

Siebert, Horst

**Working Paper — Digitized Version**

## Pay-as-you-go versus capital funded pension systems: the issues

Kiel Working Paper, No. 816

**Provided in Cooperation with:**

Kiel Institute for the World Economy – Leibniz Center for Research on Global Economic Challenges

*Suggested Citation:* Siebert, Horst (1997) : Pay-as-you-go versus capital funded pension systems: the issues, Kiel Working Paper, No. 816, Kiel Institute of World Economics (IfW), Kiel

This Version is available at:

<https://hdl.handle.net/10419/962>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# Kieler Arbeitspapiere

# Kiel Working Papers

Kiel Working Paper No. 816

PAY-AS-YOU-GO VERSUS CAPITAL FUNDED PENSION SYSTEMS.

THE ISSUES

by

Horst Siebert\*



Institut für Weltwirtschaft an der Universität Kiel  
The Kiel Institute of World Economics

ISSN 0342 - 0787

Institut für Weltwirtschaft  
Düsternbrooker Weg 120, 24105 Kiel

Kiel Working Paper No. 816

**PAY-AS-YOU-GO VERSUS CAPITAL FUNDED PENSION SYSTEMS.  
THE ISSUES**

by  
Horst Siebert\*

June 1997

759535

The authors themselves, not the Kiel Institute of World Economics, are solely responsible for the contents and distribution of each Kiel Working Paper. Since the series involves manuscripts in a preliminary form, interested readers are requested to direct criticisms and suggestions directly to the authors and to clear any quotations with them.

## Abstract

The paper compares the pay-as-you-go system and a capital funded system of old age insurance. The capital funded system has a higher rate of return. Pension income can be obtained at lower costs for the individual. This implies efficiency gains in terms of higher savings and reduced distortion in the labor markets. Respecting the claims of the pay-as-you-go system implies a transition problem which is studied in detail.

## I. Social Security in Crisis

1. Social Security is in crisis in many countries with an old-age pension system predominantly financed on a pay-as-you-go basis. The single most important factor behind this is the demographic development that leads to a progressive ageing of societies in the course of the coming decades due to declining fertility and increasing longevity. In the OECD area as a whole, the elderly dependency ratio, i.e. the number of people aged 65 or over per 100 people in the working age (15 to 64), is expected to double between 1990 and 2030 (Table 1). While the projections for demographic developments vary according to assumptions about net migration and fertility,<sup>1</sup> the fact that societies are progressively greying is not really under dispute. The process of ageing of societies is most pronounced in Germany and Italy which are left with extremely high elderly depending ratios of 49.2 and 48.3 percent, respectively, and is particularly fast in Japan which enjoyed a relatively low ratio of 17.1 percent in 1990 and is facing a ratio well above the OECD average in the year 2030.

2. One approach of identifying the need to reform the prevailing public pension systems is to compare the present value of current and future entitlements with the present value of future contributions implied in current rates of contribution. Table 2 presents OECD estimates on this for the seven major countries. Gross Liabilities add up from entitlements already accrued by today's pensioners or contributors still working, and liabilities expected to be built up in the future. The volume, expressed in relation to 1990 GDP, varies across countries according to the generosity of the system and assumptions about the development of a number of determinants, including old-age dependency ratio, average retirement age, and employment ratio. They also rely crucially on assumed discount

---

\* I appreciate critical comment by Klaus-Jürgen Gern and especially by Jens Oliver Lorz to whom I am indebted for the preparation of tables 4 and 5.

<sup>1</sup> For details of a recent projection of demographic developments in Germany using alternative scenarios on fertility see Appendix 1.

Table 1 — Elderly Dependency Ratios<sup>a</sup> in Industrial Countries

	1990	2000	2010	2020	2030	Change from 1990 to 2030 in percent
United States	19.1	19.0	20.4	27.6	36.8	92.7
Japan	17.1	24.3	33.0	43.0	44.5	160.2
Germany	21.7	23.8	30.3	35.4	49.2	126.7
France	20.8	23.6	24.6	32.3	31.1	88.0
Italy	21.6	26.5	31.2	37.5	48.3	123.6
United Kingdom	24.0	24.4	25.8	31.2	38.7	61.3
Canada	16.7	18.2	20.4	28.4	39.1	134.1
Total OECD	19.3	20.9	23.5	29.8	37.7	95.3
OECD Europe	20.6	22.1	24.7	30.8	39.2	90.3

<sup>a</sup>Population aged 65 and over as a percent of working age population.

Source: The World Bank (1994); own calculations.

Table 2 — OECD Estimates of Net Pension Liabilities<sup>a</sup> — Present Value of Current and Future Rights and Future Contributions (per cent of 1990 GDP)

	United States	Japan	Germany	France	Italy	United Kingdom	Canada
Gross Liabilities	309	496	467	729	742	537	482
Accrued Rights	113	162	157	216	259	156	121
New Rights	196	334	310	513	483	381	361
Assets	265	296	306	513	508	350	231
Existing	23	18	—	—	—	—	—
Future Contributions	242	278	306	513	508	350	231
Net Liabilities	43	200	160	216	233	186	250
<i>Memorandum item:</i> Gross Public Sector Debt as of 1995	64.3	80.7	61.6	60.0	122.0	60.0	99.6

<sup>a</sup>On the basis of a representative set of assumptions on the details of the system.

Source: Noord, Van den, and Herd (1993), Table 7; OECD (1996).

rates and real growth. Estimated gross liabilities range from a low of 309 percent of 1990's GDP in the United States to a high of 742 percent of GDP in Italy.

To arrive at net liabilities, assets of the system have to be deducted. They consist of the present value of future contributions and assets accumulated in the past. The resulting net liabilities represent the part of public pension systems that has yet to be financed under prevailing arrangements. In most countries, net liabilities of the public pension system exceed the stock of official gross public sector debt, which is a popular indicator of the public sector financial position, to a significant degree. It is evident that current benefit levels cannot be financed in the future with rates of contribution that are anywhere near current rates.

In Germany, given the prevailing level of benefits, public pension outlays are expected to rise to 17 percent of GDP in the year 2035 from currently 10 percent (OECD 1995) which will result in a deficit of the public pension scheme amounting to 9 percent of GDP at current rates of contribution to the system. To close this gap, contributions to the public pension scheme (Gesetzliche Rentenversicherung), which have risen in the past, will have to be raised from 18.6 percent of wages and salaries in 1995 to between 26.3 percent and 28.5 percent in the year 2030, depending on the scenario (Prognosis 1995). Under these circumstances, it must be in doubt whether the current system of old-age insurance in Germany is sustainable.

3. Another way of illustrating the fact that prevailing public pension arrangements are not sustainable in many countries is the construction of generational accounts. Generational accounts have been developed as a more meaningful alternative to the traditional deficit accounting (Auerbach et al. 1991, 1994). The concept explicitly takes into account the need to satisfy an intertemporal budget restriction of the government in which the present value of all future tax payments has to equal the present value of all future government consumption less

the initial stock of debt. It allows to compare the present value of lifetime net tax payments (tax payments minus transfer receipts) of a newborn in the base year to the present value of lifetime net tax payments of a representative member of unborn generations indicating the extent of intergenerational redistribution implied in current policies.<sup>2</sup> Underlying these calculations is the assumption that today's policies remain unchanged throughout the lifetime of all existing generations (including the newborn), while policy changes necessary to eventually satisfy the intertemporal budget constraint affect only future generations.

Generational accounting models are available for only a small set of countries on a comparable basis. While the calculations have to be considered with caution for a variety of reasons (Haveman 1994, Diamond 1996), it seems fair to state that there is clear evidence of generational imbalance of current policies in favor of living generations. Future generations have to bear tax burdens that exceed the tax burden of newborns in the base year (1993) to a significant degree, ranging from roughly 30 percent in Germany and Sweden to 450 percent in Italy (Table 3). The single most important factor behind this is the effect of demographic developments, most prominently through its effect on public pension systems, thus indicating the unsustainable character of current public pension arrangements.

4. One possible answer to the obvious problems is to adjust the prevailing systems in order to secure their solvency in the future. Corresponding strategies include the increase of retirement ages, lowering of benefit levels, or the correction of benefits for changes in the demography. However, there seems to be mounting scepticism with respect to the chances of stabilizing public pension

---

<sup>2</sup> For existing generations, only the net taxes over the remaining lifespan are considered in the analysis. Without extensive retrospective calculations necessary to arrive at estimates for full lifetime net taxes for existing generations, a meaningful comparison of net tax burdens can only take place between the newborn generation and unborn generations that ultimately have to restore fiscal balance.



