

Health Premiums or Health Contributions?

An Evaluation of Health Care Reform Options in Germany

By Hans Fehr and Heinrich Jess*

Abstract

The present study quantifies the revenue, distributional and efficiency effects of various reform options for the German health care system. Starting from a baseline path of the economy which represents the existing public and private mixture of health care providers in the German health care system, we introduce various reform packages which change the financing, the contribution base and the membership in the public system. Our simulations indicate that a premium system is superior to the citizen insurance model, since the former allows the redistribution to be financed through consumption taxes instead of wage taxes. Efficiency gains are maximized with the health premium model because this reform allows an immediate transition (compared to a privatization strategy) and minimizes the required compensation payments (compared to the citizen premium model) which distort labor supply. Winners of such a reform are mainly younger workers, while older workers, civil servants and self-employed will lose.

Zusammenfassung

Der vorliegende Beitrag quantifiziert die Aufkommens-, Verteilungs- und Effizienzwirkungen von verschiedenen Reformoptionen für das deutsche Gesundheitssystem. Unser Simulationsansatz berechnet zunächst den Wachstumspfad der Ökonomie wenn die gegenwärtige Mischung aus öffentlicher und privater Krankenversicherung in Deutschland beibehalten wird. Anschließend werden verschiedene Reformmaßnahmen implementiert, welche die Finanzierung, die Beitragsbasis und die Versicherungspflicht des öffentlichen Systems verändern. Es zeigt sich, dass die gegenwärtig diskutierten Prämiensysteme unter allokativen Gesichtspunkten die Bürgerversicherung dominieren, weil die implizierte Umverteilung mittels Konsumsteuern finanziert werden kann. Innerhalb der verschiedenen Prämiensysteme schneidet das Gesundheitsprämiensmodell am besten ab. Eine Privatisierungsstrategie benötigt längere Übergangszeiten und eine Bürgerprämie höhere Kompensationszahlungen, welche wiederum das Arbeitsangebot

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verzerren. Von einer Gesundheitsprämie profitieren vor allem die jüngeren Arbeitnehmer, während ältere Arbeitnehmer, Beamte und Selbständige sich verschlechtern.

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1. Introduction

Just as other branches of the social security system, the German statutory health insurance scheme has experienced an overall negative financial development since the mid-1990s. While aggregate health expenditures rose roughly in accordance with GDP growth, the share of the compulsory contribution base in GDP declined steadily. Although contributions rates exhibited the strongest increase within the overall social security system, the public health care system recorded substantial deficits during the past years. At the same time, the future financial prospects are alarming taking into account the foreseeable cost pressures from societal ageing in the future.

Since contributions are wage-related up to a specific ceiling, their steady rise reduces the incentives for taking up regular employment. If they cannot be fully passed on to employees, the employer will either substitute capital inputs in production or switch to foreign production. In addition to these labor market distortions, the system also exhibits problematic distributional implications. Although contributions are not linked with benefits, membership is only compulsory for workers up to a certain income threshold. Consequently, rich workers and self-employed individuals opt out of the public system and together with civil servants, join private, capital funded health insurance schemes where the contributions are risk-related and the interpersonal redistribution is limited to the individual health status. Finally, there exists some evidence that the cost efficiency of the present system could be improved substantially. Insurance institutions and service providers are organized in separate monopolies which negotiate the payment structure. At the same time the system relies heavily on price caps instead of patient co-payment schemes in order to reduce cost pressure. Not surprisingly, Germany belongs to the countries with the highest health care spending-to-GDP ratios within the OECD, although various indicators of health status only place it in the medium range of the OECD, see Wurzel (2003, 29).

During the recent past, the German public pension system and the unemployment insurance system have been reorganized by major reform packages. The statutory health care system, on the other hand, only experienced very modest changes. The latest reform in 2004 introduced various measures which will improve revenues and limit future spending. However, no attempt was made for a fundamental reform of the current financing system of health care and the competition among insurance institutions and service providers. The

reform of the financing system is necessary in order to secure a stable contribution base and improve the transparency of individual health care costs and burden sharing. If the implied income redistribution is shifted to the general tax system, the existing labor market distortions would be reduced and the adoption of more incentive-compatible insurance contracts would be facilitated, see Breyer and Haufler (2000). In combination with a successful reform of health care market regulations the former would raise cost consciousness and thus encourage a more efficient utilization of health care resources in the future, see Wissenschaftlicher Beirat beim BMF (2004).

Various reform proposals in this direction have been made in the recent past. They can be distinguished by the implied financing of health care (pay-as-you-go or capital-funded), the individual contribution calculation (per-capita, wage-related, income-related or risk-related premiums) and the compulsory membership structure (specific social groups or universal). The most radical reform was introduced by the so-called Kronberger Kreis (Donges et al. 2002). In essence, these experts propose a complete privatization of the current public health care system. Future contributions would then be risk-related and the complete system would be capital funded. Since they were not able to agree on a uniform proposal, the so-called Rürup Kommission (BMGS 2003) offered two alternative options. Under the “citizen insurance model” (Bürgerversicherung) the statutory health insurance scheme would be extended to individuals who are currently privately insured (i.e. top income employees, self-employed and civil servants), the contribution limit would be increased and other types of income (i.e. rents, income from capital) would be included. Alternatively, under the “health premium model” (Gesundheitsprämie), the current compulsory membership structure would be retained, but health contributions would become flat-rate and independent of labor income. In order to limit the burden for low-income individuals and families, the system includes a tax-financed compensation scheme. A similar system was originally favored by the Christian Democrats (Herzog-Kommission 2003), but after the intervention from the Christian Social Democrats, both parties now propose a so-called “solidarity premium model” (solidarische Gesundheitsprämie) which comprises a mixed system of wage-related contributions and flat-rate premiums (CDU 2004). Finally, the Council of economic Experts (SVR 2004) proposes a so-called “citizen premium model” (Bürgerpauschale) which combines the pay-as-you-go financed flat-rate health premium with a universal membership. Consequently, the private health care system would be phased out under this proposal.

The present paper aims at quantifying the revenue, distributional, and efficiency consequences of selected reform packages within a general equilibrium framework. The following section discusses the key characteristics of the existing German health care system and surveys the previous quantitative studies. Then we explain our simulation model and its calibration. Section 5 presents the simulation results and Section 6 concludes.

2. The German health care system and the current reform discussion

The German social security system consists of four main branches with separate budgets which cover unemployment, pensions, health and long-term care. With an expenditure of € 145 billion (about 7 percent of GDP) in 2003, statutory health insurance (Gesetzliche Krankenversicherung, GKV) is the second-largest subsystem following pension insurance, see Deutsche Bundesbank (2004, 16). The scheme covers medical treatment by physicians and hospitals, outlays for medicine beyond fixed patient co-payments and cash benefits to the sick. The benefits are provided by a large number of public health funds (Gesetzliche Krankenkassen), which are financed by contributions from employers and employees.¹ Whereas contributions to the statutory pension and unemployment insurance broadly match the benefits, the equivalence principle is violated in the statutory health insurance. While only sickness benefits are income-related, contributions are proportional to labor income and pension benefits up to a contribution ceiling (which is € 3.525 per month in 2005). In addition, dependent family members are co-insured without paying contributions. Due to the associated interpersonal redistribution of income, high-income earners are likely to opt out of the public insurance system. The latter is possible since the public system is only mandatory for employees up to the so-called insurance ceiling (Versicherungspflichtgrenze) which in 2005 stands at € 3.900 labor income per month. Civil servants are not included in the statutory health insurance, but the government co-pays 50 to 70 percent (depending on age and family status) of their health costs. The remaining outlays have to be covered by them. Currently about 90 percent of the population are covered by the public system.

The remaining share are self-employed and employees above the insurance ceiling who are allowed to switch to the private insurance system (Private Krankenversicherung, PKV). In the latter case they no longer have to pay contributions to the public system. The premiums to the private system are risk-related and have to be paid for dependent family members as well. Consequently, for employees with chronic illness who are above the insurance ceiling or married self-employed people with many children it might be still beneficial to remain in the public system.

Given the existing health insurance system in Germany, Table 1 classifies the currently discussed reform options which were already introduced above. Two models (solidarity premiums and health premiums) would retain the current membership structure but alter the calculation of contributions. Three

¹ As in the other social security branches, employers and employees each pay half of the contribution. For pensioners, the statutory pension insurance pays half of the contribution.

models (citizen insurance, citizen premium and privatization) aim at unifying the private and public systems but with completely different contribution calculations. Whereas the citizen insurance model automatically secures an equal burden sharing for low-income households, all premium models require a tax-financed compensation mechanism which limits the financial burden for those households.

Table 1
Classifying alternative health care systems

Financing	Contributions	Membership	
		Employees up to insurance ceiling	Universal coverage
pay-as-you-go	wage-related	Statutory health insurance (GKV)	–
	income-related	–	Citizen insurance model
	mixed contribution	Solidarity premium model	–
	flat-rate	Health premium model	Citizen premium model
funded	risk-related	–	Privatization model

It should be quite clear that the revenue requirements as well as the distributional implications of the described reform proposals are very different. A number of empirical studies have already tried to quantify these consequences.

