On the Fairness of Early Retirement Provisions

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Abstract

Declining fertility and increasing longevity have rendered public pension systems in many OECD countries unsustainable and have triggered substantial reforms of these systems. One of the officially declared reform objectives is to raise the average retirement age. Crucial parameters for this endeavor are first the legal retirement age and secondly the early retirement provisions inherent in the public pension system. In this paper we discuss several notions of "fairness" of early retirement provisions in pay-as-you-go financed public pension systems and we claim that the "right" notion of fairness depends upon the objectives pursued in the design of pension systems. We point out the problems attached to the extreme positions "efficiency" and "welfare maximization" and propose a more modest concept of equity called "distributive neutrality", which is based on the notion that the ratio between total benefits and total contributions to the pension system should not depend systematically on the individual's ability. By applying this concept to the German retirement benefit formula and taking empirically estimated relationships between average annual income, life expectancy and retirement age into account, we show that at the present discount rate of 3.6 per cent per year there is systematic redistribution from low to high earners, which would be attenuated if the discount rate were raised. This seemingly paradoxical finding is due to the fact that in our data set, there is a negative relationship between earnings and retirement age.

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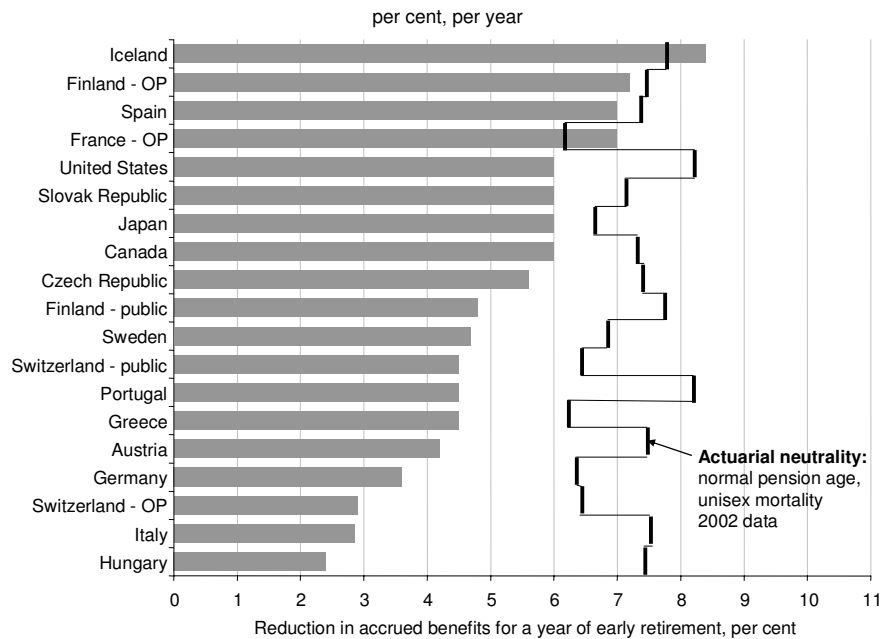*Stefan.Hupfeld@uni-konstanz.de*

1   Introduction

Declining fertility and increasing longevity have rendered public pension systems in many OECD countries unsustainable and have triggered substantial reforms of these systems. One of the officially declared reform objectives is to raise the average retirement age. Crucial parameters for this endeavor are first the legal retirement age and secondly the early retirement provisions inherent in the public pension system. In a free society, nobody can be forced to work. Therefore any public pension system must allow workers to retire before reaching the legal retirement age, but the conditions, i.e. the formula which ties the pension level to the age of retirement, are open to debate. In Germany, e.g., early retirement for non-disabled workers is currently possible up to five years before reaching the legal retirement age, and the benefit level is cut by 3.6 per cent per year of early retirement and similar discount rates apply in other OECD countries as demonstrated in figure 1, taken from the survey by Queisser and Whitehouse (2006). Critics of the present situation argue that the downward adjustment of the pension for early retirees is too small and thus encourages early retirement and increases the costs of social security (see, e.g. Herbertson and Orszag [2001], Börsch-Supan [2000]).

Clearly, the "right" rate of adjustment of the pension with respect to retirement age depends upon several factors,

1. the normative criterion underlying the concept of "right" adjustment rates: is it "pure" efficiency or are equity concerns to be taken into account?

2. potential heterogeneity among workers with respect to life expectancy,

3. informational constraints: can the government observe either the individual worker's length of life or at least factors which are correlated with life expectancy?

The purpose of this paper is twofold: In the first part, we give a survey of the possible optimality or "fairness" criteria: in Section 2, we shall focus on two different concepts of efficiency, and in Section 3 equity concerns will come into play in the tradition of the optimal taxation literature. In the second part (Section 4), we shall propose a new and more modest concept of fairness of the adjustment formula based on the notion of distributive neutrality. Its

implications will be demonstrated using recent empirical estimates of the relationship between earnings and life expectancy in the German Old Age Insurance system. Section 5 offers some concluding remarks.

per cent, per year

Reduction in accrued benefits for a year of early retirement, per cent

Figure 1: Discounts for early retirement in OECD countries

2   Homogeneous Workers: Concepts of Efficiency

There is widespread agreement that social insurance systems should be so designed as to achieve a given distributive target with the least degree of distortions to individual decisions on education, labor supply, savings, and other behavior. As an example, the German Old Age Insurance system is based on a tight tax-benefit linkage called "Teilhabe-Äquivalenz" (fairness within cohorts), a feature which is explicitly aimed at minimizing labor-supply disincentives. Such efficiency criteria are particularly important in a world of equals, in which distributional concerns play no role. However, we shall show that in the design of social security systems there is more than one possible efficiency rule.

