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A REFORM PROPOSAL FOR GERMANY'S LONG-TERM CARE INSURANCE SYSTEM

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1. Introduction

In 1995, long-term care insurance was introduced in Germany. The social insurance system, which covers about 90 percent of the population, offers capped benefits of a nominally fixed amount and is financed by contributions levied on income from wages and salaries (as well as pensions and unemployment benefits) following the pay-as-you-go principle (cf. Rothgang & Igl 2007). Due to demographic change, however, the demand for long-term care is constantly growing. As the sum of contributory income has not been growing in real terms, Germany's Social Long-Term Care Insurance (LTCI) thus faces a dilemma: either the contribution rate is going to increase or the purchasing power of LTCI benefits are declining (cf. Schmähl & Rothgang 1996; Rothgang 1997). For the last 15 years, the former route was taken. From 1993, when benefits were decided upon, to 2008 capped benefits were kept constant in nominal terms. Thus the purchasing power of LTC benefits has constantly been decreasing. Last year's reform of the LTCI system then contained a – very moderate – adjustment of benefits and an increase in contribution rate (from 1.7 to 1.95 percent of contributory income). For the future, it is nevertheless clear that there remains a trade-off between constant purchasing power of LTCI benefits and constant contribution rate. Purchasing power has already declined considerably and the legitimacy of the whole insurance system would be at risk if it was to decline much further. Therefore more funds are needed. With respect to this, two major reform strategies have been put forward: the broadening of the contribution base by including all citizens into the system and taking into account all kinds of income thus transforming the social LTCI into a so-called "citizens' insurance" on the one hand and the introduction of some kind of supplementary funding on the other hand (see Rothgang 2004; 2006 for an overview). While the former makes perfect sense in order to promote social justice, its fiscal effects are limited (cf. Dräther et al. 2009). It is therefore worthwhile to discuss how elements of funding may be fuelled into a pay-as-you-go system. Proposals to switch from a pay-as-

you-go system to a fully funded system suffer from the enormous costs of the shift which virtually rules out this option (cf. Rothgang 2004). Introducing supplementary funded LTCI with per capita payments as proposed recently (cf. PKV 2005) is not very good targeted at the roots of the problems in the LTCI. In this paper we therefore propose an element of funding which is based on fertility behaviour. According to this proposal, people who – for whatever reasons – do not raise children in a sufficient number to stabilise population, have to pay an additional contribution which is later fuelled into the LTCI system.

In order to argue this proposal we start with a re-examination of the relationship between demographic change and any social security system that insures age-related risks (section 2). In section 3 we introduce the reform proposal and argue why it increases intra- as well as intergenerational justice. Section 4 then formally demonstrates how the proposal could work and section 5 sums up the argument.

2. Demographic aging, the pay-as-you-go system and the funded system

Funded systems are sometimes said to be better equipped to deal with demographic change. This is only partly true. The demographic aging we observe in OECD countries is a result of growing life expectancy and decreasing number of births (cf. Hauser 1981). With respect to long-term care a *growing number of elderly* increases the number of dependent persons and consequently the LTC expenditures. This effect is irrespective of whether any LTCI is funded or organised according to the pay-as-you-go principle.[1] Moreover, it is hard to assume how the financing principle could influence longevity. With respect to *fertility* the existence of any kind of LTC insurance may reduce the "value" of children for potential parents and thus reduce fertility. This has been argued with respect to pension schemes (cf. Cigno 1992) – though this effect is not undisputed. The crucial question, however, is how pay-as-you-go and funded systems are affected by decreasing fertility rates.

In pay-as-you-go systems the effect seems quite obvious: If future birth cohorts are smaller so is the number of contributors. Ceteris paribus therefore the lower fertility rates are the smaller is the amount of future contributions. In reality, however, the story is more complex as the transformation of succeeding cohorts into contributors depends on the labour market, and also the productivity of contributors (and the related wages) has to be considered. Funded systems seem to be independent of succeeding cohorts as everyone saves for his or her own expenditures in old age. This is, however, not true (see Schmähl 2006) for an over-

[1] In both cases the additional expenses have to be raised by increasing contributions/premiums. In a funded system this might even cause more difficulties as the jump in premium might be excessive for the old. Therefore often an element of a pay-as-you-go system is built in funded systems.

