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Privatization of Public Pensions in Germany: Who Gains and How Much?

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Abstract

This paper examines the distributional and efficiency effects of pension privatization in Germany. Starting from a benchmark that reflects the current unfunded pension system, a fully funded system is introduced. The accrued benefits of the old system are financed by alternative tax combinations as well as deficit increases. The quantitative analysis is based on an Auerbach-Kotlikoff type simulation model that distinguishes between five lifetime income classes within each age cohort. The simulations reveal a clear trade-off between the efficiency and equity aspects of alternative financing schemes. While consumption taxes are the most efficient financing instrument, they also undermine intra- and intergenerational equity. Phasing-out the unfunded system on the other hand not only dampens the income redistribution across and within generations, but also reduces the efficiency gains dramatically.

1. Introduction

The state of the current German pension system is highly alarming. The aging society coupled with the prospect of increasing longevity is causing dramatic fiscal strains to the pay-as-you-go (PAYG) financed statutory pension scheme. In order to keep the current benefit level for future retirees, the contribution rate is projected to increase up to 30 percent during the next decades. However, already the current contribution level of 20 percent is considered to be too high. Therefore, the government enacted the 1992 Pension Reform Act and just recently presented a draft for a new Pension Reform Bill in order to restrain the expenditure growth. Both reforms intend to lower the pension level gradually and to finance a higher proportion of expenditures in the future by federal taxes. These measures, however, only improve the financial situation of the public pension system in the short and medium-run. The long-run fiscal burdens inherent in the system either require a substantial increase in the contribution rate or a dramatic reduction in the future benefit level. Since the necessary adjustments are almost unfeasible politically, the current unfunded pension scheme is seen at the 'verge of collapse' (Börsch-Supan, 1998) and unsustainable for the future. It is, therefore, not surprising that in Germany, like in many other countries, a growing number of economists are discussing the move to a fully funded pension system[1]. In essence this means that public pensions will be substituted by private retirement provisions in the future. This paper, therefore, refers to the shift to a fully funded system as "privatization" of public pensions.

While population aging is dramatically reinforcing the need for a reform of the pension system, the case for privatization could be made even in an economy with a stable demographic structure. The principle economic argument is based on the fact that the rate of return in a funded system is higher than the implicit rate of return in a PAYG system (Homburg, 1997). Consequently, a specific benefit level can be financed with a much lower contribution rate in a funded system. This mainly has two consequences. First, lower contribution rates imply a higher disposable income and therefore a higher level of welfare for households living under a funded system. Second, since contributions in a funded system yield the same return as savings, they are no longer considered to be (at least partly) a form of taxation. Pension

[1]Some recent contributions in this direction include Berthold and Schmid (1997), Frankfurter Institut (1997), Glismann and Horn (1997), Hirte and Weber (1997) and Siebert (1998).

privatization, therefore, eliminates the distortions of the labor-leisure decision under the PAYG system. Since the contribution rate is added on top of the existing marginal personal income tax rates the imposed deadweight loss is quite substantial. As pointed out by Feldstein (1996), not only the labor supply (i.e. labor force participation, number of working hours, occupational choice, etc.) is distorted, but also the form in which compensation is taken (i.e. fringe benefits or enhanced working conditions).

While the long-run prospects of a fully funded pension system look very advantageous, critics of such a switch point out the severe transitional problems. The more the PAYGO system is intragenerationally fair, the lower are the efficiency gains from privatization, see Fenge (1995). The long run welfare gains are then mainly due to redistribution, since working-age generations living at the time of the introduction of the funded system have to bear a double burden. They will have to finance the accumulated pension claims of the existing retirees and they will also have to provide savings for their own retirement. The distribution of this burden within and across generations depends on the chosen transitional arrangement. If privatization is, for example, mainly financed by progressive income taxes, then rich households bear a higher burden relative to poor households. If it is financed mainly by consumption taxes, then households with high consumption shares and low saving rates will bear a relatively higher burden. Finally, if the deficit is increased, then part of the burden is shifted to future generations. Of course, the financing of the transition also affects the above mentioned efficiency gains from privatization. Since lump-sum taxes are not available in practice, distortionary taxes have to be increased. The efficiency losses associated with these taxes have to be balanced against the efficiency gains due to the elimination of the unfunded system.

The present paper compares the distributional and efficiency implications of alternative privatization scenarios for Germany. More specifically, I analyze a phase-out of the PAYG pension system where a fully funded system is gradually introduced within 50 years. Such a privatization plan has been recently suggested by the Frankfurter Institut (1997) for Germany and has been studied by Neumann (1997) within a partial equilibrium framework. Alternatively, I also simulate an immediate elimination of the PAYG system where the old claims are financed by general taxes. The latter approach was (at least in principle) pursued by Chile in the eighties. The quantitative analysis is based on the overlapping generations model of

the Auerbach-Kotlikoff (1987) type. In contrast to Raffelhüschen (1993) and Hirte and Weber (1997) who apply a similar framework, I do not intend to simulate a Pareto-improving transition. Since the government in my model only compensates the accumulated pension claims from the former PAYGO system, privatization will always lead to welfare gains and losses for specific generations and households. In addition, two important innovations distinguish the present study from the previous ones. First, I disaggregate each generation into five different lifetime income classes. This allows the analyzation of intragenerational effects of alternative privatization schemes[2]. Second, as in Fehr and Wiegard (1998), I disaggregate the welfare changes into redistributional and efficiency components. This will improve the interpretation and the quantification of the different economic effects that are at work.

The simulations reveal a clear trade-off between the efficiency and equity aspects of alternative privatization schemes. While consumption taxes are the most efficient financing instrument, they also undermine intragenerational equity in the short run and imply a dramatic redistribution towards future generations. A phased-out substitution towards a fully funded system dampens the intergenerational income redistribution and also comes at the cost of lower efficiency gains. Efficiency gains are further dampened by policy preannouncement and deficit policy, but are increased if the interest rate is fixed by the world market.

The outline of the paper is as follows. Section 2 describes the basic structure of the simulation model and explains its representation of the German public pension system. Section 3 contains the simulation results. It first explains the disaggregation of equity and efficiency effects for different households, then it discusses the specific reform scenarios considered and reports the quantitative figures. Section 4 provides some conclusions and directions for future research.

2. A simulation model of the German pension system

This section describes the simulation model which is used to evaluate alternative privatization scenarios. The first subsection sketches its general structure. Then the second subsection explains the modeling of the German pension system in more detail. Finally, the last subsection reports some important characteristics of the benchmark equilibrium.

