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Vierteljahrshefte zur Wirtschaftsforschung

Provided in Cooperation with:

German Institute for Economic Research (DIW Berlin)

Suggested Citation: Börsch-Supan, Axel H.; Schmidt, Peter (1994) : The impact of the public pension system on retirement behavior in unified Germany, Vierteljahrshefte zur Wirtschaftsforschung, ISSN 0340-1707, Duncker & Humblot, Berlin, Vol. 63, Iss. 1/2, pp. 90-96

This Version is available at:

<https://hdl.handle.net/10419/141055>

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The Impact of the Public Pension System on Retirement Behavior in Unified Germany

by Axel H. Börsch-Supan and Peter Schmidt¹

The average German worker leaves the workforce at about age 59.5, even though the official retirement program starts at age 63. Earlier retirement is possible because of a generous interpretation of the rule that workers may retire either for health reasons or an inability to find a job that matches their qualifications (*berufsunfähig*).

Early retirement exaggerates the instability problem in the German pay-as-you-go retirement system caused by population aging. Contribution rates (payroll taxes out of gross labour income) are projected to be between 32 and 42 percent when the dependency ratio of beneficiaries to workers peaks in 2035. Since this high tax rate is as politically intolerable as a dramatic reduction of pension benefits, the most appropriate policy response is to reverse the trend toward early retirement.

Rather than imposing one or another rigid retirement age, we argue that changing to a more actuarially fair system will induce workers to retire at later ages. We argue that the peaks in retirement at specific ages observed in East and West Germany are artifacts of the actuarially unfair design of the retirement system.

A Brief Description of the German Pension System

Germany has a mandatory pay-as-you-go public pension system. Only the self-employed (8.9 percent of the labour force in 1988) and workers with very small incomes (5.6 percent) are not subject to mandatory coverage.

The public pension system in Germany is designed to maintain workers' same standard of living in retirement. This is a much more ambitious goal than that of partial income replacement in the United States and many other Western industrialized countries. The public pension system provides benefits that are roughly proportional to labour income averaged over the life course and is much less redistributive than is, for example, the United States' public retirement program. This is why the German pension system is termed "retirement insurance" rather than "social security" as in the United States.

The public pension system is the major source of income for Germans after retirement. Although some firms provide pensions, their overall impact is small. For 84 percent of the elderly in West Germany between 1984 and 1988, public retirement insurance was their only source of income. Only 16 percent received private pension income, mainly annuities from a life insurance bought by the household or by the firm on the household's behalf. Of those 16 percent, 8.5 percent had both social security and firm pension income while 7.6 percent had only private pension income². The average contribution of private pension income to total retirement income is small — about 3 percent for German elderly.

We can therefore essentially disregard the effect of private pensions and attribute all incentive effects on retirement behavior to the public pension system. This considerably facilitates the analysis of retirement behavior in Germany.

The public pension system contains strong incentives to retire. The system provides generous retirement income. The average net replacement ratio — after-tax retirement income as a percentage of the preceding after-tax labour income — is greater than 70 percent, about 33 percent higher than social security income in the United States. The high German replacement ratio gives an incentive for Germans to retire early, *ceteris paribus*. In addition, the German public pension system is not actuarially fair. The system provides only a very small increase in retirement income if workers postpone retirement. This creates a strong incentive to retire early. Prior to 1972, retirement age was 65. The Social Security Reform of 1972 introduced early retirement options.

There are now three alternative retirement options. Early retirement at age 60 is possible for women and for those male workers who cannot be appropriately employed for health or other reasons (*berufsunfähig*). The latter rule has been interpreted very broadly and used as a device to keep unemployment rates down. It is applied when no vacancies for a worker's specific job skills are available. Normal early retirement at age 63 is possible for all workers with 35 years of service³. Finally, normal retirement continues to be available to all workers at age 65. In theory, there is no upper limit on retirement. But about a quarter of the German labour force, mainly in the public sector, is still subject to a mandatory retirement age. This mainly includes the public sector. In effect, however, labour force participation is very low after age 70. The 1972 Social Security Reform introduced adjustments to the level of retirement benefits as a function of retirement age. They have been changed slightly in the recent 1992 Social Security Reform (see Börsch-Supan 1992).

