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Gebäude L 13, 17_D-68131 Mannheim_Sekretariat +49 621 181-2773/1862_Telefax +49 621 181-1863_www.mea.uni-mannheim.de

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Axel Börsch-Supan*[#], Anette Reil-Held* and Christina Benita Wilke*

*** Mannheim Institute for the Economics of Aging (MEA), Mannheim University**
[#] National Bureau of Economic Research (NBER), Cambridge, Mass., USA

ABSTRACT

Two years after the "Riester reform" the German public pension system is once again in need of reform. The demographic and labor market assumptions underpinning the Riester reform have proved to be unrealistic. An important target of current reform attempts is the formula that annually re-adjusts the benefits for all pensioners, the benefit indexation formula. Modifications of this formula can considerably ease the financial pressure of pensions on labor since this formula impacts existing pensioners as well as new retirees.

This paper presents and examines the implications of possible alternatives to the current benefit indexation formula. In particular, we examine the self-stabilizing effect of the "sustainability factor" which aims at achieving more long-run stability and intergenerational equity in the pension system by linking annual benefit changes to the so-called system dependency ratio, the ratio of beneficiaries to contributors.

Address:
Prof. Axel Börsch-Supan, Ph.D., Dr. Anette Reil-Held,
Dipl. Kff. Christina B. Wilke
Mannheim Research Institute for the Economics of Aging
(MEA), Department of Economics, Mannheim University
D-68131 Mannheim
e-mail: axel@boersch-supan.de

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1 Introduction

Germany has one of the most generous public pay-as-you-go pension systems in the world. It is characterized by early effective retirement ages and very high effective replacement rates. Most workers receive virtually all of their retirement income from this public retirement insurance. Costs are almost 12 percent of GDP, more than 2.5 times as much as the U.S. Social Security System.

The pressures exerted by population aging on this monolithic system, amplified by negative incentive effects, make this system unsustainable. This insight has led to a reform process that began in 1992 and is still ongoing.[1] The 1992 and 1999 reforms introduced measures which restrict early retirement possibilities and incentives for future retirees. The new regulations are phased in slowly but first changes became effective in 1997. As a result, effective retirement ages are expected to considerably increase within the next ten years. In 2001, the so-called "Riester reform" made a first step from a purely pay-ay-you-go to a capital funded pension system: it substantially lowered pension levels while at the same time introducing state-subsidized supplementary private pensions ("Riester pensions") in order to fill the upcoming pension gap.

Two years after the Riester reform the German public pension system is once again in need of reform. In late Fall of 2002, the government established a reform commission for "Sustainability in Financing the Social Insurance Systems", popularly referred to as the "Rürup–Commission" after its chairman, economist Bert Rürup. The Commission pointed out that the demographic and labor market assumptions underpinning the Riester reform were

[1] See Börsch-Supan and Wilke (2003) for a description of the German pension reform process.

unrealistic.[2] The Rürup-Commission's projections,[3] this time based on a broad consensus of researchers and experts, reveal that contribution rates to the public pension system will exceed 21 percent in the year 2020 and rise above 24 percent by the year 2030. Moreover, it will be impossible to maintain a level of pensions corresponding to 67 percent of net earnings. These figures are politically significant because they were written down in the Riester reform legislation as objectives that must be met; otherwise the German government is obliged to implement further reform.

A majority of the commission's members took the view that the contribution rate targets – of a maximum of 20 percent by 2020 and 22 percent from 2030 onwards – legally anchored in the Riester reform must be adhered to mainly due to economic growth considerations. Hence, further cuts in the replacement rate of the pay-as-you-go pillar (accompanied by the strengthening of substituting second and third pillar pensions) and an increase in the normal retirement age are the two main elements of the new reform package.

A centerpiece of the Commission's reform proposal is the benefit indexation formula. This is the topic of this paper. The benefit indexation formula determines the average pension benefit for all retirees on a year to year basis. Unlike changes in the retirement age, which affect only new retirees, even rather modest modifications to this formula can in the short term, and even more so in the long term, considerably ease the pressure on the financing of pensions since the formula impacts new retirees as well as existing pensioners.[4] The indexation of the stock of pensions to average current wages makes the German system year, not cohort dependent, unlike e.g. to the Swedish and the new Italian systems which are more cohort oriented.

The benefit indexation formula is the main device to control intergenerational distribution. It of course does not change the fundamental pay-as-you-go budget constraint. At any given contribution rate, this budget constraint determines the funds available for spending and thus the pension replacement rate. Vice versa, if a certain replacement rate is regarded as a desirable social policy objective, this implies expenditure levels commensurate with this objective and thus a specific contribution rate. No pension formula, whatever shape it may

[2] This did not come as a surprise. See, for example, Bonin (2002), Börsch-Supan (2001, 2002) and Schnabel (2001) who point out that, on basis of these assumptions, the Riester reform does not go far enough.

[3] A detailed description of the demographic and labor market scenario of the "Rürup-Commission" is given in the appendix.

[4] Cf. Commission on the long-term financial viability of the German social security system" (2003a) and Berkel and Börsch-Supan (2003).

take, can escape this fundamental relationship between income and expenditure which governs all pay-as-you-go pension systems.

The benefit indexation formulae discussed in this paper should therefore be regarded as alternative means of providing a plausible rationale for modifications to both contribution rates and replacement rates under alternative objectives. Such social or economic policy objectives may, for example, entail preventing contribution rates rising too much, e.g. more than the upper limits defined in the 2001 pension reform. Alternatively, a policy objective may be to guarantee a replacement rate of 67 percent of net wages. The Commission showed that these two objectives exclude each other. A third objective may be to minimize fluctuations and to make the system self-stabilizing with regard to future demographic changes and developments on the labor market.

The sustainability factor proposed by the Commission stands out from other alternatives in that it mediates between the first two objectives and fulfills the third. In contrast, the present benefit indexation formula is bound rigidly to the (unrealistic) demographic and labor projections of the 2001 reform.

The paper is structured as follows. The next section presents various new benefit indexation formulae and their impact on contribution and replacement rates. Section~3 compares the various reform options. Section~4 examines the self-stabilizing effect of the sustainability factor proposed by the Commission. Section~5 draws conclusions with particular emphasis on total retirement income, taking public as well as private pension income into account.

2 Benefit Indexation Formulae

The German pension system computes benefits according to the following formula:

(2.1) $B_{t,i} = PV_t * EP_i * AA_i$

where

$B_{t,i}$ = *Benefits of pensioner i in year t,*

PV_t = *Current pension value in year t,*

EP_i = *Number of individual earnings points collected by pensioner i until his retirement*

AA_i = *Actuarial adjustment, dependent on the retirement age of pensioner i.*

Benefits therefore have a simple structure: an individual component $EP_i * AA_i$ determined by each persons earnings history and retirement age which stays fixed for the entire retirement period, and an aggregate component PV_t which adjusts benefits over time equally for all pensioners. The determination of PV_t is the subject of this paper.

EP_i represents the "point system" and AA_i is determined by actuarial accounting rules, see e.g. Börsch-Supan and Wilke (2003). A typical worker who works for 40 years and earns the average wage receives 40 earnings points. If this worker retires at age 65, no actuarial adjustments take place (AA=1). In the second half of 2002, the current pension value PV_t was 25.86 Euro. Hence this typical worker receives a pension of 1034.40 Euro per month.

Each year, currently at July 1, the current pension value PV_t is recalculated with the aid of the benefit indexation formula. Until recently, this benefit indexation formula was essentially a simple indexation rule to the average annual level of wages and salaries (before 1992: gross wages and salaries, after 1992 net wages and salaries):

(2.2) $PV_t = PV_{t-1} * \frac{AGW_{t-1}}{AGW_{t-2}}$ (until 1992); $PV_t = PV_{t-1} * \frac{ANW_{t-1}}{ANW_{t-2}}$ (1992 to 2001)

where

PV_t: *Current pension value in year t*

AGW: *Average gross earnings of all employees*

ANW: *Average earnings of all employees, net of taxes and social insurance contributions*

Since the current pension value PV_t has a direct influence on every individual pension, the benefit indexation formula is a critical determinant for the well-being of pensioners and the amount of money spent by the public pension scheme.[5] The benefit indexation formula (2.2) gives no reference to the demographics of the system, nor to the number of employed persons, although there are limited feedbacks possible through the amount of average earnings. This is one reason for the unsustainability of the German pay-as-you-go system. The pre-1992 version of the indexation formula ("gross wage indexation") was particularly unstable in times of population aging and may lead to a vicious cycle of ever increasing contributions: If higher contribution rates lead to higher gross wages (i.e., net wages fall less than in proportion to the contribution increase), pension benefits also increase, leading to higher contributions, and so forth. This was corrected in 1992 ("net wage indexation"). Higher contributions now dampen the increase in pension benefits, a kind of burden sharing between generations.

2.1 The Riester Formula

The pension reform in 2001, the so-called Riester-reform after the then labor minister Walter Riester, tried to strengthen this tie. It introduced three changes to the formula (2.2):

(2.3) $$PV_t = PV_{t-1} * \frac{AGW_{t-1}}{AGW_{t-2}} * \frac{GAF_t - PPC_{t-1} - CR_{t-1}}{GAF_t - PPC_{t-2} - CR_{t-2}}$$

where

PV_t: *Current pension value in year t*

AGW_t: *Average gross earnings of all employees*

GAF_t: *Gross adjustment factor*

PPC_t: *Private pension component*

CR_t: *Contribution rate to the manual and white-collar workers' pension scheme*

First, the Riester formula uses as wage comparison something between gross and net wage ("modified gross earnings indexation"). Pensions will continue to be linked to annual wage developments, but will now be based on gross earnings minus the contribution rate to the retirement insurance scheme. An increase in contribution rates thus weakens the pension adjustment as in net wage indexation, but feedback effects of other branches of the social security system (notably health insurance and general taxes) are not transmitted to pension benefits.

[5] Ruland (2000) has succinctly expressed the relationship between earnings points and current pension value by regarding earnings points as "shares" in the "financial assets" held by the pension fund. The current pension value corresponds to the current "share price" which it is the function of the indexation formula to determine.

