and Stiglitz (1980, ch. 12). An application to implicit taxes involved in pay-as-you-go public pension schemes can be found in Fenge, Übelmesser and Werding

[12] *Cf.* the seminal papers by Breyer (1989) and Fenge (1995). Sinn (2000) surveys the entire debate on the efficiency of unfunded pension systems that has been triggered by these contributions. The implications of increasing tax rates for younger age cohorts that are mainly due to current demographic change are discussed in Fenge and Werding (2004).

[13] Considered in a little more detail, the relevant ρ for each cohort that is covered in a pay-as-you-go pension scheme is determined by average participation rates (in our model: l_t^i and l_{t+1}^i), average wages (W_t^i and W_{t+1}^i), and the dependency ratio (α^m and α^f), modified by potential changes of the contribution rate (τ_{t+1} against τ_t). But as l^i is always a cohort-wide average in this calculation, ρ can safely be taken to be given for each insured individual.

(2002). This paper includes an empirical assessment on which we can build in the following,

Formally speaking, within the framework of the model developed in section 2, we have to find rules defining the optimal structure of ϑ_t^m and ϑ_t^f, assuming that the government maximises utility of the average household as represented in equation (1), taking into account the (abridged) household budget constraint (2) and the additonal constraint (8) regarding the tax revenue that is required. Imposing no further restrictions, notably with respect to the form of the utility function, we obtain a variant of the "Ramsey rule", one of the most fundamental rules of optimal taxation,

$$\frac{\vartheta^f}{1-\vartheta^f} = \frac{\varepsilon^{mm} - \varepsilon^{fm}}{\varepsilon^{ff} - \varepsilon^{mf}} \frac{\vartheta^m}{1-\vartheta^m}. \tag{9}$$

According to condition (9), implicit tax rates for (married) women, ϑ^f, should be higher than those for men, ϑ^m,[14] if the (compensated) wage elasticity of female labour supply, ε^{ff}, is lower than the corresponding value for males, ε^{mm}, and if this relation between "own-price effects" (where the wage elasticity is evaluated with respect to one's own wages) is not turned over through a highly inverse relation of "cross-price effects", ε^{ij} with $i, j \in \{m, f\}$, $i \neq j$ (where the elasticity of labour supply is measured with respect to the spouse's wage).[15]

Assuing, in addition, that the household utility funtion is fully separable regarding the labour-supply decisions of each partner, implying that the cross-price elasticities are zero, (9) simplifies to the so-called „inverse-elasticities rule",

$$\frac{\vartheta^f}{1-\vartheta^f} = \frac{\varepsilon^m}{\varepsilon^f} \frac{\vartheta^m}{1-\vartheta^m}. \tag{10}$$

Here, it is only the ratio of (own-)wage elasticities, ε^m and ε^f, that determines the optimal tax structure. To limit efficiency losses arising from labour-supply responses, the tax rate imposed on the partner whose labour supply is more elastic should be lower than the tax rate for the partner with a higher elasticity of labour supply.

But theoretical considerations alone are not suited to clarify what these optimal-taxation rules actually imply for our problem. Whose labour supply is typically more elastic with respect to net wages, hence wage taxation – that of married women or of their husbands – is ultimately an empirical question. In a paper that was meant to explore a related, yet differing, subject – namely the question for optimal time-profiles of implicit tax rates over individual life cycles (with more than just one active period) – Fenge, Übelmesser and Werding (2002) come up with parallel assessments for the labour supply elasticities of

[14] The transformation to $\vartheta^i/(1-\vartheta^i)$ simply relates the tax rate to *net* earnings – expressing it as a proportional surcharge on these.

[15] Taken in isolation, these cross-price effects have the following impact: implicit tax rates for females should be higher than those for males if the compensated elasticity of labour supply of women with respect to their husbands' wages is lower than the "cross-wage" elasticity of labour supply of men.

married females and males. Their results are thus also of high interest in the current context.