While neither the German nor the American system is actuarially fair⁴, the public retirement system in Germany is particularly distortive. Early retirement is possible at age 62 in the American system. Benefits are approximately actuarially fair if taken between 62 and 65. And there is only a small actuarial penalty for those who retire later than age

¹ Funding for this paper came from by the National Institute on Aging, grant no. 3 PO1 AG05842-01.

² Data from the German Socio-Economic Panel.

³ This includes time spent at military service, education, about one year for childbearing, etc.

⁴ Actuarially fair in the sense that the adjustments would not provide an incentive to retire at any specific age given that the worker has worked until the earliest age of retirement period. See Börsch-Supan (1992) for their computation.

65. In contrast, the German system tilts the retirement decision heavily toward the earliest applicable retirement age⁵. The 1992 reform has diminished but not abolished this incentive effect.

An Option Value — Gompertz Hazard Rate Model of Retirement

In this section we explain the economic incentives to retire provided by the German pension system using an option value model (Lazear and Moore 1988, Stock and Wise 1990). The option value captures for each retirement age the trade-off between retiring now (resulting in a stream of retirement benefits that depends on this retirement age) or later (with associated streams of first labour, then retirement incomes for all possible later retirement ages).

The option value for a specific age is defined as the difference between the maximum attainable consumption utility if the worker postpones retirement to some later year minus the utility of consumption that the worker can afford if she or he retires now. If $R^*(t)$ denotes the optimal retirement age if the worker postpones retirement past age t , the option value is therefore

$$OPTV(t) = V_t(R^*(t)) - V_t(t) \quad (1)$$

where $V_t(R)$ denotes the expected discounted future utility at age t if the worker retires at age R . Since a worker is likely to retire as soon as the utility of the option to postpone retirement becomes smaller than the utility of retiring now, retirement probabilities should depend negatively on the option value.

The expected utility arises from income financing consumption and leisure before and after retirement:

$$V_t(R) = E_t \left[\sum_{s=t}^{R-1} u(Y^L_s) \cdot a_s \cdot \delta^{s-t} + \alpha \cdot \sum_{s=R}^{\infty} u(Y^R_s(R, Y^L)) \cdot a_s \cdot \delta^{s-t} \right] \quad (2)$$

where Y^L = Labour income at age $s = t, \dots, R-1$,
 $Y^R_s(R, Y^L)$ = Retirement income at age $s \geq R$,
 R = Retirement age, α = Marginal utility of leisure, a_t = Probability to survive at least until age t , δ = Discount factor, and E_t = Expectation at age t .

Because attainable consumption depends on the ratio of labour income to retirement income as well as on the adjustment of pensions to retirement age and an age-specific labour income, the option value captures the economic incentives created by the pension system and the labour market.

To capture the utility from leisure after retirement, utility during retirement is weighted by $\alpha > 1$, where $1/\alpha$ may be interpreted as the marginal disutility of work. We ignore saving in old age by specifying utility from consumption directly as an iso-elastic function of current income, $u(Y) = Y^\sigma$. Retirement income Y^R depends on the retirement date R (according to the adjustment factors displayed in Table 1) and on previous labour income Y^L (according to the applicable replacement ratio). It is also necessary to impute

labour income for the hypothetical case when a person works longer than he actually did. This imputed labour income is characterized by a cubic age-profile estimated by a semi-logarithmic regression of labour income on human capital and age⁶. The cohort-corrected age-income profiles we develop do not substantially fall in old age in contrast to the potentially misguided age-income profiles estimated from cross-sectional data.

An option value is computed for every person, using the applicable pension regulations and the personalized labour income profiles. Private pension income is ignored because it represents only a very small proportion of retirement income.

We describe the probability to retire using a parametric hazard rate model. Since few Germans return to work following retirement, we use a one-spell analysis. In order to accommodate increasing or decreasing hazard rates, we employ a Gompertz hazard with the following survival probability:

$$Prob(\text{not yet retired at age } t) = \exp[\exp(X\beta)/\gamma \cdot (1 - \exp(-\gamma t))] \quad (3)$$

The explanatory variables X are weighted by the parameter vector β and include the option value and other socio-demographic variables influencing the retirement decision.