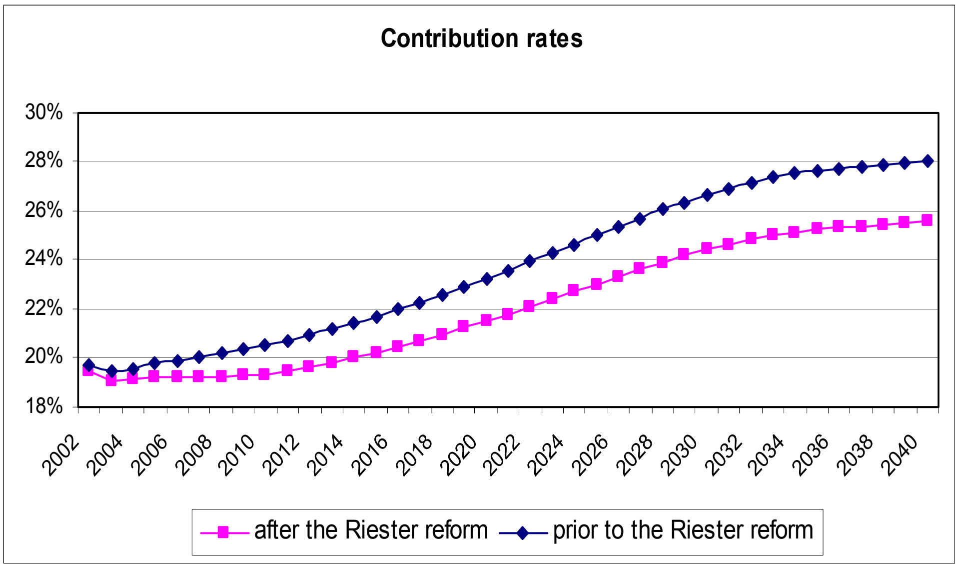
Second, pension levels are also reduced by the gross adjustment factor GAF_t which was scheduled for a one-off reduction from 1 to 0.9 in 2011. This will increase the elasticity of benefits with respect to future contribution rate increases.

The third modification introduced by the Riester reform is the so-called “Riester ladder” in the private pension contribution rate PPC_t which increases by 0.5 percent each year from 0.5 percent in 2002 to 4.0 percent in 2009. This reflects the phased increase of private supplementary pensions.[6]

The main aim of these three modifications was to dampen the increase in public pension spending (“first pillar”) below the targets described in the introduction (less than 20 percent contribution rate until 2020, less than 22 percent until 2030). At the same time the formula was designed to strengthen supplementary private occupational and individual pensions (“second and third pillar”) which are voluntary but heavily subsidized or tax privileged.

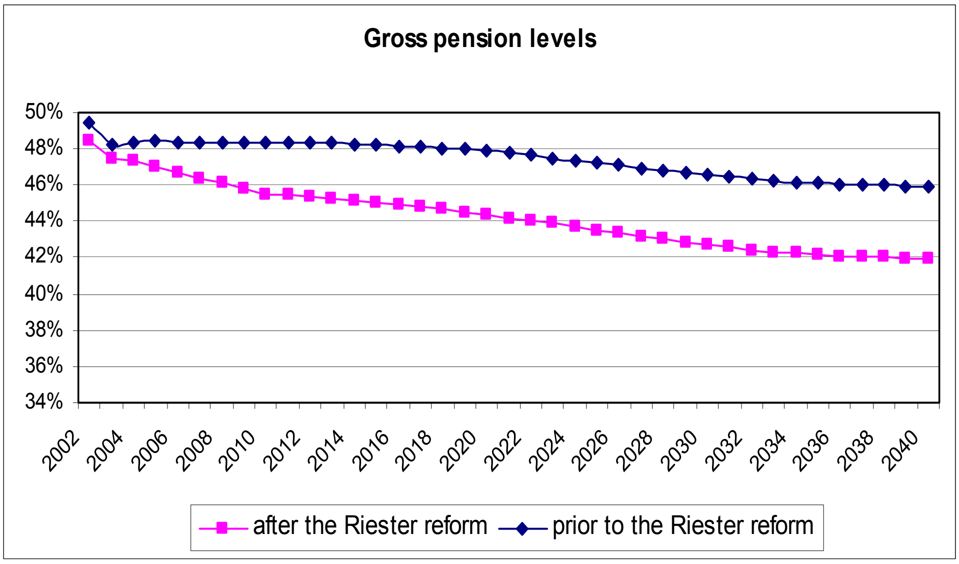
Figure 2-1 shows how contribution rates and gross pension levels would develop by applying the Riester formula and compares these paths with the contribution rates and pension levels that would have developed if pensions continued to be indexed to net wages as they were prior to the Riester reform.[7]

Figure 2-1: Riester formula



[6] Note that these pensions are voluntary and that the Riester ladder rises less steeply than state subsidies.

[7] The assumptions underlying these and the following projections are those of the Rürup-Commission. See appendix for details.



Source: Own calculations based on the MEA-PENSIM model.

It is apparent that - on the basis of the demographic and employment assumptions made by the Rürup-Commission - the Riester reform generates a significant reduction in the contribution rate compared to the situation which would have prevailed had the 1992 net indexation formula continued to apply. Nevertheless, Figure 2-1 also shows that it will not be possible to achieve the contribution rate objectives of 20 and 22 percent stipulated by the Riester reform. Furthermore, the introduction of the Riester formula will result in a major reduction in the value of pensions to around 42 percent of gross wages and fall below the target of 67 percent of net wages at about the year 2025.

The failure of the Riester formula (2.3) to achieve the Riester targets is the point of departure for this paper. It discusses several modifications to the Riester formula which are designed to meet these targets.[8] They all have the same structure, namely multiplying the original Riester benefit indexation formula by a "factor" which is a function of demographics, employment or both. We give particular attention to the so-called "sustainability factor" which was introduced by the Rürup-Commission. Looking at the various benefit indexation formulae is insightful. Specifically, we learn that a defined contribution system can almost perfectly mimic a "notional defined contribution" system, including its sustainability properties.

[8] See Breyer and Kifmann (2003) for alternative reform proposals which are not, however, motivated by the contribution rate objectives specified here but which take account in the pension formula of the life expectancy of specific groups. We do not discuss such proposals since they violate the underlying ex-ante equivalence principle of social insurance.

Specifically, we investigate:

- the "longevity factor", which in effect corresponds to the demographic factor introduced by the largely repealed 1999 pension reform,
- the "old-age dependency factor",
- the "wage bill factor", and
- the "sustainability factor" proposed by the Rürup-Commission.

These factors are multiplied with the following variant of the Riester formula (2.3):

- the "Riester ladder" (i.e. the inclusion of the old-age pension provision element of up to 4 percent in the calculation of modified gross income) is retained,
- the gross adjustment factor remains unchanged at 1 (and will not be reduced to 0.9 in 2011),
- pension benefits are indexed to wages and salaries only of those workers who are subject to mandatory insurance contributions (rather than all employees, including civil servants).[9]

The introduction of the new factor added to the indexation formulae is assumed to begin in the year 2004. We show the gross pension level for a worker on average earnings who begins working at the age of 20 and retires at the age of 65 ("reference pensioner"). We have consciously left two changes suggested by the Commission out of our considerations: the effects of the shift in the retirement age from 65 to 67 years, and the shift in the pension adjustment from mid year to the end of the year. We did so because the objective of this paper is to demonstrate the varying effects of different factors in the benefit indexation formula, and did not want to confound this with additional reform steps.

2.2 The Longevity (or „Demographic") Factor

The first reform variant is geared towards a demographic component, namely life expectancy. The growing pressure on pension insurance contributions exercised by the substantial increase in life expectancy could be eased by incorporating the pension pay-out period, i.e.

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[9] This change was also proposed by the Rürup-Commission. To date pensions have been adjusted in line with gross wages as recorded in national income accounts rather than according to developments in income subject to mandatory insurance contributions. Gross wages encompass not only income subject to mandatory pension contributions, but also earnings which exceed the contribution assessment ceiling and those of employees, in particular civil servants, not required to pay mandatory contributions.

the remaining life expectancy of the over 65-year-olds, in the benefit indexation formula.[10] This is shown by the following correction factor:

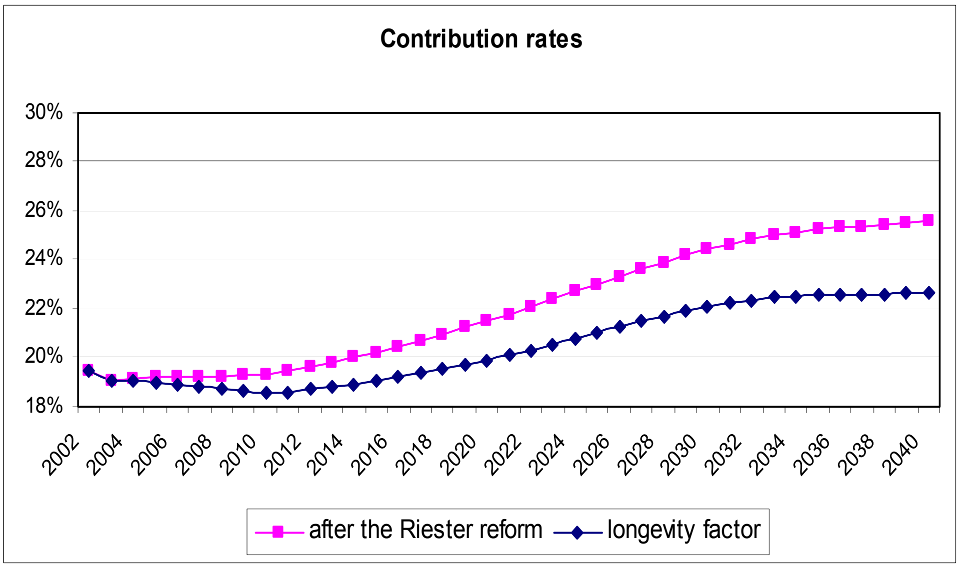
(2.4) "Riester formula" * $\frac{LE_{t-2}}{LE_{t-1}}$