2.1 No Distortion of Work Incentives

A straightforward target is the neutrality of the early retirement provision with respect to the labor supply decision of the worker: the pension system should not distort the choice of retirement age (Börsch-Supan [2000] and [2004]). This implies that net social security wealth, i.e. the present value of all future retirement benefits minus contributions, is not changed when the worker retires one period later (or earlier). This feature of a pension system is also called "marginal fairness". The normative appeal of marginal fairness is strongest in a world of equals because in this case equity concerns do not play a role and thus the pure efficiency goal of an undistorted choice prevails as the single objective. Moreover, marginal fairness has unambiguous implications only when the length of remaining life is certain because only in this case can the present value of extra retirement benefits be calculated so that it exactly matches the "pension costs" of retiring one year later.

In theory, the implications of marginal fairness are straightforward: The costs of retiring one year later are composed of the contributions paid to the pension system and the forgone benefits during the extra work year. If the length of the retirement period were known, the additional benefits could be calculated so that they exactly match this amount in present value. The discount rate to be applied in this calculation should be the "market interest rate", preferably the rate at which workers can shift their consumption possibilities over time. In the case of a worker who already disposes of savings which he can adjust to the changing stream of pension benefits (and contributions), the interest rate on government bonds seems to be the appropriate one. Matters become more complicated for a worker who has no savings apart from his social security wealth and who does not want to change his consumption pattern when he decides to work another year. This person will want to shift consumption from the retirement period to the present period by borrowing against his pension entitlements, which would require a much higher interest rate such as the one banks charge for overdraft loans.

In the practice of the German pension system, matters are complicated by the fact that retirement benefits accrue in proportion to total earnings during working life. As a consequence, the contributions paid in an extra year of working life already translate into additional benefits, where the "rate of return" equals the implicit rate of return of the pay-as-you-go system, viz. the growth rate of earnings, which is considerably smaller than the

interest rate. To achieve marginal fairness of the total return on the sum of contributions and forgone benefits, therefore, the rate of return on the forgone benefits must be much higher than the interest rate.

2.2 Minimizing the Burden on Other Generations

Incentive compatibility may be a sensible target in a one-household economy but it becomes questionable as soon as an infinite sequence of overlapping generations is considered. A much more convincing objective for this case is the requirement that the behavior of the retiree does not place a burden on others, in particular on later generations of tax-payers. With this consideration Ohsmann, Stolz, and Thiede (2004) justify the claim that the discount rate used for making present-value calculations should equal the rate of return of the PAYG system, viz. the growth rate of earnings, g. Their reasoning says that, as any Euro paid in period t as a contribution to a PAYG-financed social security scheme yields $(1 + g)$ Euros in additional retirement benefits in period $t + 1$ – holding everything else constant, the same should be true of an additional Euro paid or forgone due to postponing retirement by one period. Furthermore, they argue that the adjustment rate currently in place in Germany of 3.6 per cent per year comes close to this figure.

To assess the validity of this claim, we must make a distinction between two types of PAYG systems:

a) a pure PAYG system that never holds any fund balances (positive or negative) but adjusts the contribution rate instantaneously to keep total contributions and total payouts of retirement benefits in line at every moment in time,

b) a mixed system in which the pension administration were allowed to borrow and save on the capital market to smooth short-run fluctuations of the contribution rate.

In case b), additional contributions and forgone benefits of a person who postponed retirement by one period could be accumulated by the fund and used to pay out the additional claims accruing to that individual over the course of his retirement period. But then it is again the interest rate on the capital market, r, which is the appropriate rate of return. Clearly, it is questionable if such a system can be called PAYG and the procedure described

here requires that "additional" revenues due to changes in retirement age be distinguished from "ordinary" revenues. On the other hand, it can be argued that this case is relevant for the German situation in which almost 30 per cent of all pension outlays are financed by subsidies from the federal budget. Provided that fluctuations in net revenues do not lead to changes in the contribution rate but rather adjustments of the state subsidies and indirectly of government debt, the opportunity cost of paying one Euro in period t is in fact paying $(1 + r)$ Euro in period $t + 1$.

In contrast, in a *pure* PAYG system of type a), a shift of the retirement age of a particular individual i from period t to $t+1$, holding everything else constant, translates into a cut in the contribution rate in t but an increase in this rate in the s periods until the death of this individual. Thus it is impossible to leave all other participants in the system unaffected because it makes all contributors (workers) in period t better off and all workers in the periods up to $t + s$ worse off, so it affects participants differently according to their birth year.

Instead of the impossible target of sheltering everybody else from any consequences of individual i's behavior, a more modest target could be achieved, viz. keeping the contribution rate and the implicit taxes due to participating in the PAYG system from rising in a new steady state when *all* workers staring with a particular cohort increase their retirement age by one year. This question has been analyzed by Breyer and Kifmann (2002), and the answer is that the rate of return must not exceed the growth rate g to keep the long-run contribution rate and implicit tax rate constant. Of course, a number of cohorts in the transition period benefit from lower contribution and implicit tax rates.