Our model is computationally simpler than the Stock and Wise (1990) model and hence is a cruder approximation of the underlying dynamic programming structure (see Lumsdaine, Stock and Wise 1992). Since we are mainly interested in obtaining precise results for the distribution of retirement ages rather than in reproducing the kink points in the observed retirement distribution, we believe our simpler model is appropriate. Rather than estimating the parameters in the option value (α, δ, σ) simultaneously with β and γ , we use the parameters in Börsch Supan (1992) and estimate the base hazard rate γ and the parameters β with help of the PARAT package (Schneider 1991).

Data and Estimation Results

Estimation results are based on seven waves of the Western sample of the German Socio Economic Panel, 1984 to 1990, and three waves of the Eastern sample, 1990 to 1992. This yields six possible transition dates in the West and only two in the East. Nevertheless, we observe 510 transitions in the East (for 1903 workers) and 608 transitions in the West (for 5350 workers), reflecting the rather dramatic decline in labour force participation in the East, particularly among women. This rapid decline in labour force participation dominates the retirement behavior in the East, as we will see below.

⁵ Curiously, the German system before 1992 provided a large increase in retirement benefits for work at ages 66 and 67. However, it was ineffective because the inducements to early retirement by far offset this incentive.

⁶ Estimates can be obtained from the authors.

The definition of the dependent variable 'retired' is problematic, although less so in Germany than in other countries. Retirement definitions commonly employed in the literature include self-reported retirement status, a drop in work hours, or the receipt of retirement benefits, etc. We use the last concept, as opposed to Boersch-Supan (1992), who defines retirement as working less than 15 hours per week. Since Germany has very little part-time work and the transition from work to retirement occurs quickly, there are fewer contradictions among different retirement concepts than in the United States.

Table 1
Definition of Independent Variables

Mnemonic	Description
WEIBL	1 = female, 0 = else
GEBJAHR	year of birth
V__EHE	1 = married, 0 = else
ASCHULE	1 = more than <i>Hauptschule</i> , 0 = else
ABERBILD	1 = more than vocational training, 0 = else
V__BEHIND	degree of disability [0-100%]
V__TEILER	1 = full time employed, 0 = else
V__VOLLER	1 = part time employed, 0 = else
V__VORALO	1 = unemployed, 0 = else
V__LAND__F	1 = agricultural and forestry sector
V__BERGEN	1 = mining and energy sector
V__INDUST	1 = manufacturing sector
V__HANDEL	1 = trade sector
V__OEF__DS	1 = public service (as <i>Angestellter</i>)
V__BEAMT	1 = civil servant (<i>Beamter</i>)
V__DSTLST	1 = services, unless otherwise specified
V__BANK__V	1 = banking and insurances
V__BILDUN	1 = educational sector
V__GESUND	1 = health sector
V__SOZIAL	1 = social sector
V__JOBS__A	1 = job quality low (<i>angelernt</i>)
V__JOBS__G	1 = job quality medium (<i>gehoben</i>)
V__JOBS__S	1 = job quality high (<i>höher</i>)
V__EIGENT	1 = owns home
V__LV	1 = has life insurance
V__WERTPA	1 = owns bonds or stocks
Note: Variables beginning with V__ are for the period before an event.	
Source: 1984-90, SOEP (West).	

The independent variables are listed in Table 1. The demographic variables include gender, marital status, and year of birth. Human capital is described by two dummy variables reflecting education and vocational training. We use the degree of legal disability as a rough measure for health.

The next group of variables in Table 1 describes the employment status in the period preceding retirement or in the last period before censoring. The reference category is "only temporarily in the labour force." We also include a set of dichotomous variables for the industry in which the most recent job took place. A further group of variables describes the social status of the job and is closely related to the human capital variables above. The reference category is very low quality job (*ungelernt*). Finally, we describe the economic position of the sample person by a set of indicator variables for housing and financial wealth⁷. In addition to the independent variables listed in Table 1, we of course include the option value as an explanatory variable.

Estimation results are presented in Table 2. The first estimation excludes the option value and serves as a reference point. A positive coefficient indicates a higher transition to retirement, and a negative sign denotes a longer duration in the current state, mostly employment, sometimes unemployment.