The analysis of labour supply of German males and (married) females conducted in Fenge, Übelmesser and Werding (2002) is based on data collected through the "German Socio-Economic Panel (GSOEP)" between 1988 and 1997. Self-employed individuals and civil servants are excluded from the sample as, under current rules, they are exempted from mandatory membership in the German Statutory Pension Scheme. Differentiated by gender, the data are pooled to form two sub-samples of "young" and "old" working-age individuals (aged 20–39 and 40–59, respectively). For the present purpose, this allows for a rough, but meaningful, control for potential cohort effects that may be present especially in female labour supply decisions. Labour supply is defined in terms of decisions on working hours, assuming that the more fundamental decision to participate in the labour market will often be influenced by other considerations – rigidities in the length of certain training periods for younger individuals, the supply of child-care facilities for females, options to exit from the labour market and retire early for older workers, *etc.* The econometric estimate is based on the standard two-stage procedure suggested by Heckman (1979), where first a (gross) wage equation is estimated to impute wages for those who are not actually working, then a Tobit model (after Tobin 1958) for the unbiased labour supply function based on changes in net earnings.[16]

Building on the coefficients of this estimate – in particular, those for the net wage associated with an extra-hour of work and for other household income[17] – one can calculate the compensated wage elasticities of married women and men through a Slutsky decomposition of observable, uncompensated wage elasticities.[18] Table 1 summarises the main results, comparing wage elasticities of labour supply for married females and males and confronting them with average implicit tax rates for "young" ("*y*") and "old" ("*o*") individuals of working age (in the relevant period of time) that can be derived from the simulations for figure 2.

It turns out that, in both age categories, labour supply of married women is much higher than that of men at the same age. This is most apparent for young individuals aged 20–39, where male labour supply appears to next to be non-responsive to wages. For older individuals aged 40–59, the wage elasticity of male labour supply increases more against the parallel figure for the young than it does in the case of married women. Still, it remains well below the wage elasticity of females of the same age. All in all, the result that labour

[16] For a comprehensive description of the data set and the methods applied, together with a fuller documentation of the results, see Fenge, Übelmesser and Werding (2002, sections 4 and 5).

[17] In the context of an overall progressive tax system, a potential endogeneity problem arises with respect to how net earnings and net wage rates are determined. This problem is circumvented through evaluating the relevant figures at group-specific averages of working hours and an increase of the latter by an hour per week. (The relevant sub-groups are formed based on correspondance with respect to gender, age, education, job experience, and the number of children living in the household.)

[18] See Fenge, Übelmesser and Werding (2002, section 6).

supply decisions of women are much more responsive to wages than those of men neither appears to be mainly driven by cohort effects nor by life-cycle effects.[19] In addition, it conforms with the results of a multitude of earlier studies covering Germany and other indutrialised countries.[20]

Table 1: The structure of implicit taxes
and inverted wage elasticities for married females and males

Married females	Males
a) "young" individuals (aged 20–39)	
$\varepsilon_y^f = 0.543$ ***	$\varepsilon_y^m = 0.041$ ***
$\vartheta_y^f = 12.86\%$	$\vartheta_y^m = 12.92\%$
$\Rightarrow \frac{\vartheta_y^f}{1-\vartheta_y^f}\frac{1-\vartheta_y^m}{\vartheta_y^m} = 0.995$;	$\frac{\varepsilon_y^m}{\varepsilon_y^f} = 0.076$
b) "old" individuals (aged 40–59)	
$\varepsilon_o^f = 0.809$ ***	$\varepsilon_o^m = 0.236$ ***
$\vartheta_o^f = 10.56\%$	$\vartheta_o^m = 10.11\%$
$\Rightarrow \frac{\vartheta_o^f}{1-\vartheta_o^f}\frac{1-\vartheta_o^m}{\vartheta_o^m} = 0.952$;	$\frac{\varepsilon_o^m}{\varepsilon_o^f} = 0.292$
*** denotes significance of the results at a 1-percent level.	

Looking at implicit tax rates involved in the German Statutory Pension Scheme, table 1 reveals that these are not even higher for the birth cohorts of women actually considered than those for males in the same age categories. (The youngest individuals included in the sample for the econometric estimates were born in 1977; figure 2 shows that the gender tax gap tends to widen considerably only afterwards.) But, in any case, the ratio of the relevant tax rates (per net wage earnings) for females *vs* males is far from what would appear to be optimal to take care of the huge differences in labour-supply reactions. In the case of younger individuals, this ratio would have to be adjusted by a factor of 13, in the case of older individuals by a factor of 3.2, in favour of married women in order to bring it in line with the simple inverse-elasticities rule (10).