view on the literature). In terms of real economics the value of real estate and production sites declines if there are insufficient buyers/lodgers or workers. The same holds from a monetary economics point of view. In a funded system each cohort accumulates financial assets which have to be sold in old age (cf. Bohn 1980). If the succeeding cohort of buyers is smaller this might cause an asset meltdown – an effect that is also discussed under the heading of "age wave" (see e.g. Culhane 2001; Heigl 2001). Respective effects may be moderated if capital is invested internationally into emerging markets and alike. This, however, produces additional risks (political risks, exchange rate risks etc.). By and large, therefore, funded systems are neither inherently safe with respect to demographic change. Mainly the mechanism by which the system is affected (capital markets rather than labour markets) differs and therefore the funded system is exposed to other risks. Accordingly econometric projections suggest that the strength of the effects probably differ (Börsch-Supan et al. 2003; Börsch-Supan et al 2001). In short: funded systems are generally the same way affected by rising life expectancies[2] as pay-as-you-go systems, but funded systems are probably to a lesser extent than pay-as-you-go systems affected by declining fertility rates (cf. Enquete-Kommission 'Demographischer Wandel', p. 239-240).

So, how could a provision against the fertility risk look like? Any such provision can either influence fertility via incentives or provide a built-in mechanism to cope with floating morbidity rates. The below proposal is based on this idea: If fertility falls below a certain ceiling, members of the cohort have to pay additional contributions based on the fertility rate. This idea first provides incentives to influence birth-giving behaviour and second has a built-in-mechanism which leads to higher capital accumulation if the "production" of human capital ceases. If the additional contributions are used to build a – floating – capital stock, however, the capital market's risk of all funded systems remains. It is nevertheless much smaller than in a pure funded system, because only a part of the financing is transferred into the fund.

3. A Reform Proposal

The objective of this section is to present a reform proposal and argue why it is advantageous. First we argue, why we make the proposal, afterwards we explore some details of it.

The proposal is mainly based on the positive externality the education of children cause in all pay-as-you-go systems that insure an age related risk. In such a system the children pay for older people, irrespective of whether they educated children or not. This way the part of the elderly which didn't educate children benefits from the education of children from the

[2] Rising morbidity with constant mortality will also lead to increasing expenditures. In this respect rising morbidity has the same effect as declining mortality and is therefore not considered here separately.

others without paying for the benefit. This is the externality of the education of children in a pay-as-you-go system which insures an age related risk, (cf. Schmähl 1988; Lüdeke 2000), p 202. The extent of the positive externality depends on the number of children a couple raises.

With a decrease in the fertility rate from above 2.5 in the 1960s to about currently 1.4, the growth rate of the population decreased considerably, thus increasing the burden for the following cohorts. Moreover, nowadays about one third of a cohort remains childless (cf. Enquete-Kommission 'Demographischer Wandel' 1998, p 37; Schwarz 1992). Thus, only a part of the cohort produces the human capital (via education of children) which can be regarded as a positive externality for the rest of the cohort. This raises questions of allocative efficiency as well as of distributional justice within a given cohort and between subsequent cohorts. Since parts of the benefits of children are not internalised the decision about the number of children a couple wants to have is distorted (allocative inefficiency). Moreover, distributional justice within a cohort and between cohorts is distorted as well. Equity within a cohort demands no transfers between families with children and childless people. Between generations equity calls for a constant burden for each generation as long as the benefits for the young generation stay the same and there are no external shocks. A pure pay-as-you-go system violates all three aspects.

In its decision BvR 1629/94 from 3.4.2001 the German Federal Constitutional Court (Bundesverfassungsgericht) has accepted that the education of children causes an externality to the LTCI and therefore demanded that the legislator implements a scheme that allows for the externality (cf. Rothgang 2001). The legislator reacted by introducing an extra contribution for childless people amounting to 0.25 percent of the wage. This reaction, however, is less than perfect. First, the amount of extra contributions has not systematically been derived from the quantity of the externality. Second, the numbers of educated children is not taken into account.

In the following paragraphs it is shown, how our reform proposal addresses all three issues. We determine the extent of the externality and internalise it by making exactly the people who didn't educate enough children pay for exactly the positive externality they receive. If the externality is internalised the equity within a cohort is re-established, because the receiving people who educated 'too less children' compensate the others according to what they receive; there is no net-transfer from people who invest in the education of children and people who don't, anymore.