[2] A similar disaggregation has been applied by Kotlikoff, Smetters and Walliser (1998) to simulate alternative privatization schemes for U.S. social security.

2.1 The structure of the extended AK Model

The framework of the AK Model is by now a fairly standard tool in the numerical analysis of public finance issues dealing with intergenerational redistribution. Assuming rational expectations, the model calculates the transition path and the new long-run equilibrium for an economy after a tax reform. It features 55 overlapping generations with each adult living for 55 years, corresponding to the "natural" ages of 20 to 75. In addition to the household sector, the domestic economy contains firms and the government. In the open economy version, a foreign sector is added to complete the model.

Each household decides how much to consume and how many hours to work in each period, and when to withdraw from the workforce. For the latter decision, it compares the reservation wage with the market wage. In the present model, every generation is split into five lifetime income quintiles. Wages for each lifetime income class grow according to an exogenously specified age-wage profile which is based on estimates from the German Socio-Economic Panel (SOEP) study. Hence, in each period, the model distinguishes between 275 types of households according to age and income. Preferences for current and future consumption and leisure are governed by a time-separable constant elasticity of substitution (CES) utility function with intertemporal and intratemporal elasticities of substitution of 0.25 and 0.7, respectively. The applied discount rate is 1.5 percent. Preferences are identical for all lifetime income classes. This reflects the belief that poor households would behave like rich ones, provided they had the same (higher) income. Agents are only concernd with their own welfare, i.e. there is no bequest motive. This might appear to be quite restrictive on first sight. However, as will become clear in a later section, the present model is also able to represent an extreme altruism model, where all intra- and intergenerational redistribution effects are eliminated through countervailing transfers. The growth rate of the economy is set at 2.5 percent per year which includes the growth of the labor force and technological progress.

The producer side of the economy is represented by a constant-returns-to-scale CES production function using labor and capital as inputs. The elasticity of substitution between capital and labor is 0.9, and the resulting capital-income share is 30 percent in the benchmark equilibrium. The capital stock depreciates at 7 percent annually. Investment decisions follow the Q-theory of investment, according to which firms

will invest whenever the stock market value of their assets exceeds the cost of replacement. This is consistent with investment behavior derived from maximizing the market value of the firm when capital formation is subject to convex installation costs. Note, however, that there are no installation costs in the steady state.
The government sector supplies a given amount of public goods, which enter the individual utility function in an additively separable manner. A second item on the expenditure side of the public budget are transfers to the pension system. Government outlays are financed by issuing new debt and collecting taxes from individuals and firms. The model represents consumption taxes and corporate taxes as well as progressive taxes on labor, capital income and pensions. The consumption tax rate is 15 percent which represents an aggregate of value-added and various excise taxes. The statutory corporate tax rate in the model is set at 56 percent reflecting the corporate tax on retained earnings as well as the trade tax on capital income. In order to obtain a realistic corporate tax revenue, the tax base is reduced by investment expensing and accelerated depreciation allowances. The effective corporate tax rate in the benchmark equilibrium, therefore, amounts to 32 percent. Labor income is subject to a progressive wage tax. The respective marginal tax rates and income brackets follow the tax rate schedule of 1996 and, therefore, vary between zero and 53 percent. Taxable income is derived after deducting a uniform allowance of DM 20,000. Forty percent of pensions income is also taxed according to the same progressive tax rate shedule. Due to the high basic allowance, only pensioners of the top income class pay income taxes. Capital income is also taxed progressively. In contrast to labor income, the allowance depends on the income level and varies between DM 7000 and DM 40,000. This should reflect the fact that, in Germany, only wealthy people can take full advantage of various tax arbitrage opportunities.

2.2 The modeling of the German pension system[3]

In 1996, total expenditures of the statutory pension scheme (GRV) amounted to DM 350 billion or about 10 percent of GDP. Except for civil servants, whose pensions are paid directly from the budget, all dependent employees are compulsorily insured. Most self-employed are exempted from compulsory insurance. However, they may join the system as voluntary members. Apart from a liquidity reserve which

[3]For a comprehensive description of the current German pension system see Börsch-Supan and Schnabel (1997).

amounts to one month's expenditure, the system currently has no funding. In 1996, the contribution rate was 19.2 percent, which was applicable up to a monthly contribution ceiling of DM 8000 or about 1.8 times the average gross earnings of all insured persons. Consequently, if the employee earned less than DM 8000, 9.6 percent is deducted from his gross wage and another 9.6 percent is paid directly by the employer into the public pension system. In addition to these private contributions, the federal government provides a grant which is meant to cover benefits which are not directly related to old age insurance. These include credits for military service or child-rearing and the cost of rehabilitation benefits and health insurance for pensioners. Normal retirement with full benefits is possible in Germany after age 63 after a contribution record of at least 35 years. However, the average retirement age is much lower due to the generous early retirement options. In 1996, the overall average retirement age was 60. In the case of early retirement before age 65, a strict earnings test has to be passed when working in addition to receiving an old age pension. Since pensions are reduced quite dramatically if earnings exceed certain limits, partial retirement is extremly rare in Germany.

Pension benefits are computed by multiplying the number of "earning points" (EP) and the "actual pension amount" (APA). Additionally, there are two adjustment factors concerning the retirement age and the type of pension[4]. For each year of service, the worker receives an earning point which reflects his relative income position in that year. If he receives the average wage, then he gets exactly one earning point. If he receives more or less than average earnings he receives points on a pro-rata basis (i.e. 0.8 points if he earns 80 percent of the average, etc.). Due to the contribution ceiling, there is an upper limit of roughly 1.8 points per year of service. Various credits are given for non-contributory periods such as child-rearing and military service. If the insured worker has contributed for 35 years, earning points below 0.75 are raised by 50 percent to a maximum of 0.75. This increase predominantly benefits female pensioners who made very low contributions during their working years. When the worker retires, the sum of his earning points is multiplied by the APA, i.e. the (monthly) payment in a given year for one EP.

[4]The pension access factor – introduced in 1992 – is 1.0 for regular retirement and lower or higher for early or late retirement. The factor of pension type is 1.0 in the case of old age and invalidity pension, 0.66 in the case of vocational disability pension and 0.6 in the case of a widow's pension.

The APA is adjusted annually according to the growth of net wages. Currently, the so-called standard pension which is received after a 45-year contribution history by a worker who always earned the average wage amounts to 70 percent of average net earnings.

