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**Estimating the Impact of the 1999
Pension Reform in Poland, 2000–2050**

Warsaw, 1999

Responsibility for the information and views set out in the paper lies entirely with the editor and the author.

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Abstract

This paper gives an account of the main aims and principles of the reform measures which came into force in 1999. Its primary objective is to present estimations of the effects of these measures on the composition of the pension system, over the next 50 years, in terms of institutions, expenditures and revenues. Within the segment of retirement pensions outside agriculture, the 1999 reform is found capable of achieving its key objectives concerning work incentives, total spending and aggregate savings. However, invalidity and family pensions for all and retirement pensions for farmers represent three segments which are yet to be properly reformed.

The paper concludes that the 1999 reform should arrest a further deterioration of public sector finances with respect to pensions, but any reduction of Poland's exceptionally large both public spending on pensions and social security contributions is contingent on adopting radical reforms also in these three segments.

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I. Introduction

In the course of systemic transformation in Poland since 1989, public expenditure on pensions of all types have, in relation to GDP, more than doubled, increasing from about 6.5% in 1989 to about 14.5% in the years 1994–98. This increase by about 8% of GDP was financed in part by issuing public debt, the servicing of which further increased public expenditure by around 2.5% of GDP. The resulting total of 10.5% of GDP has been, throughout the 1990s, approximately equal to the sum of the average budget deficit of the public sector and all public expenditure on education and infrastructure investments. Thus, the large increase of transfers to the generation of current pensioners represented a heavy tax on the macroeconomic stability and growth prospects of the country and, therefore, the welfare prospects of future generations.

Apart from inter-temporal and inter-generational problems, this implicit policy of protecting the welfare of current pensioners also had adverse allocational implications. One was that the average retirement pension increased from about 60% of the national average wage in the years 1989–90 to about 70–80% in the years 1994–98. This increase forced all successive governments of the 1990s to reduce the wages of their own employees, including education and health personnel, to a level close to the average retirement pension. The other implication was that, in order to reduce the resistance to restructuring of state enterprises, the age and health criteria for entitlement to a pension have been relaxed. This led to a sharp increase of the number of pensioners. On the other hand, the total number of workers contributing to the state pension system declined. These two tendencies forced the authorities to raise considerably the social security contribution per worker, which is effectively a payroll tax paid by enterprises. This increase retarded the fall in the unemployment rate [Golinowska, 1997a,b].

The pension crisis described above helped shape the 1999 pension reform. This reform includes strong measures which came into force in 1999 [Polish Government 1997; Hausner, 1998]. This paper gives an account of the main aims and principles of this reform. However, the primary objective of the paper is to present our estimations of the effects of this reform on pension expenditures until 2050. To this end, a socio-demographic forecast has been prepared. This forecast is reported in a separate paper [Styczeri, 1999]. In this paper, the principles of the 1999 pension reform and our assumptions on the growth of the Polish economy have been superimposed on that forecast.

Specifically, the paper aims to answer the following questions:

1. How detrimental to the state of public finances will be the loss of the social security revenues diverted to the private sector (2nd pillar)?
2. How fast will the replacement ratio decline and what will be its long-term level?
3. What, over the next 50 years, will be the composition of the pension system, by pillars I, II and III, in terms of both revenues and expenditures?
4. What will be the contribution to national savings of the pension reform?
5. What would the state of the pension system in Poland have been in the absence of the reform?

The structure of the paper is as follows. After a brief overview of the pre-reform system, we give a description of the key aims and principles of the 1999 reform. This is followed by a detailed discussion of the assumptions used in our model. The answers to the five questions listed above are presented in the final section of the paper.

2. Key Problems of the Pre-reform System

The radical market-oriented reforms which Poland adopted at the end of the 1980s and the beginning of the 1990s did not extend to the pension system which, until 1999, remained fully state-managed, highly redistributive, and financed on a pay-as-you-go (PAYG) basis. Social security contributions continued to be strictly proportional to wages and paid fully by the employer. These contributions did not go into individual accounts, but into the single account of the State Pension Authority. They were thus effectively a form of tax collected for the specific purpose of financing current pensions. Employees remained largely unaware both of the size of their cumulative contributions and of any link between these contributions and future pensions. The pensions themselves were calculated not on the basis of the cumulative contributions of individuals, but by a formula which in addition to contributions was taking into account several other factors as well. For most of the 1990s this formula was,

$$\pi_i = 0.24w_* + 0.013n_iw_i + 0.007m_iw_i + \pi_i^* \quad (1)$$

where π_i is the pension paid to an individual i at the point of retirement, w_* is the national average wage, w_i is the i th average wage during the last several years (from 2

to 10) of work, n_i is the numbers of years of work and m_i is the number of non-contributory years [1]. Finally, π_i^* stands for privileges for which the individual might be eligible on account of special pension rights associated with the type of work he or she had performed. We may note in formula (1) the large size of the redistributive component, $0.24w_*$ and the existence of privileges for some categories of workers [2]. Both components weaken the link between current earnings and future pensions, thus reducing, too, the incentive to work.