The issue of equity between cohorts is more complex. The extent of the externality depends on the average fertility rate so that it is not obviously clear how intergenerational equity

should be interpreted if the fertility rate is changing between generations. In order to solve this problem in our model we use the only fertility rate – instead of the current rate at a time – as reference that keeps the size of the population and the age-ratio constant. The LTCI is made independent from changing fertility rates by the proposed internalisation, because childless people will pay an extra contribution and thereby make provisions for themselves.

The proposed internalisation can be done the following way (for a similar outline for the health insurance see Arnold 2006, p. 213-215). In economic terms –within certain limits– the accumulation of human capital (education of children in a pay-as-you-go system) and the accumulation of fiscal capital (savings in a funded system) are functional equivalents. Additional contributions according to the number of children therefore seem to be a suitable way of introducing a supplementary funded system into a pay-as-you-go system. This implies additional contributions for those without children (or just one child) into a fund which accumulates these contributions for some years and then releases them into the LTCI fund, thus simulating contributions of children. For those with more than two children the basic contribution has to be reduced accordingly. When calibrated properly the system will be sustainable with respect to fertility – whatever the fertility rate is.

The proposal contains, that each person from the age of 20 onward has to pay an extra contribution until he or she reaches the age of 60 or get a child. For each child the extra premium is paused for a time that exactly compensates the external effect of the new born child. If more than one child is born, the pauses are summed up. In the case that the sum of pauses implies that the pause would be longer granted than the normal end of the extra contribution, a bonus will be paid out.

The extra contribution for childless people is calculated from the implicit debt. The implicit debt is the present value of the extra contributions which a childless person has to pay over her life-span in order to compensate for not educating children.

The extra contribution is determined as the same annual amount (annuity) from the implicit debt. The duration of the pause of the extra contribution is determined by the extent of the externality in relation to the implicit debt. How these two components can be calculated is shown below.

The implicit debt can be paid either by educating children or by money. In order to pay the implicit debt by educating children, a couple must educate a certain number of children (reference fertility rate). If this reference fertility rate is 2.07 (complete reproduction), the implicit debt per couple (equivalent per women) is 2.07-times the externality of one child.

Thus the extent of the externality of one child must be calculated in order to get the monetary equivalent of the implicit debt.

The extent of the externality is calculated using a population with in time constant age-ratios as reference. Constant age ratios mean that the ratio of the number of old people to the number of young people is fix (constant in time).The extent of the externality is then determined as difference between the contributions in the reference population and in the reference population with one additional child.

Such a population with constant age ratio is possible with different mortality rates, different fertility rates and different size of migration. Assuming no migration and constant mortality rates, we get a population from any fertility rate that is constant over time, in the very long-run (when there are no catastrophes in between). If the size of the population is also to be constant, only one fertility rate does the trick: the fertility rate that implies exact reproduction, about 2.07 children per women.

We assume no migration, because migration causes again certain externalities which we do not want to have in the reference population. For the mortality rates we use the current age dependent probabilities and assume them to be constant over time, because the rising life expectancy is not an issue of this paper.

In order to calculate the implicit debt, the annual externality is transferred into its present value at birth of the child, multiplied by the reference fertility rate and discounted to age 0 (for simplicity) of the mother. In fact, the calculation is a bit more complex, because the age of the mother giving birth (for discounting to her age of 0) must be determined in a way that it implies for the reference population that all payments to and from individuals balance each other exactly. The details of this calculation can be found in section 4.2.1.

If one child is born, its – according to the age of the mother discounted – externality is subtracted from the implicit debt and is credited to the educating couple. The crediting is done by pausing the extra contribution. The duration of the pause is found as the duration of the extra contribution payments which would exactly match as present value the reduction in the implicit debt, i.e. match the externality of that child.

How these calculations can be done formally and numerically is shown in the following section 4.

4. A simplified numerical model of the reform proposal

In this section a simplified model is presented in order to demonstrate how the reform proposal could work and how the numerical calibration of the model can be done. For easing the

calculations we simplified the existing LTCI in the following way. We assumed that each person pays the same contribution, independently from her income.