Politicians are firstly interested in revenue requirements and contribution levels. Rürup and Wille (2004) compute an average monthly flat rate premium of € 169 for adults and € 78 for children for the health premium model. All premiums for children (i.e. in the public and in the private scheme) should be financed by general taxes. Since adult premiums in the public scheme should not exceed existing contributions, they are limited to 12.5 per cent of the individual gross income. According to the authors the required compensation payments for low-income households and induced tax revenue shortfalls add up to € 22.5 billion. In order to finance these costs, they suggest either an increase in the consumption tax, the solidarity surcharge or the introduction of a separate payroll tax for members of the statutory health insurance scheme. While the health premium model requires an increase in taxes, the citizen insurance model seems to do better in this respect. At least Sehlen et al. (2004) expect that the contribution rate could be reduced by 1.4 percentage points if the contribution base would be extended to include capital income and the public system would also comprise currently private insured persons. Finally, Grabka et

al. (2004) have quantified the financial transfers that are needed for alternative transitions to the privatization model. If the maximum burden were limited to 15 percent of income, the annual transfers would amount to € 60–70 billion (depending on the length of the transition).

From an economic point of view, it is more interesting to quantify the distributional implications of the different reforms. While the health premium model keeps the existing financing mix of health care, the citizen insurance model reduces (or even eliminates) the funded share of the German health care system. Consequently, it should not be surprising that the citizen insurance model increases the net tax burdens for future generations much more dramatically than the health premium model, see Fetzer and Hagist (2004). On the other hand, both reforms mainly redistribute within generations across income classes and social groups. Therefore, Bork and Gasche (2003) apply a detailed micro-simulation model in order to compare the intragenerational implications of the health premium, the citizen premium and the citizen insurance model. They conclude that the two premium models and the citizen insurance model have almost opposite distributional implications. The former increase while the latter reduces the burdens for low-income households, and reduce (increases) those for top income classes. Finally, Felder and Kifmann (2004) qualify the intra- and intergenerational distribution effects of various reform plans in a stylized overlapping generation model with two household types within each generation. They show that it is possible to keep the intergenerational burdens constant by introducing funded accounts within the civil insurance system.

All the previously mentioned studies are partial equilibrium, i.e. they do not include any efficiency consequences of the reforms considered. From the above discussion it should be clear that all proposals are intended to reduce labor market distortions and improve the resource allocation in the health sector. However, some simple arguments put forward by Buchholz (2005) and Haufler (2004) already cast some doubt that a switch to health premiums will automatically reduce the distortive effects of the overall tax system. They show that the premium and the insurance system are equivalent if the compensation scheme of the former is properly designed. The present model offers a richer institutional structure and applies a compensation mechanism which changes intra- and intergenerational tax burdens. Consequently, our simulations indicate differences in the labor market distortions for the reform models considered. Note, however, that our results do not include welfare gains from improved competition by insurance providers and from the adoption of more incentive compatible insurance contracts.

3. The simulation model²

Our simulation model is based on the overlapping generation approach pioneered by Auerbach and Kotlikoff (1987). The original German model of Fehr (1999) was extended in various directions, and the present version is based on Fehr and Jess (2004) and distinguishes three income classes and three occupational types within each income class. While our model includes the most recent reforms of the German statutory pension system (Gesetzliche Rentenversicherung, GRV), the phased-in transition towards a deferred taxation of retirement benefits, and the latest step of the income tax reform in Germany, the present paper concentrates on the health care sector in the model. We distinguish a funded private health care system where members pay premiums and an unfunded public system financed by payroll taxes. In the following, we discuss the structure of the model and highlight its advantages compared to previous studies.

Demographic structure

The model’s households are distinguished by their dates of birth, their lifetime labor productivity endowments and their occupational type. Each generation is split into three lifetime income classes $j = 1, 2, 3$ and three occupational types $k \in \{A, B, S\}$. The distribution of households within a generation is taken from data of the Federal Statistical Office of Germany (2001) and is reported in Table 2. About a quarter of workers belong to the lower and top income class respectively, the remaining half of the workers are in the middle income class. About 80 percent of workers are employees, the remaining workers are split between civil servants and self-employed. Employees are more likely to belong to the lower income class, whereas civil servants and self-employed are more likely to belong to the top income class.

Table 2
Income distribution in the model (in %)

	Employees	Civil Servants	Self-employed	Σ
lower class	21	1	1	23
middle class	46	4	5	55
top class	15	3	4	22
Σ	82	8	10	100

Source: Statistisches Bundesamt (2001).

² This section draws on Fehr and Jess (2004).

In order to account for the fact that rich people live longer than poor people in Germany (see Reil-Held 2000), life expectancy \hat{a}^j within a generation increases from the lower to the top income class. Within an income class, employees, civil servants and self-employed live for the same number of periods with certainty. In addition, life expectancy rises across generations, i.e. younger generations live longer than older generations. Whereas the life expectancy in the initial year 2005 is 80 years, it rises up to 86 years in 2100 and remains constant afterwards. Since economic life starts with 21, we distinguish in each period between (9×60) 540 and (9×66) 594 types of households according to age, occupational type and income class. In each period a new generation enters economic life. The population growth rates n_t are endogenously derived given the current fertility rates and the annual age distribution of women.³ Since growth rates differ across periods, cohorts grow according to

$$(1) \quad N_{t+1}^{jk} = (1 + n_t)N_t^{jk},$$

where N_t^{jk} denotes the number of the 21-year old households from income class j , occupational type k in period t . Note that the population growth rates are independent of the household type, i.e. the generational structure from Table 2 remains constant throughout the transition. Adding up all working cohorts of a specific occupational type k in a specific year t gives the total number of workers and pensioners of that type \bar{N}_t^k living in that year:

$$(2) \quad \bar{N}_t^k = \sum_{j=1}^3 \sum_{a=21}^{\hat{a}_t^j} N_{t+1-a}^{jk}.$$

Household preferences and budget constraints

Each household decides how much to consume and how many hours to work in each period. As in the original Auerbach and Kotlikoff (1987) model, the preference structure is represented by a time-separable, nested CES utility function. Lifetime utility of a representative household from a specific income class and occupation who starts working at age 21 takes the form⁴

$$(3) \quad U = \frac{1}{1 - 1/\gamma} \sum_{a=21}^{\hat{a}} \left(\frac{1}{1 + \theta} \right)^{a-1} \left[c_a^{1-1/\rho} + \xi \ell_a^{1-1/\rho} \right]^{\frac{1-1/\gamma}{1-1/\rho}},$$

³ The total fertility rate per woman is 1.41 and the average birth age in 2005 is 28.9 years.

⁴ In order to simplify the notation, we assume a long-run equilibrium in the following and omit time, income class and type indices if possible.

where c and ℓ denote consumption and leisure respectively. The parameters θ, ρ, γ and ξ represent the “pure” rate of time preference, the intra- and inter-temporal elasticity of substitution, and the leisure preference, respectively. Note that preferences are identical for all lifetime income classes and occupational types. This reflects the belief that if all households would have the same income and identical social insurance systems, then they would behave in the same way.

Given the initial asset endowment a_a households maximize () subject to the budget constraint defined by the sequence

$$(4) \quad a_{a+1} = a_a(1+r) + \underbrace{(h - \ell_a)w_a}_{y_a} - c_a - \Gamma_a$$

where r denotes the pre-tax return on savings and Γ_a represents the individual net tax liabilities (i.e. taxes and social security contributions minus transfers). All taxes in the model are collected at the household level, the tax system includes progressive taxes on labor and capital income as well as consumption taxes. As in Altig et al. (2001) we assume that technical progress causes the time endowment h_t of each successive generation to grow at a rate of η . Thus, if h_{at} is the endowment of household age a in year t , then we have $h_{at} = (1 + \eta)h_{at-1}$ for all a and t . In the simulations we assume that endowments grow annually at 1 percent.

Gross labor income y_a of the agent is derived as the product of individual labor supply and individual wage rate. The latter is the product of the gross wage w^k and the age- and class-specific earning ability e_a^j , which is taken from Fehr (1999, 60). For employees and self-employed the gross wage rate is the marginal product of labor. However, for civil servants we assume that they only receive 80 percent of their marginal product since the government provides for their pension and health care. Thus, the wage rate for an agent from income class j and occupational type k who is age a is $w_a^{jk} = e_a^j w^k$. Note that the working time is restricted up to the last working year before retirement.

The government budget

Since we neglect government debt in the model, the sum of government expenditures for public goods G_t (which are constant in per capita terms) and health care has to be balanced by individual net tax payments and the implicit contributions (due to lower gross wages) of civil servants in each period t :

$$(5) \quad \sum_{k \in B} \sum_{j=1}^3 \sum_{a=21}^{\hat{a}^j} \Gamma_{at}^{jk} N_{t+1-a}^{jk} + \sum_{j=1}^3 \sum_{a=21}^{60} 0.25 \times y_{at}^{jB} N_{t+1-a}^{jB} = G_t + \sum_{k \in B} \sum_{j=1}^3 \sum_{a=1}^{\hat{a}^j} hc_{at} N_{t+1-a}^{jk} .$$

Per capita expenditures for health (hc) are age-specific⁵ and grow up to 2050 0.7 percent faster than the economy. The latter reflects the fact that in the past, per-capita health costs have grown faster than the economy, see Fetzter et al. (2003).