In the model, I assume that all individuals retire after 40 working years at age 61. Pension benefits which they receive in year s, b_s, are computed from the sum of the earning points EP_j which the retiree has received during his past working life, multiplied by the actual pension amount of the respective year:

$$b_s = \sum_{j=1}^{40} EP_j \, APA_s. \tag{1}$$

The earning point received in working year j for his annual gross labor income y_j is calculated according to the formula

$$EP_j = \begin{cases} min(1.5y_j/\bar{y}_j; 0.75) & \text{if} \quad y_j \leq 0.75\bar{y}_j \\ y_j/\bar{y}_j & \text{if} \quad 0.75\bar{y}_j < y_j < 1.8\bar{y}_j. \\ 1.8 & \text{if} \quad 1.8\bar{y}_j \leq y_j \end{cases}$$

This formulation reflects some of the redistributional features of the German pension system mentioned above. If the individual income in year j, is below 75 percent of average income $\bar{y}_j$, then the accounted earning point is increased up to 50 percent. If the annual individual income is above the contribution ceiling, which exceeds the average income by 80 percent, then a maximum earning point of 1.8 is credited. Below the contribution ceiling and above the minimum threshold, earning points are computed from the ratio of individual income to the average income of the respective year. The actual pension amount in the second part of equation (1) is set by the government. As in reality, this number reflects the payments for one earning point. In the model, APA_s is computed so that the standard pension (i.e. where the sum of earnings points is 40) amounts to 70 percent of net average earnings, $\overline{y^n}_{s-1}$, of the previous year[5], i.e.

$$APA_s = 0.7 \, \frac{1}{40} \, \overline{y^n}_{s-1}.$$

The budget of the pension system must be balanced in each period. Therefore, the aggregate contribution rate, τ_s^p, has to be adjusted to fulfill the period budget

[5]Since the model does not take into account credits from non-contributory periods, a standard pension after 40 contribution years is quite realistic.

constraint

$$\tau_s^p PY_s = (1 - \vartheta_s) PB_s, \tag{2}$$

where PY_s defines the aggregate compulsory earnings base and PB_s is the aggregate pension outlays in period s. The share of expenditures financed by the government is denoted by ϑ_s. As discussed above, the government grant to the pension system mainly covers non-contribution related benefits. Since I cannot represent such benefits satisfactorily in the model[6], I assume that in the benchmark equilibrium the government grant is zero, i.e. $\vartheta = 0$. In principle, households still could chose to work after receiving pension payments. However, I assume that individuals face a marginal labor income tax of 60 percent if they work after passing the retirement age. This assumption is designed to capture the above mentioned earnings test applied to early retirement.

Due to the contribution ceiling, individual contribution rates might differ from the aggregate one. Workers who receive an annual income above the contribution ceiling, face a zero marginal contribution rate and a declining average contribution rate.

2.3 The benchmark equilibrium

Given the endowments and the parameters describing preferences, technologies and the fiscal system, the model can be solved for the initial steady state. Ideally, this benchmark equilibrium should reflect some stylized facts of the German economy.

An important innovative feature of the present model is that it exactly reproduces the step function of the marginal tax rate schedule for the labor income tax. Most simulation models are not able to handle such kinks in the budget constraint, where the marginal tax rate changes abruptly in response to small changes in the agent's behavior. The present model bridges this discontinuity of the budget constraint by solving for so-called "virtual" marginal tax rates which place the optimizing agent exactly at the kink if they wish to be there. Individuals of the lowest income quintile start with DM 23,000 annual labor income and then receive for most of their time up until retirement exactly DM 32,000. Since they can deduct DM 20,000 as allowances and the first DM 12,000 of taxable income are not taxed in Germany, they pay no labor income tax at all during their lives. In the third quintile, annual labor income

[6] These include credits for military service or child-rearing as well as the cost of rehabilitation benefits and health care insurance for pensioners.

starts at DM 32,000 and then increases up to DM 45,000 when they are 45, after which it then decreases again to DM 32,000 when they retire. In the top income quintile, labor income starts at DM 58,000. It increases up to almost DM 120,000 when they are 43, and then it decreases again to DM 70,000. Note that these figures include neither annual capital income nor pension benefits. If both are taken into account, then the income distribution of the benchmark matches the German situation quite well, as the first part of Table 1 demonstrates. The right column reports the quintile shares from a study which used net-of-tax income data of West German individuals in 1992 from the SOEP. The respective distributional figures from the benchmark equilibrium are reported in the second column of Table 1.

Table 1: The benchmark equilibrium

	Model benchmark	Germany 1992[a], 1996[b]
Qunitile shares of annual net income in percent		
Lowest	9.3	9.5
Second	13.7	14.0
Third	17.4	17.8
Fourth	21.6	22.8
Top	38.0	35.9
General government indicators (Percent of GDP)		
Aggregate pension benefits	7.2	10.0
Government consumption	18.4	19.6
Gross debt	60.0	60.7
Interest paid	5.4	3.7
Tax revenues	24.2	23.2
Labor income tax	9.9	7.3
Capital yields tax	1.1	1.2[c]
Corporate income tax	1.4	1.6[d]
Tax on goods and services	10.2	9.3[e]
Interest rate (in percent)	9.0	–
Saving rate[f]	7.9	12.8

Source: [a] Mueller et al. (1994, 49). [b] Deutsche Bundesbank (1997).
[c] Withholding taxes on interest and capital yields plus corporate tax on distributed profits.
[d] Trade tax on capital income plus corporate tax on retained earnings.
[e] Turnover tax and excise tax. [f] Change in assets as a percentage of disposable income.

The second part of Table 1 reports the structure of the government in the benchmark equilibrium and the corresponding actual figures for 1996. Due to the constant population growth rate, the number of pensioners relative to the number of workers

is quite low in the model. Consequently, aggregate pension benefits are below the actual level. Most of the workers are facing an average and marginal contribution rate of 10.5 percent in the benchmark. However, some high income earners who exceed the income ceiling face a marginal contribution rate of zero and a lower average contribution rate. The aggregate average contribution rate, therefore, is 10.1 percent, which is roughly half of the contribution rate in 1996, and the aggregate marginal contribution rate is 8.2 percent. Note that these marginal contribution rates reflect the distortions created by the current PAYG system quite well. The fraction of contributions which is considered to be an implicit tax is determined by the remaining periods until retirement and the difference in the return workers receive on the capital market and the implicit return of the PAYG system. If the interest rate exceeds the growth rate of the work force, then contributions made early in life are more distortive than contributions made just before retirement. Some back of the envelope calculations by Homburg and Richter (1990) indicate an average implicit tax rate of 9 percent. Hirte and Weber (1997), on the other hand, explicitly take into account the timing of the contributions. Consequently, their marginal contribution rate is close to the statutory contribution rate for young households and approaches zero percent for older households which are close to retirement.