Table 3 — Generational Imbalance Implied in Current Fiscal Policies —  
Present value of net tax payments per capita (males) of future generations discounted at a rate of 5 % (newborn generation = 100)

	Productivity growth rate		
	1	1,5	2
United States	215	200	189
Germany	126	127	127
Italy	633	546	485
Norway	134	153	168
Sweden	136	131	126

Source: Leibfritz et al. (1995), Table 10.

systems through such limited adjustments. It becomes increasingly clear that more fundamental changes in old-age insurance are inevitable.

5. Some countries, like Chile, Argentina, Columbia and Singapore, have switched to a funded pension system or plan to do so. In the United Kingdom, the public pension system is primarily restricted to a tax financed uniform basic pension.<sup>3</sup> In other economies, like Switzerland or the United States, the focus is traditionally more on individual savings accounts or financial assets to provide for retirement. In the transformation economies where, like in China, pensions were used to be paid by state firms, old age insurance will have to be uncoupled from the firms and will have to rely more on private savings.

6. Besides the question of financing social security, a main point of interest is the effect on the labor market that results from rising labor costs due to increasing social security contributions (for Germany, see Table 4). In a pension sys-

<sup>3</sup> The second pillar of the public pension system, the State Earnings Related Pension System (SERPS), while on a pay-as-you-go basis, allows for contracting out into funded private sector pension schemes.

Table.4 — Contribution Rates<sup>a</sup> to the Pay-as-you-go System in Germany

1950	10.0
1960	14.0
1970	17.0
1980	18.0
1990	18.7
1995	18.6
1996	19.2
1997	20.3

<sup>a</sup>In percent of gross wages.

tem that is tied to employment, social security contributions effectively work as tax on labor (Siebert 1997). While increased social security contributions add to the cost of labor, they reduce the net wage and widen the tax wedge. In effect, the chance that workers accept moderate (gross) wage increases in wage negotiations is lowered. Insofar as the total of wage increases and increases in social security contributions — i.e. the rise in labor cost in total — exceeds the growth in labor productivity, labor demand is weakened. Thus, the secular rise in contribution rates to pay-as-you-go financed public pension systems contributes to the problem of unemployment.

Last not least, dead weight losses through reduced capital accumulation and, as a consequence, lower growth have to be considered.

7. As a yardstick for the evaluation of social security reform alternatives the following desideration should be considered:

- The pension system has to satisfy an intertemporal budget restriction in the sense that contributions today and payments tomorrow must relate reasonably.
- The pension system should be "efficient", i.e. associated with minimal cost (burden). A system that provides a given level of retirement benefits with less contributions should be preferred. In this context, effects on important

goals of economic policy, including capital accumulation, growth, and employment, should be taken into account.

- The system should realize a maximum of equivalence between the present value of contributions and benefits for the individual.
- The goal of a pension system is to provide income after retirement (and insure against invalidity). This goal has to be separated from redistributive ambitions.

## ii. Comparing Pay-as-you-go and Capital Funded Pension Systems

8. The ultimate yardstick for evaluating the alternatives from an economic point of view is efficiency. The system that delivers more benefits from a given amount of contributions, i.e. that has the higher rate of return, is superior in terms of efficiency.

In a pay-as-you-go system, contributions of one period are directly transferred to the recipients of benefits in the same period. While members acquire claims against the system by today's contributions, no actual capital is accumulated. Contrary to this, in a funded system claims for benefits are covered by a capital stock built up by contributions in the past. After retirement, benefits are paid from interest on the capital stock and successive capital consumption.

9. In a pay-as-you-go system, the rate of return ( $\rho_{UV}$ ) on contributions for individuals of a given generation is zero in a stationary economy.<sup>4</sup> The total of contributions of the active generation equals the sum of benefits to the retired generation. Under stationary conditions, a pure pay-as-you-go system without interpersonal redistribution produces benefits that correspond to contributions for every individual. The rate of return is zero.

---

<sup>4</sup> The first generation of recipients in the start-up phase of a pay-as-you-go system receives pensions without having made contributions. We deal with this issue when analyzing the transition to a funded system.

In a growing economy, contributions of active generations (used to finance the pensions of the retired) realizes a return in the sense that contributors can expect a higher level of pensions in the future due to their increased contributions. The growth of income results in a pension level that exceeds the contributions of the past. The increase of pension benefits relative to the contributions of the past can be interpreted as the (implicit) rate of return from the individual's perspective.

When contributions are a constant share of labor income (constant rate of contribution), the system's rate of return is given through the real rate of growth of wages and salaries. The change in real wages and salaries adds up from the rate of population growth  $n$  (Samuelson's (1958) "natural rate of interest") and productivity growth  $g$ . Thus it is:

$$1 + \rho_{UV} = (1+n) (1+g) \quad \text{or} \quad \rho_{UV} = n+g.$$

A change in the rate of contribution would have to be considered additionally.

10. In the case of a funded pension system, the internal rate of return  $\rho_{KV}$  corresponds to the real rate of interest  $r$ , i.e.

$$1 + \rho_{KV} = 1+r \quad \text{or} \quad \rho_{KV} = r.$$

According to this analysis, a funded pension system is better than a pay-as-you-go system when the real rate of interest exceeds the real rate of growth of wages and salaries:

$$r > n+g.$$

11. The rates of return of both types of social security systems depend on a number of factors. In a fast growing economy, both real interest rates and wage growth are usually high due to abundant investment opportunities and high-growth of labor productivity. But while the profit from high returns goes to savers in a funded system in the first place it is the pensioners who benefit from high productivity growth in a pay-as-you-go system. Thus, in Germany the pay-as-you go system was very attractive for pensioners when the annual growth rate

of labor productivity was high, as in the sixties (5.4 percent) and in the seventies (4.1 percent). With lower productivity increases of only 2.4 percent since 1980, the system becomes less attractive.

In a situation, where a significant decrease in the population is to be expected (the projected annual rate of population growth  $n$  is  $-0.4$  percent over the next 40 to 50 years), the rate of return in the pay-as-you-go system is additionally suppressed. With zero productivity growth, the rate of return would be negative. The pay-as-you-go system is much more sensitive to demographic developments than a funded pension system.<sup>5</sup>

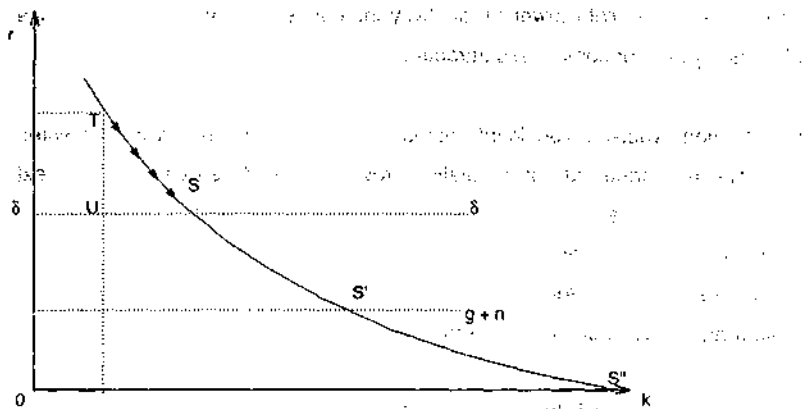
12. According to growth theory, the market interest rate is higher than the real growth rate of wages and salaries. This is true even with a rate of time preference of zero, i.e. when there is no preference for consumption today versus consumption tomorrow. This can be shown most easily in a model with capital accumulation only, i.e. for  $n + g = 0$ . If the time preference were zero, capital would be accumulated until the marginal product of capital would fall to zero (Point S" in Figure 1 that is approached asymptotically). In this stationary situation, real growth of wages and salaries is also zero. In the periods before the steady state is reached, less than the optimal capital stock is accumulated and marginal productivity is higher than the growth rate of the labor force.<sup>6</sup> With people having a positive time preference, however, (here depicted by the discount rate  $\delta$ ), the market interest rate exceeds real growth of wages and salaries during the adjustment to the long-term equilibrium as well as in the long-term equilibrium itself.