The model fits the data well: the pseudo-R², i.e., one minus the ratio of the likelihood at the estimated parameters over the likelihood at zero, is 0.54. The baseline retirement hazard rate, as indicated by γ , is strongly positive. Since it is well known that the retirement hazard rate increases quickly with age, this was expected.

The option value coefficient is highly significant, as is the difference between the two estimations. The sign is, as expected, negative, indicating a longer duration of employment when the option value to postpone retirement is large. Retirement behavior is therefore well described by the option value, the main economic incentive for retirement. We will illustrate the magnitude of the coefficient further below.

Contrary to expectations, wealth variables are not significant. These weak results may be due to the poor measurement of wealth. Poor health increases early retirement. Female heads of household retire earlier, while marital status has no influence. There is a strong cohort effect toward earlier retirement which should be interpreted as a serious warning with respect to the future viability of the German public pension system. Higher education is related to earlier retirement, as is higher job quality. The sectoral indicators vary in sign, with civil servants retiring relatively early, and workers in the agricultural, education and medical sector relatively late.

⁷ Like health, these variables describe wealth poorly — a weakness of the GSOEP.

Table 2

**Gompertz Hazard Rate Model of Retirement Age:
West Germany**
Dependent variable: Transition to Retirement

	(1)		(2)	
WEIBL	0.1893	(1.81)	0.1374	(1.31)
GEBJAHR	0.3691	(22.72)	0.3876	(23.25)
V_EHE	0.0280	(0.27)	0.0679	(0.67)
ASCHULE	-0.3855	(-3.04)	-0.2725	(-2.12)
ABERBILD	0.1765	(1.76)	0.1735	(1.73)
V_BEHIND	0.0074	(4.52)	0.0072	(4.37)
V_LAND_F	-0.6161	(-2.02)	-0.6010	(-1.99)
V_BERGEN	-0.1164	(-0.29)	-0.0594	(-0.15)
V_INDUST	-0.1833	(-1.64)	-0.1528	(-1.36)
V_HANDEL	-0.3282	(-1.84)	-0.3763	(-2.11)
V_OEF_DS	-0.2863	(-1.70)	-0.2790	(-1.66)
V_BEAMT	0.4048	(1.98)	0.4785	(2.34)
V_DSTLST	-0.5434	(-2.74)	-0.5614	(-2.83)
V_BANK_V	-0.0354	(-0.12)	-0.0351	(-0.12)
V_BILDUN	-0.6445	(-2.75)	-0.6217	(-2.65)
V_GESUND	-0.7312	(-2.70)	-0.6468	(-2.39)
V_SOZIAL	-0.3333	(-1.26)	-0.3118	(-1.18)
V_TEILER	0.3392	(1.91)	0.1988	(1.11)
V_VOLLER	0.5078	(3.07)	0.6395	(3.85)
V_VORALO	1.9613	(11.47)	1.8783	(10.91)
V_JOBS_A	-0.3520	(-3.35)	-0.2878	(-2.74)
V_JOBS_G	-0.2511	(-1.52)	-0.0134	(-0.07)
V_JOBS_S	-1.0381	(-5.61)	-1.1158	(-6.01)
V_EIGENT	-0.0480	(-0.49)	-0.0191	(-0.19)
V_LV	0.0676	(0.75)	0.0931	(1.03)
V_WERTPA	-0.0423	(-0.35)	-0.0060	(-0.04)
OVNORM	—		-0.0054	(-4.72)
Constant	-42.8713	(-30.56)	-42.5590	(-30.45)
(baseline hazard)	-0.0054	(30.61)	0.5050	(30.22)
loglik (at zero)	-2088.1	(-3871)	-2076.3	(-3871)
α (1/marginal disutility of work)			1.196	(1.43)
δ (discount factor)			0.862	(1.63)
σ (elasticity of income in utility)			1.011	(1.82)

Note: t-statistics in parentheses.
Source: 1984-90 SOEP (West), 2369 spells, 608 events.

Changing the Retirement Age

We now use our retirement model to simulate retirement ages under alternative retirement-age-dependent adjustment formulae. For each sample person, we change the option value from its actual value to the value that results from inserting alternative adjustment factors in the retirement income Y^R of equation 2.