The left-hand side of the government budget (5) shows the individual net tax payments of households in year t which are computed from the difference between taxes and social security contributions b_a minus pension benefits p_a (which are positive in and after the retirement age 61):

$$(6) \quad \Gamma_a = \tau^c c_a + 1.055 \times T05(zvE_a) + \bar{\tau}_a^r r a_a + b_a - p_a .$$

In addition to consumption taxes at rate τ^c the model includes a progressive labor income tax where the taxable income zvE is subject to the income tax schedule of the year 2005 (T05). Taxable income is computed from the difference of gross labor income (or pension benefits) and taxable allowances, i.e. $zvE_a = y_a + p_a - AP_a - AS_a$. The last two terms model the transition to the deferred taxation of pension benefits until 2040. Besides the employers' share of social security contributions, employees can deduct an increasing fraction of their contributions to the pension system as allowances of a provident nature (AP). At the same time the share of taxable pension benefits increases, i.e. the amount of special allowances (AS) falls.⁶ Special allowances also include allowances for income related expenses which are fixed at € 956 during working time.⁷

Individual net tax payments (6) also include the solidarity surcharge of 5.5 percent on wage income. Capital income, on the other hand, is taxed with a linear tax rate. Since the model features allowances on capital income, we have to compute an individual average capital income tax rate $\bar{\tau}_a^r$ for each household.

The second term in (5) reflects the implicit revenues of the government from the employed civil servants. Since their accounted gross income y^B only represents 80 per cent of their marginal product, the implicit tax amounts to 25 percent of their gross income. Finally, note that the health expenditures in the last term of (5) also include health expenditures for children. This will be important in the following.

⁵ We would like to thank Bernd Raffelhüschen for the German health expenditure profiles.

⁶ See Fehr and Jess (2004) for a detailed discussion of the transition path to deferred taxation of retirement benefits for the different occupational types.

⁷ The tax schedule and allowances are adjusted in the future in order to avoid cold progression effects.

The private and public health care system

The private health insurance is funded. The lump-sum contributions are identical across the life cycle and have to balance the lifetime health costs. Consequently, the annual payments of a 21-year old self-employed persons z^S are computed from:

$$(7) \quad z^S = \sum_{a=21}^{\hat{a}^j} hc_a R_a \Big/ \sum_{a=21}^{\hat{a}^j} R_a \quad \text{where} \quad R_a = (1+r)^{21-a}.$$

The numerator defines the present value of lifetime health care costs and the denominator shows the annuity factor which guarantees a uniform premium during lifetime. The annual premium for civil servants z_a^B is computed similarly but depends on age, since they have to finance only 50 percent of their health care costs during working life and 30 percent of their health care costs during retirement. The rest is financed by the government from general taxes. Since the premiums of younger agents are higher than their health costs, the private health insurance accumulates assets which are invested on the capital market.

Health care of privately insured children is financed by their parents on a pay-as-you-go basis. For simplification we assume that all children are born when the parents are age 21 and leave home when their parents are 40. Consequently, self-employed and civil servant households at age $21 \leq a \leq 40$ in each year pay a specific premium zc for their children which depends on the health cost of the specific year and the number of children and parents in that year. Again, the government finances 80 percent of the health costs of civil servants' children.

In contrast, contributions to the public health insurance system are income-related. Since we consider an income ceiling which is about 40 percent above average income, the contribution rate for the public health care system is computed from the annual budget equation

$$(8) \quad \hat{\tau}_t^{KV} PY_t^{KV} = \sum_{j=1}^3 \sum_{a=1}^{\hat{a}^j} hc_{at} N_{t+1-a}^{jA}$$

where PY_t^{KV} defines the aggregate compulsory earnings base for public health care contributions which includes employees' wages and retirement incomes. Starting from the aggregate health care contribution rate $\hat{\tau}_t^{KV}$ which is calculated from (8), we compute the individual marginal and average contribution rates. Below the contribution ceiling, the marginal and average contribution rates of an employee are identical with $\hat{\tau}_t^{KV}$. If the income rises above the contribution ceiling, the marginal contribution rate falls to zero and the average contribution rate decreases.

The private and public pension system

Next we consider the pension system of the three occupational types. Self-employed pay 5 percent of their gross income during working life years into a pension fund and receive an annuity from that fund when they pass the retirement age 61, i.e.

$$(9) \quad p_{61}^S = \sum_{a=21}^{60} 0.05 \times y_a^S \times (1+r)^{61-a} \bigg/ \sum_{a=61}^{\hat{a}} (1+r)^{61-a}$$

as the annual private pensions during the years of retirement. The numerator shows the capital stock at the time of retirement, whereas the denominator shows the annuity factor which guarantees a uniform benefit during retirement.

Civil servants are assumed to work for 41 years and consequently receive a tax-financed pension benefit of 71 percent of their gross income in the last year before retirement, i.e. $p_{61}^B = 0.71 \times y_{60}^B$.

Employees are members of the statutory pension system (GRV). Our model tries to represent the current features of this system in detail. Consequently, the retirement benefit of an employee is computed from the product of the sum of the earning points (*EP*) which he has received during his past working years and the actual pension amount (*APA*) of the respective year:

$$(10) \quad p_a^A = \sum_{s=21}^{60} EP_s \times APA \quad a > 60 .$$

The annual adjustment of the actual pension amount follows the so-called “modified net-adjustment” method and includes the so-called “sustainability factor” for computing individual pensions, see Börsch-Supan et al. (2003) or Jess (2004) for details. The budget constraint of the pension system in year t is

$$(11) \quad \hat{\tau}_t^P PY_t^P = \sum_{j=1}^3 \sum_{a=61}^{\hat{a}} \left[1 + 0.5 \times (\bar{\tau}^{KV})_{at}^j \right] p_{at}^{jA} N_{t+1-a}^{jA} ,$$

where PY_t^P again defines the compulsory earnings base for the employees’ pension contributions. In contrast to the public health care system, pensions are not included in the earnings base and the contribution ceiling is 100 percent above average annual income. Note that the pension fund also has to pay 50 percent of the annual health care contributions of retirees. Again, $\hat{\tau}_t^P$ represents an aggregate contribution rate, the individual marginal and average contribution rates are computed in the same way as for the health care system. However, below the contribution ceiling we consider a “tax-benefit-linkage”,

which represents the fact that in Germany future pensions are linked to former contributions. Consequently, pension contributions distort labor supply especially at early ages, but the distortions fall with age.

We are now able to define the aggregate social security contributions b_a^k of our occupational types in equation (12):

$$(12a) \quad b_a^A = [\bar{\tau}_a^P + \bar{\tau}_a^{KV}] \times y_a^A + 0.5 \times \bar{\tau}_a^{KV} p_a^A,$$

$$(12b) \quad b_a^B = z_a^B + zc_a^B,$$

$$(12c) \quad b_a^S = z^S + zc_a^S + 0.05 \times y_a^S.$$

with $\bar{\tau}_a^P$ and $\bar{\tau}_a^{KV}$ as the individual average contribution rates to the statutory pension and health care system.

This explains the main elements of the model's tax and transfer system. While the outlays are computed given per capita public goods consumption and the exogenously set parameters of the pension and health insurance systems, the budget is balanced by adjusting the consumption tax rate in each period.

The production sector of the economy is represented by a Cobb-Douglas function with capital and labor as production factors. The model KIoEs from adjustment costs and simulates a small open economy with constant gross factor prices. Consequently, the factor markets are balanced in each period by instantaneous capital in- or outflows while the goods market is balanced by changes in net exports.

4. Calibration and baseline path

In order to solve the model numerically, different preference, technology, demographic and fiscal parameters have to be specified. Table 3 reports the preference and technology parameters of the model.

They were mainly chosen in line with the existing econometric literature, see the discussion in Fehr (1999, 57 f.). In order to show that our exogenous parameters generate a realistic economic structure, the following discussion presents the model's population dynamics, the initial equilibrium in our base year 2005 and the baseline path of the economy.

The change in the population structure has an important impact on the long-term fiscal effects of health care reforms. The model's demographic dynamic is close to the first variant of the latest population projections of the Federal Statistical Office of Germany (2003). The latter assumes the lowest increase in life expectancy and the lowest immigration which results in the lowest population size of all considered future population scenarios.

Table 3

Preference and technology parameters

	Symbol	Value
time preference rate	θ	0.02
intertemporal elasticity of substitution	γ	0.25
intratemporal elasticity of substitution	ρ	0.7
leisure preference parameter	ξ	1.2
capital share in production		0.3
technological progress	η	0.01
depreciation rate		0.05

Table 4

Official and simulated population projections

Year	2002	2010	2020	2030	2040	2050	2070	2100
Population (in million)								
Model	82.4	82.3	80.5	76.4	70.7	63.2	53.4	45.8
Official ^a	82.4	82.0	80.0	76.6	72.2	67.0	n.a.	n.a.
Age groups in the Model								
1 – 20	20.9	18.4	17.2	16.4	16.0	16.3	17.5	20.5
21 – 60	55.0	55.1	51.8	46.1	45.6	45.8	44.8	43.5
61 –	24.1	26.5	31.0	37.5	38.4	37.9	37.7	36.0
Official age groups ^a								
1 – 20	20.9	18.7	17.4	16.9	16.2	15.9	n.a.	n.a.
21 – 60	55.0	55.6	53.0	47.9	47.6	46.5	n.a.	n.a.
61 –	24.1	25.8	29.5	35.2	36.2	37.6	n.a.	n.a.