Any individual i would judge the size of his or her pension in terms of the ratio π_i/w_i , the replacement ratio. The presence of large redistributive terms in (1) implies that this ratio would be high for people for whom the ratio of their own wage to the average wage, w_i/w_* is low. Let ρ be the replacement ratio such that the wage w_i buys the same standard of living as the pension ρw_i . The value of ρ is person-specific, but is usually taken to be in the range between 1/2 and 1. Suppose $\rho=0.7$. Formula (1) implies that for a large proportion of current employees, their expected pension would have been close to or larger than 0.7 times their own earnings. Such employees would have no incentive to make private savings out of their current earnings. In fact, the actual average replacement ratio for old-age pensioners rose, in the 90s, to a level between 0.7 and 0.8.

The fairly radical reform policies and the rather fast economic restructuring of the 1990s rapidly aggravated the problem of financing of the state pension system, from both the revenue and the expenditure side. The number of contributors to the social security system has declined due to increased unemployment and growing evasion. On the other hand, to alleviate the social cost of transformation, early retirement was allowed and the criteria for granting disability pensions were relaxed. These measures meant a rapid rise in the number of pensioners. To meet the escalating pension bill, higher payroll taxes were imposed on the firms. The result was a higher labour cost, which became a factor discouraging employment and encouraging evasion [Golinowska, 1997a,b; Golinowska and Hausner, 1998].

During the 1990s, demographic changes did not make a significant contribution to the financial difficulties of the pension system in the 1990s. However, demographic projections indicate that such changes could become a major additional source of tension within the next 10 to 20 years [Styczeń, 1999].

[1] These include years spent in higher education, an unpaid leave for mothers of 3 years per child up to a maximum of 6 years, and the period when a disability pension was received.

[2] The most significant privileges were granted to miners, soldiers and police, but some privileges were also given to teachers, rail workers, steel workers, sailors and others.

3. Aims of the 1999 Reform

The specific problems of the country's pension system came to the attention of experts and policy makers during the 1990s [Wiśniewski, 1992; MP&PS, 1993, 1995; Borowski and Gomułka, 1994; Polish Government, 1994; Gomułka, 1994; Golinowska, 1997a]. The key problems were thought to be the following: low effective retirement ages, excessively liberal disability criteria, high replacement ratios, large redistributive components in the pension formula and excessive privileges for some categories of workers. There was also a need to diversify the institutional architecture in two ways: by complementing compulsory contributions with voluntary ones and by complementing the state social security system with private pension funds. The motivation of the needed reforms was both microeconomic and macroeconomic. There were two main microeconomic concerns. One was to create a far tighter link between pension benefits and pension contributions, thus strengthening the incentive to work and the dis-incentive to evade. Addressing this concern required a drastic lowering of the redistributive component and the establishment of individual accounts to make the system more transparent. The other central microeconomic concern was to lower the obligatory social security contributions paid by the employer, in order to reduce labour costs and to increase employment. The key macroeconomic aims were also two. One was to bring down the aggregate level of public expenditures on pensions, as a proportion of GDP, from the very high levels it had reached during the first phase of economic transformation. Such a reduction was needed to make public finances less of an obstacle to growth, by reducing the total taxation burden and the budget deficit, and to make it rather an instrument of growth, by increasing public resources to finance education and infrastructure investment. The other aim was to induce the working population to save more on a voluntary basis. These micro and macro objectives were mutually compatible, and their achievement required a radical reform of the pension system. The reform was becoming urgent also for demographic reasons [Styczeń, 1999]. These were the same as are found in many developed countries: longer post-retirement life and lower birth rate [Chand & Jaeger, 1996; Sadka & Tanzi, 1998].

4. Principles of the 1999 Reform

The reform is limited to retirement pensions outside agriculture. It involves the creation of a new institutional architecture and the introduction of new rules concerning

contributions and benefits. Five principles can be identified as having guided these changes. Namely:

(a) The diversification principle: Security and efficiency of the pension system must be enhanced, and to do this is by diversifying the system between state and private funds and between obligatory and voluntary contributions. Moreover, the savings measures introduced in the obligatory part of the system must be sufficiently strong to pay for much of the cost of the reform.

(b) The distribution principle: The public part of the new system should continue to be of the PAYG type, while being made less redistributive and more transparent.

(c) The capital-funding principle: The private part of the system should be capital-funded and well-regulated.

(d) The savings principle: The expenditure-savings measures introduced in the obligatory part of the system must be sufficiently strong to pay for any cost of the reform, and

(e) The gradual phasing-in principle: The phasing-in of the new system must be spread over a prolonged period of time, and should not involve people near retirement.

We shall briefly discuss these principles in turn.

Principle (a). The system of retirement pensions for workers consists of three pillars: (I) state, (II) open pension funds and (III) other pension funds. Only pillars II and III are private, and only pillars I and II will receive obligatory contributions.