---

<sup>5</sup> A funded pension system is not totally immune against declining populations, because the capital stock has to adjust when optimal capital intensity had been realized already.

<sup>6</sup> Assuming a Cobb-Douglas production function  $Q = A^\alpha K^{1-\alpha}$  with  $g = 0$ , the condition  $r = \hat{r}_K > (\hat{w}L)$  translates into  $(1-\alpha)\frac{Q}{K} > (1-\alpha)\frac{K}{K} + \alpha n$  or  $(1-\alpha)\frac{C}{K} > \alpha n$  which clearly must be satisfied for  $n = 0$ .

Figure 1 — Rates of Return in the Pay-as-you-go and the Funded System.



Allowing for positive population growth ( $n > 0$ ), capital is accumulated to the extent that is necessary to equip additional workers with capital goods. In the extreme case of a rate of time preference of zero, the market interest rate approaches  $n$  in the long-term. But with a positive time preference, it seems realistic to assume that the rate of time preference exceeds the population growth rate.<sup>7</sup> In this case, the rate of return of a funded pension system exceeds the rate of return in a pay-as-you-go system.

The rate of return on capital increases when technical progress is introduced. Thus, together with the rate of population growth  $n$  the rate of technical progress  $g$  constitutes a lower bound for the market interest rate.

But there is a lower bound that is still higher: the rate of time preference  $\delta$ , which stops capital accumulation before the equation  $r = g + n$  is satisfied. While a situation of  $n + g > \delta$  is theoretically possible, it is not a realistic scenario because it would mean being in an economic Cockaigne, where supply

<sup>7</sup> In the industrial countries, population growth has been an annual 0.9 percent in the period 1950–1992, the real interest rate is higher.

would grow more rapidly than necessary to compensate for the time preference.

Taxation is one reason to presume that the market interest rate exceeds the discount rate because it establishes a wedge between the marginal productivity of capital and the discount rate. Take for example a situation when the net national product is taxed at a rate  $\tau$ . Considering the simple case of an economy without technical progress, the optimality condition<sup>8</sup>

$$(1 - \tau)f'(k) = \delta + n$$

states that the market interest rate has to exceed  $\delta + n$  by  $\tau f'(k)$ . From this follows that the market interest rate is higher than the discount rate for an economy with stationary population in long-term equilibrium.

Two further modifications strengthen the argument that the rate of return of funded pension system is higher than of a pay-as-you-go system. When technical knowledge is incorporated in investment — in younger cohorts of the capital stock — it is not possible anymore to discriminate between steady-state equilibrium and the growth path to this equilibrium. Every capital accumulation results in an upward shift of the steady-state equilibrium. In addition, in the con-

8 Maximizing

$$\text{Max} \int_0^{\infty} u(c) e^{-\delta t} dt$$

under the condition

$$\dot{k} = (1 - \tau)f(k) - c - nk$$

yields

$$H = u(c) + \lambda [(1 - \tau)f(k) - c - nk]$$

$$\frac{\partial H}{\partial c} = u'(c) - \lambda = 0$$

$$\dot{\lambda} = \lambda - [(1 - \tau)f'(k) - n]$$

with  $\dot{\lambda} = 0$  in the long-term equilibrium.

text of an open economy, it has to be considered that in a funded system capital can be invested in the world market, thus realizing high rates of return even when domestic investment opportunities are limited. Summing up, there is a variety of reasons to expect on theoretical grounds the rate of return in a funded pension system to exceed the rate of return in a pay-as-you-go system.

13. Empirical investigations for Germany confirm that the rate of return for capital funds is higher than the implicit rate of return of the public pension system working on a pay-as-you-go basis. The Council of Economic Advisers (1996, number 406) finds that the real rate of return on capital in West Germany with an average rate of 4.7 percent per year exceeded the average annual real growth rate of gross wages and salaries by 2.3 percentage points (Table 5). The standard pension during the same period showed real growth of only 1.9 percent per year; during the period between 1980 and 1995 the increase in the standard pension slowed down to a mere 0.5 percent per year.<sup>9</sup> Note that these rates are overstated because of increasing unemployment; the full employment rates would be lower.

14. It can be objected that a proper comparison of the rates of return of both systems should consider risk and should be made from an ex-ante point of view. This opens the field for a debate on which kind of risks should be taken into account. It cannot be denied that investment risk (including the risk of portfolio investment), inflation risk, exchange rate risk and country risk exist

---

<sup>9</sup> For the US, Feldstein (1996) calculates an implicit rate of return for participants in the social security system (OASDI) of 2.6 percent per year since 1960 using the average annual rate of growth of real wages as a proxy. He points out, however, that in reality the effective rate of return has been substantially higher because the rates of contribution have increased rapidly with the consequence that pensioners who have contributed at low rates now enjoy high level benefits (intergenerational redistribution). According to Feldstein's calculations, the real rate of return on capital in the business sector since 1960 amounted to an average 9.3 percent per year. From this follows that interest foregone in the pay-as-you-go system was a substantial 6.7 percent per year.



Table 5 — Return on Real Assets, Real Interest Rate, and Real Wage Growth in West Germany, 1970–1995

Year	Return on real assets <sup>a</sup>	Real interest rate		Growth rate of real gross compensation of employees <sup>a</sup>	Growth rate of real „standard“ pension <sup>a</sup>
		Return on securities <sup>a</sup> deflated by			
		Domestic producer price index	Consumer price index of all households		
1970–94 <sup>b</sup>	4.7	4.6	4.1	2.4	1.9
1970–79 <sup>b</sup>	4.9	3.3	3.2	3.9	3.7
1980–89 <sup>b</sup>	4.3	5.0	4.7	1.3	0.9
1990–94 <sup>b</sup>	5.1	6.3	3.9	1.8	0.2
1990–95 <sup>b</sup>	–	6.3	4.5	1.6	–0.1

<sup>a</sup>For details of the definitions see Table 1 in the Appendix. — <sup>b</sup>Arithmetic average; real gross compensation and standard pension: geometric average.

(Sachverständigenrat 1996, number 410 ff.), but these risks can be partly hedged, they can be avoided. In addition, some regulation is needed to reduce these risks and protect those who save for their old age. The capital funded system loses its advantage in the case of major political upheavals in which the capital stock is destroyed (war) or property rights are not respected (revolutions). Institutional arrangements of a society such as old age systems should, however, not be based on such extreme situations. It must be the aim of policy and constitutions to provide an umbrella of stability under which economic decisions can be taken.

15. The superior rate of return of a funded system means that a given pension level can be financed with lower contributions. The possibility of buying the same product at a lower price represents a welfare gain for individuals. Putting it the other way round: By forcing people into a pay-as-you-go system the cost of old-age insurance is driven up resulting in a loss of welfare.

From a macroeconomic point of view, the pay-as-you-go system has a zero rate of return because forced savings of contributors are instantly consumed by

pensioners. In contrast, in the funded pension system the average insured holds a capital stock. This very capital produces the macroeconomic rate of return of a funded system.<sup>10</sup>

The macroeconomic rate of return can be interpreted as the "productivity" of an institutional arrangement. This argument draws on a macroeconomic production function including the institutional arrangement of the pension system as an additional factor of production. With respect to a national product net of the cost for old-age insurance over the life cycle of a generation, the productive capacity of an economy using a funded pension system is higher compared to an economy using a pay-as-you-go system.

16. When comparing pay-as-you-go and funded pension systems, it has also been considered that in the former the equivalence of contributions and benefits is usually not possible. According to Aaron's (1966) theorem, equivalence is secured with a constant rate of contribution when the growth rate of wages and salaries in each period is as high as the market rate of interest. In the more realistic case that the market interest rate exceeds the growth rate of wages and salaries, equivalence of contributions and benefits requires the rate of contribution to be raised every period — a situation that is obviously not sustainable. It is true that the insured acquire higher claims with higher contributions. But even when borrowing against these claims on the capital market is allowed for, contributory equivalence is unsustainable (Breyer 1990:134) when borrowing is limited (in relation to wages and salaries). It is interesting to note that the German constitutional court has reduced the meaning of contributory equivalence to an equivalence of rank.

---

<sup>10</sup> Welfare gains through the reduction of inefficiencies on the labor market have to be added.