Table 3 summarizes the results of our simulation. The first row gives the baseline retirement age under the old German public pension system as observed in 1984. The second row predicts the effects of the 1992 German Social Security Reform. This reform will remove some but by no means all of the distortions toward early retirement when it is finally fully implemented in 2002. It will increase the average retirement age by about half a year. The microsimulation also reveals that retirement before age 60 is reduced from 32 percent to 28 percent.

The lower panel of Table 3 compares the German system before and after reform with a system that is not distortionary with respect to the choice of retirement age. The adjustment factors are computed for three alternative discount rates using equation (1). The first row represents a relatively low discount rate of 3 percent, the second row a higher discount rate of 7 percent, and the fourth row a discount rate of 14 percent, which corresponds to the one estimated in the retirement probability model. The simulation reveals a strong reaction to this change in the social security system. A nondistorting system would substantially shift the retirement age. Even evaluated at the lowest discount rate, a nondistortionary system would increase the average retirement age by about one year. Using the estimated parameter values, however, implies a shift in the retirement age of more than two years. The effects of a nondistortionary system are most powerful in the reduction of early retirement, i.e., retirement before the normal retirement age. Retirement at ages 59 and below would drop from currently 32 percent to 27 percent (adjustments com-

Table 3

Retirement Age and Early Retirement

	Mean Retirement Age	Early Retirement (Retirement Age < 60 in percent of all transitions)
System Before 1992 Reform	58.5	32.2
After 1992 Reform	59.0	28.4
Non-distortionary System		
Adjustments at $r = 3.0\%$	59.3	26.6
Adjustments at $r = 7.0\%$	59.7	23.4
Adjustments at $r = 13.8\%$	60.7	18.4

Source: Own computations using Table 2 coefficients.

puted for a 3 percent discount rate), to 23 percent (adjustments computed for a 7 percent discount rate), and down to 18 percent when the adjustments are computed for the estimated 14 percent discount rate.

Is Retirement Behavior Different between East and West Germany?

As we have seen in the preceding section, West German retirement patterns are characterized by the bunching of retirement at certain ages, in response to the strong incentives of the public pension system. How did the East Germans react when the West German pension system was introduced there?

Comparing the West and the East German retirement patterns, the large percentage of very early retirees is the most impressive observation. Figure 1 shows two effects for the East Germans, with associated peaks at ages 57 and 62. The first is a result of labour market policies, implemented in 1991, to keep statistical unemployment rates low in East Germany (*Vorruehstandsregelung*). The second peak, visible in the 1990 graph, is the result of the generous replacement rates at early retirement (*flexible Altersgrenze*), before the unemployment rate skyrocketed. The Figure shows great labour force sensitivity to retirement rules. This analysis, however, cannot separate demand factors (the threat of unemployment) from supply factors (retirement behavior).

We try to better describe labour supply behavior by re-estimating the Gompertz-hazard rate model of retirement on the three waves of the East German SOEP. Results are presented in Table 4, in an analogous fashion to the West German results.

Comparing the figures and the estimation results, two seemingly contradictory observations emerge. On the one hand, the unconditional retirement profile in East Germany is very different from the West German one, with an even larger percentage of very early retirees. This is reflected in the larger baseline hazard rate γ in the East German estimation results. On the other hand, the coefficients of the option value in the Gompertz regressions are similar. Although the coefficient in East Germany is a bit larger than the West German one, the difference is not significant. Hence, *conditional on the different incentives* in East and West Germany, the response to these incentives was very similar and very strong in both parts of the country.

The Viability of the German Public Pension System

The German public pension system has provided substantial income support to retired workers at increasingly earlier ages. But there are clouds on the horizon. The population aging process will strain our pay-as-you-go social security system because fewer contributors will have to support more retirees. Hence it is questionable whether we can afford such a generous pension system in the future.

Here, we construct a population forecast model using the official census predictions of age- and gender-specific mortality, fertility and immigration. We then apply the 1990 age- and gender-specific labour force participation rates to the population forecast and compute the ratio of pensioners to workers. Using current replacement ratios, this yields the balanced-budget contribution rates of the pay-as-you-go pension system. Panel A in Table 5 shows this baseline prediction.