It might effectively over-burden the results presented here to derive an "optimal" structure of implicit tax rates in a quantitatively exact fashion. For this kind of purpose, the empirical design is certainly a bit too rough. Also, alternative approaches to household-level decision making are neglected here (and, correspondingly, cross-wage elasticities of each partner's labour supply that could

[19] This is confirmed by a series of more differentiated estimates for sub-groups of 5 age cohorts each that are also reported in Fenge, Übelmesser and Werding (2003, tables 7a and 7b).

[20] The estimates provided by Franz (1985), Strøm and Wagenhals (1991) or Untiedt (1992) focus on female labour supply; they support that wage elasticities of women are cinsiderably high, but do not allow for comparisons with those of men. The studies by Buslei and Steiner (1999) or Kaltenborn (2000) clearly confirm our results. For a comparative survey of parallel results obtained for other countries, see Blundell and MaCurdy (1999).

differ from zero are ignored). Furthermore, we only look at implicit taxes involved in the pension system, not at other taxes imposed on wage earnings. (Note, however, that the German "splitting" approach to jointly taxing a married couple's income involves higher tax rates for second earners – mostly women – than for typical breadwinner-males (see, for instance, Ott 1993; or Zameck 1997). But what our results should be taken to indicate is that the gender-specific structure of implicit taxes involved in pay-as-you-go pension schemes are most likely to violate fundamental rules of optimal taxation and that this is mainly a by-product of how survivor benefits are currently being assessed, or how they interact with the survivor's own, non-derived pension entitlements. This problem could even become more pressing to the extent that women show increasing rates of labour-force participation, while the gender wage gap is closing over time. Instead of letting implicit tax rates imposed on married women rise with these trends – as they would do automatically under current rules – they should rather be reduced below the comparable tax rates for men. (Only, we would possibly over-state our case if we wanted to say by how much.)

4 Options for reforming survivor benefits

The efficiency problems highlighted in the preceding sections are mainly due to the fact that survivor benefits usually substitute for pension entitlements that are based on the survivor's own contributions. If, under current socio-economic conditions, survivor benefits are also less and less justified by distributional objectives, abolishing them might appear to be a natural solution.[21] Compared to the status quo, a solution of this kind implies financial losses in terms of a given couple's joint benefit entitlements if, according to the distinction introduced in section2, the wive belongs to "case 1". There would be no such loss in "case 2" if the different types of benefits would off-set each other on a one-for-one basis. Since part of the benefits is often exempted from the reduction, and since reduction rates can be smaller than 100%, total benefit entitlements would also decrease for case-2 households if survivor benefits were wiped out. On the other hand, these losses for married couples may effectively indicate that an out-dated type of extra-benefits is abolished, allowing for reductions in the pension system's budget. In any case, abolishing survivor pensions implies that net wages and implicit tax rates for married couples are given by

$$w_t^{m\prime} = \left(1 - \tau_t \left(1 - \alpha^m \frac{1+\rho_{t+1}}{1+r_{t+1}}\right)\right) W_t^m = \left(1 - \vartheta_t^{m\prime}\right) W_t^m \tag{11}$$

$$w_t^{f\prime} = \left(1 - \tau_t \left(1 - \alpha^f \frac{1+\rho_{t+1}}{1+r_{t+1}}\right)\right) W_t^f = \left(1 - \vartheta_t^{f\prime}\right) W_t^f \tag{12}$$

with

$$\vartheta_t^{f\prime} < \vartheta_t^{m\prime} \quad \text{because} \quad \alpha^f > \alpha^m.$$

[21] As they are not affected by the criticisms raised here, this conclusion need not apply to survivor pension paid to partners of working age who are prevented from (full) labour-force participation through child-care obligations, at least on a transitory basis.

As long as life expectancies of women are higher than those of men, the ratio of the implicit tax rates they are faced with would unambiguously move in a direction that should lead to smaller welfare losses in the light of standard estimates regarding the differences in wage elasticities of female *vs* male labour supply. When assessed by the strict inverse-elasticity rule as stated in section 3, the solution is not necessarily optimal. But we already said that one should be reluctant to take the simulations and estimates presented here as a precise yardstick for the reforms that are necessary.