where LE_t = remaining life expectancy at age 65 in year t

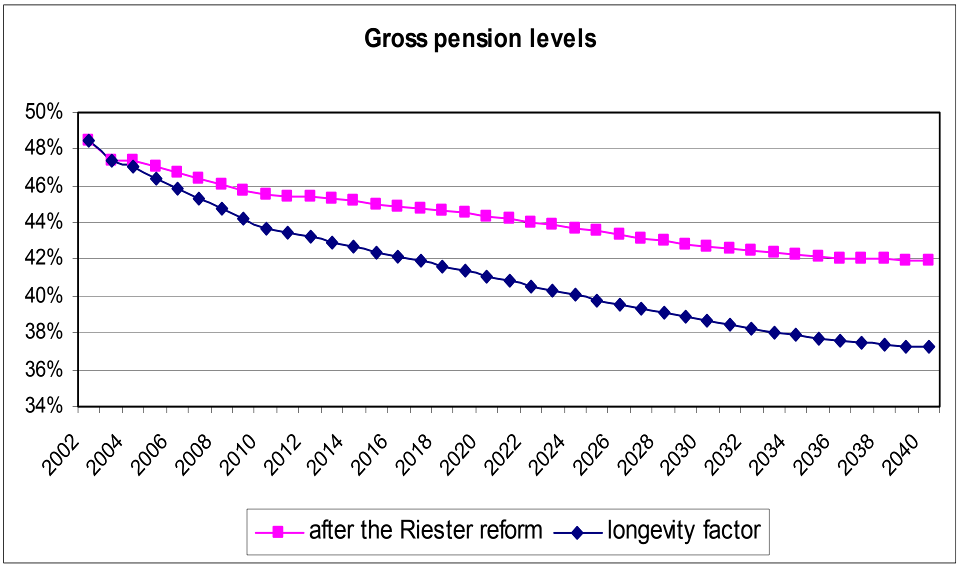
In principle this correction factor corresponds to the "demographic factor" in the legislation enacted by the Christian Democrat government in 1998 and subsequently suspended by the succeeding Social Democrat government. Although the demographic factor basically takes account of the higher life expectancy of new retirees, it does also affect existing pensioners who will benefit as well from longer pension pay-out periods.

Figure 2-2 shows how, in comparison with the Riester formula as a reference scenario, contribution rates and gross pension levels would develop if the longevity factor was introduced:

Figure 2-2: Longevity factor



[10] The most convincing, but by no means only possible, method is to take account of recent changes in life expectancy (in the last two periods). However, depending on data availability, it is legitimate to refer to earlier periods.



Source: Own calculations based on the MEA-PENSIM model.

By taking account of increasing life expectancy, the longevity factor takes considerable steam out of the annual pension adjustment and, with a contribution rate which is under 20 percent in 2020 and 22 percent in 2030, also enables contribution rate objectives to be reached. Owing to the budgetary restraints on the pay-as-you-go system, pension benefits as a percentage of gross earnings will be significantly lower at around 41 percent in 2020 and 38.5 percent in 2030.

The Commission decided not to re-employ this factor. In light of the proposed increase of the normal and the early retirement ages, the introduction of a purely longevity-oriented factor would in effect penalize new retirees twice for longer life expectancy.

2.3 The Demographic Old-Age Dependency Factor

As well as imposing a double burden on new retirees, another disadvantage of the longevity factor is that demographic change is not only affected by higher life expectancy but also by two other demographic variables – the decline in the birth rate and migration – which are not accounted for by either the longevity factor or the abandoned demographic factor.

A more consistent approach is therefore to integrate all the forces influencing the age structure of the population in a correction factor. As far as pension adjustment is concerned this can be achieved by taking account of the development of the old-age dependency ratio which expresses the number of people at retirement age relative to the number of people of working age. In order to permit only a partial transmission of the financial pressures generated by demographic trends to pensioners, the pension formula can be weighted with an additional parameter (α) which enables the burden to be spread among contributors and pensioners.

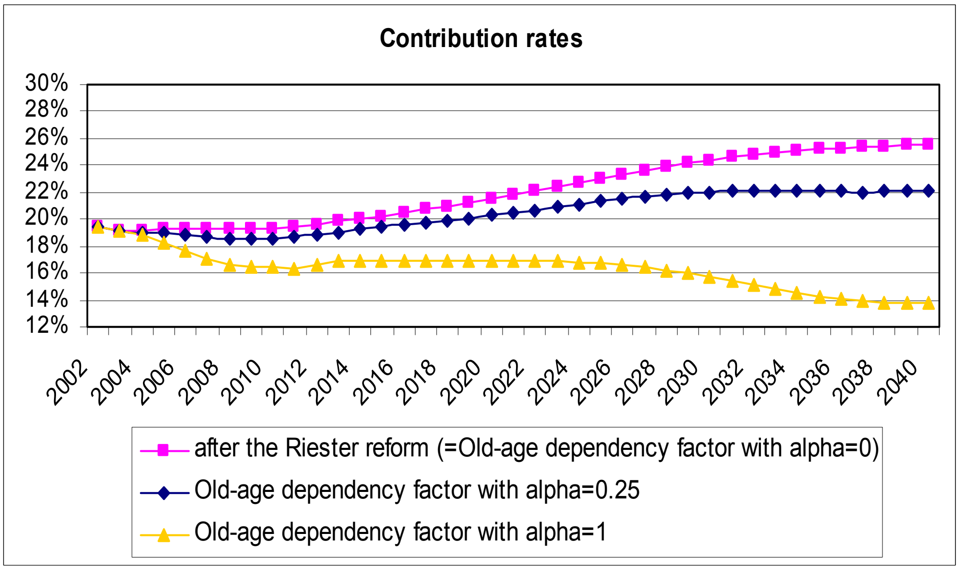
$$\text{(2.5)} \quad \text{“Riester formula”} * \left[\left(1-\frac{OADR_{t-1}}{OADR_{t-2}}\right) * \alpha + 1\right)\right]$$

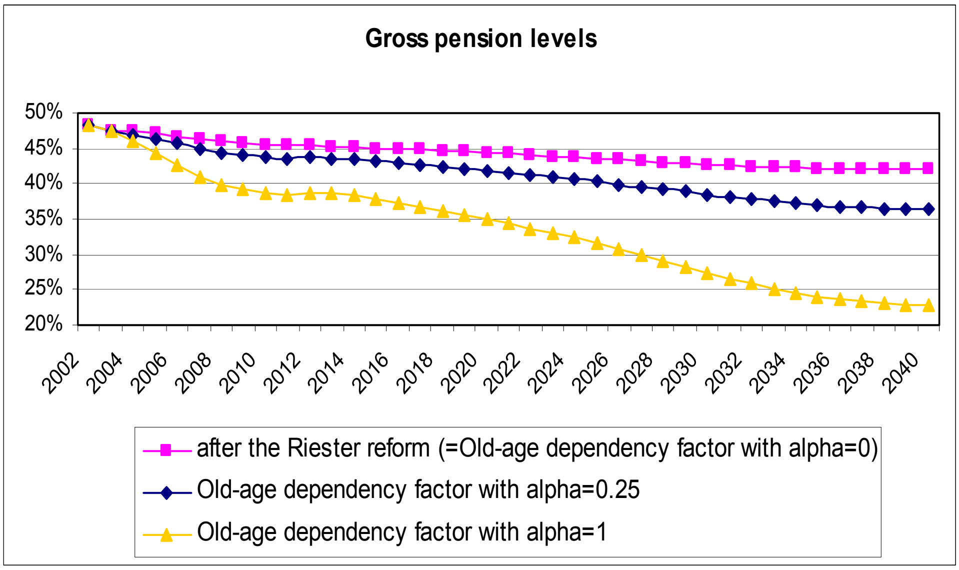
where $OADR_t$= (number of people in the population aged 65+/number of people in the population aged 15-64) in year t

If α equals 1, the full impact of the old-age dependency factor will reduce pension benefits; if α is set to zero, the previous “Riester formula” would apply. If α equals 0.5, contributors and pensioners will bear a more or less equal share of the added burden.

Figure 2-3 shows how contribution rates and pension levels develop for three different values of α:

Figure 2-3: Old-age dependency factor





Source: Own calculations based on the MEA-PENSIM model.

When pension adjustments take account of the old-age dependency ratio this has a quite dramatic effect on contribution rates and pension levels.[11] Incorporating the ratio in unadulterated form in the pension adjustment (α=1) results in very low levels of pension. On the other hand, while α of 0.25 would fail to meet the term contribution rate target for the year 2020 by a small margin, it would be sufficient to meet the long-term contribution rate target for the year 2030. At 42 percent, pension levels in 2020 are correspondingly slightly higher than they would by applying the longevity factor; in 2030 they would also be around 38 percent, however.

2.4 The Wage Bill Factor

The way in which pension financing develops in the future depends not only on demography but also on future patterns of gainful employment. The drawback of both demographic factors is that they are not able to take account of changes in labor force participation rates which would be capable of compensating to some extent for the impact of demographic change. In contrast, the next two factors take account of these changes.

One way of capturing the eroding contribution base implied by demographic trends is to incorporate the changes in the size and productivity of the labor force:

[11] See Table 2 in the appendix for the old-age dependency ratio values.