### III. Efficiency Gains for the Economy

17. Using a funded pension system results in welfare gains on the level of the individual that transform into increased efficiency for the total economy. Economic efficiency is enhanced when allocative distortions, in other words: wedges between price signals, are reduced. Two different sources of increased efficiency can be isolated: (1) more capital is accumulated in an economy with a funded pension system, and (2) distortions on the labor market are reduced. In this section, the efficiency aspects of both systems are discussed; the problems of transition to a funded system are picked up in the next section.

#### *Enhanced Capital Accumulation*

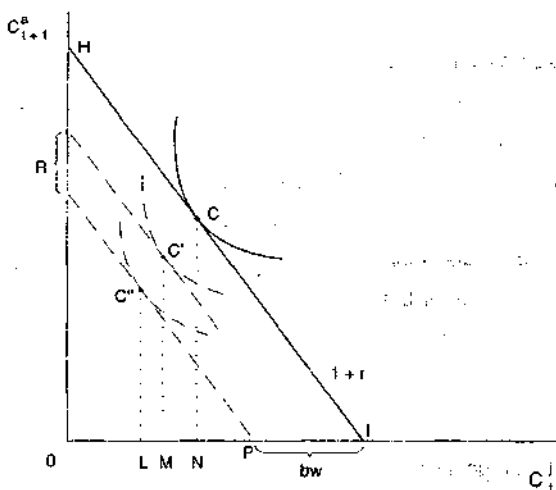
18. In contrast to a pay-as-you-go system, the contributions to a funded system represent savings that are invested in the capital market. Capital accumulation is enhanced.

In order to investigate the influence of the type of pension system on savings, a situation with no public pension system is taken as a point of reference (Figure 2). The active generation saves to provide for consumption after retirement<sup>11</sup> ( $C_{t+1}^a$ ) realizing a return that corresponds to the market interest rate  $r$ ; the slope of the resulting budget line IH is  $1 + r$ . The point of optimal consumption (savings) is C. Such a situation corresponds to a funded system on a voluntary basis.

---

<sup>11</sup> The formal problem is one of maximization over two periods under an intertemporal budget restriction. Using more complex general equilibrium models with overlapping generations yields similar results (Blanchard and Fisher 1989:112).

Figure 2 — Pension Systems and Saving

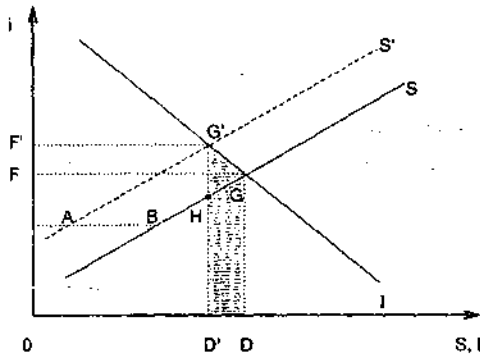


The introduction of a pay-as-you-go system requires the active generation to pay contributions of  $bw$  shifting the budget line to the left by amount  $IP$ . Individuals expect a pension  $R$  that shifts the budget line outside again (but to a smaller extent than  $bw$  due to incomplete equivalence).<sup>12</sup> For all other intertemporal decisions the relevant interest rate remains  $r$ . The individual chooses point  $C'$  (with the present value of consumption reduced by  $NM$ ). Comparing the points  $C'$  (pay-as-you-go system) and  $C$  (funded system) reveals that a funded system produces a higher level of consumption in the present period, namely  $ON$  instead of  $OM$ , and higher savings for the second period, namely  $CN > C'M$ . The funded system is associated both with higher savings and with higher consumption.

<sup>12</sup> The slope of the line  $IC'$  (not drawn) indicates the "interest rate" of the pay-as-you-go system. Note that this rate may be zero (45° degree line).

19. Figure 3 illustrates the effect of a pay-as-you-go scheme on the capital market. Point G depicts the capital market equilibrium with voluntary savings for retirement (corresponding to Point C in Figure 2). With contributions to the pay-as-you-go system of AB and assuming that the savings supply curve indicates the intertemporal decisions of households at varying interest rates (it consists of households with differing time preference), the introduction of a pay-as-you-go system in a closed economy leads to a shift of the point of equilibrium from G to G'.<sup>13</sup> The introduction of a pay-as-you-go system works as a tax on savings, creating a wedge G'H between the marginal productivity of capital of firms and the net interest rate households are facing (Neumann 1986). The low rate of return in the pay-as-you-go system leads to reduced savings driving up the market interest rate. In turn, a change from pay-as-you-go financing to capital foundation in the pension system would remove the tax wedge and result in a movement from G' to G. Savings would rise, and the market rate of interest would fall. From all this follows that, both systems compared, the equilibrium real rate of interest tends to be lower in the funded pension system.

Figure 3 — Effect of Pay-As-You-Go Financing on the Capital Market



<sup>13</sup> Note that the distance AB is estimated to be as high as 10 percent of GDP, which is in the magnitude of the savings ratio of private households.

The shaded area DGG'D' in Figure 3 depicts the loss in efficiency (dead weight loss) that is the result of entertaining a pay-as-you-go system.<sup>14</sup> Due to lower savings and a lower capital stock, the level of GDP per head and the growth rate are both lower compared to an economy with a funded system. The loss in efficiency is accentuated when the fact is considered that technical knowledge is incorporated in new capital. To sum up, pay-as-you-go financing leads to losses in output and growth.

20. In the case of a (small) open economy, these results do not change fundamentally when a significant segmentation of national capital markets is assumed. With perfect international capital mobility, the world market interest rate would continue to be relevant after introducing a pay-as-you-go system in our *Gedankenexperiment*; there would be no change in interest rates. Because of the decline in domestic savings, however, capital must increasingly be imported and, at given rates, interest payments to foreigners do rise.

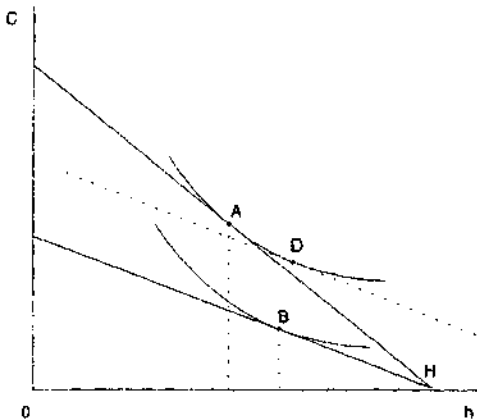
#### *Increased Efficiency of the Labor Market*

21. A funded pension system removes distortions on the labor market that result from the extra-cost of old-age insurance inherent in a pay-as-you-go system. The extra-cost works like a tax on labor driving a wedge between gross and net wages and distorting the decision between work and leisure. The tax effects a rotation of the budget line downwards in point H (Figure 4), the optimal point changes from A to B (associated with a lower level of utility). The incentive to work is reduced in the course of a lower (net) wage (resulting in the substitution effect AD towards leisure), while the associated reduction of income that results for a given amount of working hours works in favor of an increased labor supply (income effect DB). The total effect on labor supply is negative when the substitution effect dominates the income effect.

---

<sup>14</sup> Feldstein (1996) calculates a deadweight loss of 2 percent of GDP for the United States.

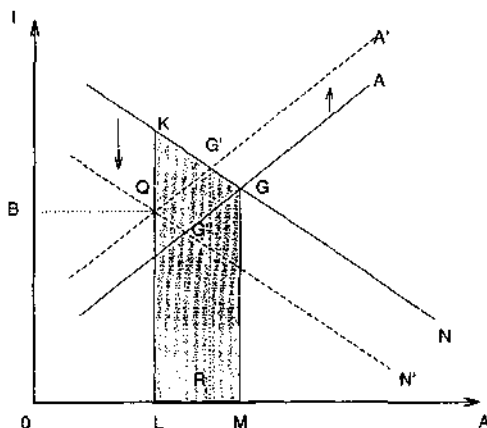
Figure 4 — Pension Systems and Labor Supply



22. In the case of contributions being partially paid by employers, two effects of a pay-as-you-go system on the labor market can be distinguished (Figure 5):

- (1) As a reaction to the extra-cost of old-age insurance that is working as an extra-tax on labor income, workers will reduce their labor supply (assuming a dominating substitution effect). The labor supply curve shifts to the left, equilibrium moves from  $G$  to  $G'$ , corresponding to the movement  $AB$  in Figure 4. The quadrangle  $G'GMR$  depicts the associated income loss, the vertical distance between the labor supply curves being the relevant tax wedge from the worker's point of view. In addition, workers will consume less and save more (not shown in the figure).
- (2) The part of the contributions paid by the employer effects a downward shift in the labor demand curve due to increasing labor costs. The resulting new equilibrium lies in  $G''$ .