^a Federal Statistical Office of Germany (2003), variant one. – n.a. not available.

Table 4 compares the official projections and the model's simulations of the total population and the population structure dynamics. Our population projection shows a decline in the total population in Germany by almost 40 million people over the next hundred years. The currently available official projections end in the year 2050, but at least during the period 2002-2040 the two projections correspond quite well. Even more important is the population structure. Table 4 compares the official and the model's dynamics of the population shares of different ages between the initial year and 2050. Although we apply various simplifying assumptions (i.e. no immigration, identical life length etc.) our projections match the medium-term official age structure surprisingly well.

Table 5 shows the initial equilibrium of year 2005 in our model economy and the respective reference values in the years 2003/2004. On the expenditure side of GDP one has to take into account that public consumption in our model includes all public health expenditures whereas in the official statistics, only benefits in kind (Sachleistungen) are included. In addition, since our model neglects various public transfers we had to increase public consumption in order to receive realistic tax revenues. Gross investments are fairly high due to the depreciation rate, which is set at 5 per cent. The government indicators show realistic aggregate tax revenues and social security expenditures in our initial equilibrium. Regarding the tax structure, the labor income tax revenue is fairly high, since we neglect unemployment. The consumption tax rate is adjusted in order to balance the budget.

Table 5
The initial equilibrium in year 2005

	Model economy	Germany 2003/04*
Expenditures on GDP (in %)		
Private consumption	48.9	58.6
Public consumption	23.5	19.3
Gross fixed investment	22.0	17.8
Export-import	5.5	4.3
Government indicators (in % GDP)		
Aggregate tax revenues	17.8	23.2
Labor income tax ^a	8.6	7.2
Capital income tax	0.9	1.1
Consumption tax	8.2	8.5
Aggregate GRV-pensions	11.0	10.8
Aggregate civil servants' pensions	1.3	1.7 ^b
Aggregate GKV-expenditures	6.5	6.7 ^b
Aggregate PKV-expenditures	1.1	1.3 ^b
Average gross annual income (in €)	27.687	29.428
Interest rate (in %)	4.5	n.a.
Saving rate (in %)	14.1	10.2 ^b
Capital-output ratio	3.2	3.4 ^b

* Source: Institut der deutschen Wirtschaft (2004), GDV(2004).

^a incl. solidarity surcharge. – ^b reference year 2002.

The average gross annual income in Table 5 is significantly lower than in reality. This is mainly due to the small income differences between the occupational types. Table 6 reveals that civil servants earn substantially less in gross income due to the fact that the government already provides for their

pensions and health care.⁸ In reality, gross income of self-employed and civil servants is about 50 percent higher than the income of workers, see Statistisches Bundesamt (2004). Since we assume identical human capital endowments for all occupational types, it is not possible to generate such differences in gross income.

Table 6
Average gross labor income in base year (in €)

	Employees	Civil servants	Self-employed	Σ
lower class	20.845	16.727	22.319	20.730
middle class	27.023	20.996	27.788	26.654
top class	39.032	29.020	38.347	37.542
Σ	27.638	23.471	31.465	27.687

Taking into account all the simplifying assumptions of our model, we feel that the initial equilibrium is fairly close to reality.

Due to the demographic transition, the economy will change in the years after 2005. Therefore, the reference solution of the model is not a steady-state equilibrium but a baseline path of the economy between the initial year 2005 and the final steady-state, which is computed under the assumption that the current health care system is not removed in the future. Table 7 presents the dynamics of some central economic variables in the baseline path of the economy.

Table 7
Baseline path of the model

Year	2005	2010	2020	2030	2040	2050	2100
Employment, capital, GDP ^a	0.0	8.6	13.5	2.6	3.8	5.3	14.3
Consumption ^a	0.0	6.7	19.6	25.4	33.6	30.2	35.8
Ex-Im (in % of GDP)	5.5	9.3	9.8	-2.5	-12.6	-8.5	-10.7
Average wage tax rate	12.4	12.6	11.4	9.4	9.5	9.8	9.7
Consumption tax rate	17.3	16.1	18.2	23.0	23.6	23.0	25.5
GRV-contribution rate	19.5	19.0	21.2	24.1	24.5	23.2	23.1
GKV-contribution rate	9.9	10.2	11.3	14.2	16.0	16.8	18.0
PKV-payment (in €)	186	191	202	211	219	223	223
PKV-child-payment (in €)	54	58	60	67	72	76	78

^a Changes expressed are percentage differences to base year.

⁸ Of course, the income differences in Table 6 also reflect differences in the labor supply behavior of the occupational types which is implied by the different social security systems.

The first line shows the dynamics of employment, capital and GDP compared to the base year. In the small open economy all three variables will change in the same way. On first sight it might seem surprising that employment increases throughout the transition although the population ages. Note, however, that we measure employment in efficiency units which rise due to the assumed technological progress. During the first phase of the transition, employment (in efficiency units) rises quite strongly, after 2020, however, the baby boom generations of the 1960s retire, which reduces employment growth significantly. The significant reduction of the average labor income tax rate after 2010 is a consequence of the transition to the deferred taxation of retirement income. Starting in 2005, employees will subtract a rising share of their pension contributions from their tax base which reduces the average labor income tax rate. Since the rise in tax revenues from pension benefits is much weaker, the consumption tax rate has to increase in order to close the gap between public consumption outlays and tax revenues.⁹ In line with the official projections, contribution rates of the public pension system will almost remain at their current level until 2020. Afterwards, however, they rise significantly until 2050 even though we have included the latest pension reform measures. Due to the tax benefit linkage, the marginal contribution rate of the public pension system is much lower than the average contribution rate. On the other hand, public health care contribution rates are much lower than in reality. Of course, the latter is due to the fact that in reality, a significant fraction of co-insured family members is not working and many workers with income above the insurance ceiling have left the public system. Given the fact that our model includes provisions for private health care outlays, the expenditures and the monthly lump-sum payment match reality quite well.

Note that public health care contributions increase even more dramatically than pension contributions since we assume a growth of per capita health care expenditures of 0.7 per cent until 2050. The latter also applies to the private system. As a consequence, monthly payments to the private system also increase but much less than in the public system due to the existing assets of the private system.¹⁰ On the other hand, since private child care payments are assumed to be financed on a pay-as-you-go basis, they grow more dramatically than the premiums for adults.

This suffices to explain the baseline path of the model economy. The following section discusses the consequences of different reform measures.

⁹ Since the population is aging, outlays for public consumption grow faster than the income tax base, which also increases future consumption tax rates.

¹⁰ If we assume no additional growth in health care costs, private premiums are constant throughout the transition.

5. Simulating health care reforms

Now we turn to the numerical results of the reform variants considered. Since the solidarity premium model is a mixture of the existing system and the health premium model, we do not consider it separately and concentrate on the remaining reform models from Table 1. We first discuss our modelling approach and then present the resulting macroeconomic, efficiency and distributional consequences. We assume that the reforms are announced and implemented in year 2006. Consequently, the initial year 2005 from Table 5 is not affected by the reform.

5.1 Modelling the reform options

The health premium model

As discussed already above, the health premium model which was originally introduced by the Rürup Commission consists of three central elements. First, the current employers' share of health contributions is transferred to the employee and taxed. In our context this simply means that the allowances of a provident nature AP are reduced by the employers' share of health contributions. Second, current contributions to the statutory health system are transformed into premiums, which are identical for all employees. Third, low-income individuals and families receive a tax-financed compensation which restricts their burden to a pre-specified share of labor income.

Consequently, we first compute the premium without compensation z_t^A from the budget of the health care system:

$$(13) \quad z_t^A \bar{N}_t^A = \sum_{j=1}^3 \sum_{a=21}^{\hat{a}^j} hc_{at} N_{t+1-a}^{jA} .$$

Note that compared to (8) we do not include health expenditures for children, since the latter are financed in the future from the general budget.¹¹ Next we compute the individual contribution z_a^A from

$$(14) \quad z_a^A = \begin{cases} z^A & \text{if } z^A < \alpha \times (y_a^A + p_a^A) \\ \alpha \times (y_a^A + p_a^A) & \text{otherwise} \end{cases} .$$

where α defines the pre-specified maximum share of gross income for the premium. The principle idea is that no employee should pay higher premiums

¹¹ However, in order to facilitate comparison, we do not follow Rürup and Wille (2004), who propose to finance the health care expenses of all children from the general budget.

than contributions under the current system. Consequently, the maximum payment is fixed at 13 percent of gross income which in the future will include the employers' share of health care contributions.¹² However, it is not clear how this share changes in the future. Since this is of crucial importance, we simulate a variant with a constant maximum share ($\alpha_t = 0.13$) and a variant where the maximum share is increasing as the contribution rate in the baseline path (i.e. $\alpha_t = \max[0.13; \hat{\tau}_t^{KV}]$). Note that the maximum premium is fixed relative to gross wage income or pensions, i.e. no capital income is included in the base. This is a simplification, since Rürup and Wille (2004) also propose relating the maximum share to gross income which would include capital income as well.