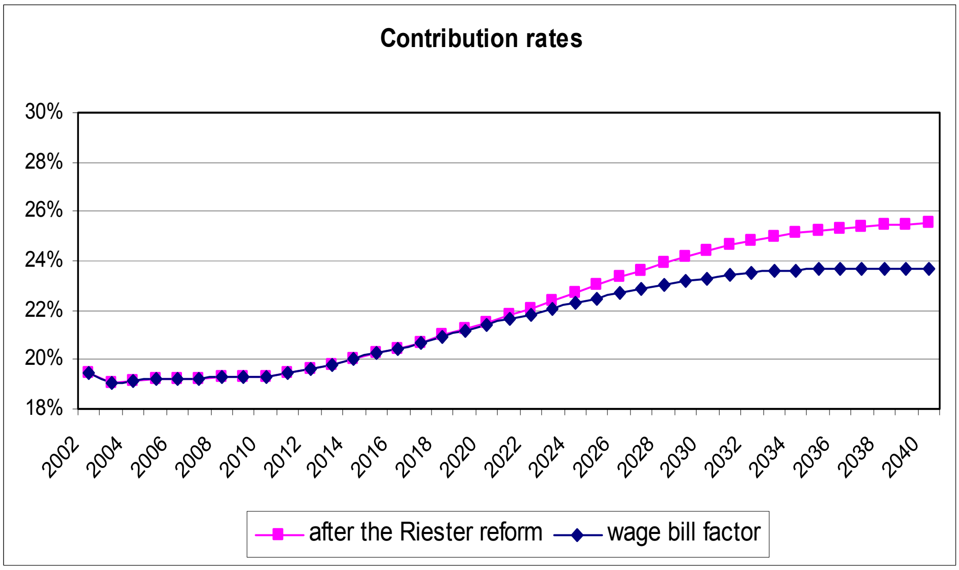
$$\text{(2.6)} \quad \text{"Riester formula"} * \max\left(\frac{LF_{t-1}}{LF_{t-2}}, 1\right)$$

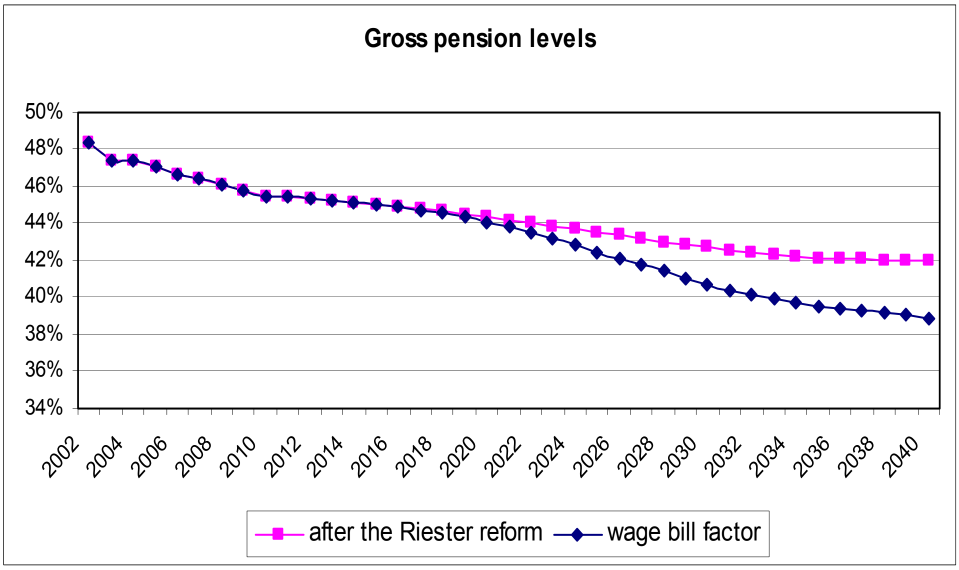
where LF_t = Size of labor force in year t

In combination with the changes already integrated in the "Riester formula" relating to income subject to mandatory insurance contributions, this wage bill factor in effect integrates the total wage bill in the pension adjustment, thus dynamizing pensions in a way which reflects the rate of return generated by the pay-as-you-go system.

As it happens, however, the current "secondary babyboom" yields a kind of demographic tailwind during the following about seven years. Only after 2015 will the German labor force begin to decline significantly. Hence, the total wage bill could well increase in the next few years which would result in a higher pension adjustment. This would create a misleading perception; rather, the added revenue should be used to replenish the depleted reserve buffer. For this reason the factor is limited to a maximum value of 1 which would hold the contribution rate steady as long as the demographic tailwind lasts and will boost the fluctuation reserve. Only after demographic developments begin to pick up steam again after the year 2015 will this pension adjustment bring about a reduction in pension levels and thus slow down the increase in the contribution rate; see Figure 2-4.

Figure 2-4: Wage bill factor





Source: Own calculations based on the MEA-PENSIM model.

The figure clearly illustrates that this variant would not allow contribution rate objectives to be attained. As the available estimates only predict a shrinking active labor force as of 2015, the restraining influence on pension adjustments would come too late.

2.5 The Sustainability Factor

One reason for the inadequate effect of the wage bill factor is that it only takes the contribution side of the pension insurance equation into account. The sustainability factor consequently not only incorporates demography and employment, but also takes account of the number of contributors and pensioners. The relative number of pensioners to contributors, the so-called system dependency ratio, is the most important long-term determinant of pension financing.[12]

Incorporating the sustainability factor in the benefit indexation formula enables annual increases in pensions to be linked to the two most important factors determining the financing of pensions (the number of contributors and the number of pensioners). The sustainability factor thus has a stabilizing impact on the pension system which is dealt with in more detail in Section 4. As described in the case of the old-age dependency ratio, a weighting factor α can also be used here to spread burdens among contributors and pensioners:

[12] The “equivalence system dependency ratio” has been developed to avoid the distortions produced by extremely low contributions and/or pension benefits. This ratio standardizes the number of pensioners by converting standard pensions into the number of “equivalence pensioners”. The number of “equivalence contributors” is likewise calculated by standardizing the average earner.

$$\text{(2.7)} \quad \text{“Riester formula”} * \left[\left(1-\frac{PQ_{t-1}}{PQ_{t-2}}\right) * \alpha+1\right]$$

where PQ = [pensioners / (contributors + unemployed)]

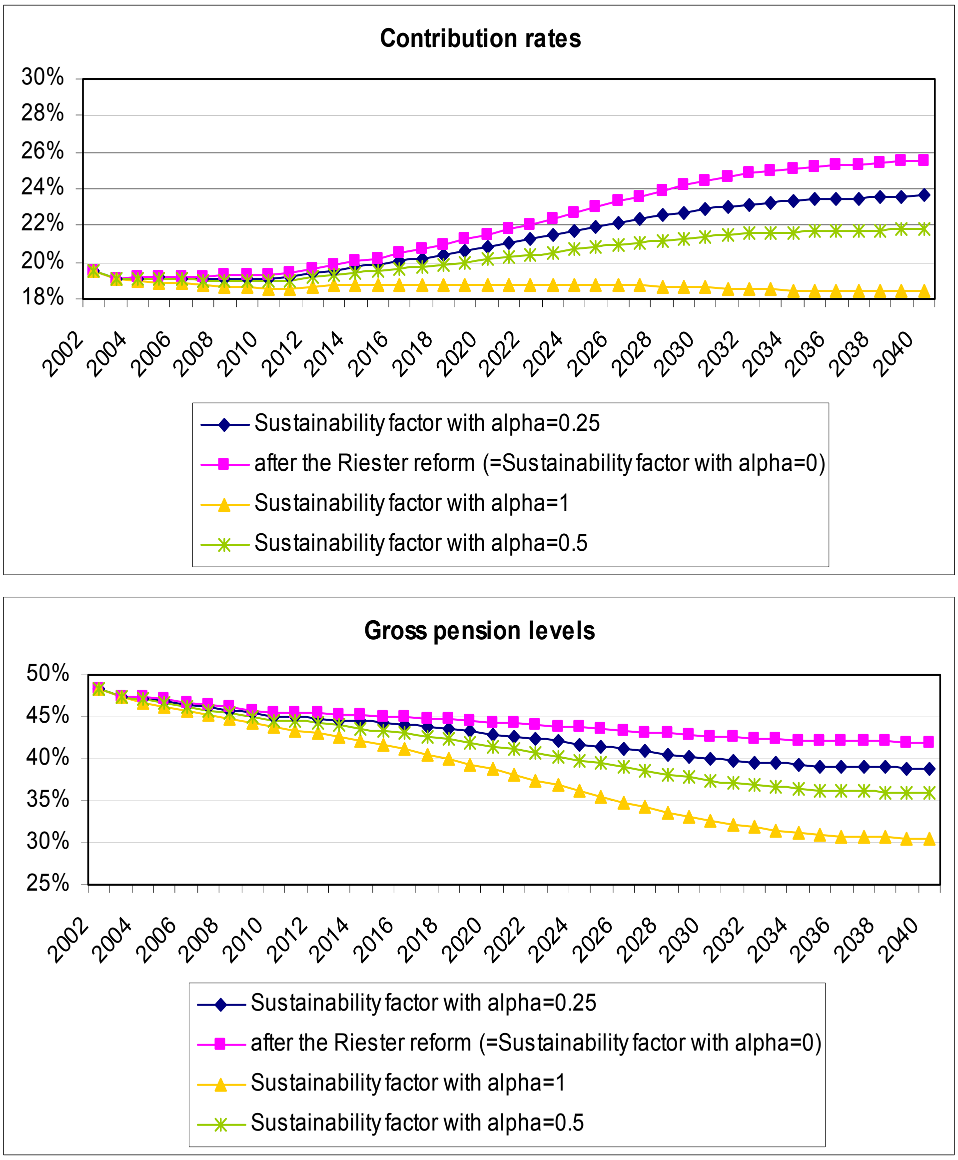
or, number of equivalence pensioners / number of equivalence contributors

If α equals zero, the current benefit indexation formula would remain unchanged and the financial burden generated by a higher proportion of pensioners in the population would be shouldered entirely by the labor force. If α equals one, however, this would imply a purely receipts-oriented pensions expenditure policy.

The danger of unsystematic, discretionary changes being made in pension levels is of course inherent in the weight α. This would fatally undermine people's already dented confidence in the long-term stability of the pension system. The idea is therefore to set α at a focal point value and leave it there. It is needed at the time of introduction for two reasons. First, the weighting factor α implicitly sets the target contribution rate to be achieved. By setting α to ¼, the Riester targets will be met (e.g. the maximum contribution rate target of 20 percent by 2020 and 22 percent after 2030 formulated in the Riester reform). Second, α serves as an emergency valve should the *PPC* component in the Riester formula (cf. equation 2.3) proves to be unconstitutional. By setting the weighting factor α to ⅓ rather than ¼, the Riester targets will be met even if *PPC* is omitted from the Riester formula. Figure 2-5 illustrates the outcomes generated by this reform option for variations of α values.[13]

[13] In this case the sustainability factor is calculated on the basis of changes in the two preceding periods (t-1, t-2). A sensitivity analysis shows that the results are only around 0.2 percentage points lower if, alternatively (e.g. if dictated by the data available) a time delay of (t-3, t-4) is selected across the board for all the components of the indexation formula. This difference will increase to 0.3 percentage points after the year 2032.

Figure 2-5: Sustainability factor



Source: Own calculations based on the MEA-PENSIM model.