Figure 5 — Effect of Pay-As-You-Go Financing on the Labor Market



Combining both effects yields a reduction of labor input to the point Q. The shaded area GKLM depicts the efficiency loss for the economy.<sup>15</sup>

23. The above effects on capital accumulation and the labor market have been investigated using partial analytics. It is, however, to be considered that repercussions in a general equilibrium framework have to be taken into account. For example, with the introduction of a pay-as-you-go system, real wages and salaries decline to the area OBQL as illustrated in Figure 5. The elasticity of wages and salaries, which are the basis of contributions to social security, with respect to the type of system is an important variable in order to estimate the effects of a transition from one system to another. In the case of a significant elasticity in a general equilibrium framework, the introduction of a pay-as-you-go system would substantially undermine the capacity to finance the system with the result that rates of contribution will have to be raised. Furthermore, there are incentives to reduce the base for contributions by substituting income that is subject

<sup>15</sup> For the United States, this dead weight loss has been estimated to be 1 percent of GDP (Feldstein 1996).



to the social security tax with income that is tax exempt (e.g. labor income of "non-dependents", fringe benefits) or with other kinds of non-cash earnings (Feidstein 1996). Another important aspect is the effect of capital accumulation on labor productivity and vice versa. Because of  $F_A(A,K) > 0$  and  $F_{AK} > 0$ , lower investment results in lower labor productivity and in further suppressed labor demand.

#### IV. The Transition towards a Funded System

24. Recognizing the superiority of a funded pension system over a pay-as-you-go system in terms of economic efficiency does not necessarily mean that a transition to a funded system should be recommended because transition is associated with an additional burden.<sup>16</sup> The problem is that the claims of the generations that have contributed to the pay-as-you-go system still have to be financed. While the claims in a pay-as-you-go system are not funded on real assets because the contributions of the active generations are instantly consumed by retired generations, pensioners are certainly justified to expect that due to their past contributions they rightfully receive a pension.

These existing claims have to be financed from taxes that ultimately have to be borne by the active generations. Therefore, active generations have to bear an additional burden: Adding to the foregone consumption (savings) that provides for the own retirement within the new funded system is the tax payments in order to finance the inherited claims from the pay-as-you-go system.

25. The transition could be designed in a way that from a fixed date contributions would have to be made to a funded system. Claims stemming from contri-

---

<sup>16</sup> This corresponds to the phenomenon that in the start-up period of the pay-as-you-go system, the first generation receives a pension without having made contributions. With a finite planning horizon the last generation of pensioners receives nothing.

butions to the pay-as-you-go system in the past would be retained in a certified form. This procedure would effectively 'make an implicit public debt explicit';<sup>17</sup> the government would have to serve the resultant debt. Contributions to the new funded pension scheme would be lower than contributions to the pay-as-you-go system had been before. By certifying pension claims of the pay-as-you-go system, it is possible to spread the burden of serving and eventually redeeming the associated debt over a longer period of time than is needed to fully phase in a newly introduced funded pension system.

26. An alternative proposal would restrict the funded pension scheme to new entrants into the labor market. This, however, would only shift the burden of transition further into the future. Against the background of decreasing populations, the burden per head would tend to rise. Accordingly, the funded pension scheme should include all workers from the beginning.

27. The question is whether the transition to a funded pension system that fully assumes the obligations of the pay-as-you-go system accumulated in the past is welfare improving. This is equivalent to asking whether the benefits of future generations due to the lower cost of old-age insurance exceeds the burden from serving the debt that results from exchanging the claims to the pay-as-you-go system with government bonds. Formally, the necessary condition of the present value of the net gain of transformation to be positive<sup>18</sup> (Feldstein 1995:14) is

---

<sup>17</sup> The making explicit of public debt is not associated with additional absorption on the capital market.

<sup>18</sup> It is assumed that in the transition savings would be unchanged from the pay-as-you-go system. The inherited debt is made explicit by issuing government bonds with an interest rate  $r$ . Then the net gain in individual periods is (assuming  $n = 0$ ):

$$\left[ (1+g)^0 (r-g) - r \right] T_0, \left[ (1+g)^1 (r-g) - r \right] T_0, \left[ (1+g)^2 (r-g) - r \right] T_0, \dots, \left[ (1+g)^{t-1} (r-g) - r \right] T_0.$$

The present value of the gains from transition is  $\sum_1 (r-g) T_0 (1+g)^{t-1} (1+\delta)^{-t} - \sum_1 r T_0 (1+\delta)^{-t}$ .

$$(1) \quad T_0 \left[ \frac{r-n-g}{\delta-n-g} - \frac{r}{\delta} \right] > 0 \quad \text{or}$$

$$(1') \quad T_0 \left[ \frac{(r-\delta)(n+g)}{(\delta-n-g)\delta} \right] > 0$$

where  $\delta$  is the marginal rate of time preference and  $T_0$  the amount of government bonds compensating for the claims against the old system.

As can be seen from condition (1) the sufficient condition for the net gain of the transition to be positive is that  $r > \delta > g+n > 0$  is satisfied.  $\delta > g+n$  is necessary for convergence that allows condition (1) to be interpreted as the present value of the net utility and can be expected to hold because, otherwise, the discounted stream of all future income would be infinite (see above, number 12).

For the condition  $r > n+g$  to hold, marginal productivity of capital has to exceed the real rate of wage growth. The condition is satisfied during adjustment to the steady state; it also holds in the steady state if the marginal rate of time preference exceeds the real economic growth rate, and when capital is taxed driving the market interest rate still higher.

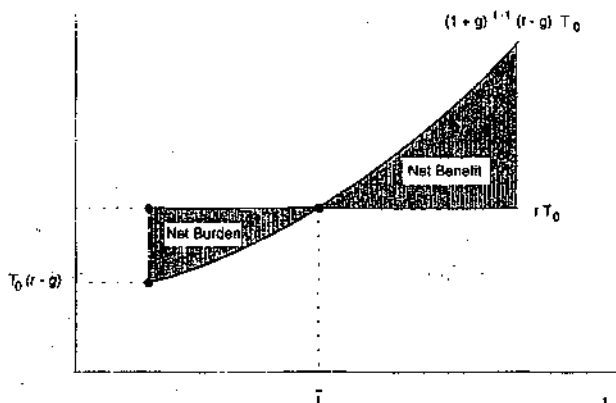
In addition,  $r > \delta$  has to be satisfied. This condition says that the market interest rate, i.e. the marginal productivity of capital, has to exceed the marginal rate of time preference. In other words, the marginal rate of transformation between consumption today and tomorrow has to exceed the marginal rate of substitution over time. Note that this condition for a transition to a funded system to be welfare improving is not required when the rates of return of both systems are compared. The condition may be considered to be problematic in the sense that the market interest rate equals the marginal rate of time preference in the steady state. According to (1'), no Pareto-improving transition would be possible. During adjustment towards the steady-state, the marginal rate of time preference, while depending on the level of consumption, equals the market interest in every period (in a transitory equilibrium). However, a pay-as-you-go sys-

tem establishes a wedge between marginal productivity of capital and marginal rate of time preference (see numbers 12 and 19). Then,  $r > \delta$  is satisfied. In addition, positive real growth ( $n + g > 0$ ) is assumed for the analysis below.

28. The development of net gains per period over time is depicted in Figure 6. In time  $\bar{T}$ , gains and burdens per period cancel out. In later periods net gains result; with infinite horizon, the area of net benefits is open to  $\infty$  while the area of net losses is limited. As has been shown before, gains and losses per period have to be discounted to calculate the present value of net gains of transforming the system. In other words: To decide upon a change of systems, a social welfare function would be needed. Discounting gains and losses over time using a constant discount rate  $\delta$  corresponds to applying a simple social welfare function.

29. Estimating the point in time in which net losses are turned into net gains is a difficult task. The estimate depends on various factors, including the difference in the rates of return, assumed demographic developments, details of the pay-

Figure 6 — Time Profile of Net Burden and Net Benefit per Period



as-you-go system started from, and how the inherited claims are handled. In a quantitative assessment under the assumption that the rate of return in a funded system exceeds the implicit rate of return in the pay-as-you-go system by 2 percentage points, the German Council of Economic Advisers estimates the transition to be profitable in 40 to 50 years.