The proposal allows for internalisation. In order to internalise the positive externality of children in the LTCI it is necessary to a) determine its monetary equivalent (section 4.1) and b) to implement a scheme that ensures that this amount will be paid by the right persons (section 4.2).

4.1 Calculating the positive externality of a child on the LTCI

As already described in section 3, the reference point of the proposal is a population with a constant age ratio of old and young (reference population). The extent of the externality can then be determined as the difference of the contributions to the LTCI between the reference population and a population with one additional child.

In order to calculate the external effect over a life-span, we begin with calculating the *annual* external effect (section 4.1.1) and use the result to calculate the externality of a child as *present value* at his birth (section 4.2.1).

4.1.1 The Annual Externality

In the LTCI the total expenditures (TE) for a given period, let's say a year, can be calculated as the number of persons at risk (the old, denoted by o)[3] multiplied by the average expenditure for each person at risk, denoted by ltc:

(I) $TE = ltc * o.$

The old and the young, both pay contributions to the long-term care insurance system – as is the case in Germany. The number of contributors is denoted by p (payer). For simplicity we assume that contributions are calculated as a constant amount per capita (c) for young and old. Overall contributions to the pay-as-you-go system are then defined as

(II) $TC = c * p$

As contributions must equal expenditures in a pay-as-you-go system we get the budget constraint as in equation (III)

(III) $TC=TE$

Using equation (II) and (III), in equation (IV) this is solved for c.

[3] Unlike e.g. the Japanese LTCI which provides benefits only for the old, the German LTCI also provides benefits for the young. Empirically, however, less than 18 % of all beneficiaries are below the age of 60, and 89 % are 65 or older (Bundesministerium für Gesundheit 2009). For simplicity we therefore assume that only the old receive LTC benefits.

$c * p = ltc * o <=>$

(IV) $c = ltc * o / p$

The first derivate to p reveals, how the contribution for every paying person changes, if there were one paying person more:

(V) $c' := ltc * \frac{-o}{p^2}$

As easily seen the effect (c') in contribution of one paying person depends on the number of the contribution payers (p).

In the reference population we have (by definition) a constant ratio of the number of the young to the old people. Thus we can define a time constant age ratio of the old to the payers $a=o/p$ in the reference population. Using this in (V) we obtain:

(VI) $c' = ltc * \frac{-a}{p}$ with $a := \frac{o}{p}$

This is what each contribution paying person has to pay more (because of the minus it is less) when the paying people consist of one person more. The total effect (e) on the pay-as-you-go system is therefore (sum of the effect on each payer)

(VII) $e := c' * p = -ltc * a = -c$

In our simple model this is what a person has to pay additionally to the pay-as-you-go system annually (again, because of the minus it is less) in order to keep the contributions of all others constant in the case that she educates one child more than required by the reference fertility rate f.

4.1.2 Externality as Present Value and German Figures

From e we can derive the monetary equivalent of a child for the pay-as-you-go system (externality) by calculating the present value at the moment of its birth:

(VIII) $v := c * \sum_{t=20}^{100} (1+i)^{-t} * l_t$

20 is assumed to be the average age of beginning to pay contributions to the LTCI

100 is assumed to be the maximum life expectancy

i: interest rate

l_t: probability to live after t years from birth

One could argue that the expenditures which an additional person causes for the LTCI, must be taken into account. But for them the next generation has to pay the LTC expenditures, so that the contributions suffice to find out the external effect of one child (cf. Sinn 1997; Schmähl et al. 2006).

Now we can apply to (v) the following German figures:

LTC expenditures in 2007: about 18 bn € annually[4]
Number of old people (in 2010): 21.3 m[5]
Expenditure per old person: ltc = 18,000/21.3 = 845 € annually
Assume an interest rate i = 0.04 (4%)
Use reference fertility rate: 2.07 (Derived birth growth: 1)
Assume present mortality rates to stay constant[6]
Contribution payers: age from 20 to death
Old (persons at risk): age older than 59

…we obtain

a = 0.377
c = 845*0.377 = 318.57 € annually
v = 318.57*10.66 = 3,398.92 € (present value for the LTCI contributions at birth)

Starting from here a scheme is necessary to make the people with too less children (measured by the reference fertility of complete reproduction) pay for the negative externality they induce on the children educating parents.