If α equals one, the sustainability factor would imply a purely receipts-oriented pensions expenditure policy. The contribution rate would remain stable, while pensions would sink to around 30 percent of gross earnings. The overall impact of the sustainability factor is less drastic than that of the old-age dependency factor as the sustainability factor takes account of both demographic trends and the partially compensating effects of changes in patterns of gainful employment. The decline in the size of the working age population is compensated to some extent by the assumed increase in activity rates for women and older workers which will boost the number of contributors to the system.[14]

[14] See Table 3 in the appendix for details on the underlying labour market assumptions.

A weighting factor α of 0.5 spreads the additional burden created by the new factor equally between contributors and pensioners and generates, in contrast, a contribution rate of 20.1 percent in 2020 and 21.4 percent in 2030. In this case, pensions in 2030 would be worth around 37 percent of gross earnings.

Higher pensions are generated by setting a lower value for α. If α equals 0.25, for example, a contribution rate a little lower than 23 percent in 2030 would raise the level of pensions to 40 percent of gross earnings. If the calculation also takes account of the proposed change in the timing of pension adjustments to January and the increase in the age of retirement to 67 recommended by the commission, then, at α equal to 0.25, and according to the calculations of the commission it would be just about possible to achieve contribution rate targets – i.e. the contribution rate targets of a maximum of 20 percent by 2020 and 22 percent by 2030 legally anchored in the Riester reform.[15]

[15] Cf. the projections of the Commission (2003c).

3 Comparison of effects on contribution rates and benefits

When comparing these four formula modifications it is helpful to call to mind the two extreme organizing principles according to which a pension system can be run:

(1) The contribution rate can be stabilized at a particular level so that the burden of demographic developments is borne entirely by the older (pensioner) generation.

(2) Pension levels can be maintained at a particular level so that the burden of demographic developments is borne entirely by the younger generation (the working population).

The choice among various “factors” and “benefit indexation formulae” can be interpreted as a search for a third way in between:

(3) Compromises between the first two options.

A little algebra shows that an adjustment strictly proportional to the change in system dependency ratio corresponds to principle (1). This is the sustainability factor with a weighting factor of α=1.

In the past policies have complied with principle (2). Contribution rates have been altered to suit the financing needs of politically determined pension levels (which since the 1970s have been around 70 percent of the net earnings of dependent employees).

All the indexation formulae discussed in this paper may be interpreted as a weighted average between principles (1) and (2) whereby the degree to which the older or younger generations shoulder the burden of demographic pressures changes over time. The “generational weightings” in tax, demographic, and/or labor market developments shift depending on the indexation formula used. Net wage indexation uses the effect of contribution rates to adjust benefits, see the beginning of Section 2. The original Riester formula (2.3) contains the gross adjustment factor, the Riester ladder, and the contribution rate as elements of this generational weighting. Demography and gainful employment are therefore only indirectly included in the net wage indexation and Riester formulae.

The formula modifications discussed in this paper increase the weighting of demography and gainful employment in the benefit indexation formula by adding explicit references to demography and employment. This is particularly the case for the sustainability factor with a weighting α of less than 1.

There is no such thing as a "natural weighting" scheme, i.e. a natural compromise between the generations, unless one makes bold assumptions about the welfare of each cohort, say, in an intertemporal model of overlapping generations. Such model needs to make tightly specified assumptions about preferences for consumption and leisure of each generation, and model the feedback and incentive effects of social insurance on the level of production.[16] Such a welfare analysis may be insightful to study in particular the effects of those assumptions on intergenerational distribution, probably of less value for actual policy evaluation, and certainly beyond the scope of this paper. Rather, the point of departure for the reform proposals was to achieve a politically pre-defined contribution target.[17]

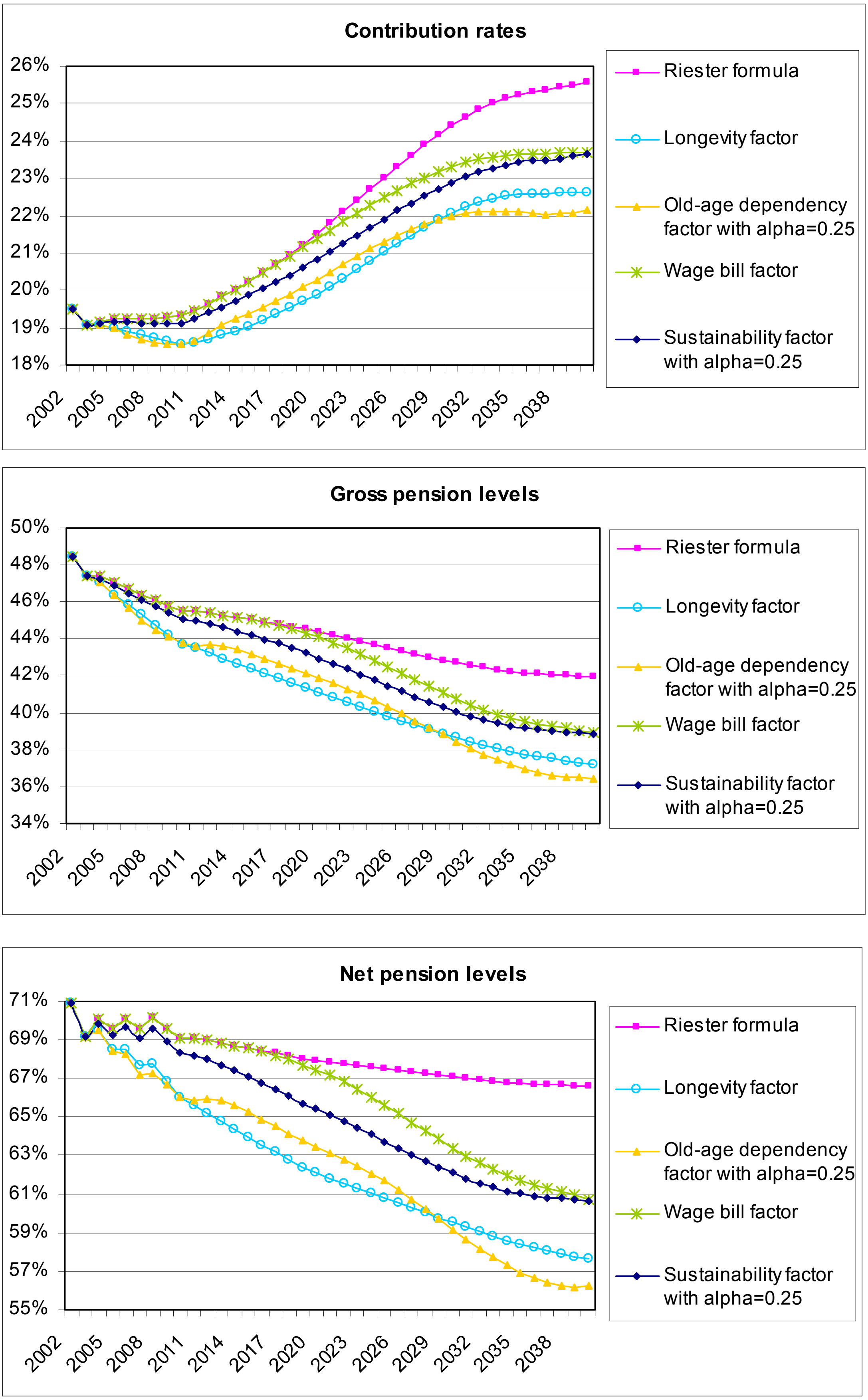
By virtue of their construction, the sustainability factor - or any other of the factors discussed here - will only approximately achieve the contribution rate targets of 20 percent in the year 2020 and 22 percent after 2030. A factor capable of achieving a defined, exogenously chosen contribution rate precisely would have to build this target into it. This would in effect severe the link between the current benefit indexation formula and earnings, a politically undesirable outcome.

Figure 3-1 summarizes the contribution rates and pension levels generated by the various benefit indexation formulae. We report both gross and net pension levels. Net pension levels should be interpreted with care. The anticipated introduction of deferred taxation of pensions recommended in 2003 by a commission on pension taxation will treat cohorts differently. The gradual introduction of deferred taxation will be realized in phases, first as a tax relief for the members of the active labor force and later as a tax burden on pensioners who benefited from the changes while they were still working. The differential treatment of cohorts makes it impossible to compare net pension levels over time and thus makes intertemporal comparisons meaningless. In order to avoid such distortions, the bottom panel of Figure 3-1 displays net pension levels holding – contrafactually – taxes fixed at today's levels.

[16] Cf. Börsch-Supan (2003).

[17] One may interpret this political pre-determination as an outcome of the maximization of welfare as described above, filtered of course by the political process.

Figure 3-1: Overview of reform options



Source: Own calculations based on the MEA-PENSIM model.

The different benefit indexation formulae differ in terms of the level and the gradient of the contribution rate and the pension level.

The *wage bill factor* generates the highest contribution rates and the highest pension levels since its pension-reducing effect only begins to cut in with the decline in the size of the labor force after the year 2015.

The *sustainability factor* with a weighting α of 0.25 corresponds most closely to the targeted contribution rates.[18] If one adds the fiscal relief provided by the increase in the statutory retirement age and the shift in the annual pension adjustments from July to next January, the sustainability factor will actually achieve the contribution rate targets of 20 percent in 2020 and 22 percent in 2030.

The *old-age dependency factor* with a weight of α=0.25 and the *longevity factor* (quite close to the old „*demographic factor*“ introduced in the failed 1999 reform) cut further into future pensions and therefore generate relatively low contribution rates.

Overall, these simulations show the obvious. Whatever benefit indexation formula is adopted, the fundamental interaction between the contribution rate and pension levels remains unchanged: higher contribution rates generate higher benefit levels, and vice versa. If the targeted maximum contribution rates of 20 percent up to 2020 and 22 percent thereafter are to be achieved, annual pension adjustments have to be more moderate, resulting in lower pension levels. The decision by the Rürup-Commission to recommend the *sustainability factor* as a means of modifying the benefit indexation formula can be mainly ascribed to its system-stabilizing characteristics which are discussed in more detail in the following section.

[18] According to MEA calculations, the equivalence pensioner ratio will develop as follows:

2002	2010	2020	3030	2040
45.2	47.7	54.0	63.9	68.3

See Tables 1 - 3 in the appendix for the values of the other underlying factors in the pension formulae.