With respect to pensioners we assume that statutory pensions increase by the health care contributions of the reform year which are financed by the pension system, i.e.

$$(15) \quad p_a^A = (1 + 0.5 \times \hat{\tau}_{05}^{KV}) \sum_{s=1}^{60} EP_s \times APA,$$

where $\hat{\tau}_{05}^{KV}$ defines the health care contribution rate in the pre-reform year 2005. Note that this procedure automatically shifts the burden of future health contribution increases from employees to pensioners. In the future, the budget of the statutory pension system (11) no longer includes health care contributions. This is considered an important advantage of the health premium system, see BMGS (2003, 163).¹³

Summing up, the aggregate social security contributions of employees change under the health premium model from (12a) to

$$(16) \quad b_a^A = \bar{\tau}_a^P \times y_a^A + z_a^A$$

while for civil servants and self-employed the contributions (12b) and (12c) from the baseline path remain unchanged. In order to finance the compensation scheme, we increase consumption taxes in the model.¹⁴

¹² We follow here the proposal of the Council of Economic Advisers (SVR 2004), while Rürup and Wille (2004, 15) propose a maximum payment of 12.5 percent.

¹³ For distributional reasons Rürup and Wille (2004, 13) also propose including fictive employers' contributions in the tax base of civil servants. However, we do not include this element in our reform.

¹⁴ Rürup and Wille (2004) also propose to increase the solidarity surcharge in order to finance compensation payments. We do not follow this proposal in this paper but comment on it below.

The citizen premium model

Under the citizen premium model the current private health care system would be phased out and all households would ultimately be covered by the statutory system which is financed by premiums. Since the currently private insured self-employed and civil servants have already built up assets in the private system, we assume that only the labor market entrants are forced into the new public system after 2005. Consequently, the complete citizen premium model is not implemented in our model before the mid-2060s when the last privately insured generation (i.e. the generation who was age 22 in year 2006) dies. Already in year 2045 all working households are insured in the new statutory health insurance and the budget

$$(17) \quad z_t^H (\bar{N}_t^A + \bar{N}_t^B + \bar{N}_t^S) = \sum_{k \in B} \sum_{j=1}^3 \sum_{a=1}^{\hat{a}^j} hc_{at} N_{t+1-a}^{jk}.$$

of each year t is balanced by adjustments of the lump sum premiums z^H . Note that now - in contrast to the health premium model above - the health care costs of children are included in the budget of the public health care system. Of course, also the citizen premium model includes a compensation scheme as in (14) which ensures that no household has to pay premiums which are above the pre-specified maximum share of 13 percent of gross income. Therefore, aggregate social security contributions change under the citizen premium model to

$$(18a) \quad b_a^A = \bar{\tau}_a^P \times y_a^A + z_a^H,$$

$$(18b) \quad b_a^B = z_a^H,$$

$$(18c) \quad b_a^S = z_a^H + 0.05 \times y_a^S.$$

Since civil servants now have to pay much higher health care contributions, we assume that their gross income is increased by 7 percent, i.e. the implicit contributions to the government in equation (5) fall from 25 to 15 percent. Civil servants, who are members of the new statutory system receive higher pensions due to their higher gross wage income when they enter the retirement age. For employees, on the other hand, pensions are adjusted as under the health premium system, see (15) above. The Council of Economic Advisors did not explicitly state how to finance the compensation payments. In order to facilitate the comparison, we assume an identical financing as in the health premium model.

The privatization model

The transition to the privatization model is similar to that in the citizen premium model. We assume that young employees who enter the labor market after 2005 are privately insured and have built up assets. Older employees remain in the public system, but the contribution rate is limited to 13 percent and the deficit is financed by general taxes. Consequently, the public system is eliminated around 2065 when the last employee from the top income class dies.¹⁵ After 2005 the budget of the public system in year t is

$$(19) \quad 0.13 \times PY_t^{KVP} + Z_t = \sum_{j=1}^3 \sum_{a=v}^{\hat{a}^j} hc_{at} N_{t+1-a}^{jA}$$

where $v = 22 + t - 2006$ defines the age of the youngest cohort in the public system and PY_t^{KVP} defines the respective contribution base which is steadily shrinking. Of course, during the transition the tax-financed health care costs Z_t will increase initially but they finally decrease to zero again when the system is completely eliminated. Aggregate social security contributions of employees now depend on their age, i.e.

$$(20) \quad b_a^A = \begin{cases} [\bar{\tau}_a^P + 0.13] \times y_a^A + 0.065 \times p_a^A & \text{if } a \geq v \\ \bar{\tau}_a^P \times y_a^A + z^S + zc_a^S & \text{otherwise} \end{cases}$$

Note that premiums in the private system are computed as in (7) on the baseline path. However, the changing contribution base slightly modifies the pay-as-you-go financed premiums for children from Table 7.

In contrast to the premium models above, the privatization model does not include compensation payments to low-income households in order to limit the burdens of the reform. Of course, as before, employees who are members of the private system receive higher pensions according to (15) when they retire.

The citizen insurance model

Originally, the Rürup Commission (BMGS 2003) described the citizen insurance model as comprising three main elements: the extension of the mandatory public system to currently private insured self-employed and civil servants, an increase in the contribution ceiling of the health care system up to the level of the pension ceiling, and, finally, the broadening of the contribution base by capital and rent income. In our simulations we refrain from a broad-

¹⁵ This long transition is in sharp contrast to the assumptions in Grabka et al. (2003) and explains the differences in the financing requirements, see below.

ening of the contribution base by capital income.¹⁶ Since the increase in the contribution ceiling is heavily disputed, we only extend the mandatory membership in our calculations. Again, we assume that currently private insured cannot be forced into the new public system. Consequently, only self-employed and civil servants who enter the labor market in and after the reform year 2006 become members of the citizen insurance system, and the existing private system is phased out during the next 60 years. Therefore, the final budget constraint of the citizen insurance model is

$$(32) \quad \hat{\tau}_t^{KVI} PY_t^{KVI} = \sum_{k \in \mathcal{B}} \sum_{j=1}^3 \sum_{a=1}^{\hat{a}^j} h_{cat} N_{t+1}^{jk} - a$$

where the new contribution base PY_t^{KVI} also includes income from self-employed and civil servants up to the contribution ceiling of the public health system.

Summing up, while the health premium model mainly changes the contributions of employees, the citizen insurance model changes the social security contributions of self-employed and civil servants:

$$(22a) \quad b_a^A = (\bar{\tau}_a^P + \bar{\tau}_a^{KV}) \times y_a^A + 0.5 \times \bar{\tau}_a^{KV} p_a^A,$$

$$(22b) \quad b_a^B = \bar{\tau}_a^{KV} \times (y_a^B + p_a^B),$$

$$(22c) \quad b_a^S = \bar{\tau}_a^{KV} \times (y_a^S + p_a^S) + 0.05 \times y_a^S.$$

Note that we assume that the statutory pension system will only pay health care contributions for employees and not for civil servants. Of course, the gross income and pensions of civil servants who are members of the citizen insurance model is increased in the same way as in the citizen premium model.

5.2 Macroeconomic effects of the reforms

Table 8 shows the consequences of the reform scenarios for some specific macroeconomic aggregates. Overall, the switch from contributions to premiums reduces the marginal tax burden on labor for most households. Consequently, labor supply and employment increase. In the open economy the latter induces an immediate inflow of capital from abroad, so that GDP also rises in the same magnitude. Due to the taxation of the employers' share of health contributions (and the higher employment), average wage tax rates and revenues rise, so that the consumption tax rate falls initially. The higher output is

¹⁶ Since already the taxation of capital income involves enormous compliance costs, the enforcement of health care contributions on capital income seems highly unlikely.

spent for domestic consumption or exported abroad. During the transition, premiums rise due to ageing. They are higher in the citizen premium model, since they also finance their members children's health costs. Note that the premiums of the privatization model are the same as in Table 7 above. Premiums in the private system rise less than in the public system due to the already accumulated assets. Note, however, that the premiums of the public systems in Table 8 apply to a specific year while the premiums of the private system apply to a specific generation. As explained above, the increase in health care costs is now neutral for the pension system. Consequently, the pension contribution rate falls steadily during the transition.¹⁷

In our first simulation we keep the maximum premium burden constant at 13 percent of income. Therefore, compensation payments rise dramatically from about 0.4 percent of GDP in year 2010 to 3.6 percent of GDP in the year 2100 so that consumption taxes have to increase dramatically during the transition. As shown by Haufler (2004) and Buchholz (2004), the premiums of those households that receive compensation payments are turned into distortive contributions. In order to isolate this negative effect on aggregate labor supply, we assume in the second ("variable burden limit") simulation that the pre-specified maximum share of gross income for the premium α rises like the health care contributions of the baseline path. Consequently, compensation payments are mostly eliminated so that the consumption tax rate – after a slight initial increase – could even fall below its baseline level. Of course, since health care financing is now not distortive, labor supply, employment and wage income tax revenues rise dramatically compared to the simulation with the fixed burden limit.¹⁸

For the citizen premium model, we assume again a fixed maximum share of gross income. Compared to the "base case" variant of the health premium model, labor supply and employment (and as a consequence, consumption) are now reduced. The latter is due to two different effects which increase compensation payments. First, since the premiums are now higher, more employees receive compensation payments. Second, some low-income civil servants and self-employed who pay premiums in the first simulation receive compensation payments under the citizen premium model. Therefore, aggregate compensation payments rise now from 0.6 percent of GDP in year 2010 to

¹⁷ Rürup and Wille (2004, 13) compute an initial reduction of the statutory pension contribution rate by 1,07 percentage points since now employers health contributions increase the contribution base of the pension system. Since our model does not distinguish between employees and employers health care contributions, we do not capture this effect.