4.2 Scheme to Assign the Externality Individually

The objective of this section is to define amounts which people have to pay who cause an externality, and to propose practical modes of paying. In a first step we must identify which individual conditions should lead to a compensation payment.

In a stable population no compensation payments are necessary, actually. That's why finding out what makes the population deviate from stability will give us the conditions which demand for compensation. In order to make a population (without migration) stable (i.e. the age ratios constant), each year the same growth rate of the number of new born children must be achieved. Therefore a change in the birth giving behaviour has an effect on the pay-as-you go system if the changed behaviour changes the growth rate of the number of new born children. That means, in order to assign the externality to individual behaviour, a link must be established between the number of new born children and the birth giving behaviour. It is obvious that the number of children born by women is relevant. But the age of the parents is in fact important, also.

[4] Rothgang 2008, p. 83
[5] Statistisches Bundesamt 10. koordinierte
[6] Statistisches Bundesamt 10. koordinierte

Actually it is not relevant, how old the parents (mothers) are who give birth to them. But if their age changes, the number of new born children will change, because of two effects:

a) the number of women change, because of deaths (dying effect)

b) a transition effect

For illustration, imagine a population where all children are born by women at their age of 30. If suddenly all women get the children at their age of 31, for one year no child will be born (transition effect). From age 30 to 31 some women died. If the rate of children per women stays constant, lesser children will be born, because there are lesser 31 year old women than 30 year old women (dying effect).

Because of these effects, a change in the average age of women giving birth affects the pay-as-you-go system. Therefore a change in the average age of women giving birth must induce payments to compensate for the change. A change in the average behaviour can only be transmitted to individual behaviour, if individual deviations from the average cause a extra contribution payment or a bonus. In this case, giving birth at an age younger than the average age of women giving birth, induce a bonus from the capital fund, whereas later birth giving demands for an extra contribution to the capital fund. If individual behaviour of different people changes, so that the average does not, the bonuses and the extra contributions compensate each other, so that the capital fund has a zero balance. In the case that the individual behaviour changes the average the capital fund will hold a compensating stock automatically.

The extra contribution must be calculated in a way that it can compensate the LTCI for the case that the person didn't educate children. Thus the present value of the extra contributions equals the implicit debt. The implicit debt is a sum owed to the LTCI by the potential parents as present value at a certain age. This debt can be paid earlier or later, but then interests have to be paid.

The implicit debt can be paid in money into a capital fund or by giving birth to children. Giving birth to a child is equivalent to paying the present value of the contributions of the child v into a capital fund which is linked to the pay-as-you-go system. The difference between the debt and the paid amount (by educating children or by money) reflects the externality of the birth giving behaviour on the pay-as-you-go system. If it is paid into a capital fund which compensates the pay-as-you-go system, the pay-as-you-go system stays unaffected by the birth giving behaviour.

Summing up, the compensation amount must depend on the ages of the parents at which they get their children. The compensation is a bonus if the children are earlier born than on average of the reference population and negative otherwise. Each person can be imagined to

have an implicit debt and interest must be paid for late paying it back. Paying back can be done by educating children or by money.

In the following section it is shown, how the amount of the implicit debt can be calculated. Afterwards the bonus / extra contribution payments are calculated and a suggestion is made how these amounts should be distributed over the life-span.

4.2.1 Calculating the implicit debt

The following considerations lead us to the formula for the implicit debts. First we specify which conditions the implicit debt must fulfil. From these conditions we find the formula of implicit debt.

In the reference population, there is no need for payments from the capital fund to the pay-as-you-go system, because the pay-as-you-go system is sustainable in itself. That's why the sum of all payments to and from the capital fund by individuals should equal zero in this case. Condition 1 formal:

(i) $\sum_{\forall t} g_t * l_t * f * b_t = 0$

f: number of children per women needed for complete reproduction

b_t: compensation payment (bonus) at age t, if the woman gave birth at age t to 1 child

g(t): birth rate at age t, normalised in a way that the total fertility rate equals 1

g(t)*l(t): birth figures at mother's age t in the reference population

The individual payment to the capital fund is calculated as present value of the implicit debt minus the present value of f new born children for the pay-as-you-go system. For the ease of calculation it is assumed that f babies are given birth at the same moment (mother's age), formally we get condition 2:

(ii) $b_t = f * v - d_t$

d_t: implicit debt, depending on the mother's age t at giving birth

The implicit debt is determined by these two conditions using the following definition of the present value of the implicit debt d_t as the accordingly discounted value of the implicit debt at birth d_0:

(iii) $d_t := d_0 * \frac{(1+i)^t}{l_t}$

d_0: implicit debt at age 0 of the potential parents.