4 Self-Stabilizing Characteristics of the Sustainability Factor

One of the main problems confronting public pensions is the crisis of confidence in the system provoked by frequent and unsystematic adjustments in the recent past.[19] The 1992 reform was followed by repeated changes in statutory pension rules, culminating in the largely abortive 1999 reform. The benefit indexation formula has also wound up as a political plaything. Between the introduction of indexing to net wages in 1992 and the switch to (modified) gross wage indexing with the Riester reform, the benefit indexation formula was suspended in 2000 and pensions temporarily indexed to inflation simply in order to avoid an increase in contribution rates.

With the 2001 Riester reform the system switched to a multi-pillar model. However, very few people believed at that time that this reform was sufficient to keep the pension system solvent over the long term (cf. Boeri, Börsch-Supan and Tabellini, 2003). An important task of any new reform will be to find a formula which is capable of providing a systematic response to the kind of unforeseeable changes which we will always have to live with in the labor market (as well as to, admittedly less likely, swings in demographic trends).

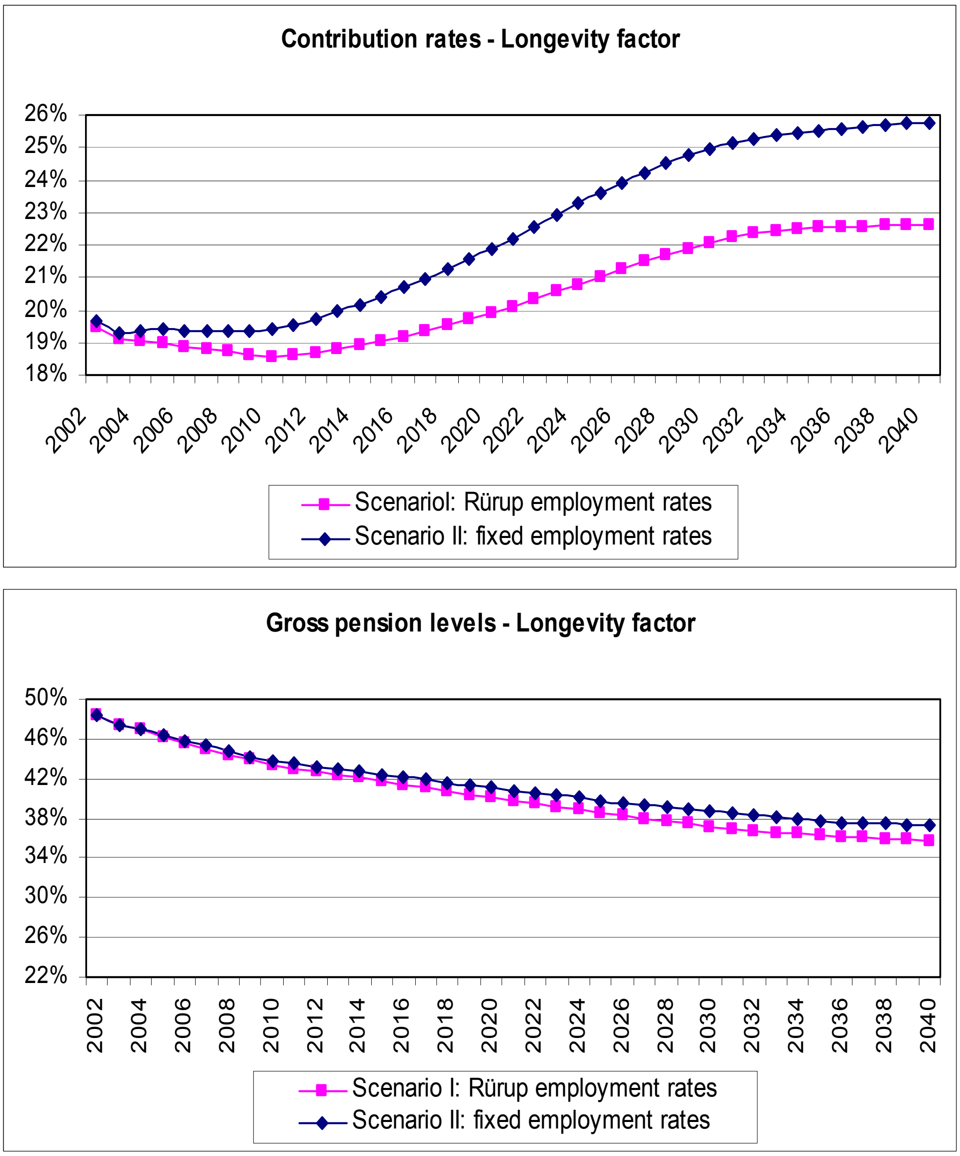
In the following we examine how contribution and replacement rates react to changes in the labor market under two benefit indexation rules: the longevity factor and the sustainability factor. For simplicity, we model two somewhat extreme scenarios. Scenario I is relatively optimistic and corresponds to the Rürup labor market scenario that was also the basis for the preceding calculations. It assumes that female activity rates will continue to rise in the future and will reach a level equal to today's rates in the Scandinavian countries, that the mean retirement age of 59.5 years today will increase by about three years and that unemployment rates will be decreased by 50 percent. Scenario II is much more pessimistic. It assumes that age and gender specific labor force participation rates remain the same as they are today. The point of these two scenarios is not so much to serve as realistic forecasts – we rather want to present the stabilizing impact of the sustainability factor even in a "worst case" scenario. We believe that the most likely scenario is closer to scenario I than to scenario II.

Figure 4-1 depicts the effect of the two labor force scenarios on contribution rates and benefit levels under the longevity factor. The pessimistic assumption in scenario II of an unchanged labor market situation leads to a large increase in contribution rates which would rise to 25

[19] See Borgmann and Heidler (2003) for the history of the German benefit formula and the aligned political risk.

percent in 2030. Hence, the pension benefit indexation formula responds to the labor market developments only indirectly through rising contribution rates while pension benefit levels drop by only around 1.5 percentage points. Under the longevity factor the main burden of adjustment is therefore borne by the contributors (the young generation).

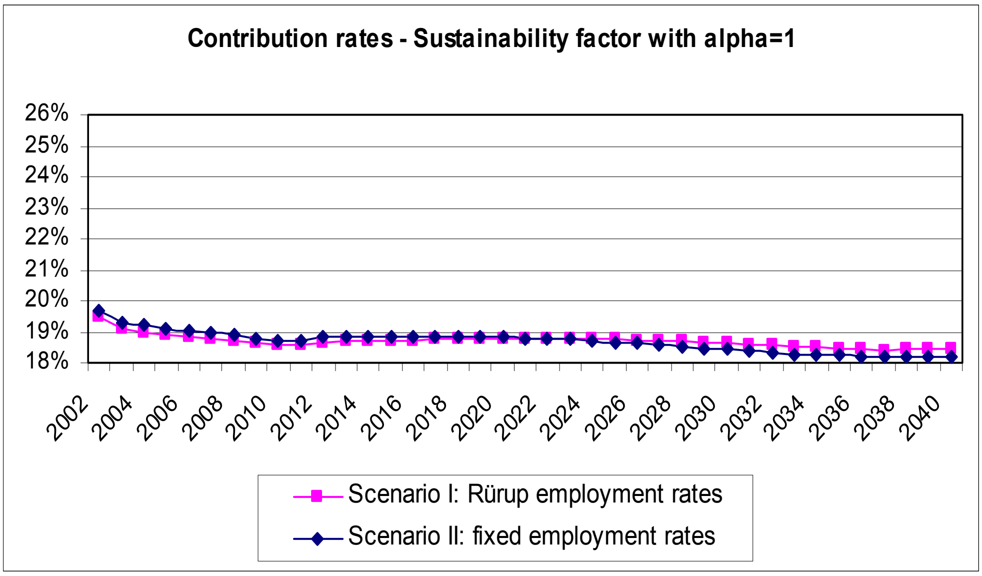
Figure 4-1: Longevity factor combined with changes in the labor market scenario

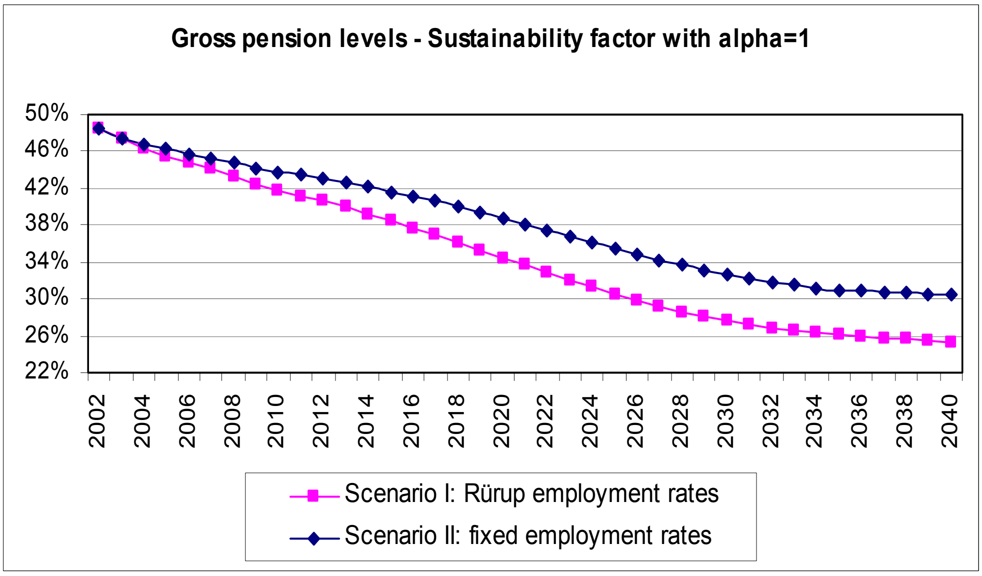


Source: Own calculations based on the MEA-PENSIM model.

Figures 4-2 and 4-3 illustrate how this intergenerational burden sharing is changed under different weights in the sustainability factor. We begin with the extreme case in which full account is taken of the sustainability factor in the pension adjustment (α=1). Figure 4-2 clearly illustrates the stabilizing impact of the sustainability factor on contribution rates: unexpected changes in the labor market have practically no influence at all on contribution rates and only affect pension benefit levels. In the case illustrated here, the pension level is more than four percentage points lower than in the reference scenario. The sustainability factor in which α equals 1 implies a purely income-oriented expenditure system which has a self stabilizing impact on contribution rates.