3 Heterogeneous Workers: Concepts of Welfare Maximization

With inequality in initial endowments of productivity, health or life expectancy, efficiency is not the only objective in designing a pension system, and equity considerations come into play. The usual procedure chosen in the optimal taxation literature is to first propose an (Utilitarian) social welfare function and to derive a first-best allocation, and in a second step to make realistic assumptions on the observability of distinguishing characteristics and

derive a second-best solution and propose a system of incentives which are suitable to bring about the second-best allocation in the presence of these informational constraints.

3.1 Heterogeneity in Productivity and Health

Cremer, Lozachmeur, and Pestieau (2004) [1] consider a world in which workers differ in two unobservable characteristics, productivity and health, whereas life expectancy is still the same for everybody. Health status is here distinguished by the rate at which disutility from working increases over the life cycle, with faster growth indicating worse health. In a first-best solution, consumption is the same for all types, but sick people are allowed to retire earlier than healthy ones, and the differences in income are equalized using person-specific lump-sum transfers.

With asymmetric information, when productivity and health are positively correlated but unobservable and period income and retirement age are observable, the desired redistribution from the high-productivity and the healthy to the low-productivity and ill types can be accomplished by positive marginal taxes both on period income and on the length of the working life (ibid., p.2272). By taxing longer stays in the job (i.e. subsidizing early retirement), the ill type can be induced to retire earlier whereas the healthy type, who would lose more income from retiring early, can be discouraged from mimicking the ill type and thus, by using this additional incentive, the self-selection constraint can be relaxed, which means that the tax rate on period income can be lowered. Interestingly, the same result obtains if individuals differ in either productivity or health but not both.

According to this result, generous early retirement provisions can be interpreted as some kind of disability insurance in a world in which health and thus disability can not be (perfectly) monitored. The result is the more remarkable as it is not based on any differences in life expectancy in the population.

3.2 Heterogeneity in Life Expectancy

Another potential source of inequality is life expectancy. This is particularly relevant in the context of social security systems because total retirement

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[1]For a similar model see Sheshinski [2003].

benefits depend as much on per-period benefits as they do on the length of the retirement period, a fact that is often overlooked in the design of these systems.

This point is taken up by Bommier et al. (2005) who assume that length of life is certain but varies across individuals. The authors consider a benevolent social planner who maximizes a utilitarian welfare function which is concave in individual utilities, which can be justified either with inequality aversion or with risk aversion with respect to length of life. If length of life were public knowledge, (first-best) welfare maximization would entail that the long-lived retire later and consume less per period than the short-lived.

When length of life is private knowledge, a typical optimal taxation situation occurs in which the social planner can only achieve a second-best optimal allocation in which various pairs of consumption and retirement age are offered in such a way that the long-lived do not benefit from mimicking the short-lived. The screening instrument proposed by the authors is a (positive or negative) "retirement bonus" $B(z)$ which depends upon retirement age z and is added to an individual's gross earnings. The central result of the paper (ibid., p.14) states that when disutility from work is linear in the length of the working-life, then $B'(z) < 0$, i.e. the retirement bonus is falling in retirement age, which means that there is an implicit tax on working more years. The intuition behind the result is that the desired redistribution from the long-lived to the short-lived can be accomplished by taxing continued activity because the long lived have a stronger demand for retirement consumption and therefore more incentives to work longer.

4   Fairness when Income and Life Expectancy are correlated

The concepts of pure efficiency discussed in Section 2 are not appropriate in a world of heterogeneous individuals. On the other hand, the welfare criteria used in the approaches described in Section 3 are based on highly controversial normative foundations. First, individual utilities must be assumed to be measurable on a cardinal scale and interpersonally comparable. Secondly, a specific functional form of the social welfare function must be given. Finally, specific policy implications can only be derived if the functional form of the individual utility functions is given as well. Thus while these approaches are

useful in uncovering the relationship between certain widely held value judgments concerning equity and the general design of social security systems, more specific implications on the size of adjustment rates for early retirement can not be expected from these exercises.

Therefore, in the following we shall propose a more modest concept of "fairness" of social security systems, which is consistent with the usual concept of fairness as distributive neutrality and has the advantage of giving rise to specific propositions on the "fair" size of early retirement discounts.

4.1 The Concept of Distributive Neutrality

The principle of "Teilhabe-Äquivalenz" underlying the design of the German social security system is based on the general notion of distributive neutrality: within a cohort, the expected retirement benefits shall be proportional to total contributions paid over the working life. The specific way in which this principle is implemented, however, consists in making per period retirement benefits proportional to total contributions, disregarding the length of the benefit spell. This is innocuous as long as there is no systematic variation in life expectancy across social groups. However, it becomes highly questionable when life expectancy is positively correlated with income, education and other indicators of social status (Breyer [1997]), and there is ample evidence from many countries that this correlation indeed exists (for Germany, see, e.g., Reil-Held [2000], von Gaudecker and Scholz [2006]).

Given these observations, we postulate the following "fairness" criterion:

Definition: *"Distributive neutrality" is satisfied in a social security system if the ratio between total benefits and total contributions does not vary systematically with average annual earnings.*

This criterion is modest insofar as it does not advocate a specific equity norm, but only reformulates the principle of "Teilhabe-Äquivalenz" in such a way as to leave room for taking certain well-established empirical relationships into account.