¹⁸ In another simulation which is not shown in Table 8, we finance compensation payments with an increase in the solidarity surcharge as suggested by Rürup and Wille (2004). In this case, employment, capital, GDP and consumption increase much less than in the base case simulation.

Table 8

Macroeconomic consequences of the reform models^a

	Health premium model with fixed variable burden limit	Citizen premium model	Privatization model	Citizen insurance model
<i>Employment / capital / GDP</i>				
2010	2.3	1.4	2.4	0.0
2020	1.7	0.9	1.3	-0.3
2035	2.0	3.3	1.8	-0.4
2050	1.0	3.1	0.5	-0.6
2100	0.6	3.3	-0.2	-0.6
<i>Consumption</i>				
2010	2.3	1.5	2.5	-0.1
2020	2.2	1.6	1.9	-0.3
2035	2.3	3.4	1.8	-0.5
2050	2.7	4.5	1.8	-0.7
2100	4.1	7.1	2.1	-1.7
<i>Ex-Im (in % of GDP)</i>				
2010	1.1	0.8	2.0	-0.1
2020	-0.5	-2.4	-0.5	-0.2
2035	0.7	1.4	1.1	-0.1
2050	-0.8	0.1	0.2	0.0
2100	-1.4	-0.4	-0.9	0.4
<i>Premium/ Contribution rate</i>				
2006	181	202	187	0.1
2010	189	211	191	0.0
2020	210	230	202	0.2
2035	244	263	216	-0.6
2050	273	293	223	-0.8
2100	280	308	223	-0.3
<i>Average wage tax rate</i>				
2010	1.3	1.4	1.4	-0.1
2020	1.4	1.3	1.4	0.0
2035	1.8	1.9	1.8	-0.2
2050	1.9	2.0	1.9	-0.2
2100	1.8	2.1	1.8	-0.4
<i>Consumption tax rate</i>				
2010	-0.5	-0.1	-1.4	-0.4
2020	0.1	0.5	-0.3	-1.3
2035	2.3	0.4	2.1	1.6
2050	3.4	0.3	3.5	0.8
2100	3.9	-0.5	5.3	-6.6
<i>GRV contribution rate</i>				
2010	0.0	0.0	0.0	0.0
2020	-0.2	-0.2	-0.2	-0.1
2035	-0.5	-0.4	-0.5	-0.3
2050	-0.6	-0.5	-0.6	-0.5
2100	-0.6	-0.7	-0.7	-0.8

^a Changes in employment and consumption are reported in percent of baseline path. Premiums are reported in €. All other changes are in percentage points.

5.3 percent of GDP in year 2100. Those households that paid premiums in the first simulation and now receive compensation payments will reduce their labor supply compared to the previous simulation.

When the privatization model is implemented, labor supply and employment hardly change initially. The additional savings are invested abroad. Consequently, imports and consumption increase, which in turn allows to be reduced the consumption tax rate slightly. Throughout the transition, the number of employees in the private system increases. Therefore, labor supply, employment and taxable income rise steadily. While consumption taxes fall in the first phase of the transition, they have to increase in the medium run due to the rising transfers to the public health care system. In the long run, when the old public system is completely eliminated, employment and consumption are much higher, so that the consumption tax rate could be reduced substantially.

Finally, the last column shows that labor supply, employment, income and consumption sharply decreases, if the citizen insurance model is used. Although membership is extended, the health care contribution rate remains almost constant in the short- and medium-run. Only after 2050, when all households are covered by the citizen insurance, does the contribution rate fall by almost one percentage point as estimated by Sehlen et al. (2004). Of course, since the public pension system is not directly affected by the reform, the pension contribution rate only changes marginally.¹⁹

5.3 Welfare and efficiency effects of the reforms

Given the reform path of the economy, we compute the welfare changes for each household type and generation. As shown in Fehr (1999, 85) the normalized utility change of a specific household, dU/λ , can be decomposed into the respective changes of the tax burden ΔT , factor income ΔFP and excess burdens ΔEB , i.e.

$$(23) \quad \frac{dU}{\lambda} = -\Delta T + \Delta FP + \Delta EB$$

where λ represents the marginal utility of income. Since changes in tax burdens and factor prices sum up to zero across all households, it is possible to compensate the individual income effects in a separate simulation. The remaining utility changes after compensation represent the individual efficiency consequences of the reforms considered. In the following tables we have computed the normalized utility changes without and with compensation.

¹⁹ We have also simulated the proposed increase in the contribution ceiling. In this case, labor supply and employment in our model would be reduced even further so that consumption taxes have to increase more sharply than in Table 8.

In the present overlapping generations model, the consumption tax is equivalent to a wage tax and a lump sum tax on initial assets, see Auerbach and Kotlikoff (1987, 62). Due to this lump sum tax feature, consumption taxes are more efficient than equal yield wage taxes. Consequently, efficiency gains of the reform increase more the faster the tax structure is shifted from wage to consumption taxation. Table 9, which reports the aggregated efficiency effects of the different reform scenarios, shows three central results of our simulations: first, all premium models yield aggregate efficiency gains while the citizen insurance model yields an aggregate efficiency loss. Second, the efficiency gains are substantially increased if the maximum share of gross income for the premium is adjusted. Third, the health premium model yields the highest efficiency gains, the citizen premium model the lowest and the privatization model lies in the middle. In absolute terms our calculations project an annual efficiency gain from the reform between roughly € 22.5 and € 32.5 billion depending on the implementation of the reform. On the other hand, the annual efficiency loss of the citizen insurance amounts to € 4 billion.²⁰

Table 9
Aggregate efficiency effects of the reform

	Health premium model with fixed variable burden limit		Citizen premium model	Privati- zation model	Citizen insurance model
in % of tax revenue ^a	5.5	6.4	4.5	5.0	−0.8
in bill. € p.a. ^b	27.5	32.0	22.5	25.0	−4.0

^a In the baseline simulation.— ^b Computed from aggregate tax revenues in 2003.

The following tables show the allocation of the efficiency effects to the different household types and indicate the distributional implications of the different reform models. It should be quite clear that a move towards consumption taxation implies a redistribution from older to younger households. However, our calculations show that the occupational types are affected quite differently by the reforms. Let us first turn to the health premium model.

Table 10a shows the welfare and efficiency effects of the first simulation where the burden limit is fixed at 13 percent of gross income during the whole transition. The lower part displays the welfare changes expressed in percent of

²⁰ In the simulation where we finance the compensation payments of the health premium model with a solidarity surcharge, aggregate efficiency gains decrease from € 27.5 billion to about € 18.5 billion. If we introduce the citizen insurance model and increase the contribution ceiling, aggregate efficiency losses would rise dramatically from € 4 billion to about € 30 billion.

Table 10a

**Welfare and efficiency effects of the health premium mode
with a fixed burden limit^a**

Birth year	Employees		Civil servants		Self-employed	
	Welfare	Efficiency	Welfare	Efficiency	Welfare	Efficiency
<i>Lowest class</i>						
1940	-0.3	0.0	0.8	0.0	0.8	0.0
1950	-1.0	3.4	-0.4	-0.1	-0.6	-0.2
1960	4.0	10.7	-2.4	-0.6	-3.0	-0.7
1980	1.7	10.7	-3.5	-0.9	-4.3	-0.9
2000	7.3	10.3	-5.6	-1.6	-5.9	-1.4
<i>Middle class</i>						
1940	-0.3	0.0	1.0	0.0	1.0	0.0
1950	-0.3	2.6	-0.4	-0.2	-0.8	-0.2
1960	8.5	-0.4	-3.1	-0.9	-4.1	-1.0
1980	7.3	9.4	-4.4	-1.1	-5.4	-1.4
2000	12.9	10.2	-7.0	-2.1	-7.3	-2.0
<i>Top class</i>						
1940	5.5	0.0	1.4	0.0	1.3	0.0
1950	3.2	6.2	-0.7	-0.3	-1.2	-0.3
1960	6.1	0.9	-4.3	-1.3	-5.4	-1.5
1980	10.6	9.3	-6.0	-2.0	-7.3	-2.0
2000	15.8	11.2	-9.3	-3.1	-9.9	-3.0
<i>Lowest class</i>						
1940	-0.02		0.05		0.00	
1950	-0.07		-0.02		-0.03	
1960	0.30		-0.14		-0.17	
1980	0.17		-0.29		-0.33	
2000	0.88		-0.49		-0.50	
<i>Middle class</i>						
1940	-0.02		0.04		0.04	
1950	-0.02		-0.02		-0.03	
1960	0.49		-0.14		-0.17	
1980	0.58		-0.28		-0.32	
2000	1.19		-0.40		-0.47	
<i>Top class</i>						
1940	0.17		0.04		0.04	
1950	0.10		-0.02		-0.03	
1960	0.23		-0.13		-0.15	
1980	0.57		-0.26		-0.30	
2000	0.98		-0.43		-0.43	