Principle (b). Obligatory contributions are to remain proportional to earnings, a form of payroll tax, but will now be subject to a cut-off point equal to 2.5 times the average wage. To make the tax more transparent, half of the contribution paid before the reform by employers is now to be added to wages and paid by employees. The key innovation, however, was the establishment of personal accounts to which all the obligatory contributions of those in the new system will be assigned. These personal contributions, if not used as pensions, can be inherited by survivors.

Principle (c). The private pension funds which constitute pillar II will receive a specified part of all the obligatory contributions. However, a key question which reformers had to address was: How does one protect future pensioners from inefficient pension funds? A twofold solution was adopted. Firstly, contributors are free to move their savings between funds. Secondly, it is laid down that any recognised fund must, as a condition of remaining in business, guarantee to all its contributors a rate of return not less than 2 percentage points below the pension industry's average rate. This solution is likely to force less efficient funds out of business. To prevent a collapse of the industry into a monopoly, it will be necessary to issue constantly new licenses to new funds.

Principle (d). The part of the obligatory contributions which is diverted to pillar II represents a loss of revenue to pillar I. Thus, the reform implies a deterioration of public

finances in the initial phase of its implementation. To contain this deterioration, supplementary reforms are needed in pillar I. The most important of these are: tighter criteria for entitlement to invalidity pensions, increasing the effective retirement age (from 56 in 1997), by reducing the scope for early retirement, and reducing the rate of growth of real pensions (to a minimum of 0.15 in the years 1999–2000 and 0.20 from 2001, of the growth rate of real wages). Further expenditure-saving reforms are planned to replace the subsidy component, now about 95% of total spending, of the pension system for farmers.

Principle (e). A gradual phasing-in of the reform is intended, above all, to protect the rights of older workers. Hence the provision of the reform that people aged 50 and above will all remain in the old system, while those between 30 and 50 years old will have the right of choice, and only those aged 30 and below are compelled to join the new system. This arrangement has two advantages: it reduces sharply the political resistance to reform and it helps to contain the financial cost of its implementation.

5. Assumptions of our Pension Model

Productivity Growth

The assumption which would be also a key determinant of future pension contributions concerns the growth rate of GDP per worker. It is assumed that this rate will decline linearly, from 4.5% in 1997 to 2% in 2050. The end rate of 2% is thought to be close to the long-term growth of GDP per worker in the European Union (EU). We follow Chand and Jaeger (1996) in taking the latter to be 1.5%. The initial rate of 4.5% is close to the growth performance which Poland has experienced during the years 1993–1998. This assumption implies that the GDP per worker, estimated to be 40% of the EU average in 2000, will increase to 91% of this average by the year 2050. The driving force of this catching up is expected to be convergence to the EU in terms of education standards and human capital, and the transfer to Poland of more efficient technology from the world's Technology Frontier Area. Both these factors should induce higher investments, which in turn will sustain the transfer of technology and the spread of education.

The demographic forecast made by Styczeń (1999) envisages that the population of Poland will increase from 38.8mln now to 40mln in 2020, and then decline to 36.7mln in 2050. As employment is to follow, broadly, a similar pattern, changes in GDP per worker are expected to correspond closely to changes in GDP per head.

Employment and Wages

Labour supply is implied by this demographic forecast, and a constant unemployment rate at the 1997 level is assumed. Wages are taken to depend, in any given year, on sex, education, community (agricultural or non-agricultural) and age. This wage function was estimated using observed data for the year 1996. These estimates for all workers were then adjusted proportionately to conform to the aggregate condition that the average wage must grow at the same rate as that assumed for the GDP per worker.

Choice of Pension System

Persons who in 1999 belong to the age group 31–50 are to decide whether or not to join the new system. In our model, this decision to join depends on age. Namely, for each year-group the proportion of those joining this new system declines linearly with age, from 95% for the 31-year group to 5% for the 49 year-group.

Pension Contributions

It is assumed that the obligatory contribution will continue to be based on the PAYG principle, and that the rate of the payroll tax will remain unchanged at the present level of 0.455 of pay net of this tax and 0.313 of pay gross of tax, subject to the cutoff point of 2.5 times the average wage. A fraction equal to 0.24 of the wage is to finance retirement pensions in pillars I and II and the remaining fraction of 0.215 is to finance disability pensions, sickness pay and accidents allowances in pillar I. The part diverted to pillar II equals 0.09 of the wage, hence a fraction of 0.15 is retained by pillar I to pay current retirement pensions.

With respect to pillar III, it is assumed that voluntary contributions to private funds will be made by persons whose expected pensions from pillars I and II are less than 70% of the expected wage, net of the contribution, at the end of their working life. The contribution of any given person is taken to be the same throughout his or her working life in terms of its present value by the time of retirement [Wiśniewski, 1992]. The discount rate assumed is 3%. The choice of a 70% minimum replacement rate is made on the grounds that such a rate is needed to sustain the same standard of living around the point of retirement. We also assume that the working period begins immediately after graduating from school (but not before the age of 18) and ends at the statutory retirement age. The proportion of this period actually worked is, in our model, 0.95 for persons with higher education qualifications and 0.85 for all other persons.