Government consumption outlays are slightly below the actual figure for 1996. The debt level in the benchmark equilibrium amounts to 60 percent of GDP, which is a realistic figure for 1996. However, due to the high interest rate, the interest payments are above the actual figures and due to the low growth rate, the deficit-output level is only 1.5 percent. Aggregate tax revenues in the model, on the other hand, approximate the actual figure quite well. Note, however, that the labor income tax in the model also has to cover revenues from other taxes which are not explicitly taken into account. Overall, the government sector is underrepresented in the model, since aggregate government outlays sum up to almost 50 percent of GDP in Germany. Of course, this is mainly due to the fact that I do not take into account transfers due to social assistance programs and other state-organized insurance schemes for health, unemployment, accident and nursing care. In a model without uncertainty it is almost impossible to model such transfers satisfactorily. At the same time these programms do not seem to have an important effect on the welfare consequences of pension privatization.

Finally, note that I model a closed economy in the initial steady state. Consequently, the interest rate is determined endogenously by private savings. However, private savings are low, mainly because of the pension system. Furthermore, the public deficit crowds out part of the capital stock and, consequently, the interest rate is quite high in the benchmark equilibrium[7].

3. Simulation and policy analysis

This section contains the simulation exercises. Before I present the numerical results, I first have to explain the welfare decomposition used in this study.

4.1 The decomposition of welfare changes

In order to evaluate the pension privatization experiment, I compute the changes in economic welfare or utility (ΔU) for the different generations and households. These welfare changes must be due to either (re)distributional effects or to efficiency effects. Distributional effects alone arise for two different reasons. On the one hand, the elimination of the PAYG system changes the net tax burdens (ΔT). After the reform, each household faces a different tax payment and receives a different pension benefit than under the old system. On the other hand, pension privatization may also affect gross-of-tax prices, especially in the closed economy. If, for example, the marginal product of labor increases after the privatization while the marginal product of capital falls, then workers will gain at the expense of those who consume their savings. In the following, ΔP denotes that part of the total welfare change which is due to changes in gross-of-tax factor prices. Turning to the efficency component of welfare changes, behavioral reactions come to the fore. In order to avoid taxes, households or firms will substitute away from the more heavily taxed activities. The change in economic welfare which is exclusively due to tax avoidance activities is denoted in the following with ΔTA. As Fehr and Kotlikoff (1996) or Fehr and Wiegard (1998) show, the total individual welfare change following a policy reform can be decomposed into the three components:

$$\Delta U = -\Delta T + \Delta P + \Delta TA.$$

The first term on the right-hand-side (RHS) captures welfare changes due to changes in the present value of net tax burdens. The negative sign indicates that an increase

[7] However, Feldstein (1996, 9) indicates that this figure is close to the average U.S. pretax rate of return over the past 35 years.

in the present value of tax payments will decrease welfare. The second term, ΔP, records welfare changes that are due to changes in the present value of factor incomes. The sum of the two terms measures the redistributional effect of the tax reform for a specific household. Finally, ΔTA quantifies changes in the present value of individual tax payments that are due to tax avoidance reactions. Note that tax avoidance efforts refer to behavioral reactions, including income as well as substitution effects. However, efficiency effects or changes in excess burdens are related to substitution effects only. In order to isolate the efficiency effects of policy reforms, one has to eliminate the income effects by compensating households for any distributional gains or losses. In the present context, the redistributional content of the policy (i.e. $-\Delta T + \Delta P$) has to be neutralized by countervailing transfers. After compensation, the first two terms on the RHS of the above equation are zero, and the last term is converted into the pure efficiency effect or the present value of the changes in excess burdens (ΔEB).

In the following section, I numerically calculate the welfare changes (ΔU) for different households and generations and decompose it into its redistributional components ($-\Delta T, \Delta P$) and its efficiency part (ΔEB). Note, however, that efficiency and redistribution terms do not add up exactly to total welfare changes. This, of course, is due to the fact that in general $\Delta EB \neq \Delta TA$.

I close this section with a final remark regarding the no bequest assumption of the preference structure. As explained above, I isolate the efficiency effects of a specific privatization scenario by neutralizing all intra- and intergenerational income effects. Such a situation can be interpreted as a Barro-Ricardo world, where all generations and households are linked by an operative altruistic bequest motive. This explains the above remark that the present model incorporates bequests in an indirect way.

4.2 Some numerical results

The simulations start from the initial steady state of year 0 as described above. In the AK Model, privatization of the pension system is quite simple. It just requires that the workers receive no more earning points (i.e. $EP_s = 0$) after a specific year. Since the model features a perfect capital market, forcing individuals to private pensions accounts would make no difference, since it only crowds out voluntary private savings. Hence, there is no need for a private pension system in the model. I also assume that the restrictions for working after retirement are loosened as well. Those

generations who are not retired in the initial year of the privatization can now work without the earnings test until age 64 although they still receive pensions from the old system starting at age 61. Therefore, the privatization experiment in the model mainly involves the decision on how to finance the accrued pension benefits from the old system. In this respect, I first consider a scenario with an immediate elimination of the PAYG system where the pensions of the elderly are financed by consumption taxes. While the consumption tax rate is adjusted to balance the budget, the government outlays now also include the accrued pension claims (i.e. $\vartheta_s = 1$). Of course, such a policy reform is not very realistic. Therefore, I contrast it in the second simulation with the more realistic case where the PAYG system is phased-out, and the pensions of the elderly are financed by contributions of the working generations (i.e. $\vartheta_s = 0$). Again, the consumption tax is adjusted to balance the budget of the government. The remaining experiments are intended to test the sensitivity of the results of the phase-out scenario with respect to specific assumptions. I first introduce a preannouncement period of five years, then I consider a partial deficit financing scenario, and finally I repeat the phase-out policy in a small open economy. When privatization is partially deficit financed I assume that the deficit is increased from 1.5 percent of GDP to 3 percent of GDP which finances 20 percent of the pension claims (i.e. $\vartheta_s = 0.2$).

4.2.1 Macroeconomic response

Let us now turn to the numerical results. Table 2 shows the macroeconomic adjustment for the five privatization scenarios described above. The table presents the changes in employment, capital stock, GDP, asset prices, wages, interest rate, the consumption tax rate, and the contribution rate at four points during the transition: in year 1 when the privatization starts, in year 5 and year 15 after the privatization, and in the long-run[8]. Note that the changes in the interest rate, the consumption tax rate and in the contribution rate are in percentage points, not in percentage of initial values.