^a The upper part shows the present value of changes expressed in € 1000. The lower part shows changes as a percentage of the present value of remaining lifetime earnings.

remaining lifetime resources. For employees, the reform clearly redistributes from older low and middle income households to younger ones. In the long run, the middle income class benefits the most (in relative terms) since – in contrast to the top income class – their gross labor income was below the contribution ceiling. The low income class receives tax-financed compensation payments which limit their premium burden but at the same time distort their labor supply. Elderly employees from the low and middle income class even experience welfare losses since they are hurt by the increase in consumption taxes while they pay the same health contributions as before. Civil servants and self-employed people experience rising welfare losses due to consumption tax increase. Self-employed lose slightly more, probably due to their higher gross income and consumption.

The upper part of Table 10a displays the welfare and the efficiency consequences in Euros. Note that almost all employees experience efficiency gains from the reduced labor market distortions. The taxation of the employers' contribution share increases their marginal wage tax but this effect is dominated by the reduced distortions due to premium payments. Note that the employees of the middle and top income class who are born in 1960 experience significantly lower efficiency gains (or higher efficiency losses). The latter are above the contribution ceiling when the reform is implemented. Consequently, their labor supply is hardly affected by the premiums, while they still experience the increase in the marginal wage tax. Since the top income class is mostly in the highest income tax bracket, their marginal tax rates increase much less and their efficiency gains are therefore higher than in the middle income class. Civil servants and self-employed, on the other hand, experience rising efficiency losses due to the consumption tax increase.

If we increase the maximum share of gross income paid into the health care system, the rising ageing burden of the unfunded health care system is again shared by the employees in Table 10b. Consequently, only older civil servants and self-employed are slightly worse off due to the increase in consumption taxes compared to Table 10a; all others are much better off. With respect to employees, the reduction of compensation payments places a higher burden on low income and elderly households, and increases the welfare of middle and top-income households in the long run. Finally, as one would expect, efficiency gains mainly increase in the long run.

Next we turn to the citizen premium model in Table 11. Consider first the welfare effects for civil servants and self-employed in the lower part. All generations born before 1985 remain in the private system. Consequently, compared to Table 10a, their welfare losses are cushioned since they benefit in the short and medium run from the lower consumption tax increases shown in Table 8. Generations born after 1985, however, become members of the new public system. Consequently, low and (partly) middle income households receive compensation payments from the government. For self-employed the

Table 10b

**Welfare and efficiency effects of the health premium model
with a variable burden limit^a**

Birth year	Employees		Civil servants		Self-employed	
	Welfare	Efficiency	Welfare	Efficiency	Welfare	Efficiency
<i>Lowest class</i>						
1940	-2.7	0.0	-0.2	0.0	-0.2	0.0
1950	-2.0	1.6	-0.3	0.0	-0.5	-0.1
1960	4.8	10.2	-0.6	-0.2	-1.0	-0.2
1980	1.9	8.4	-0.5	-0.2	-1.2	-0.2
2000	8.6	15.4	-0.4	-0.2	-0.5	-0.2
<i>Middle class</i>						
1940	-3.4	0.0	-0.3	0.0	-0.3	0.0
1950	-1.7	0.5	-0.4	-0.1	-0.7	-0.1
1960	9.5	-0.9	-0.8	-0.3	-1.5	-0.3
1980	8.0	7.2	-0.6	-0.3	-1.5	-0.3
2000	15.8	15.1	-0.5	-0.3	-0.6	-0.3
<i>Top class</i>						
1940	-0.1	0.0	-0.4	0.0	-0.4	0.0
1950	-0.3	4.3	-0.6	-0.1	-0.9	-0.1
1960	7.7	0.8	-1.2	-0.4	-1.8	-0.5
1980	11.9	7.9	-0.9	-0.4	-1.9	-0.5
2000	20.3	15.0	-0.6	-0.4	-0.7	-0.4
<i>Lowest class</i>						
1940	-0.16		-0.01		-0.01	
1950	-0.13		-0.02		-0.03	
1960	0.37		-0.04		-0.06	
1980	0.21		-0.04		-0.09	
2000	1.03		-0.04		-0.04	
<i>Middle class</i>						
1940	-0.16		-0.01		-0.01	
1950	-0.08		-0.02		-0.03	
1960	0.55		-0.04		-0.06	
1980	0.65		-0.04		-0.09	
2000	1.46		-0.03		-0.04	
<i>Top class</i>						
1940	0.00		-0.01		-0.01	
1950	0.01		-0.02		-0.02	
1960	0.29		-0.03		-0.05	
1980	0.64		-0.04		-0.08	
2000	1.26		-0.03		-0.03	

^a The upper part shows the present value of changes expressed in € 1000. The lower part shows changes as a percentage of the present value of remaining lifetime earnings.

latter induces welfare gains compared to Table 10a. On the other hand, the top income self-employed are worse off under the new system, since the unfunded premiums rise much stronger than the previous funded premiums on the baseline path, see Tables 7 and 8. Civil servants who are forced into the new system are worse off in all income classes, because the increase in their net-incomes does not fully compensate the higher premiums. Since health costs of their children now have to be financed by the parents directly, employees experience a slight welfare reduction compared to Table 10a. Finally, the upper part of Table 11 shows that especially the low and middle income civil servants and self-employed, who are forced into the new public scheme, experience efficiency losses. Of course, this reflects the distortions due to compensation payments explained above.

Compared to the first simulation, the privatization model has three main differences. First, as documented in the lower part of Table 12, civil servants and self-employed are much better off now since the consumption tax rises much less. Second, and for the same reason, elderly employees are better off compared to Table 10a. Third, young employees in the low income class benefit if they remain in the public system, in the top income class it is exactly the opposite. The explanation for the latter is shown in the upper part. All employees who switch to the private system achieve enormous efficiency gains. In the lowest income class, however, they are completely neutralized by the increase in premiums which they have to pay under the private system. On the other hand, the reform hardly changes the tax burdens of rich employees. Consequently, their welfare effects are mainly due to the computed efficiency gains.

Finally, consider the welfare and efficiency effects of the citizen insurance model. If the latter only comprises a mandatory membership for young civil servants and self-employed, the welfare changes in Table 13 are qualitatively similar to those in Table 11. Especially low-income self-employed people benefit from the citizen insurance model since their health contributions are reduced substantially. However, the welfare losses especially for younger generations are now significantly higher. As with the citizen premium model, the citizen insurance model does not affect elderly employees significantly. On the other hand, for younger and future employees, the citizen insurance model is much worse in welfare terms. The upper part of Table 13 shows that the welfare differences are mainly due to efficiency effects. The citizen insurance model implies a dramatic efficiency reduction for employees and losses for civil servants and self-employed who are forced into the public system. Of course, their marginal contributions, which are currently zero, would rise dramatically, which in turn distorts their labor supply. Consequently, their welfare is reduced although some households benefit from the reduced tax burden.

Table 11

Welfare and efficiency effects of the citizen premium model

Birth year	Employees		Civil servants		Self-employed	
	Welfare	Efficiency	Welfare	Efficiency	Welfare	Efficiency
<i>Lowest class</i>						
1940	1.2	0.0	2.7	0.0	2.6	-0.1
1950	-0.5	3.4	1.3	0.0	1.0	-0.1
1960	2.9	10.2	-1.2	-0.3	-1.6	-0.4
1980	0.0	8.5	-2.9	-0.8	-3.4	-0.8
2000	5.4	8.1	-9.7	-11.5	8.6	-8.7
<i>Middle class</i>						
1940	1.4	0.0	3.4	-0.1	3.3	-0.1
1950	0.2	2.7	1.6	0.0	1.2	0.0
1960	7.4	-1.1	-1.6	-0.5	-2.4	-0.6
1980	4.9	7.4	-3.7	-1.0	-4.5	-1.2
2000	9.9	7.0	-11.4	-6.0	-2.3	-8.4
<i>Top class</i>						
1940	5.0	0.1	4.8	-0.1	4.4	-0.1
1950	3.0	4.4	2.0	0.0	1.5	0.0
1960	5.3	0.5	-2.3	-0.7	-3.2	-1.0
1980	7.8	7.6	-5.2	-1.7	-6.1	-1.8
2000	11.9	8.3	-15.3	-3.6	-5.1	-7.6
<i>Lowest class</i>						
1940	0.07		0.15		0.15	
1950	-0.03		0.07		0.05	
1960	0.22		-0.07		-0.09	
1980	0.00		-0.24		-0.27	
2000	0.64		-0.85		0.72	
<i>Middle class</i>						
1940	0.06		0.13		0.13	
1950	0.01		0.06		0.05	
1960	0.43		-0.07		-0.10	
1980	0.40		-0.23		-0.26	
2000	0.91		-0.77		-0.14	
<i>Top class</i>						
1940	0.15		0.12		0.12	
1950	0.09		0.05		0.04	
1960	0.20		-0.07		-0.09	
1980	0.42		-0.22		-0.25	
2000	0.73		-0.71		-0.22	

^a The upper part shows the present value of changes expressed in € 1000. The lower part shows changes as a percentage of the present value of remaining lifetime earnings.