(iii) in (ii):

$$\text{(iv)}\ b_t = f * v - d_0 * \frac{(1+i)^t}{l_t}$$

(iv) in (i) gives

$$\sum_{\forall t} g_t * l_t * f * (f * v - d_0 * \frac{(1+i)^t}{l_t}) = 0$$

Solve for d_0:

$$\sum_{\forall t} g_t * l_t * f * v - \sum_{\forall t} g_t * l_t * d_0 * \frac{(1+i)^t}{l_t} = 0$$ [splited into 2 sums, divided by f]

$$v * f * \sum_{\forall t} g_t * l_t = d_0 * \sum_{\forall t} g_t * l_t * \frac{(1+i)^t}{l_t} = 0$$ [2nd sum to the right hand side, d_0 and v taken out of the sum]

Solution:

$$\text{(v)}\ d_0 = v * f * \frac{\sum_{\forall t} g_t * l_t}{\sum_{\forall t} g_t * l_t * \frac{(1+i)^t}{l_t}}$$

Using the current mortality rates and the distribution of births on the women's age in Germany gives the implicit debt at birth d_0:

$d_0 = 0.31070*f*v$

$d_0 = 0.\ 31070*2.07*3{,}398.92 = 2{,}186.05$ €

d_0 is the implicit debt at age 0 and can be discounted by the formula (iii) to any age, see figure 1.

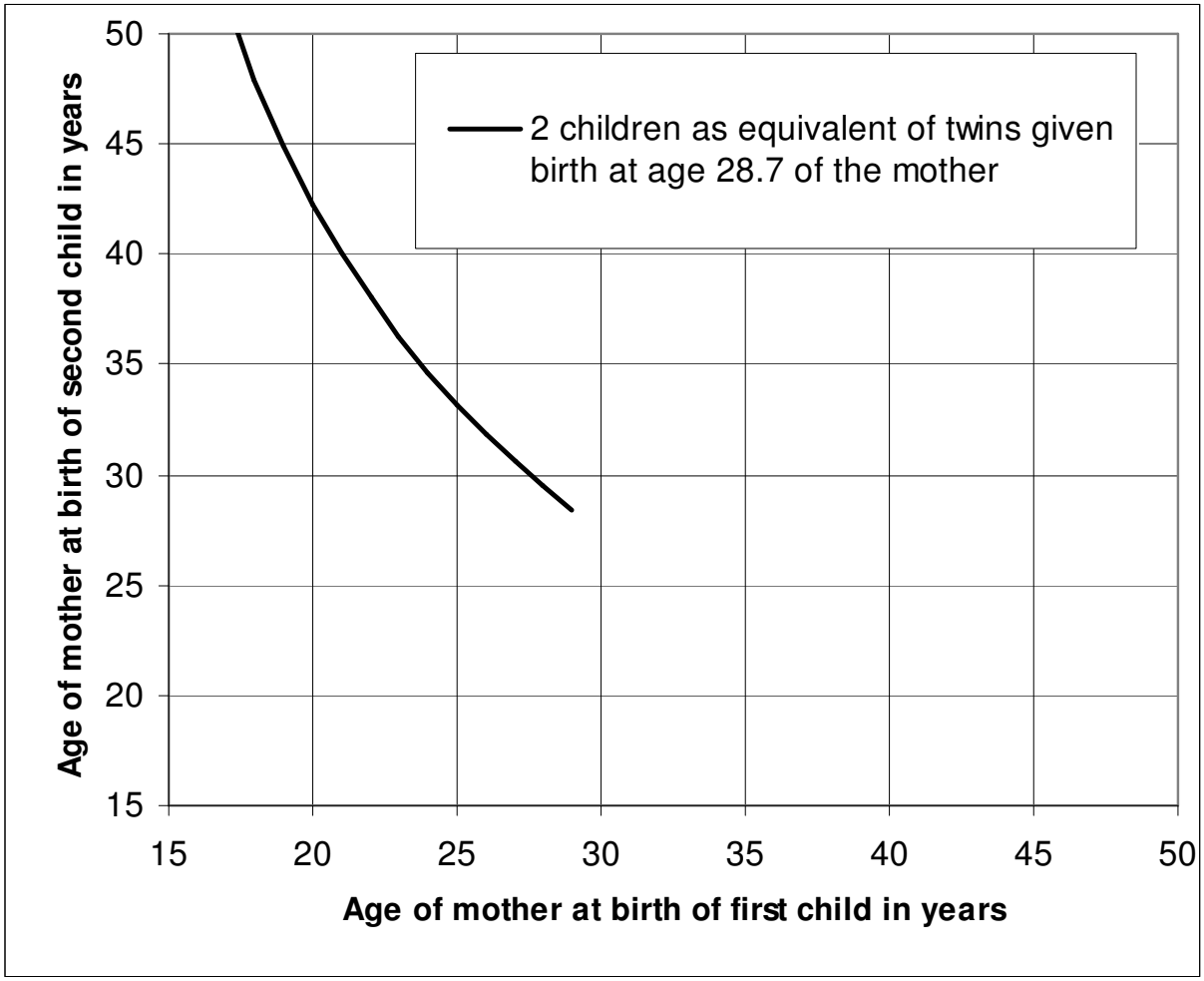
Figure 1: Present Value of the Implicit Debt at the Age of Potential Parents