Let us first compare the two base case scenarios. Of course, since privatization is financed by currently living domestic generations alone, both simulations feature

[8]The capital stock and the interest rate are fixed in the inital year of the transition. Therefore, they are reported for year 2 instead. Since the contribution rate is always reduced to zero in the long-run equilibrium, it is reported for year 30 instead.

Table 2: Macroeconomic effects of privatization[a]

	base case		sensitivity of phase-out		
Variable	immed. elimin.	phase-out	time lag	debt policy	smopec
Employment					
Year 1	1.6	0.3	-0.4	1.2	0.0
Year 5	2.8	1.9	-0.3	2.5	2.1
Year 15	3.6	3.0	2.5	3.0	3.4
Year infinity	5.6	5.6	5.6	4.2	1.2
Capital stock					
Year 2	0.3	0.0	-0.1	-0.1	0.2
Year 5	2.0	0.2	-0.6	0.0	0.9
Year 15	7.8	2.9	1.2	1.3	2.6
Year infinity	29.9	29.9	29.9	13.8	1.2
GDP					
Year 1	1.1	0.2	-0.2	0.8	0.0
Year 5	2.6	1.4	-0.4	1.7	1.8
Year 15	4.8	2.9	2.1	2.5	3.2
Year infinity	11.9	11.9	11.9	6.8	1.2
Asset price					
Year 1	2.0	-0.4	-0.8	-0.5	1.3
Year 5	3.4	1.1	-0.9	0.6	1.4
Year 15	3.1	1.9	1.7	1.1	0.9
Year infinity	-1.0	-1.0	-1.0	-0.4	0.0
Wage					
Year 1	-0.5	-0.1	0.1	-0.3	0.0
Year 5	-0.2	-0.5	-0.1	-0.7	-0.3
Year 15	1.2	0.0	-0.3	-0.5	-0.2
Year infinity	6.7	6.7	6.7	2.8	0.0
Interest rate					
Year 2	0.9	0.9	0.0	0.8	0.0
Year 5	-0.1	0.2	0.1	0.3	0.0
Year 15	-0.6	0.0	0.2	0.1	0.0
Year infinity	-2.0	-2.0	-2.0	-0.9	0.0
Consumption tax					
Year 1	9.7	0.3	0.4	-0.1	-0.3
Year 5	10.0	-0.3	0.6	0.2	-0.5
Year 15	6.7	-1.5	-0.8	0.6	-1.2
Year infinity	-7.5	-7.5	-7.5	-0.2	-4.5
Contribution rate					
Year 1	-10.1	0.0	0.0	-2.1	0.0
Year 5	-10.1	-0.4	0.0	-2.1	-0.4
Year 15	-10.1	-1.9	-1.0	-3.4	-1.9
Year 30	-10.1	-5.6	-4.3	-6.5	-5.6

[a] All changes reported are percentage increases over baseline steady state, except for changes in interest, consumption tax and contribution rates, which are already expressed as changes in percentage points.

the same long-run equilibrium. If the accrued benefits have to be financed by consumption taxes, then the tax rate has to increase by 9.7 percent on impact. But at the same time the pension contribution rate is eliminated so that labor supply and savings increase on impact. Consequently, wages fall on the labor market to absorb the higher labor supply. Firms will increase employment by 1.6 percent in the initial year which in turn improves the marginal product of capital and drives up the asset prices by 2.0 percent. On the capital market, the higher investment demand induces a higher interest rate despite the higher savings. On impact, the capital stock only rises by 0.3 percent. During the transition, new generations enter the labor force making labor supply and savings increase further. While the rising employment further increases asset prices and investment demand, the rising savings dampen the increase in the interest rate on the capital market. The capital stock and GDP, therefore, rise strongly during the whole transition. The higher capital stock in turn improves the marginal product of labor. Consequently, labor demand and employment increase, while wages rise. In contrast, the marginal product of capital decreases and, consequently, asset prices will fall again. After the initial increase, the consumption tax rate can be reduced because the burden from the old pension system falls, and the revenue from the labor income tax increases steadily. In the long-run equilibrium, the capital stock has increased by 29.9 percent, wages are 6.7 percent higher and the consumption tax rate has fallen from 15 percent down to 7.5 percent.

Consider now the adjustment in the second experiment where the accrued pension benefits are still financed by contributions. On impact, the consumption tax rate as well as the contribution rate only vary slightly. Consequently, labor supply and savings increase much less than before and wages only have to fall slightly to balance the labor market. On impact, employment now increases only by 0.3 percent. Since asset prices increase much less than before, the high contribution rate also dampens the capital accumulation during the initial periods quite significantly.

Next, the phase-out experiment is repeated with a time lag of five years. Since households know that the contribution rate will fall after year 5, they reduce their labor supply during the preimplementation phase. Consequently, asset prices, investment demand and the capital stock also fall before the implementation of the pension reform. As labor income tax revenues fall, the consumption tax rate has to increase. After the implementation of the new pension system in year 6, all vari-

ables jump on a new path in order to reach the same long-run equilibrium as in the previous experiment.

While alternative tax financing schemes and policy preannouncement only have transitional effects, partial deficit financing will also change the long-run equilibrium. As shown in the fourth column, an increase in the deficit-GDP ratio by 1.5 percent allows to reduce the contribution rate significantly on impact. Therefore, labor supply and employment increase much more strongly than in the base case experiment. But a higher deficit also crowds out investment on the capital market. As a result, the capital stock even falls slightly on impact and the capital accumulation during the transition is much slower. In the long-run, the capital stock increases now by 13.8 percent. In the long-run equilibrium, the increased deficit-output ratio results in higher interest payments. At the same time, the long-run labor income tax revenue falls compared to the previous experiments. Consequently, the long run consumption tax rate now falls only slightly by 0.2 percent.

The last column of Table 2 reports the results if the phase-out experiment is run in a small open economy. In the short-run, the capital accumulation is now faster due to capital inflows from abroad. The changes in labor supply can be explained by two different price reactions. On the one side, the fixed interest rate eliminates the negative short-run human capital effect of the closed economy experiment. This might explain the dampened initial increase in employment. At the same time, the strong initial increase in asset prices implies a negative income effect for middle aged generations, which might explain the stronger increase in labor supply during the early transition compared to the closed economy. However, during the transition, capital accumulation is dampened, since the interest rate cannot fall as in the closed economy experiment. The lower capital accumulation decreases the labor demand of firms and, consequently, employment rises less than in the previous experiment. Wages can vary only temporarily during the transition. In the long-run equilibrium, employment increases in accordance with the capital stock so that wages will return to their initial level[9]. Due to the higher long-run interest rate, the debt service is now higher than in the closed economy experiment. In addition, labor income tax revenues are lower than before. Consequently, the long-run consumption tax rate is higher than in the closed economy.