30. The assessment of the period  $\bar{t}$  for Germany may go as follows. From a fixed date new claims are exclusively built within a funded system. Existing claims for pensions are respected. A person retiring in the period in which the change of the system takes place will receive its pension according to the pay-as-you-go system. The implicit rate of return of the pay-as-you-go system is assumed at 2 percent in real terms, the pension, accordingly, is raised by 2 percent annually. Workers who retire in later periods realize a part of their pensions from the pay-as-you-go system (according to the number of years of contribution), while the other part comes from the funds accumulated in the years after the system's change. Assuming 45 years of work, a worker who retires 10 years after the change of the system has claims against the pay-as-you-go system from 35 years. The corresponding pension is raised by 2 percent per year. As time goes by, the share of pensions stemming from the pay-as-you-go system successively decreases due to the fact that newly retired cohorts have increasingly less years of contribution to the pay-as-you-go system. It, however, takes as much as 59 years to fully phase out the old system when 15 years of retirement is assumed.

31. The present value of pensions due in the years 0 to 59 is calculated using a discount rate of 4 percent. The present value of all pension claims from the pay-as-you-go system is DM 6.890 billion. The present value of pensions is decreasing over time, the present value of the annual burden shrinks from DM 314 billion to DM 86 billion in 30 years (Table 6). Using a credit to be redeemed within 45 years to finance the present value of this pension obligations, according to these back-of-the-envelope calculations, yields a gross burden of 14.5 percent of wages and salaries. The gross gain of the newly established

funded pension system increases over time. In the transition period, therefore, the economy is confronted with an additional burden that is decreasing over time.

32. It has to be borne in mind, however, that in a funded system a given level of pension benefits can be financed with lower contributions. Assuming a level of benefits of 60 percent of wages and a ratio of three contributors per pensioner, the pay-as-you-go system produces a rate of contribution of 20 percent of wage income.<sup>19</sup> Due to the higher rate of return in the funded system, a lower rate of contribution yields the same level of benefits. As time goes by, the funded system will increasingly displace and eventually drive out the pay-as-the-go system. Consequently, the average rate of contribution to the funded system successively decreases (Table 7). Eventually, the contribution rate in percent of gross wages is reduced from 20 percent of gross wages to 11 percent, implying a gain of 9 percentage points.

Table 6 — Pension Claims from the Pay-As-You-Go System During Transition

t =	Pension claim of newly retired $t_0 = 1$	Pension claim of average retired $t_0 = 1$	Pension outlays in time t Bill. DM	Present value of pension outlays Bill. DM
0	1.00	1.00	314.30	314.30
10	0.78	0.92	361.91	237.74
20	0.56	0.71	332.11	151.57
30	0.33	0.49	278.33	85.81
40	0.11	0.27	185.06	38.55
45	0.00	0.16	119.19	20.41
50	0.00	0.07	56.40	7.94
55	0.00	0.01	13.84	1.60
59	0.00	0.00	0.00	0.00

Assumptions: Pension growth of 2 percent per year; discount rate: 4 percent per year.

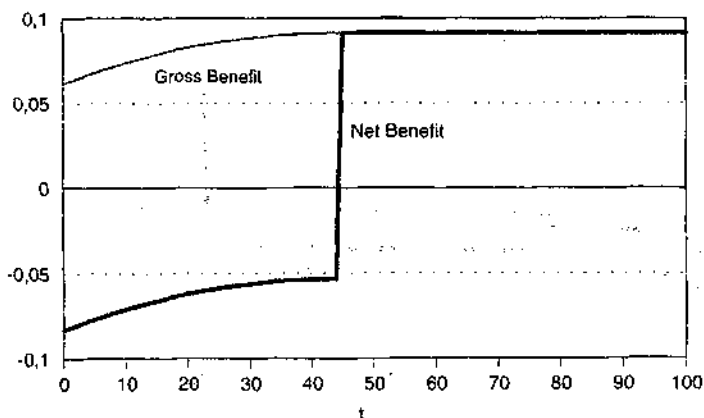
<sup>19</sup> In order to simplify the analysis we do not distinguish between gross and net wages.

Table 7 — Contribution Rates in Percent of Gross Wages

t =	Contribution rate in the pay-as-you-go system	Contribution rate in the capital funded system	Reduction in contribution rate
0	0.200	0.139	0.061
10	0.200	0.126	0.074
20	0.200	0.117	0.083
30	0.200	0.112	0.088
40	0.200	0.109	0.091
45	0.200	0.109	0.091
50	0.200	0.109	0.091

33. When the cost of transition to a funded system is calculated, the tax burden of 14.5 percent of wages and salaries in the transition period of 45 years has to be taken into account. The net benefit from transition is the difference of gross benefit, i.e. the difference in the rates of contribution to the alternative systems, and the tax burden. Net benefits are negative at first, and increase successively. After 45 years, the net benefit for every following period amounts to some 9 percent of wages and salaries (Figure 7).

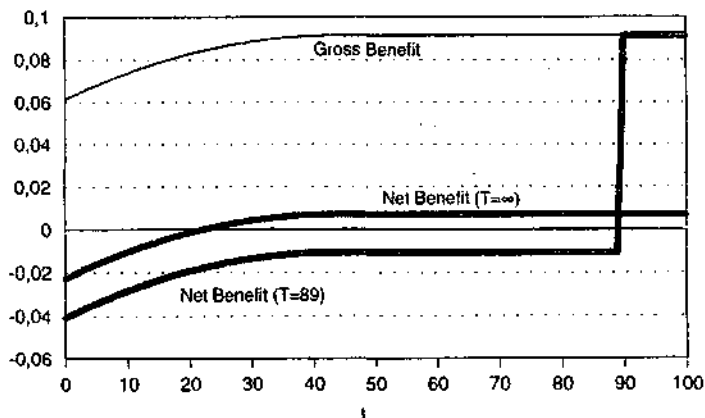
Figure 7 — Gross Benefit and Net Benefit per Period in Percent of Gross Wage Income during Transition Using 45-years Bonds



When the government bonds issued to compensate for pension claims against the pay-as-you-go system are redeemed over a longer period of 90 years, the tax burden would be reduced to 10.2 percent of wages and salaries during transition (Figure 8). In the extreme case of infinite maturity, the corresponding tax burden would be 8.4 percent. Accepting the pension claims only at a discount in order to let older generations bear some of the burden of the transition, could also reduce the tax rate needed to finance redemption in the transition period.

34. The underlying assumption of an annual rise in pensions of 2 percent per year over the next 30 years is not particularly realistic. In Germany, the real standard pension increased by only 0.9 percent from 1980 to 1995, and by a mere 0.1 percent from 1990 to 1995. The revision of the pension law in 1992 further slows down pension growth (Glismann and Hom 1995). Contributing to the low rate of return in the pay-as-you-go system is the decrease in population (by an average 0.4 percent per year). Calculating the transition with an implicit real rate of return in the pay-as-you-go system of zero, reduces the present

Figure 8 — Gross Benefit and Net Benefit per Period in Percent of Gross Wage Income during Transition Using Bonds with Longer Maturity





value of pension claims to DM 5,300 billion. As a result, the long run gains of a transition increase to 14.5 percent.

35. Turning to the effect on savings, the transition to a funded system results in increased savings. This follows from the fact that the contributions to the funded system lead to additional savings. The generation of the transition period has to build up the pension funds to finance their consumption after retirement and, at the same time, bear the tax burden to finance existing pension-claims.

For simplicity, it is assumed that transition is completed within one period and that the burden is not carried over to future generations via issuing of long-term bonds. Under these assumptions, the tax corresponds to the contributions in the pay-as-you-go system  $bw$  (distance  $IP$  in figure 2). Because no pension claims are acquired ( $R=0$ ), the budget restriction is shifted inwards once again for the period of transition. The point of optimal consumption is  $C'$ . The individual has to increase savings by  $LM$  to secure income after retirement.

When the transition is completed, the budget restriction  $IH$  applies, with optimal consumption in  $C$ . Savings increase once again because the present value of income increases by  $IP$ . Note that reduced expected pension income induces individuals to increase savings as well as higher disposable income in active years.