4.2 Implications for Early-Retirement Discounts in the German Pension System: Theory

In applying the neutrality concept proposed above to the specific situation of the German pension system, the existence of certain regularities has to be taken as given. In particular, it is assumed that there is an exogenous (and monotonous) relationship linking life expectancy L to "ability" a, which is a proxy for socio-economic status. Furthermore, individuals possess private information on their life expectancy (see, Hurd and McGarry [1995]), which they take into account in their retirement decisions. Given the early retirement provisions of the pension system which prevail at the time of their retirement, Wolfe [1983] and Hurd, Smith, and Zissimopoulos [2002] find that the lower an individual's life expectancy, the more attractive is early retirement. This implies another monotonous relationship which links retirement age E to ability a. The "true" relationships $E(a)$ and $L(a)$ will be inferred from empirical estimates based on data from the German social security system (see Section 4.3, below) and the duration of the benefit spell, D, is defined as the difference between life expectancy and retirement age, $D(a) = L(a) - E(a)$.

Let E_0 be the age at which a worker becomes eligible to early retirement without taking any health related contingencies into account. After this date, potential future contributions and benefits are discounted with the real interest rate ρ. At age E_0, his accumulated lifetime income is denoted Y_0. According to the benefit formula valid in this system, annual benefits B are proportional to total (taxable) lifetime income, Y, and are subject to a discount rate x for every year of retiring earlier than at age 65. Therefore, if they are discounted to age E_0, they are given by

$$B \;=\; bY\left[1 - x(65 - E)\right] \int_E^L e^{-\rho(t - E_0)}\mathrm{d}t. \tag{1}$$

On the other hand, total contributions C are proportional to lifetime income and consist of two parts: those contributions which were paid before age E_0 and which are proportional to total income up to this age, Y_0, and the discounted value of future contributions up to the chosen retirement age E,

$$C = c \left[Y_0 + a \int_{E_0}^{E} e^{-\rho(t-E_0)} \mathrm{d}t \right], \tag{2}$$

where c denotes the contribution rate. We do not discount previous contributions for two reasons. First, this is consistent with German pension law, which treats all contributions equally, no matter when they were paid; and secondly we can not observe the time-path of contributions but only the sum so we could not implement discounting in our data set.

Hence the ratio of total benefits and total contributions, r, is determined by

$$
\begin{aligned}
r &= B/C \\
&= \frac{bY \left[1 - x(65 - E) \right] e^{-\rho[E-E_0+L]} \left(e^{\rho E} - e^{\rho L} \right)}{c \left[a \left(e^{-\rho(E-E_0)} - 1 \right) - \rho Y_0 \right]}.
\end{aligned} \tag{3}
$$

Now, if we know the functions $E(a)$, $L(a)$, $Y(a)$, and $Y_0(a)$, we can write the benefit-contribution ratio r as a function of ability a, given the discount rate x. Distributive neutrality is then satisfied if there is no systematic (monotonous) relationship between the benefit-contribution ratio r and ability a, while the system is redistributive in a regressive (progressive) way if r is an increasing (decreasing) function of a.

4.3   Empirical Estimation

The variables used in this analysis are taken from a data set on pension discontinuations from 1993 to 2003, FDZ-RV (2005), published by the Federation of German Pension Insurance Institutes (VDR, now: Deutsche Rentenversicherung Bund). It contains a 10% sample of all discontinued public pensions due to the death of the beneficiary, which amounts to roughly one million observations. However, each observation corresponds to a pension, and not to an individual retiree, who can (subsequently or even simultaneously) benefit from more than one pension. Taking this into account, we are left with a sample of 98,399 pensioners whose benefits are based on own contributions. The most important variables are the sum of pension benefit claims (in points), the length of the work life, the retirement age, and the

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age at death. From the first two variables we construct the average claims earned per year of work. One point corresponds to contributions based on one year of the average annual income. Other variables which are contained in the data set have to be taken with care – they are only reliable when they have been used for the calculation of benefits, otherwise they are either unreliable or missing. See table 1 for descriptive statistics of the variables used.

Weighting Function   Our sample suffers from a selection bias. Since we observe a death cohort (though a rather large one), life expectancies are biased downwards. In each death cohort, a large variety of birth cohorts are included, and we know that life expectancy has been increasing with the year of birth. However, this increase is only partially taken into account in the sample, as especially individuals from younger birth cohorts (whose ex ante life expectancy should be higher) only appear in the sample if they died relatively young. Ideally, we would like to observe a birth cohort of which all individuals have already died; obviously, this is only possible for very old birth cohorts (born around 1900) in order to get unbiased estimates. However, as life expectancy has been increasing over time, these very early birth cohorts may not be representative for more recent cohorts and therefore not suitable for drawing policy conclusions.