[9] In a model without adjustment costs, wages would also be fixed during the transition.

Table 3: Aggregate equity and efficiency effects of pension privatization

	base case		sensitivity of phase-out		
	immed. elimin.	phase-out	time lag	debt policy	smopec
	Annual aggregate efficiency gain				
in % of tax revenue	6.87	4.74	3.21	4.64	5.70
in bill. DM	54.96	37.92	25.68	37.12	45.60
	Annual Gini-coefficient[a] (Base year: 0.270)				
Year 1	0.261	0.273	0.267	0.269	0.274
Year 10	0.279	0.287	0.286	0.285	0.285
Year 20	0.276	0.284	0.285	0.282	0.284
Year infinity	0.299	0.299	0.299	0.296	0.295

[a] Based on annual disposable income.

4.2.2 Welfare, efficiency and equity

More interesting than the macroeconomic consequences are of course the welfare implications of pension privatization for different households and generations. Are there any efficiency gains from pension privatization? What are the distributional implications of the different reform scenarios I consider in this study? Before I discuss the details of the simulation results, the efficiency and distributional consequences of the policy reforms are presented with some aggregate indices in Table 3.

In the upper part of Table 3, I report the annual efficiency gains in percent of the tax revenue from the initial equilibrium and in billion DM. As shown, the model predicts an annual efficiency gain between 25 and 55 billion DM for a privatized pension system. Of course, these numbers have to be interpreted carefully, since they depend on the chosen parametrization. Nevertheless, these numbers are in the range of the back-of-the-envelope calculations by Homburg and Richter (1990) who estimate an annual efficiency gain of 36 billion DM from privatization of the German pension system.

The lower part of Table 3 summarizes the distributional implications by reporting the Gini-coefficients of annual net income for specific years during the transition and

for the final steady state. The relevant Gini-coefficient in the benchmark was 0.270. Therefore, pension privatization will increase annual income inequality in the long run. However, the interpretation of the Gini-coefficients is especially problematic, since they are based on *annual* net income. A systematic evaluation of the welfare consequences of pension reform, however, has to be based on lifetime income. This will be done in the following.

Table 4 and Table 5 report the associated welfare changes of these experiments for different income quintiles of representative generations. The head column in both tables lists the different income quintiles and representative generations for which the welfare effects are reported. I have selected only the lowest, the middle and the top income quintile. In addition, I also report the aggregate effect for the entire generation. The numbers in the head column refer to the birth year of a household or generation. The policy reform starts at the beginning of period 1 (which is identical with the end of period 0). The number "0", therefore, refers to the generation born at the end of period 0 which starts working 20 years after the tax reform. Similarily, the number "-20" refers to the generation which starts working in the reform period while the number "-70" means that this generation is 70 years old at the time of the reform and has 5 years to live. Finally, "Infinity" denotes the generations born after the new steady state equilibrium has been reached. The following columns report the individual welfare changes (ΔU) and its decomposition into distributional ($\Delta T, \Delta P$) and efficiency (ΔEB) components. All welfare changes are expressed as percentages of the remaining lifetime resources of the respective generation in the benchmark equilibrium. This is the standard practice in dynamic simulation models[10]. Similarily, whenever I refer to aggregate effects across income classes and/or generations, the present value of remaining lifetime resources over the respective household group is used as the reference magnitude.

The results of the consumption tax experiment are reported in the left part of Table 4. Assume for a moment that the model does not distinguish between different lifetime income classes. In this case one would report the aggregate, generation-specific welfare measures in the lower part of Table 3. Not surprisingly, privatization increases the welfare of currently young and future generations at the expense of generations older than 30 years of age. The long-run welfare increase amounts to

[10]For a discussion, see Fullerton and Rogers (1993, 22f.).

Table 4: Welfare effects of pension privatization: base case[a]

	Immediate PAYG elimination				Phase-out of PAYG pensions			
Birth year	ΔU	$-\Delta T$	ΔP	ΔEB	ΔU	$-\Delta T$	ΔP	ΔEB
Lowest Quintile								
-70	-1.42	-1.62	0.50	-0.03	0.09	-0.06	0.15	-0.01
-50	-1.75	-2.36	-0.02	0.81	-0.98	-1.77	0.13	0.66
-30	-0.42	-0.50	-0.38	0.29	-0.75	-0.85	-0.15	0.29
-20	0.74	0.61	-0.35	0.26	-0.20	-0.15	-0.27	0.19
0	4.22	3.17	0.25	0.37	3.00	2.59	-0.14	0.28
Infinity	7.78	5.58	1.33	0.42	7.78	5.58	1.33	0.42
Third Quintile								
-70	-1.53	-1.78	0.53	-0.01	0.16	-0.01	0.15	0.00
-50	-1.06	-2.20	-0.01	1.08	-0.11	-1.06	0.14	0.58
-30	0.11	-0.68	-0.40	0.73	-0.28	-0.57	-0.16	0.12
-20	1.05	0.34	-0.35	0.64	0.13	-0.07	-0.26	0.20
0	3.81	2.32	0.21	0.93	1.21	2.02	-0.16	0.66
Infinity	6.61	4.20	1.23	1.10	6.61	4.20	1.23	1.10
Top Quintile								
-70	-1.36	-1.56	0.44	0.00	0.15	0.00	0.13	0.00
-50	-1.17	-1.72	-0.03	0.43	-0.14	-0.95	0.11	0.55
-30	0.33	0.78	-0.34	-0.19	-0.27	-0.66	-0.18	0.33
-20	1.36	1.21	-0.25	0.64	0.12	0.04	-0.24	0.28
0	3.79	3.02	0.58	0.96	2.66	2.47	0.06	0.72
Infinity	6.10	4.38	1.95	1.25	6.10	4.38	1.95	1.25
Aggregate								
-70	-1.45	-1.66	0.48	-0.01	0.15	-0.01	0.14	0.00
-50	-1.20	-2.03	-0.02	0.81	-0.26	-1.10	0.13	0.58
-30	0.13	-0.18	-0.38	0.39	-0.35	-0.67	-0.16	0.23
-20	1.15	0.70	-0.32	0.62	0.07	-0.06	-0.26	0.24
0	3.66	2.35	0.35	0.89	2.64	2.06	-0.08	0.64
Infinity	6.35	4.01	1.52	1.09	6.35	4.01	1.52	1.09

[a] Changes expressed as percent of the present value of remaining lifetime resources.

more than 6 percent of initial lifetime resources. Most of the welfare effects are explained by changes in net tax burdens which are computed in the third column. This simply reflects the fact that the consumption tax rate increases for generations living in the reform year, but decreases again even below its initial level in the long-run. The fourth column reports the income effect which is due to changes in pre-tax prices. The elderly gain is due to the initial increase in asset prices, while some middle-aged generations will lose a little bit since they have to buy the more expensive capital stock and due to the temporary fall in wages. Generations living in the new steady state experience quite a significant income increase due to the long-run rise in wages.