Fully individualising benefit entitlements for married spouses cannot be achieved without approporiate transition periods. Otherwise, the reforms could annihilate life-cycle planning of married couples, especially of female partners in marriages with a traditional division of labour, at a very late stage without giving those affected the time to respond to the new framework through behavioural changes. If individuals have failed to build up sufficient pension entitlements of their own from the very beginning, it is difficult to make up for that already when it is still some time to go until retirement age. Granting higher pension benefits to women whose individual benefit entitlements are small because of parental leaves – a requirement defined by the German Court of Justice with respect to any future pension reform since 1992 – may solve this problem partially but not fully.[22]

Another, more important shortcoming of this type of a solution is that the resulting time profile of household income over the periods of joint retirement and survivorhood – which is when the surviving spouse has to live on his own benefit entitlements only even if they are rather small – may not at all correspond to a profile that is optimal with respect to the timing of goods consumption, or the relevant inter-temporal substitution elasticities. Instead, current income in the period of survivorhood will typically be too small when compared to the sum of a couple's individual benefit entitlements received earlier on.

Part of the German pension reform enacted in 2001 is the option of continously splitting invidual pension entitlements between the two partners on a 50-to-50 basis (for couples who married after 1 January 2001, or where both spouses were born after 1 January 1962). At the same time, couples who use this option have to give up entitlements for receiving survivor benefits. A consequence of this solution, if it were chosen by a large number of households, is that part of the potential reductions in pension expenditure through the abolishment of survivor benefits will not materialise because entitlements will typically be transferred from males – with higher life-time earnings but lower life expectancy – to their wives. Apart from that, the splitting option would also be a step towards removing the efficiency loss indicated by our results presented in section 3 as it fully equalises the implicit tax rates for married females and their hus-

[22] The solution suggested in the remainder of this paper is thus open to being augmented by additional changes in the way child-rearing activities are reflected in individual pension entitlements. For proposals of this kind for the German Statutory Pension Scheme, see Sinn and Werding (2002; 2005).

bands.[23] At the same time, the resulting time profile of household income during the full retirement period – with a 100-to-50 ratio between benefit entitlements during the sub-periods of joint survival and survivorhood, respectively – may still not correspond to an optimal time path of the household's consumption. Existing rules for the definition of survivor benefits are mainly based on factors (for the conversion of benefit entitlements of defunct spouses into survivor benefits) between 50 and 60%, additionally exempting part of the survivor's own entitlements from being reduced in return.[24] In any case, a simple splitting model may be too rigid in the allocation of the pooled benefit entitlements of a given couple both to the prtners and over time. Even a model with variable splitting factors, where spouses can freely choose how much of their benefit entitlements to transfer between them may not be suited to insure the basic biometrical risks – which of the partners will outlive the other and by how long? – on which the problem of an adequate provision for survivors ultmately rests.

A solution that is superior in terms of the flexibility of re-allocating individual benefit entitlements, the insurance of relevant life-expectancy risks, as well as the fiscal costs is given by a joint annuitisation of a given couple's individual benefit entitlements. Irrespective of the actual time profile of benefit payments, providing for a partner with lower benefit entitlements who is most likely to live longer than the other can in principle also be accomplished through making private savings or through buying appropriate life-insurance cover. But "framing" these kinds of decisions through some sort of public provision, linked to a mandatory pension system, may nonetheless be to the advantage of many individuals – especially if this can be arranged for in a simple and cost-saving way. To the extent that this contributes to consumption profiles with higher utility levels, and helps avoiding cases of under-provision, offering such a scheme could lead to genuine welfare gains.

The basic idea behind the solution to be sketched here is that, applying actuarial principels and without granting any extra-benefits for survivors, the present value of a married couple's pooled benefit entitlements can be shifted rather freely between the sub-periods of joint retirement and expected survivorhood. Compared to the case where benefit entitlements are fully individualised, benefits paid out while both partners are still alive would have to be reduced by a certain margin, in order to top up pension benefits for the survivant spouse. In both sub-periods, public pensions could then cover an equivalent share of current consumption, first of the couple, then of the single survivor. If individual benefit entitlements, the age of each partner (and, hence, contingent life expectancies) are given, a solution of this kind can be realised through the simple