Our approach to correcting this selection bias is relatively simple. The selection that occurs is not based on individual decision making – it is solely a matter of data selection. Among the later birth cohorts, deaths at young age are over-represented. The relationship is empirically linear (which corresponds to the usually perceived increase of life expectancies), so a linear weighting function, which decreases with the birth year, potentially corrects this bias. However, ex ante we cannot be sure about the slope of weighting function; we only know that it has to be linear and non-negative over the whole support. The parameter of choice is therefore only the slope, while the intercept serves as a normalizing constant that limits the range of the potential slopes in order to ensure the non-negativity constraint. If GBJ denotes the year of birth (normalized to zero for the earliest birth cohort), the weighting function w takes the following form, with s being the slope parameter:

$$w(GBJ) \quad = \quad 1 - s \cdot GBJ \tag{4}$$

With the intercept set to one, s can vary between zero (hence, a weight of one for all birth cohorts) and 0.0128, which just ensures that the weight for the latest birth cohort is still positive. The selection criterion for our choice of the slope parameter remains to be determined. We select the weighting function which minimizes the difference between the weighted average life expectancy in our data and the exogenously known life expectancy. Yet, the maximum average age at death obtained with this method (i.e. the one which results from the steepest weighting function) is still lower than the value of life expectancy observed in population statistics.[2]

Descriptive Statistics

	all obs.		restr.		restr., weights	
	mean	st. dev.	mean	st. dev.	mean	st. dev.
retirement age E	58.47	7.37	58.04	5.54	58.48	5.56
age at death L	65.85	7.84	65.32	6.31	66.16	6.14
total points Y	31.14	17.42	42.71	13.00	42.69	13.21
— till $E_0 = 60$, Y_0	36.19	22.34	47.59	15.20	44.82	14.82
points per year a	1.06	0.42	1.12	0.30	1.11	0.31
sex = female	32.63%	—	0%	—	0%	—

Based on FDZ-RV (2005). With all observations, $n = 98,399$ Restricted to male observations with at least 25 years of contributions, $n = 51,075$.

Table 1: Descriptive Statistics

Estimation   In principle, more than one definition of retirement and therefore of the benefit spell can be distinguished. Our variable retirement age E is the age of the first receipt of any pension based on own contributions, which can be the old-age pension, but also disability pensions. This notion is in line with our theoretical approach because it takes all paths into

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[2]Notice however that the concept of life expectancy in a given year always refers to age-specific death rates of this year and not to the average age at death of the death cohort of this very year.

retirement including disability pensions into account. Insofar as claiming disability benefits carries some information on the innate ability (including the health capital) of the individual, this is certainly the superior concept compared to the alternative of taking the first receipt of an old-age pension as the age of retirement.

Furthermore, the following procedures were performed with the data. First, observations on women were excluded. Since ability (or the earnings capacity) cannot be observed directly, it has to be ensured that the average benefit claims are a good proxy. In the simplest case, namely when an individual has worked during his whole career and contributed to the public pension system, benefit claims are a linear transformation of income.[3] This even holds if the individual under observations had longer times of education before starting to work or if he or she raised children. The measure is then only slightly diluted, as claims are increased by these activities in order to compensate for the loss of regular contributions. The close relationship between total income and benefit claims, however, is not guaranteed once the individual has been self-employed or has worked as a civil servant for some time in his career. During these times, usually no contributions are paid, as membership in the public pension system is not mandatory (or even possible) anymore. We therefore restrict our sample to those pensioners who worked at least 25 years in a job where contributions are mandatory. This sample contains 51,075 observations. Our results differ compared to the ones using the whole sample, but are robust with respect to the exact choice of the number of years required.

In this data set we do not observe the value of Y_0, which we can construct by

$$Y_0 \quad = \quad Y - a(E - E_0). \tag{5}$$

To estimate the relationships $E(a)$, $L(a)$, $Y(a)$, and $Y_0(a)$, we assume quadratic functional forms for the first two in order to account for potential non-linearities. The income variables Y and Y_0 are by definition linear in average annual earnings a.

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[3]Up to a certain income, beyond which contributions (and therefore claims) are capped. The maximum contributions are based (in 2006) on a monthly gross income of EUR 5250 and are adjusted on a yearly basis.

$$E = \epsilon_0 + \epsilon_1 a + \epsilon_2 a^2 + \mu_1 \qquad (6)$$

$$L = \lambda_0 + \lambda_1 a + \lambda_2 a^2 + \mu_2 \qquad (7)$$

$$Y = \kappa_0 + \kappa_1 a + \mu_3 \qquad (8)$$

$$Y_0 = \gamma_0 + \gamma_1 a + \mu_4. \qquad (9)$$

The regression results are given in table 2. In the baseline regressions, we do not include further control variables, as the question of causality of a for E and L is irrelevant for our argument of distributional neutrality.[4] Though all a and a^2 coefficients are significant at least on the .99 significance level, the predictive power of a for retirement age and of life expectancy is comparably low. The respective R^2 does not exceed .0071, in one regression it is even as low as .024.

Estimation Results

Dep. Var.	const.	a	a^2	R^2
E	65.85	−9.21	2.16	0.071
	(0.20)	(0.37)	(0.18)	
L	72.29	−9.33	3.20	0.026
	(0.26)	(0.50)	(0.26)	
Y	1.89	36.66	—	0.730
	(0.13)	(0.13)		
Y_0	−1.93	42.02	—	0.762
	(0.19)	(0.18)		

Data set includes only male observations with at least 25 years of own contributions. All a and a^2 coefficients are significant at least on the .99 level (robust standard errors in parenthesis).

Table 2: Estimation Results

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[4]In a sensitivity analysis we augmented the regressions with two control variables, namely the number of months the person had spent in unemployment during his career and the number of months he spent in ill-health – as far as the spell of ill-health was relevant for the calculation of benefit claims. This yields only marginally different results, with figures not different in shape, but only hardly shifted downwards. However, significance of the coefficients of the controls does not fall below the .95 level. Including a time trend to capture the effect of the sequential introduction of discounts for early retirement in the retirement age regression has only a minor impact on the results.