Figure 1

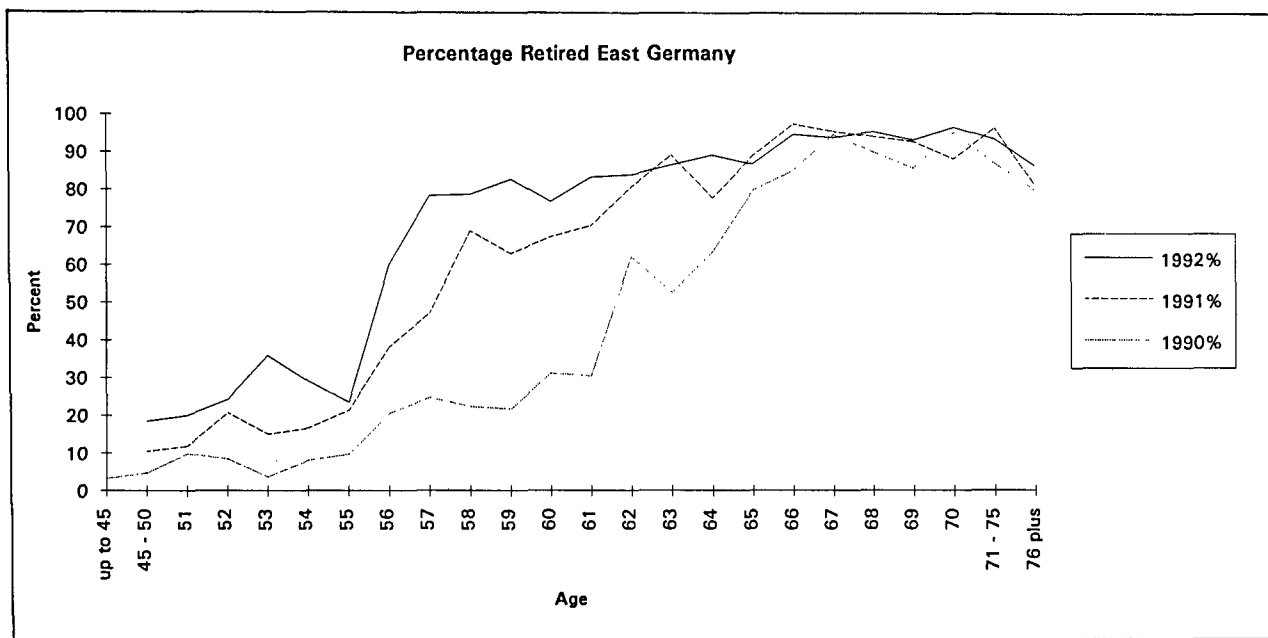


Table 4

**Gompertz Hazard Rate Model of Retirement Age:
East Germany**
Dependent variable: Transition to Retirement

WEIBL	0.0403	(0.37)
GEBJAHR	1.6618	(22.73)
V_EHE	-0.1525	(-1.08)
ASCHULE	0.2133	(1.87)
ABERBILD	—	—
V_BEHIND	0.5336	(3.18)
V_LAND_F	2.9415	(13.41)
V_BERGEN	3.7599	(10.05)
V_INDUST	2.8144	(16.50)
V_HANDEL	3.0762	(11.45)
V_OEF_DS	2.8337	(14.67)
V_BEAMT	—	—
V_DSTLST	—	—
V_BANK_V	—	—
V_BILDUN	2.7155	(10.43)
V_GESUND	—	—
V_SOZIAL	—	—
V_TEILER	0.6602	(2.06)
V_VOLLER	0.4911	(1.66)
V_VORALO	0.7352	(1.66)
V_JOBS_A	-0.1802	(-1.56)
V_JOBS_G	-15.1938	(-0.08)
V_JOBS_S	-14.6006	(-0.04)
V_EIGENT	-0.2569	(-2.25)
V_LV	0.1808	(1.59)
V_WERTPA	-1.2915	(-4.36)
OPTVAL	-0.0065	(-4.29)
constant	-151.2875	(-23.08)
γ	1.6718	(22.98)
loglik (at zero)	-661.3	(-2261)
Note: t-statistics in parentheses.		
Source: 1990-92 SOEP (East), 965 spells, 382 events.		