Source: *own calculation.*

The solid curve describes the implicit debt of a couple (equivalence to one women) discounted to different point in time, i.e. different ages of the mother. Beside the implicit debt the present value of one child is shown (long dashed line). The present value of one child is always lesser than the present value of the implicit debt, thus it is no possible to "pay back" the implicit debt by educating only one child.

Giving birth to twins at the mother's age of 28.7 equals giving birth to fictional 2.07 children at the average age of mothers (29.3) giving birth in the reference population. This can be seen from the present value of new born twins for the LTCI (dotted line). At the intersection with the implicit debt you can see the age of a woman (28.7) giving birth to twins which would exactly 'pay' the implicit debt. This can also be reached by giving birth to two children; one before the age of 28.7 and one after (see the following figure 2).

Figure 2: Combinations of mother's ages at birth for two children exactly paying the implicit debt.



Source: *own calculation.*

The curve describes combinations of mother's ages at the moments the first and the second child is born. If the combination of ages matches one of the combinations described by the curve, the implicit debt is exactly paid by the birthing of children. At the right end of the curve, the first and the second children are born in the same moment, they are twins. At an age of 28.7 of the mother giving birth to twins will exactly pay the implicit debts of the parents. If the combination is left/below the curve, the present value of the external effect of the children to the LTCI is bigger than the implicit debt and can be paid out to the parents (bonus). If it is right/above the curve, the implicit debt is not completely paid by the two children and the parents must still pay some amount to the capital fund (extra contribution).

Formula (v) and figure 1 give us the implicit debt. From this we need to calculate bonuses and penalties and decide when in the life span they have to be paid. How this can be done is shown in the following section.

4.2.2 Bonuses and Penalties over the Life-span

The implicit debt can be "paid" by giving birth to two children exactly at the mother's ages described by the curve in the previous figure 2. In the case that a person doesn't educate children or the children are not born exactly at the mother's ages given by the curve, a compensation must be paid to or from the capital fund in order to make the pay-as-you-go system unaffected by the deviant birth giving behaviour.

The present value at age T of the bonus is given by formula (ii), which can be modified to include several children born at different mother's ages t_1, t_2…:t_n

$$\text{(iia)}\quad b(T) = \frac{(1+i)^T}{l_T} * \left(-d_0 + v * \sum_{k=1}^{n} (1+i)^{-t_k} * l_{t_k} \right)$$

This amount can only be known if the potential parents can't get children anymore, e.g. because of physical alterations happening by aging. From age 50 onwards all women are infertile and – considering the usual maximal age difference in a couple – it can be assumed that men cannot get children anymore from age 60 onwards. Thus at these ages the amount described by (iia) could be calculated and a bonus paid or an extra contribution demanded. For a 60 yrs. old couple without children an extra contribution of about 25,000 € is due (see figure 1). As a lot of public measures (e.g. progressive taxation, obligate unemployment insurance) aimed at smoothing the income changes a person experiences over the lifetime, this amount should be distributed to several years also. If one starts paying it back earlier, the absolute sum needed is lower because of interests.