We restrict a to lie in the interval $(0, 3)$. The boundedness of a results from the inspection of our data, meaning that the highest income per year is restricted to be not greater than three times the average. We cannot unambiguously distinguish between claims earned because of own work or because of times of education, parenting, and other (minor) reasons. The maximum of a (especially in the cases without restrictions on the minimum number of years of contribution) is therefore higher than what could have been achieved by contributions based on work only, in which case we had $a^{\max} = 2.15$.

4.4 Results and Interpretation

Using the regression results described in table 2, we can first calculate the return function $r(a)$ based on the presently valid discount rate $x = .036$, which is depicted in figure 2. We observe that for all values of a larger than about 0.7, the return ratio is an increasing function of our ability variable, which confirms the conjecture that the present pension regulations systematically redistribute income from the less able to the more able individuals, mainly due to differences in life expectancy.
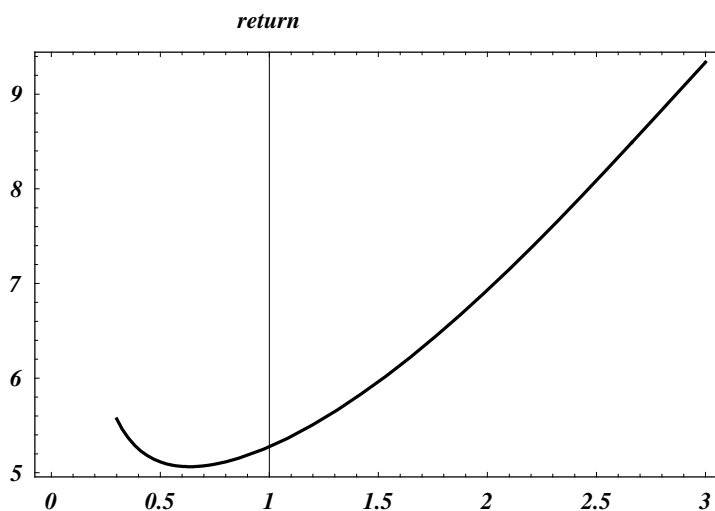
Axes drawn at $a = 1$ and $rc/b(1)$, $\rho = 0.03$

Figure 2: Ratio of Benefits and Contributions

Figure 3 shows simulated returns for different discount rates, varying

from 0 to 10 per cent per year, given our functional form. We observe that these functions are still increasing over a wide range of values of a and the slope is the larger the smaller the early-retirement discount rate. This counter intuitive result – to achieve at least approximate distributive neutrality, the early-retirement discounts have to be raised – is certainly a consequence of the decreasing $E(a)$ function, i.e. of the fact that – at least in our data – men with high annual income not only lived longer but they also retired earlier than men with lower income.
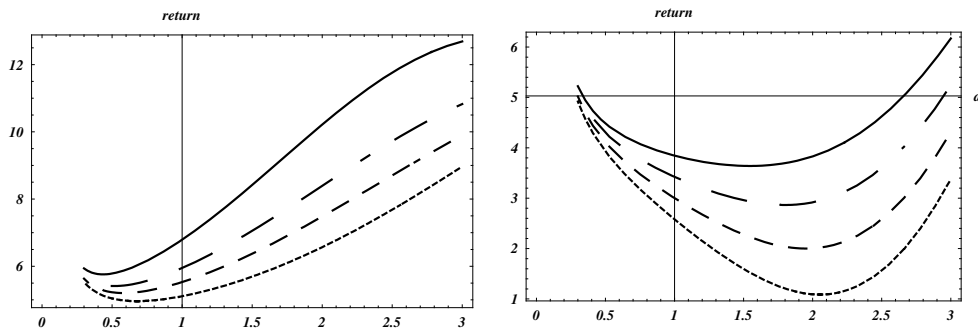
Left from top to bottom: $x = 0$, $x = 0.02$, $x = 0.03$, and $x = 0.05$. Right from top to bottom: $x = 0.07$, $x = 0.08$, $x = 0.09$, and $x = 0.10$.

Figure 3: Ratio of Benefits and Contributions

4.5 Direct Estimation of the Ratio-Ability-Relationship

A further possibility to estimate the relationship between the ratio of benefits to contributions and ability is to construct the variable r as defined in equation (3) and explain the ratio r by ability a directly:

$$r = \rho_0 + \rho_1 a + \rho_2 a^2 + \mu \tag{10}$$

See figure 4 for a variety of results, given discounts ranging from $x = 0.00$ to $x = 0.10$, the values also used in figure 3. Similar to the estimation procedure proposed above, the slope of the fitted function $r(a)$ is smaller the higher the early retirement discount is. However, the functional form of the fitted r function looks somewhat different when the direct estimation is used—namely either monotonously increasing or decreasing—whereas when r is constructed using the basic relationships $L(a)$, $E(a)$, $Y(a)$, and $Y_0(a)$,