Next, I neutralize these intergenerational income effects in order to compute the changes in excess burdens. There are two countervailing effects on economic efficiency in the short and medium-run. On the one hand, the elimination of the contribution rate and the removal of the earnings test will enhance economic effi-cency. On the other hand, the increase of the consumption tax rate will reinforce the distortions of the consumption-leisure choice. Although initially the consumption tax rate increases almost by the same amount as the contribution rate is reduced, there is good reason to expect that the efficiency losses from the consumption tax increase are dominated by the efficency gains from the contribution rate elimination. Since the pension contribution rate is imposed on top of the progressive labor income tax, the deadweight loss is substantially higher than the pure value of the marginal contribution rate suggests. This intuition is confirmed by the numbers reported in the efficiency column of Table 3. While those generations who are already retired hardly experience any efficiency changes, excess burdens are strongly reduced for generations which are close to retirement. Of course this reflects the removal of the earnings test at retirement. For younger generations the efficency gains are lower, but they increase again for generations which enter the work force after privatization. The latter, of course, reflects the fall of the consumption tax rate during the transition.

Consider now the implications for different income classes. While the qualitative pattern is quite similar for all income classes, the quantitative differences require some additional comments. First, note that the intergenerational redistribution due to changes in tax burdens is stronger for lower income quintiles than for higher income quintiles. Tax burdens increase for poor elderly much more strongly than for rich elderly. In the long-run, on the other hand, they are reduced for poor households much more strongly than for rich households. Two reasons are responsible for this finding. On the one side, the contribution rate under the PAYG system was regressive due to the contribution ceiling. On the other hand, due to the progressive wage tax, rich households consume relatively more leisure than poor households. The increase in the consumption tax rate is, therefore, regressive while the long-run reduction in the consumption tax rate favors poor households more. The factor price column shows another quantitative difference between income classes: rich households benefit significantly more strongly from the long-run increase in wages. The reason is that the exogenously specified age-earnings profile is not only higher,

but also steeper for rich households in comparison to poor households. Summing up the income effects across generations we note that poor and rich households gain at the expense of middle-income households. Not only income effects, but also the efficiency effects differ quantitatively across income classes. The fifth column shows that efficiency effects are relatively low for poor and rich households, but relatively high for middle income households. Since the marginal labor income tax for poor households is zero or quite low, the distortion from the pension contribution rate is also low. Rich households, on the other hand, face a zero contribution rate during most of their working life. Consequently, some generations might even experience a loss in efficiency after privatization.

The right part of Table 4 reports the welfare consequences of a phased-out PAYG system. Compared to the immediate elimination of the previous experiment, there are mainly three differences: first, tax burdens now increase less for the elderly, but more for middle-aged generations. Second, since the short and medium-run capital accumulation is slower, phasing-out the PAYG system also dampens the intergenerational redistribution due to changes in pre-tax prices. Finally, the efficiency gains from privatization are reduced now quite significantly. This clearly demonstrates the trade-off the policy maker has to face: phasing-out pensions dampens the intergenerational redistribution, but also reduces efficiency substantially. The intragenerational disaggregation reveals some interesting differences across income classes. Consider a thirty-year old household at the time of the pension reform. On aggregate, his tax burdens increase compared to the previous experiment since contributions have to be paid earlier than consumption taxes. However, if he belongs to the middle income quintile, then his tax burden falls just slightly. The efficiency column reveals that this household's labor supply is affected quite strongly by the financing of the pension reform. If he still has to pay contributions for pensions, then his labor supply is much lower than in the first experiment and consequently the labor income tax burden is lower. Thirty-year old households in the top income quintile, on the other hand, face a zero marginal tax burden from contributions. They even increase their labor supply compared to the consumption tax financing case and consequently their labor income tax burden increases strongly. Finally, the labor supply of a thirty-year old who belongs to the lowest income quintile is hardly affected. His tax burden increases slightly, since his tax payments are earlier in life.

Similar considerations can be made for all other age groups in the different income quintiles.

Table 5 reports the welfare and efficiency consequences of the last three experiments which are intended to test the sensitivity of the phase-out scenario. Since in each simulation only one assumption is changed compared to the base case, the reported figures have to be compared with the respective numbers in the right part of Table 4.

If the pension reform is preannounced, consumption taxes have to increase while the capital stock falls during the preimplimentation phase. As shown in Table 5, this mainly has two implications: First, the efficency gains from privatization are considerably reduced for generations living in the initial years after the policy announcement. This is, of course, due to the intertemporal substitution in labor supply towards future periods. Second, initial elderly generations are hit by the increase in tax burdens and by the immediate fall of capital prices. On the other hand, the time lag is beneficial to generations around age 50, since they fully experience the higher wages as well as the removal of the earnings test. Policy preannouncement, therefore, reduces the overall efficiency gains and favours initially living middle-aged generations at the expense of already retired and initially living younger generations.