36. During the transition towards a funded system, the economy displays a higher savings ratio. Higher savings tend to promote growth. In addition, employment is rising due to enhanced efficiency in the labor market. The additional tax revenue associated with higher growth and employment helps financing the transition. Such kind of general equilibrium repercussions have not been taken into account in the above calculations.

37. Often it is argued against a funded pension system that the capital stock necessary to fund the prevailing level of benefits is unrealistically high. The capital stock necessary to cover the present value of existing pension claims amounts to DM 6,900 billion at a discount rate of 4 percent and average real annual pension growth of 2 percent (DM 5,300 billion at constant real pensions). The replaceable gross stock of fixed assets in the economy amounts to a much higher DM 14,400 billion in Western Germany (in prices of 1991). Furthermore, it has to be considered that total savings and the real capital stock in relation to GDP can be expected to rise with the introduction of a funded system.

38. The problem to be decided upon by economic policy can clearly be seen from Figures 6, 7 and 8. From time  $\bar{t}$ , significant gains from the reduced cost of old-age insurance can be realized in every following period. During a transition period a substantial additional burden has to be shouldered. The transition to a funded system can thus be seen as an investment that requires forgoing consumption today to yield profits in the future. It seems evident that such an investment of a society needs a long-term policy orientation.

Developments of society are path dependent. The introduction of a funded system is complicated by the fact that a pay-as-you-go system is already established. Societies should, however, be able to transform their institutional arrangements in order to improve efficiency in the long-term even when a limited number of generations is required to give up some consumption and when the utility of a limited number of generations is reduced.

#### V. Some Practical Aspects of Introducing a Funded System

39. It is evident that the level of pensions in the public old-age pension system (in Germany: 70 percent of net wages in the standard case) will have to be lowered in the future. A lower expected level of benefits can be expected to induce

the active generation to increase individual provisions for retirement. Consequently, individual accounts for the purpose of providing income after retirement will play an increasingly important role in financing consumption of retired generations in the future. This is in the self-interest of young generations even if the relative burden in active years increases compared to that experienced by older generations.

40. Economic policy would be wise to accept this tendency towards a funded system. Having in mind the superior efficiency of a funded system, economic policy should support this kind of process by adjusting the institutional framework. What is required most is a clear long-term perspective for old-age pension systems that reduces uncertainty and helps individuals planning their consumption pattern over the life-cycle. Within this framework, an option for a funded pension system should be explicitly be introduced, or at least be left open. Since a transition to a funded system involves two generations (of 30 years each), a long-term commitment of policy is required. One instrument of policy to commit itself to stick to a transformation of the system could be a constitutional amendment fixing certain principles of the pension system that could only be changed by a broad majority in parliament. In the following, some practical aspects of a transformation of the pension system shall be considered.

41. When evaluating the state of the prevalent pay-as-you-go system, it is not sufficient that the budget restriction is satisfied at a given point in time. Instead, the accrual future obligations have to be taken into account. The present value of future obligations has to equal the present value of future contributions. This requirement cannot be attained through adjustment of the pension benefit formula alone. It is important to explain the intertemporal budget constraint to the public. Future obligations should be made clear.

One option of a public pension system facing financial disequilibrium in the future is to build a capital stock in due course in order to finance excess expendi-

tures in later periods. In such a way, a funded system could be introduced over several generations.

42. Individual pension claims should be published regularly (e.g. on a yearly basis) in order to reduce uncertainty and, at the same time, open the possibility of certification of claims.

43. While a funded pension system, in principle, can be part of a public old-age insurance, the transformation of the system usually is associated with privatization. Individuals should be free to choose among suppliers of old-age insurance; private companies could compete with public agencies. An important additional aspect is that with a private sector system the danger of politicians abusing the funds is reduced.

The additional savings associated with a funded system must not be used to fund additional public expenditures (Sachverständigenrat 1988, number 373). Therefore, limits to public deficits should be respected.

44. To exclude problems of adverse selection, private insurers must not be allowed to discriminate when contracting. For the individual, the change of insurers should be possible at low cost. The risks associated with individually different longevity are borne by the insurer when the contract provides for paying monthly pension benefits.

45. The institutional framework should contain an obligation to insure for old-age at a minimum level, i.e. to contribute to a pension scheme in order to reduce moral hazard.

The proposal of a tax financed basic pension that provides an — unconditional — minimum income after retirement does not solve this problem. The problem with this proposal is that the principle of equivalence of benefits and contributions is totally abandoned in the sphere of the basic pension. Such a system

would have detrimental incentives and cannot be recommended on similar grounds as various negative income tax proposals (Siebert 1995).

46. Introducing a minimal old-age insurance that is obligatory and financed with contributions could help to avoid these kind of adverse incentives. Contributions for pensions that exceed the minimum pension level would be on a voluntary basis. To prevent old-age poverty, retirement income would be provided by social assistance to persons whose income in active years did not allow to contribute to the minimum pension scheme. In order to give incentives to contribute, the minimum pension must exceed the level of social assistance sufficiently. This is a specific problem in Europe where social welfare provides a lower income floor.

47. The share of voluntary savings in providing retirement income would also be increased when the maximum income subject to contribution to the public pension system would be frozen at its current level for a substantial period of time, say two generations, or when the maximum income would be lifted by less than the rate of growth of net wages and salaries. In such an approach, the equivalence of contributions and pension claims could prevail. Proceeding in such a way, would leave more and more income (in relation to national income) outside the public pension scheme effectively altering the overall pension system through the back door. At the same time, however, the public pension system would increasingly get into financial disequilibrium; in the transition phase, pension outlays would more and more have to be financed through external sources, or pension levels would have to be cut.

48. A basic principle for the reform of old-age insurance should be that contributions are to be separated from employment contracts. The fact that employers pay part of the contributions does not mean that they actually bear the associated burden. Effectively, workers have to pay for old-age insurance in full: in the long run, to keep the real gross compensation of employees within the limits given by productivity, wages have to adjust, or, otherwise, unemployment

will increase. To make the system more transparent, the full share of contributions should be paid from workers' income.

49. One precondition for such a reform would be to create equivalence of pension claims and contributions by eliminating interpersonal distribution from the old-age insurance scheme. Retirement incomes of contributors whose resulting pension claims would be below the (social) subsistence level due to low incomes in active years would have to be supplemented by social assistance.

50. Separating the obligation to contribute to the public pension system and the fact of being employed, eliminates incentives to manipulate the labor status in order to disqualify from membership of the system. Decisions on being employed or self-employed, how long hours to work, or the kind of occupation, would not be influenced by rules in the public pension system.

51. To sum up, strengthening of funded elements can contribute to overcome the problems the public pension system is currently facing. A major goal of reform should, from an economic perspective, always be to increase individual's freedom to choose.

## Appendix

Table 1 — Demographic Development and Old-age Dependency Ratios for Germany, 1995–2040, Using Various Assumptions on Fertility<sup>a</sup>

		1995	2000	2010	2020	2030	2040
Constant Fertility	Population	81 539	82 182	81 036	78 445	74 347	68 800
	Aged 20 – 59 <sup>b</sup>	47 113	45 967	45 629	42 709	36 011	33 118
	60 years and over <sup>b</sup>	16 874	18 758	20 447	22 695	26 376	25 308
	Old-age dependency ratio <sup>c</sup>	35.8	40.8	44.8	53.1	73.2	76.4
	Aged 20 – 65 <sup>b</sup>	51 445	51 493	49 966	48 414	42 512	37 406
	65 years and over <sup>b</sup>	12 542	13 232	16 110	16 990	19 875	21 020
	Old age dependency ratio <sup>d</sup>	24.4	25.7	32.2	35.1	46.8	56.2
Declining Fertility	Population	81 539	82 034	80 117	76 667	71 685	65 043
	Aged 20 – 59 <sup>b</sup>	47 113	45 967	45 629	42 562	35 098	31 255
	60 years and over <sup>b</sup>	16 874	18 758	20 447	22 695	26 376	25 308
	Old-age dependency ratio <sup>c</sup>	35.8	40.8	44.8	53.3	75.1	81.0
	Aged 20 – 65 <sup>b</sup>	51 445	51 493	49 967	48 266	41 600	35 642
	65 years and over <sup>b</sup>	12 542	13 232	16 110	16 990	19 875	21 020
	Old age dependency ratio <sup>d</sup>	35.8	25.7	32.2	35.2	47.8	59.0
Increasing Fertility	Population	81 539	82 399	82 379	81 049	78 347	74 523
	Aged 20 – 59 <sup>b</sup>	47 113	45 967	45 629	42 924	37 345	35 702
	60 years and over <sup>b</sup>	16 874	18 758	20 447	22 695	26 376	25 308
	Old-age dependency ratio <sup>c</sup>	35.8	40.8	44.8	52.9	70.6	70.9
	Aged 20 – 65 <sup>b</sup>	51 445	51 493	49 967	48 629	43 847	39 989
	65 years and over <sup>b</sup>	12 542	13 222	16 110	16 990	19 875	21 020
	Old age dependency ratio <sup>d</sup>	35.8	25.7	32.2	34.9	45.3	52.6

<sup>a</sup>For net migration, a medium scenario (A) has been assumed. — <sup>b</sup>Thousand persons. — <sup>c</sup>Number of persons aged 60 and over in percent of persons aged 20–59. — <sup>d</sup>Number of persons aged 65 and over in percent of persons aged 20–64.