Rules for calculating pension capitals under the new system.

Initial capitals are those amounts which workers are given at the start of the reform, in 1999. These are purely nominal amounts registered on personal accounts in pillar I. They are supposed to reflect pension rights which had been earned before 1999. These

initial capitals are supplemented by new contributions during the remainder of the working life. Total current capitals earn interest, and the interest rate is specified to equal:

$$r = \max[0, 0.75 (g_w + n)] \quad (2)$$

where g_w is the growth rate of real wages and n is the growth rate of employment.

Capitals in pillar II earn market rate of return. We assume that this rate, net of the cost of running the funds, equals 3% per year throughout the period 2000–2050.

Rules for pensions in pillars I and II

Initial pensions under the new system are given by accumulated capitals divided by life expectancies. This rule applies to both pillars, I and II. The subsequent valorisation of pensions is required by law to be not less than the minimum annual rate, of $0.15 g_w$ in the years 1999–2000 and $0.2 g_w$ in all subsequent years 2001–2050. The new pension law does not specify, however, any maximum annual rate of valorisation. This asymmetry represents a risk to the finances of the pension system. Invalidity and survivors' pensions are paid under the rules of the old system. These benefits are estimated on the basis of data for 1986, as functions of our socio-economic variables. These functions are then adjusted, so that estimated average benefits are equal to actual averages for each type of benefit. It is assumed that these adjusted functions will continue to apply in the future.

6. Simulation Results

In this section, we shall discuss the simulation results by answering the five questions posed in the Introduction.

Question 1: How detrimental to the state of public finances will be the loss of the social security revenues diverted to the private sector (pillar II)?

The part of the obligatory contribution which goes to pillar II will lie in a range between 1.5% and 3.0% of GDP (Fig. 9 and Table 5). The gradual phasing-in of the reform ensures that this part is below or close to 2% of GDP in the initial ten years. This is nevertheless a significant loss.

Question 2: How fast will the replacement ratio decline and what will be its long-term level?

Figures 3, 4 and 5 give this ratio for different types of pensions in various segments of the pension system. We also tested the sensitivity of that ratio with

respect to the indexation coefficient μ (defined as the ratio of the growth rate of real pensions to the growth rate of real wages). The results are shown in Figures 3A to 3D. For the purpose of gauging the impact of the reform, we also show the replacement ratio which would have existed in the absence of any reforms (Figures 3E and 3F). All these estimates imply that, under the old system, the replacement ratio would decline, but would nevertheless remain high, 53% to 60% depending on the indexation rule. The reform keeps the sensitivity of the ratio to the indexation rule limited. However, it also pushes the ratio down significantly. The effect is that for pensions in pillars I and II the ratio would fall, by the year 2040, to a level between 39% and 46%, depending on the indexation rule. It is also significant that the average state pension under the new system (pillar I) would drop to about 30% of the average wage by 2050 (Table 3, I-newA + I-new B). These estimates indicate that the reform should be effective in achieving its objectives with respect to the replacement ratio.

Question 3: What, over the next 50 years, will be the composition of the pension system, by pillars I, II and III, in terms of both expenditures and revenues?

The answer with respect to expenditures is provided by Figures 6, 7 and 8, and Table 4. As the new system is open mainly to younger age groups, during the 1st quarter of the 21st century most retirement pensions will continue to be paid by the state system. Invalidity and survivors pensions represent some 50% of all benefits, and the state system will continue to pay these in the 2nd quarter of that 21st century also. However, the composition of revenues by pillars would undergo a significant change already in the 1st quarter (Fig. 9 and Table 5). The revenues collected by the state sector will dominate other revenues not only in the 1st quarter, but also throughout the 2nd quarter. This particular result of the projection reflects mainly two assumptions. One is that invalidity and family pensions will continue to be large and financed fully by pillar I. The other assumption is that the present rate of social security compulsory contributions will remain unaltered. These two assumptions are related. If rules for entitlement to invalidity and family pensions were to be tightened, then the weight of pillar I would decline in terms of both expenditures and revenues.

Questions 4: What will be the contribution to national savings of the pensions system?

Table 6 and Figure 10 show the estimated surpluses of contributions over expenditures in pillars II and III. These estimates are firmer with respect to pillar II than III. Assuming they are correct, the combined net savings of the two pillars will increase during the first 15 years of the period under consideration, reaching a maximum of about 4.3% of GDP. These savings will then begin to decline, becoming negative towards the end of this period. The balance of pillar I deteriorates during the 1st half of the period in question. However, this deterioration would have been

bigger in the absence of reform. Figure 11 and Figures 11A and 11D should be compared to Figures 11E and 11F. Comparison of the financial situation of the state pension sector under the 1999 reform to that without any reform reveals a basic similarity in the 1st quarter of the 21st century, but a large difference in the 2nd quarter. Under the reform, an initial deterioration by some 2% of GDP is followed by a gradual improvement, amounting to about 3% of GDP at the end of the 2nd quarter. In the absence of any reform, the initial deterioration, also by about 2% of GDP, is followed by a further gradual deterioration, amounting approximately to an additional 2% of GDP by 2050.