[23] On analogous terms as in equations (11) and (12), the result is now uniformly given by:

$$w_t^i = \left(1 - \tau_t \left(1 - \frac{\alpha^f + \alpha^m}{2} \frac{1+\rho_{t+1}}{1+r_{t+1}}\right)\right) W_t^i = (1 - \vartheta_t)\, W_t^i$$

[24] See Fenge *et al.* (2003, table 1.15). In Germany, the conversion factor is currently 55%, as was mentioned in section 2. Until 2000, it was 60% and, on average, the most recent reduction is off-set by higher exemptions for own benefit entitlements of survivors who have raised children.

choice of just one parameter that governs the relevant deductions and top-ups at each point in time. If the pool of risks is large enough, insurance against deviations of individual life expectancies and the actual sequence of deaths from what had to be expected can be easily provided.

The core parameter of the joint-annuitisation model we have in mind is a deduction rate δ by which benefits actually paid out during joint survival are reduced, thus allowing for higher benefit payments to the survivor later on. The present value of total expected benefits of a given couple has to remain unchanged against a scenario where benefit entitlements are purely individual. This implies that the incentive effects of joint annuitisation with respect to each partner's labour-supply decisions are the same as those associated with equations (11) and (12).

Within the framework developed in section 2 – where life expectancies of males and females were taken to be fixed and the time structure was generally modelled in a rough fashion only – shifting benefit entitlements between the periods of joint survival and survivorhood must satisfy:

$$p_{t+1}^{m\prime} + p_{t+1}^{f\prime} = (1+\rho_{t+1})\tau_t(\alpha^m W_t^m l_t^m + \alpha^f W_t^f l_t^f) \equiv \tag{13}$$

$$\equiv \quad (1+\rho_{t+1})\tau_t \left[\alpha^m \underbrace{(1-\delta)\left(W_t^m l_t^m + W_t^f l_t^f\right)}_{\text{pooled pension benefits ex deduction}} + \right.$$

$$\left. +(\alpha^f - \alpha^m)\left(\underbrace{W_t^f l_t^f}_{\text{pension benefit } f} + \underbrace{\frac{\delta\alpha^m}{\alpha^f - \alpha^m}\left(W_t^m l_t^m + W_t^f l_t^f\right)}_{\text{top-up for the survivor}} \right) \right]$$

By the choice of δ, the increase in pension benefits during the period of survivorhood, $\alpha^f - \alpha^m$, exactly corresponds to the deduction accepted by the partners during their joint retirement period, α^m, on present-value terms.

Now, how should δ be chosen in order to establish the partners' preferred time profile of current benefit payments over the full retirement period? Obviously, this is dependent of the relative size of their individual benefit entitlements as well the actual difference between their contingent life expectancies at the moment of joint annuitisation. Based on equation (13), but correcting for the expected length of the relevant sub-periods to estimate the relative size of current ("annual") benefits, we can define the relative level of benefits for the surviving spouse, π:

$$\pi = \frac{1}{1-\delta}\frac{W_t^f l_t^f}{W_t^m l_t^m + W_t^f l_t^f} + \frac{\delta}{1-\delta}\frac{\alpha^m}{\alpha^f - \alpha^m} \tag{14}$$

Assuming that benefits are jointly annuitised when both partners (simultaneously) enter retirement and plugging in for the α^is actual values for the average

duration of pension benefits paid to men and women in the German Statutory Pension Scheme (as of 2002),[25] table 2 shows the results for π (ratio of benefits paid to the survivor over benefits paid to the couple during joint survival) as a function of the relative amounts of (life-time) earnings, hence benefit entitlements, and alternative choices regarding the deduction rate δ. It turns out that relatively small deductions during joint survival are sufficient to ensure a relative level of pension benefits that corresponds to what current rules for survivor benefits are meant to provide for ($\pi \geq 60\%$ being the target level, it appears, irrespective of whether the survivant spouse holds own benefit entitlements or not). That it is the easier to get into this range of πs the higher individual benefit entitlements of the surviving partner are should not be surprising.