the function r includes higher polynomials of a, and therefore has a non-monotone shape.
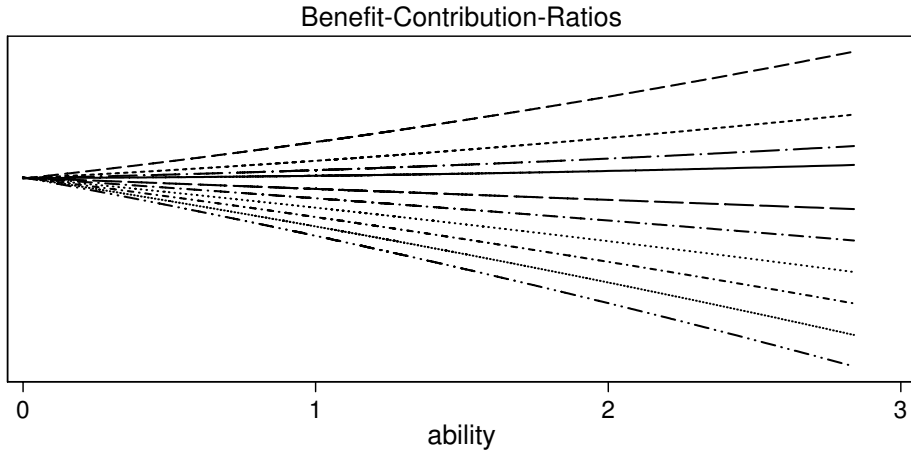
Benefit-Contribution-Ratios

Figure 4: Direct Estimation of the Benefit-Contribution-Ratio as a Function of Ability

4.6 Achieving Distributional Neutrality

If we want to apply our criterion of distributional neutrality to the different $r(a|x)$ functions, given that x is a constant, the return functions have to be linearized. We then compare the linear return functions $r_{\text{lin}}(a|x)$ with respect to their slope parameter and choose the discounts x that minimize the absolute value of this slope. As the method of linearization we choose least squares, because it inherently takes the distribution of ability a into account. By this method, we fit straight lines to the return functions based on 1000 different discount rates on the interval $(0, 0.10)$. The discount rate that minimizes the slope of r_{lin} turns out to be 0.0591. See figure 5, where the relationship between discounts x and the slope parameter is depicted in the left panel. In the right panel, the (unrestricted) return function $r(a|x = 0.0591)$ is compared to the resulting linearized form. The search for the neutralizing discounts as well as figure 5 are based on ability a to lie between 0.3 and 2.15, which is the theoretical maximum of benefit claims earned per one year of work.

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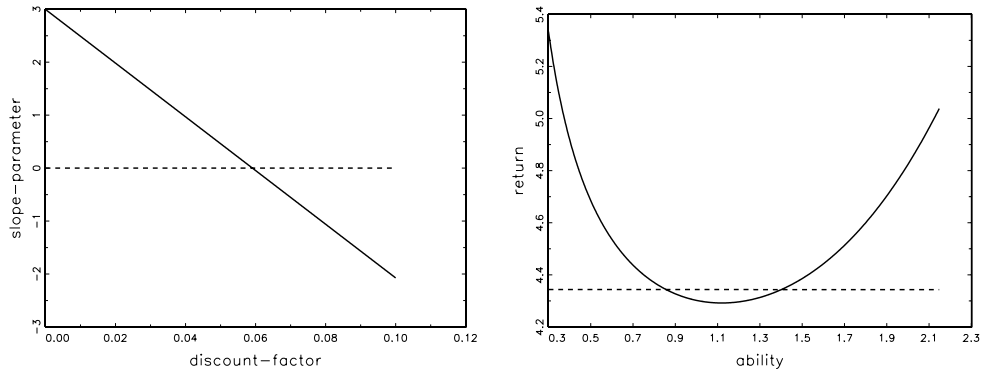
Left: Slope-Parameter, given the Discount Rate x, Right: Benefit-Contribution Ratio and
Linearized Form, given $x = 0.0591$.

Figure 5: Linearization

Hence, we find that the current discounts of $x = 0.036$ are too low to achieve distributional neutrality. The main reason for this result is the negative relationship between ability and retirement age. However, this might be a consequence of the data set we use. The individuals under observation died between 1993 and 2003. With an average benefit duration of approximately 8 years, many retired between 1985 and 1995, a period in which the federal government allowed the rather excessive use of early retirement schemes. Additionally, these early retirement schemes were offered mainly by large companies, which are known to pay higher wages for the same level of qualification. So our measure a does not only capture ability, but also differences in firm size, economic sector etc., and along these dimensions possibilities to retire early differed for (otherwise equal) individual workers. We therefore propose to see our results as an exemplary application of a method to achieve distributional neutrality within the public pension system, whereas actual policy advice should be based on more recent data, which allows to infer on the behavior of future retirees.

A further refinement of our results would need a theoretical model that explains retirement behavior not only depending on ability, but also on discounts for early retirement x. Until now, our estimated functions $E(a)$ are based on the discounts which were in place at that time. Although we principally observe a policy change (namely, the introduction of flexible retirement along with the phasing-in of actuarial discounts in 1992), this legislation did not introduce actuarial discounts alone. The reaction on a variation in x is

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therefore hard to disentangle from simultaneous amendments of the German social security code.

5 Concluding Remarks

In this paper we discussed several notions of "fairness" of early retirement provisions in pay-as-you-go financed public pension systems. We advanced the thesis that the "right" notion of fairness depends upon the objectives pursued in the design of pension systems, which can range from the pure efficiency goal of achieving a "distortion-free" retirement decision to the very ambitious equity goal implicit in maximizing a social welfare function in the tradition of optimal taxation theory. We pointed out the problems attached to both of these "extreme" positions and proposed a more modest concept of equity, called "distributive neutrality", which is based on the notion that the rate of return on total contributions to the pension system should not depend systematically on the individual's ability.