Question 5. What would the state of the pension system have been in the absence of any reforms?

To answer this question more accurately, several corrections have been made to the balance of the pension system. The main correction arises from the fact that only about 80–85% of contributions due are actually collected. The corrected balances are shown in Figures 11G and 11H. The deterioration by some 4% of GDP during the first half of the 21st century would bring the budget deficit of the state pension systems outside agriculture to about 5% of GDP by the end of that period. The deficit of the agricultural pension fund is about 2.5% of GDP, so that the total deficit will increase during the period from about 3% to about 7.5% of GDP.

This large deterioration under the "no reform" scenario would be due primarily to the expected significant ageing of the population. Table 8 and Figures 12 and 13 show the large impact of this phenomenon on key demographic variables: the support ratio and the elderly dependency ratio. Moreover, within the elderly group, the proportion of those aged 75 and over is expected to increase somewhat (Table 8, the VER index).

7. Concluding Remarks

Poland's pension reform is comprehensive and radical only with respect to retirement pensions outside agriculture. Within this particular segment of the social security system, the 1999 reform is capable of achieving its key objectives concerning work incentives, total spending and impact on aggregate savings. However, the pension law specifies the minimum valorisation rate but does not specify any maximum rate. This asymmetry represents a risk to the finances of the public part of the pension system. Invalidity and family pensions for all and retirement pensions for farmers, represent areas yet to be properly reformed. Invalidity and family pensions for workers will continue to

be financed by a payroll tax. This tax is exceptionally large now, and the pension reform merely ensures that it will not need to be increased further. The tax can be reduced only if the exceptionally large number and size of invalidity and family pensions are also reduced. With respect to pensions for farmers and their families, these remain financed to the extent of some 94% by general taxes. Given the poverty of most farmers, these pensions are likely to remain an important part of Poland's welfare system.

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Appendix

I. Notation

Types of benefits:

| | |
|-----------|---|
| L, | all kinds outside agriculture |
| s + a, | sickness and accidents outside agriculture |
| inv., | invalidity outside agriculture |
| surv., | survival (family) outside agriculture |
| N (or n), | nursing allowance |
| M, | allowance to bring pension to a statutory minimum |
| pens., | retirement and invalidity pensions, and s + a |

Types of institutions:

| | |
|----------|--|
| I-old, | old state system not covering farmers, military, police and judiciary |
| KRUS, | agricultural system |
| I-new A, | imputed capital on personal accounts, in pillar I, new system |
| I-new B, | post-reform contributions on personal accounts in pillar I, new system |
| I-new, | I-new A + I-new B |
| I, | I-old + I-new |
| II, | private funds, obligatory contributions |
| III, | private funds, voluntary contributions |
| OFE, | open pensions funds |

Other notations:

| | |
|------|--|
| EDR, | elderly dependency ratio, defined as population aged 65 and over as a percentage of the population aged 15–64 |
| VER, | very elderly ratio, defined as the population aged 75 and over as a percentage of the population aged 65 and over |
| TDR, | total dependency ratio, defined as the population aged 0–14 and 65 and over as a percentage of the population aged 15–64 |
| SR, | Support ratio, defined as the ratio of the contributors to beneficiaries. |