Source: Bundesministerium des Innern (1996); own calculations.

Table 2 — On the Rates of Return of Pension Systems

Year	Return on real assets <sup>a</sup>	Real interest rate		Growth rate of real gross compensation of employees <sup>a</sup>	Growth rate of real "standard" pension <sup>a</sup>
		Return on securities <sup>a</sup> deflated by			
		Domestic producer price index	Consumer price index of all households		
West Germany					
1970	5.9	3.3	4.7	14.0	2.9
1971	5.5	3.5	2.6	4.8	0.9
1972	5.2	5.2	2.4	3.9	10.2
1973	4.8	2.5	2.2	5.0	3.9
1974	4.0	-2.5	3.4	1.6	4.3
1975	3.8	4.1	2.9	-2.7	4.2
1976	4.7	4.5	4.0	3.3	5.7
1977	4.7	3.9	3.0	2.8	6.2
1978	5.1	5.2	3.6	3.4	-2.0
1979	4.9	2.9	3.5	3.4	0.9
1980	3.6	0.9	3.0	3.0	-1.3
1981	2.9	2.3	3.7	-2.0	-1.9
1982	2.8	3.0	3.5	-2.2	0.2
1983	3.9	6.6	4.7	-1.5	2.0
1984	4.2	4.9	5.6	1.6	0.9
1985	4.4	4.6	4.9	1.4	0.9
1986	5.0	9.2	6.6	5.2	2.7
1987	4.9	9.0	6.0	3.5	4.0
1988	5.5	5.3	5.2	2.8	2.0
1989	5.6	3.7	4.1	1.9	0.0
1990	5.9	7.0	6.0	5.4	0.2
1991	5.6	5.9	4.7	4.9	1.0
1992	5.1	6.5	3.8	2.6	-1.2
1993	4.5	6.6	2.9	-2.9	0.5
1994	5.0	6.4	4.2	-0.8	0.3
1995	-	5.2	5.1	0.7	-1.7



Year	Return on real assets <sup>a</sup>	Real interest rate		Growth rate of real gross compensation of employees <sup>a</sup>	Growth rate of real "standard" pension <sup>a</sup>
		Return on securities <sup>a</sup> deflated by			
		Domestic producer price index	Consumer price index of all households		
Germany					
1991	5.1	-	-	-	1.0
1992	4.6	6.5	2.7	2.9	-1.2
1993	4.1	6.4	2.0	-2.6	0.5
1994	4.6	6.4	4.2	0.2	0.3
1995	5.2	5.1	5.1	1.3	-1.7
1996	-	6%	4%	¼	0.4

<sup>a</sup>For details of the definitions see Sachverständigenrat 1996, Table 53.

Source: Sachverständigenrat 1996/97, Table 53; calculations of Sachverständigenrat.

## Bibliography

- Aaron, H. (1966). The Social Insurance Paradox. *Canadian Journal of Economics and Science*, 32 (3), 371-374.
- Auerbach, A.J., J. Gokhale, L.J. Kotlikoff (1991). Generational Accounts: A Meaningful Alternative to Deficit Accounting. *Tax Policy and the Economy*, 5, 55-110.
- (1994). Generational Accounting: A Meaningful Way to Evaluate Fiscal Policy. *Journal of Economic Perspectives*, 8 (1), 73-94.
- Blanchard, O.J., S. Fisher (1989). *Lectures and Macroeconomics*. Cambridge, Mass.
- Breyer, F. (1990). *Ökonomische Theorie der Alterssicherung*. München.
- Bundesministerium des Innern (1996). *Modellrechnungen zur Bevölkerungsentwicklung in der Bundesrepublik Deutschland bis zum Jahr 2000*. Mimeo.
- Diamond, P. (1996). Generational Accounts and Generational Balance: An Assessment. *National Tax Journal*, 49 (4), 597-607.
- Feldstein, M. (1974). Social Security, Induced Retirement, and Aggregate Capital Accumulation. *Journal of Political Economy*, 82 (5), 905-926.
- (1995). Would Privatizing Social Security Raise Economic Welfare? NBER Working Paper 5281.
- (1996). The Missing Piece in Policy Analysis: Social Security Reform. *American Economic Review*, 86 (2), 1-14.
- Glismann, H.H., E.-J. Horn (1995). Die Krise des deutschen Systems der staatlichen Alterssicherung. *ORDO, Jahrbuch für die Ordnung von Wirtschaft und Gesellschaft*, 46.
- Gischer, H. (1996). Die Höhe der Rentenversicherungsbeiträge im Kapitaldeckungsverfahren. Einige einfache Zusammenhänge und Beispielrechnungen. *Wirtschaftswissenschaftliches Studium*, 25 (6), 274-279.

- Haveman, R. (1994). Should Generational Accounts Replace Public Budgets and Deficits? *Journal of Economic Perspectives*, 8 (1), 95–111.
- Homburg, S. (1987). Theorie der Alterssicherung. Berlin.
- (1988). Umlage- versus Kapitaldeckungsverfahren. *Wirtschaftswissenschaftliches Studium*, 17 (12), 605–609.
- Kotlikoff, L.J. (1996). Privatization of Social Security: How it works and why it Matters. *Tax Policy and the Economy*, 10, 1–32.
- Leibfritz, W., D. Roseveare, D. Fore, E. Wurzel (1995). Ageing Populations, Pension Systems and Government Budgets: How Do They Affect Saving? OECD Working Papers No. 68.
- Mitchell, O.S., S.P. Zeldes (1996). Social Security Privatization: A Structure for Analysis. *American Economic Review*, 86 (25), 363–367.
- Neumann (1986). Möglichkeiten zur Entlastung der gesetzlichen Rentenversicherung durch kapitalbildende Vorsorgemaßnahmen. Tübingen.
- (1998). Vom Umlageverfahren zum Kapitaldeckungsverfahren: Optionen zur Reform der Alterssicherung. Stellungnahme für das Frankfurter Institut — Stiftung Marktwirtschaft und Politik, mimeo.
- Noord, P. van den, R. Herd (1993). Pension Liabilities in the Seven Major Economies. OECD Working Paper No. 15.
- OECD (1995). *OECD Economic Outlook*, 57 (June).
- (1996). *OECD Economic Outlook*, 60 (December).
- Prognos (1995). Perspektiven der gesetzlichen Rentenversicherung für Gesamtdeutschland vor dem Hintergrund veränderter politischer und ökonomischer Rahmenbedingungen. DRV-Schriften, Band 4. Frankfurt/Main.
- Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung (1988). Arbeitsplätze im Wettbewerb. Jahresgutachten 1988/89. Stuttgart.

- (1996). Reformen voranbringen. Jahresgutachten 1996/97. Stuttgart.
- Samuelson, P.A. (1958). An Exact Consumption Loan Model of Interest with or without the Social Contrivance of Money. *Journal of Political Economy*, 66 (6), 467-482.
- Siebert, H. (1995). Geht den Deutschen die Arbeit aus? Neue Wege zu mehr Beschäftigung. München.
- (1997). Die Einschränkung des Lohnbildungsspielraums durch die Kosten der Sozialversicherung. *Die Weltwirtschaft*, Heft 1, 2-8.
- Weizsäcker, Robert K. von (1990). Population Aging and Social Security: A Political-Economic Model of State Pension Financing. *Public Finance*, 45 (3), 491-509.
- World Bank (1994). *World Population Projections*, 1994-95 Edition.