Table 2: Relative level of benefits for survivors (π)

	$\delta =$				
$W^f l^f / W^m l^m$	0.025	0.05	0.075	0.1	0.15
0.00	8.9%	18.3%	28.2%	38.6%	**61.3%**
0.25	29.4%	39.3%	49.8%	**60.8%**	84.9%
0.50	43.1%	53.4%	**64.2%**	75.7%	100.6%
0.75	52.9%	**63.4%**	74.5%	86.2%	111.8%
1.00	**60.2%**	70.9%	82.2%	94.2%	120.2%

In reality, there are a number of additional complications for the solution sketched here to be workable that are not covered by the simplified model developed in section 2. First, the partners could retire at different points in time. Basically, (outstanding) pension entitlements of a married couple can jointly annuitised at any point in time during their retirement phase. The effect of δ becomes weaker the shorter contingent life expectancy of the partner who is likely to die first. But in principle, the re-assessment of benefits can be done when the first of the spouses enters retirement as well as when the second one retires.

Second, life expectancy of females is higher than that of males in all industrialised countries, and married women are typically younger than their husbands almost everywhere. Still, in individual cases it is perfectly possible that it is the man who lives longer than his wife. If joint annuitisation were only made in the light of the opposite case, this could lead to an over-provision for the surviving husband. In terms of distributional objectives, this is certainly less of a problem than potential under-provision – for instance, because the latter may give rise to other benefit entitlements that could have been avoided if provisions had been made in good time. On the other hand, the time profile of retirement income that has been chosen, through δ, based on expectation values may be missed

[25] In West-Germany, the corresponding value for males is 14.6 years, for females 18.8 years (see *Verband Deutscher Rentenversicherungsträger*, 2003, 133).

and a sub-optimal structure of consumption over the full retirement period may be the consequence. But if mortality rates are known for both partners, the choice of δ can be translated into a choice of the relative level of benefits, π, or a choice of the time profile of paying out $p^{m\prime}_{t+1} + p^{f\prime}_{t+1}$ which is then considered the true objective of insurance. Irrespective of the actual sequence of deaths, this preferred profile could then be established under any realisation of the risks insured.

Third, the retirement period also has a certain length and time structure, a feature that is captured by our model only in a very rough fashion. In reality, the question arises which discount rate should be used for assessing relevant present values: the capital-market rate of interest (adjusted for a risk premium associated with an insurance of longevity risks) or, more in line with how a pay-as-you-go scheme is actually operated, the pension scheme's internal rate of return? By actuarial standards, the first of these options is certainly more appropriate. In any case, it is the only solution that is really neutral with respect to the choice of the timing of benefit payments.

In a related context, with respect to the definition of "actuarially" fair reductions of pension benefits in cases of early retirement, it is sometimes argued that calculating these reductions using the internal rate of return as the relevant discount rate would yield results by which the effective retirement age becomes neutral with respect to a pay-as-you-go pension system's budget,[26] while using the market rate of interest would imply higher reductions of benefits, hence reductions of total pension expenditure. Conversely, turning regular old-age pensions into top-ups for survivors at a market interest rate could then imply that, when aggregated over time, total pension expenditure increases – at least, top-ups paid during the survivorhood period are higher than earlier deductions by a rate that exceeds the fundamental growth rate of the pension budget.

We have already explained that, perhaps following a certain period of transition, abolishing traditional survivor benefits should definitely reduce total pension expenditure. If, in addition, paying out part of the individual benefit entitlements of married spouses were postponed until the period of survivorhood of just one partner, there is a further, transitory reduction in expenditure which, on present-value terms, is exactly off-set by higher expenditure later on. It would therefore appear a natural solution to channel these transitory reductions into a special "survivors' reserve" (not into transitory reductions of contribution rates or transitory increases in benefit levels) in order to actually pre-fund for the benefit entitlements that are simply becoming effective with a delay. If this is how the scheme were operated, jointly annuitising pension benefit entitlements of married couples on an actuarial basis, at a discount rate derived from the capital-market rate of interest, should not cause any budgetary problems. There may be some additional complications that realistically would have to be taken into account, but basically the simple model developed in this paper just needs to be augmented by a little more time structure – in years, not rough periods and sub-periods, thus capable of offering a more detailed picture

[26] See, for instance, Ohsmann, Stolz and Thiede (2003).

of what can happen to the household and how this can be dealt with in terms of accumulating, transferring and decumulating both spouses' benefit entitlements – to make it operative for real-world applications.

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