By applying this concept to the German retirement benefit formula and taking empirically estimated relationships between average annual income (as a proxy for ability), life expectancy and retirement age into account, we were able to calculate the relationship between average annual income and the benefit-contribution ratio which is increasing over a wide range of parameter values. Thus distributive neutrality is presently violated but instead there is systematic redistribution in favor of high-ability persons. As this group is not only enjoying higher life expectancy but – at least according to our data – also retires earlier, lowering early-retirement discounts, as e. g. proposed by Sheshinski (2003), would in this case exacerbate this redistribution.

It should be emphasized that our empirical approach is based on the unrealistic assumption that the choice of retirement age is not already affected by the existing early-retirement discounts. If this were indeed the case, as could be expected, we would have to replace the $E(a)$ function by a relationship of the form $E(a; x)$. The present data set does not allow to estimate such a function as the discounts were phased-in gradually and thus a corresponding variable would be perfectly correlated with a time trend. Moreover, different groups of persons were subject to different values of x, but we did not have this information.

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Finally, an alternative (and equivalent) approach to achieving distributive neutrality would consist in estimating only the $L(a)$ function which maps annual income into life expectancy and then inferring the expected length of the benefit spell by subtracting the retirement age chosen by the individual from his or her estimated life expectancy. Annual retirement benefits can then be calculated so that total discounted expected retirement benefits are a given (and equal) percentage of total lifetime contributions. The resulting benefit formula would be a variant of the "notional defined contribution" system, adjusted for income-group specific differences of life expectancy. Deriving the respective benefit formula will be the topic of future research.

References

BERKEL, B., AND A. BÖRSCH-SUPAN (2004): "Pension Reform in Germany: The Impact on Retirement Decisions," *FinanzArchiv*, 60(3), 393–421.

BOMMIER, A., M.-L-LEROUX, AND J.-M-LOZACHMEUR (2005): "Varying Life Expectancy and Social Security," *mimeo, Journal of Public Economics, forthcoming*.

BREYER, F. (1997): "Sind äquivalente Renten fair?," in *Reform des Sozialstaats I*, ed. by R. Hauser, pp. 169–180. Berlin.

BREYER, F., AND M. KIFMANN (2002): "Incentives to retire later – a solution to the social security crisis?," *Journal of Pension Economics and Finance*, 1(2), 111–130.

———— (2004): "The German Retirement Benefit Formula: Drawbacks and Alternatives," *FinanzArchiv*, 60, 63–82.

BÖRSCH-SUPAN, A. (2000): "A Model under Siege: A Case Study of the German Retirement Insurance System," *Economic Journal*, 110, F24–45.

———— (2004): "Faire Abschläge in der gesetzlichen Rentenversicherung," *Sozialer Fortschritt*, 53, 258–261.

CREMER, H., J.-M. LOZACHMEUR, AND P. PESTIEAU (2004): "Social Security, Retirement Age and Optimal Income Taxation," *Journal of Human Resources*, 88, 2259–2281.

DEUTSCHE RENTENVERSICHERUNG BUND (2005): "Rentenversicherung in Zeitreihen," *DRV Schriften*, 22.

FDZ-RV (2005): "Scientific Use File Demografiedatensatz Rentenwegfall 1993-2003, SUFRTWFXXDemo," Data set from Deutsche Rentenversicherung Bund.

HERBERTSON, AND ORSZAG (2001): "The Costs of Early Retirement in the OECD," *Working Paper, Institute of Economic Studies, University of Iceland*, W01:02.

HURD, M., AND K. McGARRY (1995): "Evaluation of the Subjective Probabilities of Survival in the Health and Retirement Study," *Journal of Human Resources*, 30, S268–S292.

HURD, M., J. SMITH, AND J. ZISSIMOPOULOS (2002): "The Effects of Subjective Survival on Retirement and Social Security Claiming," *NBER Working Paper*, 9140.

OHSMANN, S., U. STOLZ, AND R. THIEDE (2004): "Rentenabschläge bei vorzeitigem Rentenbeginn: Was ist versicherungsmathematisch fair?," *Sozialer Fortschritt*, 53, 267–271.

QUEISSER, M., AND E. WHITEHOUSE (2006): "Neutral or Fair? Actuarial Concepts and Pension-System Design," *OECD Social, Employment and Migration Working Papers*, 40.

REIL-HELD, A. (2000): "Einkommen und Lebenserwartung in Deutschland: Leben Reiche länger?," *Discussion Paper, University of Mannheim*, SFB 504.

SCHILS, T. (2005): *Early Retirement Patterns in Europe: A comparative Panel Study*. Dutch University Press, Amsterdam.

SHESHINSKI, E. (2003): "Optimum Delayed Retirement Credit," *CESifo Working Paper no. 889, March*.

VON GAUDECKER, H.-M., AND R. D. SCHOLZ (2006): "Lifetime Earnings and Life Expectancy," *MEA Discussion Paper*, 102-06.

WOLFE, J. (1983): "Perceived Longevity and Early Retirement," *Review of Economics and Statistics*, 65, 544–551.

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