The contribution rate in 1990 was 18.7 percent of gross wages paid equally by employers and employees. We estimate that this contribution rate will rise steadily to a peak of 35 percent around the year 2035. While this tax rate

is lower than the ones predicted in earlier studies (e.g., Schmähl 1989) — as a result of the recent immigration wave — it is still high, especially when it is piled on top of a 15 percent health insurance tax and when about 40 percent of general taxes are added. The conclusion is quite simply that such high rates are unsustainable.

Panels B through D of Table 5 show the pensioner-per-worker ratio and the balanced-budget contribution rate for three different shifts in the changes in the retirement age. The first shift corresponds to the change induced by the 1992 Social Security Reform while the second and third correspond to the transition to a nondistortionary system, evaluated at 7 and 13.8 percent discount rates.

The effect of the 1992 Social Security Reform is rather small. In 2035 it reduces the Social Security contribution rate only about 1 percent. Changing to a nondistortionary system, however, will reduce the contribution rate by more than 4 percent (at the estimated discount rate). This effect corresponds to more than a quarter of the projected increase in the contribution rate, four times larger than the effect of the 1992 Social Security Reform. And this change makes the system fairer in the sense that it abolishes the implicit subsidy of early retirees by late retirees, keeping replacement rates and statutory retirement ages unchanged⁸.

Conclusion

The public pension systems in Germany currently greatly encourages workers to retire as early as possible. If such policy signals are allowed to continue they will aggravate the coming imbalance between the number of workers and pensioners caused by population aging.

The German Social Security Reform of 1992 will remove some but by no means all of these distortions. We predict it will increase the average retirement age by only about half a year. A truly age-neutral system would shift the retirement age by up to four times as much. Such a system would also be more efficient because it would avoid the bunching of retirement age caused by current retirement rules.

The longer change is delayed, the less likely it is to ever occur. Political power will shift from the working population to the older generation. From about the year 2015 on, the majority of voters in Germany will be pensioners and workers who will retire within the next ten years. It is doubtful if this aging electorate will vote for a reduction of benefits in order to keep labour supply disincentives at a reasonable limit.

⁸ The levels of the projections are of course sensitive to demographic and employment assumptions. See Boersch-Supan (1993) who also studies macroeconomic repercussions. However, the impact of changing the system to an actuarially fairer one is rather stable under alternative scenarios.

Table 5

Ratio of Pensioners to Workers and Social Security Contributions
Based on 1992 Census Population Forecast Assumptions

	Current Retirement Age		1992 Social Security Reform		Non-Distorting System			
					DiscRate = 7.0%		DiscRate = 13.8%	
	(A)		(B)		(C)		(D)	
	P/W	SS-CR	P/W	SS-CR	P/W	SS-CR	P/W	SS-CR
1990	0.55	18.7%	0.55	18.7%	0.55	18.7%	0.55	18.7%
1995	0.57	19.5	0.57	19.4	0.56	19.2	0.55	18.9
2000	0.62	21.2	0.61	20.9	0.60	20.5	0.58	19.9
2005	0.67	22.9	0.66	22.5	0.64	21.9	0.62	21.0
2010	0.71	24.3	0.69	23.7	0.67	22.8	0.63	21.6
2015	0.76	25.9	0.74	25.2	0.71	24.2	0.67	22.9
2020	0.82	27.9	0.79	27.0	0.76	25.9	0.71	24.3
2025	0.90	30.7	0.87	29.7	0.83	28.4	0.78	26.5
2030	0.98	33.5	0.95	32.4	0.91	31.1	0.86	29.2
2035	1.02	34.5	0.99	33.7	0.95	32.5	0.90	30.8
2040	1.01	34.2	0.98	33.4	0.95	32.3	0.90	30.7
2045	0.99	33.7	0.96	32.8	0.93	31.6	0.88	30.0
2050	0.98	33.3	0.95	32.4	0.91	31.1	0.86	29.4

Source: Own computations based on the predicted shifts in Table 3.

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