Figure 4-2: Sustainability factor (α=1) combined with changes in the labor market scenario

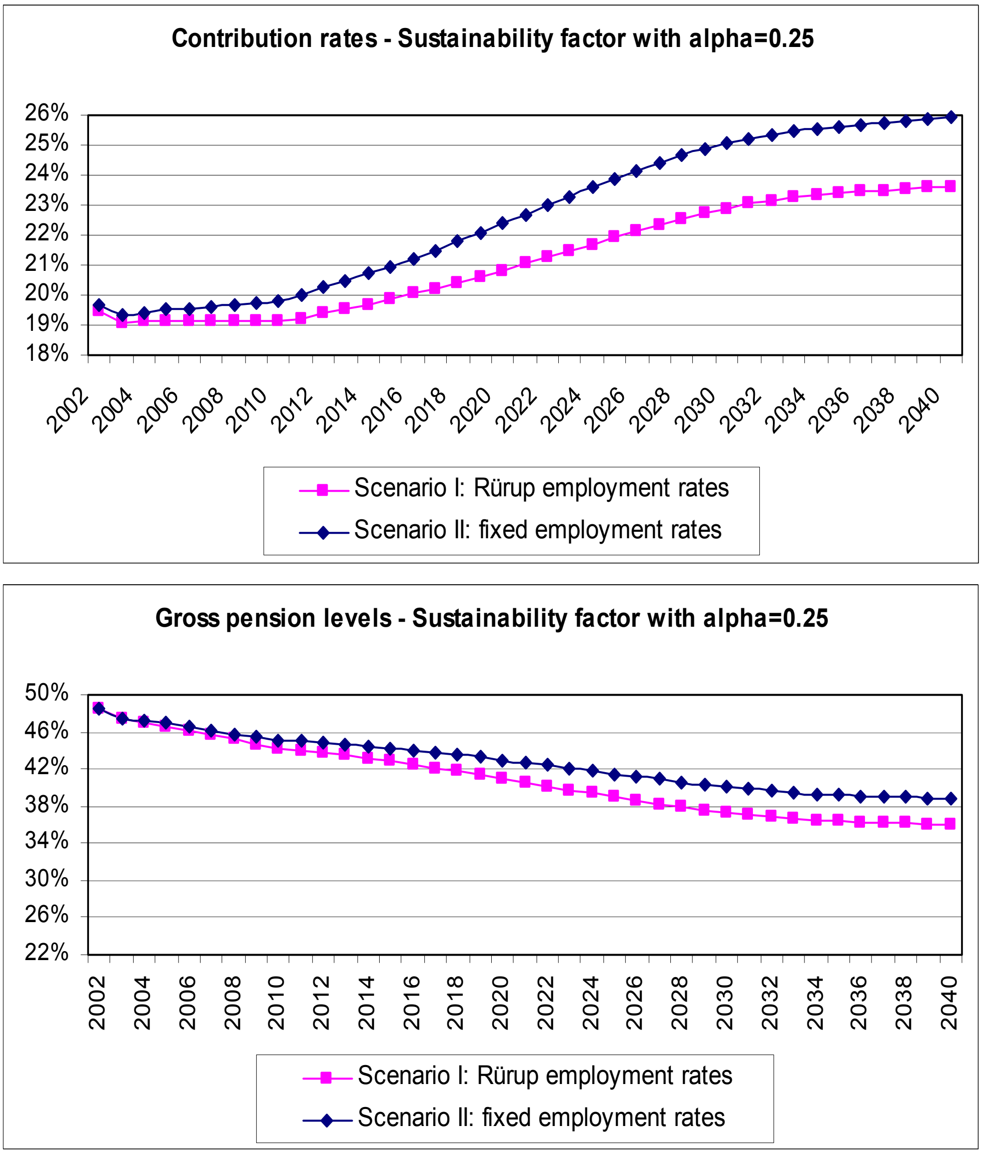




Source: Own calculations based on the MEA-PENSIM model.

Choosing values of α<1 tempers this extreme intergenerational burden sharing. The recommendation submitted by the Commission is based on a weighting factor of α=0.25. Even in this case has the sustainability factor a stabilizing impact; see Figure 4-3.

Figure 4-3: Sustainability factor (α=0.25) combined with changes in the labor market scenario



Source: Own calculations based on the MEA-PENSIM model.

A comparison with Figure 4-1 shows that changes in the labor market have a much weaker impact on the development of contribution rates than under the longevity factor (or that of the former demographic factor, which has an identical effect). The longevity factor leads, for example, to a contribution rate in 2030 which is 3 percentage points higher, while the sustainability factor limits the increase in contribution rates in 2030 to 2 percentage points. The drop in pension benefit levels is accordingly larger. The financial pressure generated by negative developments on the labor market are thus not merely passed on to contributors (as is essentially the case with the longevity factor) but are shared between contributors and pensioners.

5 Conclusions

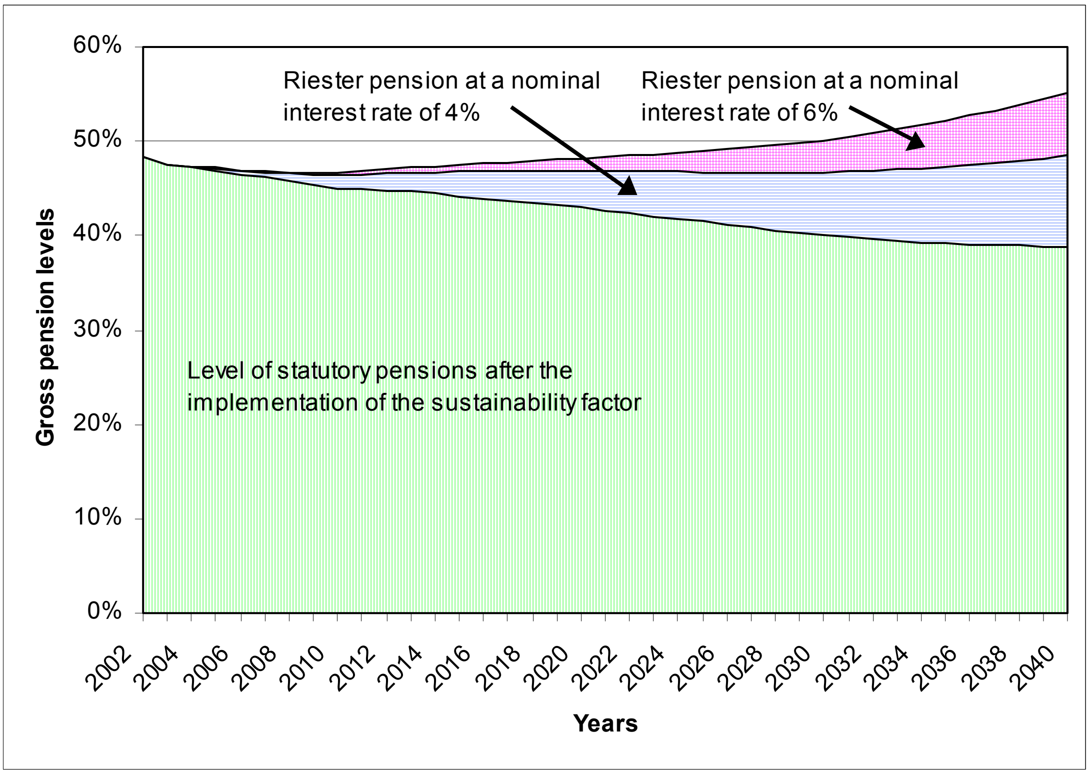
Barring further reforms, present demographic trends will result in a significant increase in the contribution rates to the German public pension system. Since growth considerations dictate that such an increase must be avoided, this paper presented several options to adapt the benefit indexation formula in a way to achieve the contribution targets defined by the Riester reform.

The *longevity factor* could prove politically risky because it could be easily perceived as a "doubly punitive" increase in the state retirement age. The *old-age dependency factor* has a very strong impact on pension levels and contribution rates; it can, however, be flexibly calibrated by means of a weighting factor. The disadvantage of both of these factors is that a purely demographic adjustment is inappropriate in that it neglects changes in the employment situation. The *wage bill factor* is the least suitable as the impact of this factor comes too late. The *sustainability factor* has a much more elegant and equitable effect in that it not only takes account of the demographic relationship between the number of contributors and pensioners, but also integrates changes in the employment market. By indexing pension benefits to the system dependency ratio, the sustainability factor is self-stabilizing (fully if $\alpha=1$, partially otherwise) and thus introduces defined contribution elements to a defined benefit formula.

It is in the very nature of the pay-as-you-go system that if contributions are stabilized this results in a significant reduction in gross pension levels. However, future generations of pensioners will not only receive the standard pensions calculated at the levels presented here. If the Commission's recommendation to raise the age of retirement is implemented, longer working lives will also result in more earnings points and thus higher pensions. The calculations of the Rürup-Commission show that this effect will lift gross pension levels by around 1.5 percentage points.[20]

Moreover, the Riester reform introduced substantially subsidized private (occupational or individual) pensions as a supplementary pillar. Figure 5-1 shows that supplementary private pensions at the recommended saving rate of 4 percent of gross income will be capable of compensating for the long-term reduction in pension levels and will thus enable today's overall level of retirement income to be sustained in the future. Balancing the benefit reductions with the build-up of private pensions was the second most important target pursued by the Rürup-Commission.

Figure 5-1: Total pension benefits



Source: Own calculations based on the MEA-PENSIM model.

Note: The Riester pension has been calculated for a "reference pensioner" assuming that he or she sets aside savings in accordance with the Riester ladder up to the year 2008 and saves 4 percent per annum of his or her gross earnings after 2009. The nominal interest rate during the saving phase is 4 or 6 percent. Pensions are assumed to be indexed to an inflation rate of 1.2 percent during the disbursement phase. The duration of the disbursement phase is linked to the development of life expectancy.

This balanced effect only applies after the build-up of private pensions comes into full effect. The long transitional period until a full introduction of the subsidies[21], however, generates a temporary low in the overall level of pension provision. This can only be filled if the baby-boom generation saves more.[22] This is the unfortunate consequence of the failure to introduce at an earlier stage a multi-pillar system of the type which passed into law in the Netherlands and Switzerland, for example, as early as in the mid-1980s.