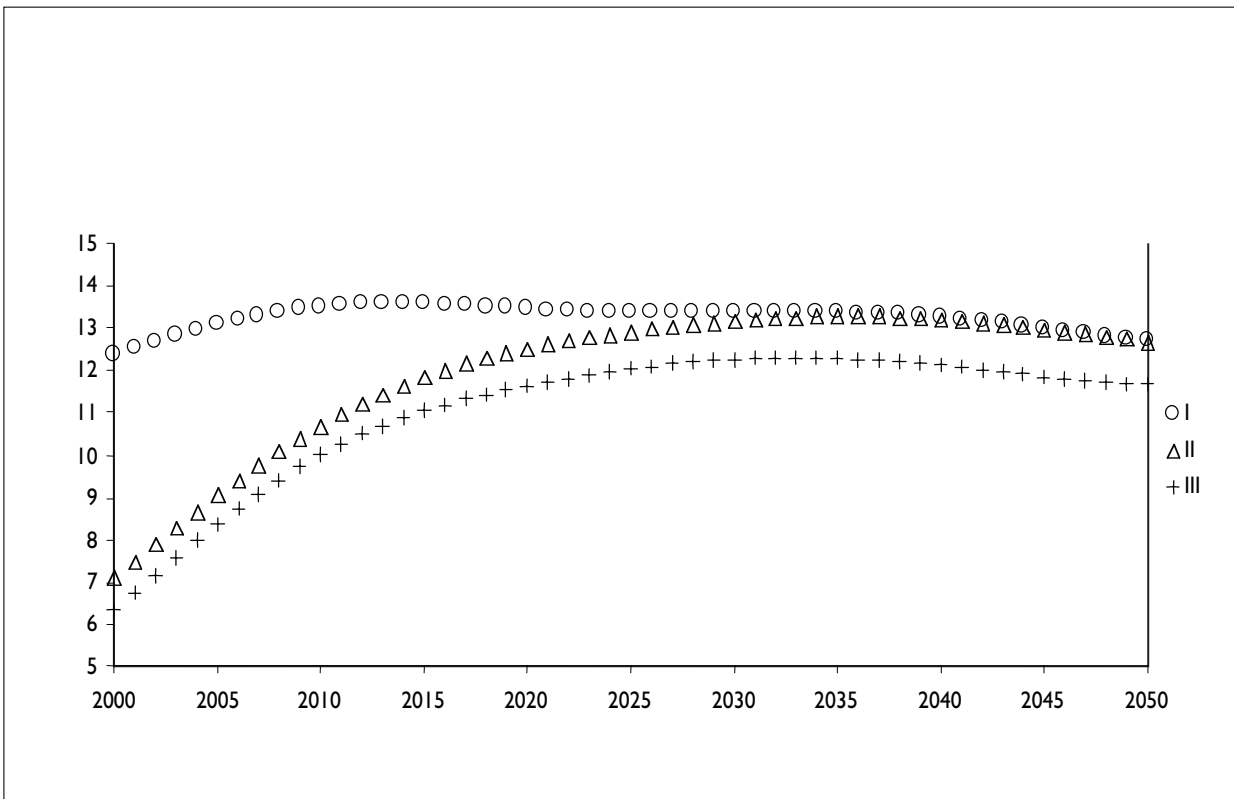
Figure I. Numbers of retirement persons in millions paying contributions in pillars I, II and III

Figure 2. Numbers of persons in millions receiving pensions under the old and new systems