The left debt can be paid out in different ways. It can be translated into an annually equal sum (annuity), it can be paid once, it can be linked to the personal income, it can be paid in advance and (partially) paid back in the case of born children etc. Here many practical considerations come in. We present two variants:

a) the most simple variant,
b) a more practical solution avoiding sudden variants of income.

The most simple variant arranges for that the implicit debt at birth is translated into an annual equal amount ('childless annuity') paid from age of 20 onwards till death. In the case of a new born child of the payer the present value of the contributions of that child to the LTCI (v = 3,398.92 € for Germany) is paid out once in a sum (child bonus). The advantage of this solution is its simplicity and direct link to the real effects. The drawback is that even parents who "paid" the implicit debt by educating enough children must pay the childless annuity till they are 60 or till they die (depending on how the annuity is calculated). The age-span used to annualise the implicit debt can generally be chosen freely.

Another drawback is caused by sudden changes of income. It can be avoided if the bonus is not paid out in a sum, but instead the childless annuity is suspended for a certain period for each child born. The period must be calculated in a way that the present value of the saved annuity equals the present value of a new born child v.

If the extra contribution should be paid from the age of 20 till 60, it amounts to 236 € for a couple, i.e. 118 € per person. In this case a pause of about 21 years from the date of the birth onwards matches the present value of a child for the LTCI of 3,398.92 €. In the case that the pause of the extra contributions is longer than the childless annuity should be paid (till the age of 60), a bonus can be paid out at that age to compensate it.

5. Conclusion

Many pay-as-you-go systems in modern nations insure age related risks (pension, health, long-term care). For all these systems the demographic aging which all western countries are facing is a major challenge. One important reason for the demographic aging is that the fertility rate has been decreased in the last 50 years and the number of childless people increased. The rising number of childless people implies an equity problem between children educating parents and people who save these costs.

These facts call for the compensation of the decreased fertility rates in order to make the pay-as-you-go system independent of changes of the fertility rates and simultaneous for a solution of the equity problem between childless people and children educating people.

These objectives are reached by the model presented here for the German long-term care insurance. The proposal makes the following arrangements. Each person reaching the age of 20 has to pay an amount of 236/2 = 118 € (236 € per women equals to 236 € per couple, i.e. 236/2 € per person) annually (extra contribution) as long as he or she is childless or reaches the age of 60 into a capital fund which simulates the contributions of children to the LTCI for people who didn't educate children. The present value of this extra contribution matches the implicit debt imposed by the pay-as-you-go system. This is the amount that each person in the next generation has to pay in order to finance the long-term care expenditures of the old people.

If a child is born, the extra contribution is paused for 21 years which equals the present value of the amount that the child will pay one day. After 21 years the normal childless annuity has to be paid again, if not another child is born. In the case that the summed up pauses make the parents to have the right to pause the annuity till over their age of 60, a bonus is paid to compensate for that. From age of 60 onward no childless annuity is owed.

The system works perfectly if it were introduced from the very begin of the LTCI. In the real case the system is already there and a transition mechanism must be designed. This is a solvable problem, because all the necessary calculations are already presented here and only a paying mechanism and an idea is needed how to distribute the calculated left implicit debt of the already living people over the rest of their individual lives.

This proposal solves the financing and equity problems caused by a changing birth giving behaviour. They do not solve problems stemming from rising life expectancy, declining immigration and rising prevalence rates, new technological possibilities or rising costs of care.

The advantages of this proposal are that…

- the immunisation of the pay-as-you-go long-term care insurance against changes in the birth giving behaviour
- the implicit transfer from parents who educate children to childless people is abolished, thus equity between childless and educating children is re-established
- the internalisation of the externality corrects (and increases) the incentive for the education of children in a way that the long-term care insurance does not distort it anymore
- a declining fertility rate does not shift the burden to the new generation, anymore.

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