Table 12

Welfare and efficiency effects of the privatization model^a

Birth year	Employees		Civil servants		Self-employed	
	Welfare	Efficiency	Welfare	Efficiency	Welfare	Efficiency
<i>Lowest class</i>						
1940	2.4	0.0	2.3	0.0	2.2	0.0
1950	5.1	0.1	2.3	0.2	2.6	0.1
1960	4.3	0.1	0.2	0.0	-0.2	-0.1
1980	5.4	1.1	0.2	0.1	-0.3	0.1
2000	-0.5	20.1	3.2	0.7	3.3	0.7
<i>Middle class</i>						
1940	3.1	0.0	2.9	0.0	2.9	0.1
1950	5.9	0.3	2.9	0.3	3.2	0.2
1960	5.3	0.0	0.2	-0.1	-0.6	-0.2
1980	5.9	0.5	0.3	0.2	-0.3	0.1
2000	10.7	19.4	4.0	1.0	4.2	0.8
<i>Top class</i>						
1940	4.2	0.1	4.0	0.1	3.9	0.1
1950	8.0	0.4	3.9	0.4	4.4	0.4
1960	6.4	0.0	0.1	-0.1	-0.7	-0.2
1980	5.9	0.7	0.3	0.3	-0.3	0.1
2000	19.9	20.2	5.6	1.5	5.9	1.4
<i>Lowest class</i>						
1940	0.15		0.12		0.13	
1950	0.33		0.12		0.13	
1960	0.33		0.01		-0.01	
1980	0.57		0.02		-0.02	
2000	-0.07		0.28		0.28	
<i>Middle class</i>						
1940	0.14		0.12		0.12	
1950	0.28		0.11		0.12	
1960	0.31		0.01		-0.02	
1980	0.47		0.02		-0.02	
2000	0.98		0.27		0.27	
<i>Top class</i>						
1940	0.13		0.10		0.10	
1950	0.25		0.10		0.11	
1960	0.24		0.00		-0.02	
1980	0.32		0.01		-0.01	
2000	1.23		0.26		0.26	

^a The upper part shows the present value of changes expressed in € 1000. The lower part shows changes as a percentage of the present value of remaining lifetime earnings.

Table 13

Welfare and efficiency effects of the citizen insurance model^a

Birth year	Employees		Civil servants		Self-employed	
	Welfare	Efficiency	Welfare	Efficiency	Welfare	Efficiency
<i>Lowest class</i>						
1940	-0.1	0.0	-0.6	0.0	0.1	0.0
1950	-0.4	0.0	-1.9	0.0	-0.2	0.0
1960	-0.4	-0.2	-1.8	-0.1	-0.7	-0.1
1980	-0.2	-0.1	-1.2	-0.1	-0.9	-0.1
2000	1.1	0.7	-10.9	-12.9	6.0	-16.1
<i>Middle class</i>						
1940	-0.2	0.0	-2.7	0.0	0.2	0.0
1950	-1.0	-0.9	-2.6	0.0	-0.2	0.0
1960	-0.4	-0.1	-2.4	-0.1	-1.1	-0.2
1980	-0.1	-0.3	-1.5	-0.1	-1.5	-0.2
2000	1.4	0.5	-20.2	-17.5	-5.3	-16.5
<i>Top class</i>						
1940	-0.2	0.0	-3.4	0.0	0.2	0.0
1950	-0.6	-0.1	-3.1	-0.1	-0.3	-0.1
1960	-0.5	-0.1	-2.9	-0.1	-2.0	-0.3
1980	-0.2	-0.3	-1.9	-0.2	-3.4	-0.4
2000	1.3	0.2	-23.6	-9.1	-14.7	-10.6
<i>Lowest class</i>						
1940	-0.01		-0.03		0.01	
1950	-0.03		-0.10		-0.01	
1960	-0.03		-0.11		-0.04	
1980	-0.02		-0.10		-0.07	
2000	0.14		-0.95		0.50	
<i>Middle class</i>						
1940	-0.01		-0.11		0.01	
1950	-0.05		-0.10		-0.01	
1960	-0.03		-0.11		-0.04	
1980	-0.01		-0.09		-0.09	
2000	0.13		-1.36		-0.34	
<i>Top class</i>						
1940	-0.01		-0.09		0.01	
1950	-0.02		-0.08		-0.01	
1960	-0.02		-0.09		-0.05	
1980	-0.01		-0.08		-0.14	
2000	0.08		-1.09		-0.65	

^a The upper part shows the present value of changes expressed in € 1000. The lower part shows changes as a percentage of the present value of remaining lifetime earnings.

6. Qualifications and conclusions

As the Tables 10–13 reveal, the welfare consequences of the reforms considered are fairly small in absolute numbers. For most households, the welfare change is below € 5,000, even in the extreme cases the benefits and costs add up to not more than € 25,000. Of course, these absolute Abbs have to be interpreted with caution, since they reflect some specific features of our simulation model. For example, our model does not consider dependent family members, unemployment and transfers from social assistance and other insurance institutions. It could be possible that the reforms have dramatic consequences for some specific social groups which are not considered in the model. The modest welfare changes also reflect the fact that for many households the resulting income effects are (partially) neutralized by substitution effects. Since static models do not include such behavioral reactions, they only compute the pure income effects of policy reforms. In addition, like other studies, our model does not include administrative costs. The latter might be important in our context, since they might differ quite substantially across the currently discussed reform options. In the case of the solidarity premium model (not considered here), administrative costs seem to be prohibitive.

Keeping these qualifications in mind, our simulations still indicate two central qualitative results. First, all premium models are clearly superior to the insurance model with respect to the macroeconomic, efficiency and distributional consequences. Premiums increase employment, yield efficiency gains and improve the welfare of young and future generations. Extending contributions to civil servants and self-employed people would reduce employment and efficiency and harm young and future civil servants and self-employed people without improving the welfare of employees significantly. Only on first sight does this seem to be in contrast to the theoretical analysis of Buchholz (2005) and Haufler (2004). However, since we change the structure of the tax system (from income to consumption taxation) as well as the tax base (by including other occupational types) our assumptions are quite different. Our simulations highlight differences between the reform models when they are implemented in a realistic setting, but they do not contradict the equivalence result from Buchholz (2005) and Haufler (2004). The economic benefits of the premium models compared to the civil insurance model are even strengthened if we increase (as intended) the contribution ceiling.

Second, within the premium models it should be quite clear that an increasing burden limit would yield the highest efficiency gains. In this case, compensation payments and (as a consequence) labor supply distortions are minimized. If the burden limit is kept fixed during the transition, the health premium model is superior to the citizen premium model and the privatization model with respect to the implied efficiency consequences. The efficiency difference between the health premium model and the citizen premium model is due to two reasons. On

the one hand, the health premium model finances expenses of children from the general budget while the citizen premium model includes these expenses in its own budget. This mainly explains the premium differences in Table 8. On the other, however, lower premiums reduce the necessary compensation payments and (as a consequence) labor market distortions. If health expenses of children were financed by the health premium system, the respective premiums would be the same as in the citizen premium model. In this case, the aggregate efficiency gains would be reduced from 5.5 percent of tax revenue to 4.8 percent. The remaining efficiency difference is due to the compensation payments to low-income civil servants and the self-employed. These transfers induce additional distortions for these occupational types which do not appear in the health premium model. In the case of the privatization model the financing of children's expenses is not distortive. The lower efficiency gains are mainly due to the long transition period. In contrast to the two other models it takes about forty years until all households pay premiums. Consequently, annual efficiency gains increase only slowly during the transition. Of course, one could increase the speed of the transition to the privatization model as in Grabka et al. (2003). This would increase the efficiency gains but at the cost of a much stronger redistribution from low-income to top-income households.

Summing up, our simulations indicate that the health premium model with a rising burden limit and tax-financed child expenses is the superior reform model. Of course, one could extend this analysis to also include simulations in the closed economy. This would hardly change the qualitative results and still include the central shortcoming of this study. Since our model only quantifies the incentive effects of different financing schemes, we do not capture the expected cost reductions from improved competition in the health care sector and the demand changes from the introduction of individual co-payment schemes. As argued by the Wissenschaftlicher Beirat beim BMF (2004) and Breyer and Haufler (2000), these effects are the most important for an economic evaluation of different reform options. Consequently, our study can only serve as one small piece of a picture and a step towards a more comprehensive evaluation of the economic effects of health care reforms.

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