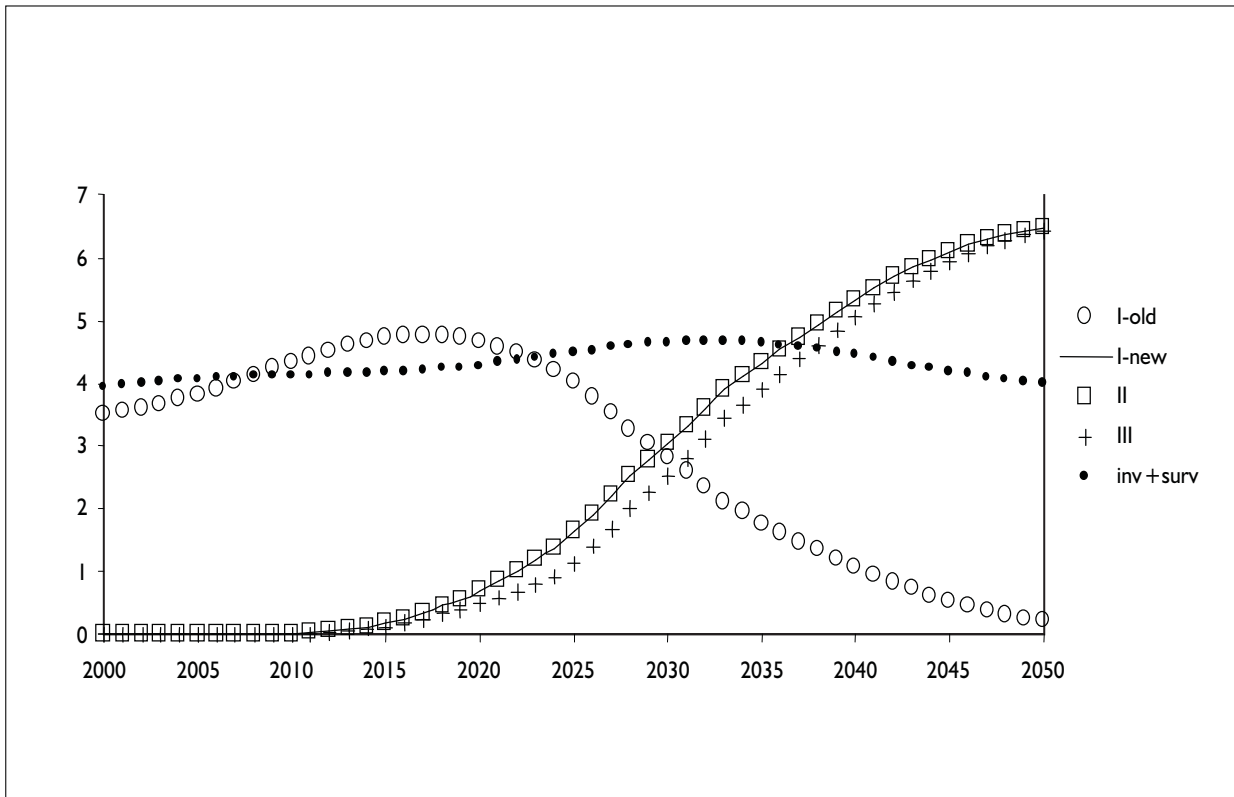
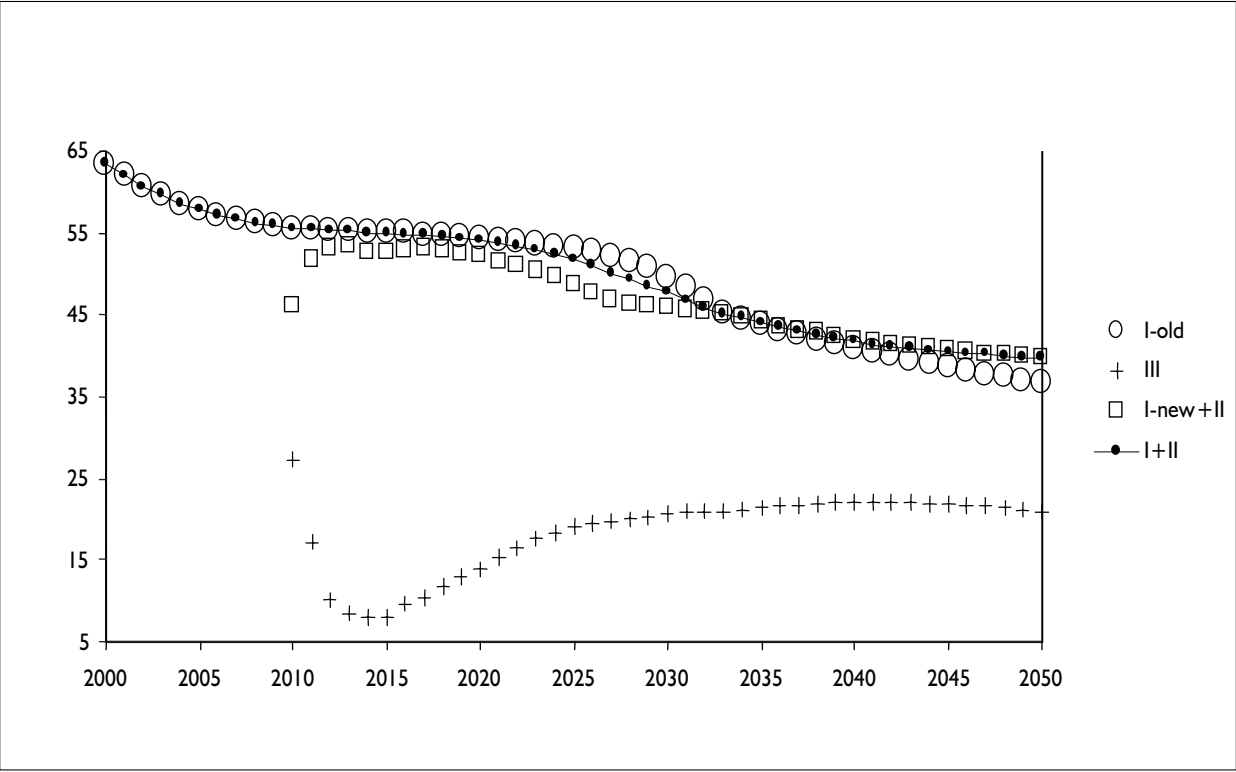


Figure 3. Average total retirement pensions, under the old system, the new one and under both systems from pillars I and II, as proportions of average wage



Figures 3A to 3D. Sensitivity of the replacement ratio (defined as the ratio of the average total retirement pension from pillars I and II to the average wage) with respect to the indexation coefficient μ , equal to the ratio of the growth rate of real pensions to the growth rate of real wages