The duration of such a temporary low depends on the capital returns – refer to Figure 5-1. If contributions receive nominal 6 percent interest rather than the assumed 4 percent, the overall level of pension provision will exceed that provided by the public pension system today

[20] Kommission für die Nachhaltigkeit in der Finanzierung der Sozialen Sicherungssysteme (2003c).

[21] The so-called "Riester ladder", see (2.3).

[22] Cf. Birg and Börsch-Supan (1999)

considerably earlier. The actual average rate of return on productive capital – minus 2 percent for administrative costs und insurance against biometric risks – was around 4.8 percent for the period 1970 to 1995, in other words almost exactly in the middle of the two rates of return scenarios illustrated in Figure 5-1.

The burden which demographic change imposes on the pay-as-you-go pension system cannot be eliminated by reform. However, it can be spread among the generations in a more economically appropriate and a more equitable manner than under the current benefit indexation formula. The modifications to the benefit indexation formula discussed in this paper, in particular the sustainability factor augmented by supplementary private pensions, have an important role to play in achieving this.

Appendix: Demographic and labor market assumptions

The calculations which are presented in this paper are based on the demographic and labor market forecasts produced by the Rürup-Commission. The key assumptions for the forecast period from 2003 to 2040 are:[23]

(A) Demography

(1) Fertility

The fertility rate will remain unchanged at 1.39 births per woman. The currently lower fertility rate in the eastern Germany is expected to converge to the west German figure by 2010.

(2) Mortality

Life expectancy is the key factor affecting the financing of pensions in the period up to 2040 as changes in the birth rate will only impact pensions after the year 2040 and changes in migration – set to remain within historical levels – do not have the same impact as changes in mortality. While the Riester reform was based on longevity projections which were lower than the life expectancy figures which applied even at the time the reform was adopted, remaining life expectancy at age 65 is now expected to rise to the year 2040 by around three years for men and by about three and a half years for women.[24]

Table 1: Remaining life expectancy at age 65

	Remaining life expectancy at age 65				
	2000	2010	2020	2030	2040
Men	15.8	17.1	17.8	18.4	19.0
Women	19.5	20.8	21.9	22.6	23.2

Source: Commission on the long-term financial sustainability of the German social security system (2003b).

(3) Migration

Migration has fluctuated markedly in the past and migration levels are very difficult to

[23] Kommission für die Nachhaltigkeit in der Finanzierung der Sozialen Sicherungssysteme (2003b).

[24] The assumed increase in life expectancy is neither excessively optimistic or pessimistic and corresponds roughly with the assumptions in Birg and Börsch-Supan (1999). There are other less conservative forecasts (i.e. ones which predict much higher life expectancy), such as the predictions of B. Oeppen and Vaupel (2002), as well as forecasts such as those produced by the Federal Statistical Office which are generally based on a very low (in retrospective terms, too low) life expectancy estimates.

predict, at least over the short term. However, in Germany dramatic shifts in net immigration have tended in the past to swing back relatively quickly to the long-term historical averages. Up to the year 2040 forecasts therefore predict steady net migration of 200,000 people (400,000 immigrants and 200,000 emigrants) corresponding more or less with long-term past trends.

These three assumptions generate the population figures presented in Table 2:

Table 2: Key demographic data (1 January 2001/10/30/40) in millions

	2001	2010	2030	2040
Population	82.3	82.7	81.1	78.3
15-64 age group	55.8	54.6	49.1	45.3
65+ age group	13.7	16.9	22.0	23.9
80+ age group	3.1	4.1	6.2	7.6
Old-age dependency ratio (%)	24.5	30.9	44.8	52.6

Source: Commission on the long-term financial sustainability of the German social security system (2003b).
Note: The old-age dependency ratio is the number of people aged 65 and older divided by the number of people aged between 15 and 64.

(B) Employment

The labor market forecasts underlying the Riester reform have proved to be far too optimistic. The estimates produced by the Rürup-Commission assume that employment will reflect demand for labor.[25] Based on growth in per capita gross domestic product of 1.8 percent per annum, consistent long-term increases in wage levels of 3 percent per annum, and an annual increase of 1.8 percent in productivity, the employment situation will be as shown in Table 3.

Table 3: Size of the future labor force based on the assumptions of the commission

In millions	2001	2010	2030	2040
Working age group	43.1	44.0	40.0	37.7
Active working population	38.9	39.7	37.8	36.0
Contributors	32.5	33.3	31.8	No values
Unemployed	3.9	3.6	1.7	1.4

Source: Commission on the long-term financial sustainability of the German social security system (2003b).

[25] Cf. Prognos (2002).

It is instructive to compare the active labor force figures with those for the population of working age. While Table 2 shows that the size of the working age group of 15 to 64-year-olds will decline between 2001 and 2040 by 10.5 million, the active labor force is predicted to shrink in the same period by only 2.9 million. This difference can be explained by a fall in unemployment by 2.5 million, or a reduction in unemployment by the year 2030 to around one third of current levels. The high demand for labor in the Rürup-Commission's model also implies that there will be a significant expansion in labor supply, and a major increase in the participation rates of women and older workers in particular.

It is not clear over the long term, however, whether long term labor supply follows labor demand or vice versa. A supply-side based calculation of the size of the active labor force undertaken by MEA reveals that the figures in Table 3 represent an increase in female activity rates by the year 2040 equal to half the current difference between the participation rates of men and women plus a shift in the actual retirement age by the year 2040 of around 3 years.

These assumptions may well be regarded as optimistic. The employment situation in the year 2030 forecast by the Rürup-Commission corresponds roughly to the current employment picture in Denmark. In other words, the commission's predictions are not unrealistic but depend on dramatic labor market reforms similar to those already implemented in Denmark.

(C) Health insurance contributions

In terms of health insurance contribution rates we again follow Commission's assumptions (Variant B: very slight increase to 14.3 percent of gross wages in the year 2030, and constant thereafter). This is an optimistic assumption which implies a radical reform of the health care system. Should, on the contrary, contribution rates to the statutory health insurance continue to rise, contribution rates to the pension system would also increase and pension benefits decrease more than projected. The reason for this is that the pension system takes over the so-called "employer's share" of heath insurance contributions. Hence, 50 percent of pensioners' health insurance contributions is paid by the pension system.

References

Berkel, B., and A. Börsch-Supan (2003): Renteneintrittsentscheidungen in Deutschland: Langfristige Auswirkungen verschiedener Reformoptionen, MEA Discussion Paper 31-03, Mannheim Research Institute for the Economics of Aging, Mannheim University.

Birg, H., and A. Börsch-Supan (1999): *Für eine neue Aufgabenteilung zwischen gesetzlicher und privater Altersversorgung*, GDV: Berlin.

Boeri, T., A. Börsch-Supan, and G. Tabellini (2002): Would you Like to Reform the Pension System? The Opinions of European Citizens. *American Economic Review, 92(2)*, 396-401.

Börsch-Supan, A. (2000): A Model under Siege: A Case Study of the Germany Retirement Insurance System, *The Economic Journal*, 110 (46), 24-45.

Börsch-Supan, A. (2001): After the reform is before the reform: further steps for a long-term reform of the German pension system, In: *Zeitschrift für Wirtschaftspolitik*, No. 2, 159-168.

Börsch-Supan, A. (2002): A Blue Print For Germany's Pension Reform, MEA Discussion Paper 02-02, Mannheim Research Institute for the Economics of Aging, Mannheim University.

Börsch-Supan, A. (2003): On the concept of intergenerational equity, In: *Zeitschrift für Wirtschaftspolitik*, in print.

Börsch-Supan, A., and R. Schnabel (1998): Social Security and Declining Labor Force Participation in Germany, *American Economic Review 88.2*, 173-178.

Börsch-Supan, A., and C.B. Wilke (2003): The German Public Pension System: How it Was, How it Will Be, MEA Discussion Paper 34-03, Mannheim Research Institute for the Economics of Aging, Mannheim University

Bonin, H. (2001): Will it last? An Assessment of the 2001 German Pension Reform, IZA Discussion Paper, (343), Bonn.

Borgmann, C. and M. Heidler (2003): Demographics and Volatile Social Security Wealth: Political Risks of Benefit Rule Changes in Germany. Discussion Paper 107/03, Institut für Finanzwissenschaft, University of Freiburg.

Breyer, F. and M. Kifmann (2003): The German Retirement Benefit Formula: Drawbacks and Alternatives. DIW Discussion Paper 326, DIW Berlin.

Kommision für die Nachhaltigkeit in der Finanzierung der sozialen Sicherungssysteme (2003a): Anhebung der Altersgrenzen – Begründung, http://www.bmgs.bund.de/deu/gra/themen/sicherheit/kommission/index.cfm.

Kommission für die Nachhaltigkeit in der Finanzierung der Sozialen Sicherungssysteme (2003b): Szenario der Kommission zur demographischen und ökonomischen Entwicklung bis zum Jahr 2040, http://www.bmgs.bund.de/deu/gra/themen/sicherheit/kommission/index.cfm.

Kommission für die Nachhaltigkeit in der Finanzierung der Sozialen Sicherungssysteme (2003c): Modifikation der Rentenanpassungsformel zur Begrenzung des Beitragssatzanstiegs: Begründung, http://www.bmgs.bund.de/deu/gra/themen/sicherheit/kommission/index.cfm.

Oeppen, J., and J. Vaupel (2002): Enhanced: Broken Limits to Life Expectancy, Science 296 (5570), 1029–1031.

Prognos (2002): Deutschland Report 2002-2020, Basel.

Ruland, F. (2000): Neugestaltung der Rentenformel im bestehenden Umlageverfahren. Vortrag bei Speyerer Sozialrechtsgesprächen, www.vdr.de.

Schnabel (2001): Die Rentenreform 2001: Gutachten zur Rentabilität, Generationengerechtigkeit und den wirtschaftlichen Annahmen der Regierung. Deutsches Institut für Altersvorsorge (DIA), Cologne.

Thiede, R. (1998): Das Rentenniveau in der gesetzlichen Rentenversicherung – Bedeutung, Entwicklung und Missverständnisse, Die Angestelltenversicherung Jahrgang 45.

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