While policy preannouncement will affect the welfare effects of households living in the initial years of the transition, it will not reduce the enormous welfare gains of generations living in the long run. In order to dampen this intergenerational redistribution, advocates of the reform recommend an increase in the deficit in order to shift part of the burden of privatization towards future generations. The middle part of Table 5 shows that such a policy works in principle, but it can also have some unintended side effects. Compare first the aggregate effects without (lower right part of Table 4) and with (lower middle part of Table 5) debt financing. A permanent deficit increase diminishes the intergenerational income redistribution via both channels: the long-run rise in the consumption tax increases the tax burdens for young and future generations. In addition, the decreased capital accumulation during the transition significantly reduces the redistribution due to changes in pre-tax prices. The efficiency column also shows that some middle-aged generations experience efficiency gains compared to the base run, while future generations experience efficiency losses. This is, of course, due to the fact that the service of the increased

Table 5: Welfare effects of pension privatization: sensitivity of phase-out[a]

	time lag		debt policy		Smopec	
Birth year	ΔU	ΔEB	ΔU	ΔEB	ΔU	ΔEB
Lowest Quintile						
-70	-0.33	0.00	0.45	-0.02	0.27	0.03
-50	-0.19	0.64	-0.87	0.67	-1.03	0.85
-30	-0.78	0.20	-0.61	0.29	-0.75	0.21
-20	-0.43	0.22	-0.06	0.19	-0.09	0.07
0	2.02	0.25	1.94	0.23	2.53	0.26
Infinity	7.78	0.42	3.94	0.30	5.28	0.41
Third Quintile						
-70	-0.32	0.00	0.40	-0.01	0.30	0.03
-50	0.32	0.58	-0.04	0.72	-0.16	0.72
-30	-0.32	0.07	-0.07	0.23	-0.24	0.21
-20	-0.10	0.11	0.34	0.24	0.25	0.24
0	1.97	0.54	2.00	0.54	2.53	0.75
Infinity	6.61	1.10	3.60	0.73	4.91	1.15
Top Quintile						
-70	-0.26	0.00	0.30	0.00	0.26	0.03
-50	0.44	0.50	-0.02	0.47	-0.18	0.72
-30	-0.29	0.33	0.03	0.13	-0.21	0.48
-20	-0.11	0.24	0.44	0.29	0.26	0.29
0	1.87	0.55	2.06	0.48	2.75	0.79
Infinity	6.10	1.25	3.51	0.69	5.03	1.31
Aggregate						
-70	-0.29	0.00	0.36	-0.01	0.28	0.03
-50	0.29	0.55	-0.16	0.62	-0.30	0.75
-30	-0.37	0.18	-0.11	0.22	-0.32	0.31
-20	-0.16	0.20	0.32	0.27	0.20	0.24
0	1.94	0.51	2.02	0.49	2.55	0.70
Infinity	6.35	1.09	3.65	0.69	5.02	1.13

[a] Changes expressed as percent of the present value of remaining lifetime resources.

debt has to be financed by distortionary consumption taxes. The intragenerational disaggregation reveals that especially rich households experience efficiency losses. Of course, this is again due to the income ceiling which implies a zero marginal contribution rate for households in the top income quintile. In addition, due to the regressivity of the consumption tax in the present model, debt financing also undermines intragenerational equity.

Finally, I consider the phase-out scenario in a small open economy. Redistributive effects due to changes in gross-of-tax prices are now zero in the long run. Since capital inflows increase the corporate tax revenue, the consumption tax rate even falls in the short-run and labor supply is distorted less. The last column of Table 5 therefore reveals higher generational specific efficiency gains. For most poor income households, however, excess burdens are slightly higher due to the higher consumption tax rate during the transition. The lower excess burdens for households of the middle and top income quintile might be due to the constant long-run wages which imply a lower marginal wage tax rate. Since tax burdens fall and asset prices increase in the short-run, especially the initial elderly are better-off in a small open economy compared to the closed economy.

4. Conclusions

The aim of the present paper was to compare some realistic policy scenarios for privatization of the German pension system. Therefore the policy reforms examined in the paper only compensated the accrued pension claims from the old system which are observable for the government. Although the number of the alternative financing schemes studied by the paper are quite limited, the obtained results still allow to draw some broad policy conclusions.

First, the privatization of the PAYG public pension system is a means of enhancing the efficency of the overall tax and transfer system. As reported in Table 3, even in the worst case scenario the annual efficency gains amount to DM 25 billion. This figure can more than double if an alternative financing scheme is used and the reform is implemented without a considerable time lag. The main reason for these efficiency gains is the long run switch from the payroll tax base to the less distortive consumption tax base. Additional efficiency gains also result from the elimination of labor supply distortions around the retirement age. Of course, these figures represent an argument in favor of privatization.

Second, a clear warning also seems to be in place: there is no free lunch from privatization. Given the highly progressive tax system and the highly complex public pension system of Germany, one can hardly expect a Pareto-improving privatization scenario. As a consequence, some households will experience welfare losses from privatization. The present paper demonstrates the double trade-off faced by the policy maker: maximizing the efficiency gains from privatization takes place at the cost of dramatic intra- and intergenerational redistribution. Reducing these distributive effects of privatization by means of labor taxation, policy preannouncement or debt financing will also dampen the efficiency gains from privatization.

Third, the simulation model highlights the regressivity of consumption taxation although it applies a lifetime incidence approach. This might be surprising on first sight, since in a life cycle setup, lifetime consumption is usually proportional to lifetime income. Consequently, a number of recent lifetime incidence studies contradict the regressivity result of traditional annual incidence studies, see the overview in Chernick and Reschovsky (1996). However, in the presence of a highly progressive labor income tax, rich households consume relatively more leisure than poor households. For this reason, poor households have to bear a higher burden than rich households when consumption taxes are increased.

Finally, the simulation results also indicate that distribution analysis based on annual income may be highly misleading. While the Gini-coefficients of Table 3 which are computed with annual income clearly show a deterioration in the income distribution, a comparison of the long run welfare consequences of different lifetime income classes gives the opposite result. Households in the lowest lifetime income quintile gain considerably more than households in the middle and top income quintile.

Of course, although the simulation model incorporates many complex details from reality, it also abstracts - as does any model - in important ways from reality. The quantitative numerical results, therefore, have to be interpreted cautiously. Especially the stable demographic structure and the perfect capital market of the present model seem to undermine the usefullnes of the quantitative findings. A more realistic demographic structure has to represent the aging of the current population and the long run decrease in the labor force. In principle, such population dynamics are relatively straightforward to incorporate in the AK model using time dependent

population growth rates. The benchmark situation then is not represented by a steady state path but by a transition path which reflects the currently projected increase in the contribution rates. Alternative privatization schemes are then applied to dampen or to eliminate the future increase in contribution rates. It is very much likely that such a setup will yield much higher long run efficiency gains from privatization, since the the present model puts the existing PAYGO pension system in a rather favourable light. Various authors have also incorporated liquidity constraints into the overlapping generations framework. In the presence of liquidity constrained households, it makes a difference whether people are forced by the government into private saving accounts or whether they contribute voluntarily. The simulations of Cifuentes and Valdés-Prieto (1997) indicate that liquidity constraints can have a strong impact on the macroeconomic adjustment and the welfare consequences after privatization. In future work, I therefore plan to extend the model in these directions.

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