Fig. 3A. $\mu=1.0$

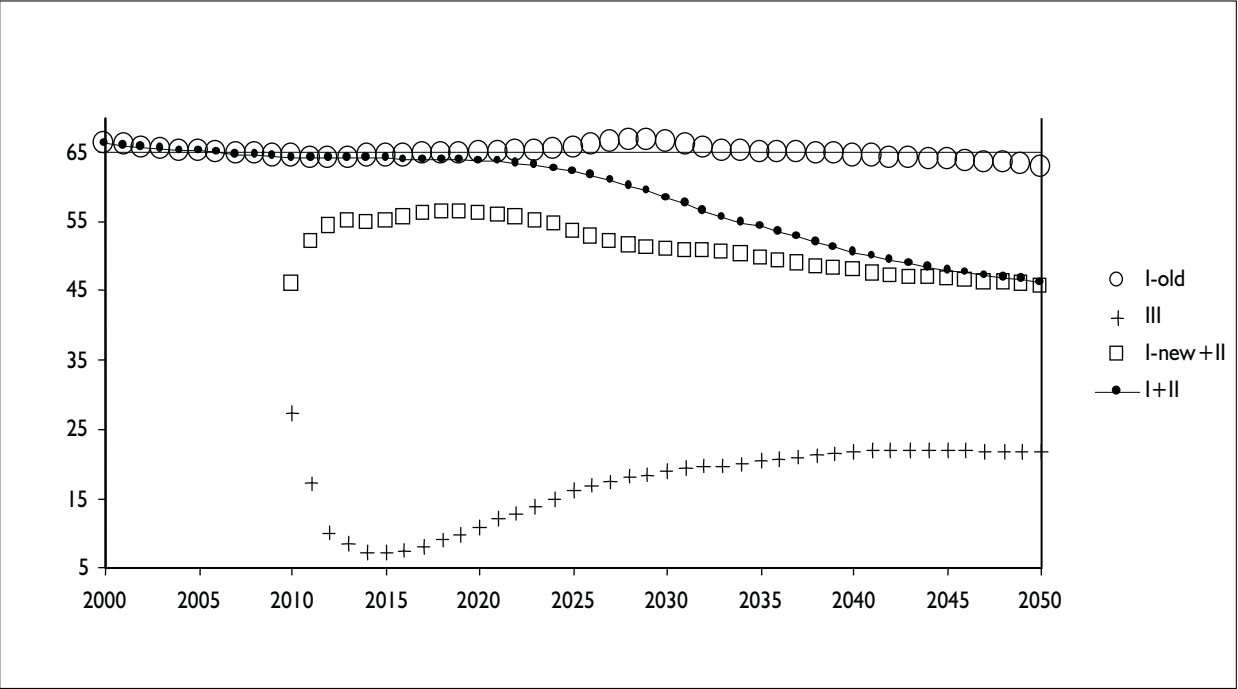


Figure 3B. $\mu=0.8$

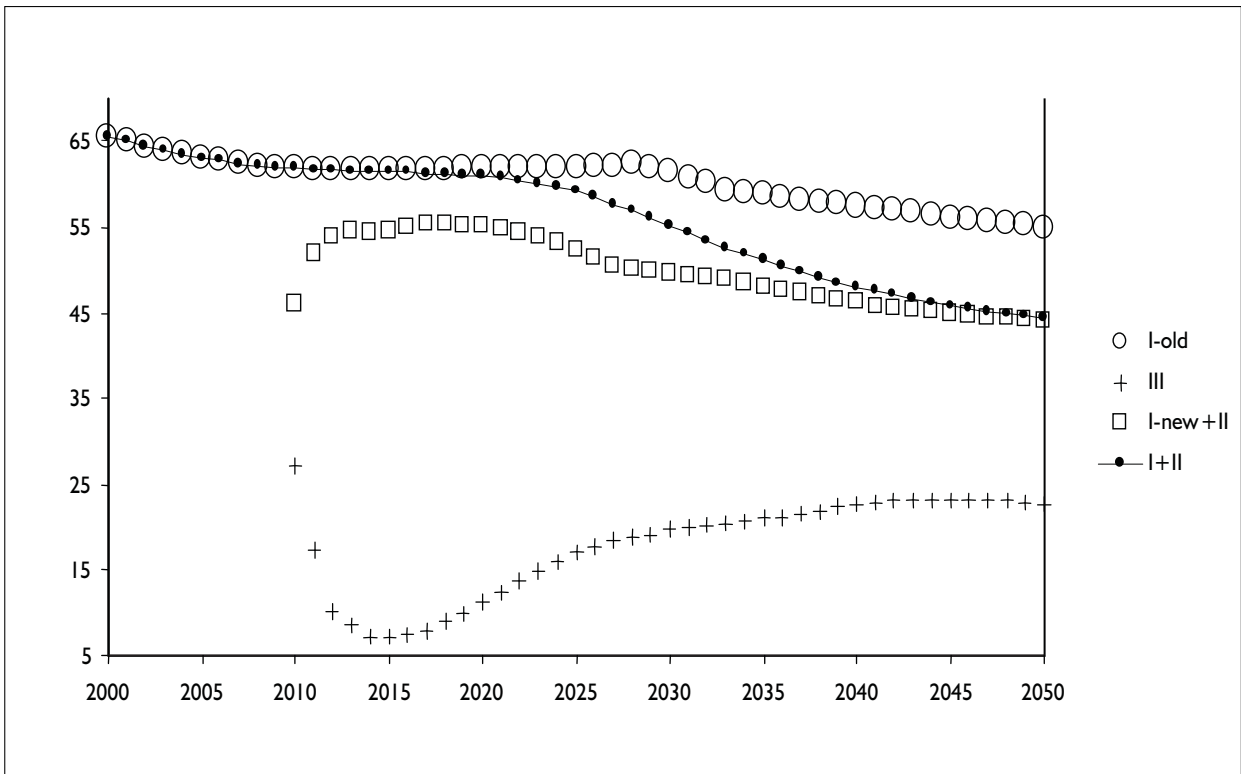


Figure 3C. $\mu=0.6$

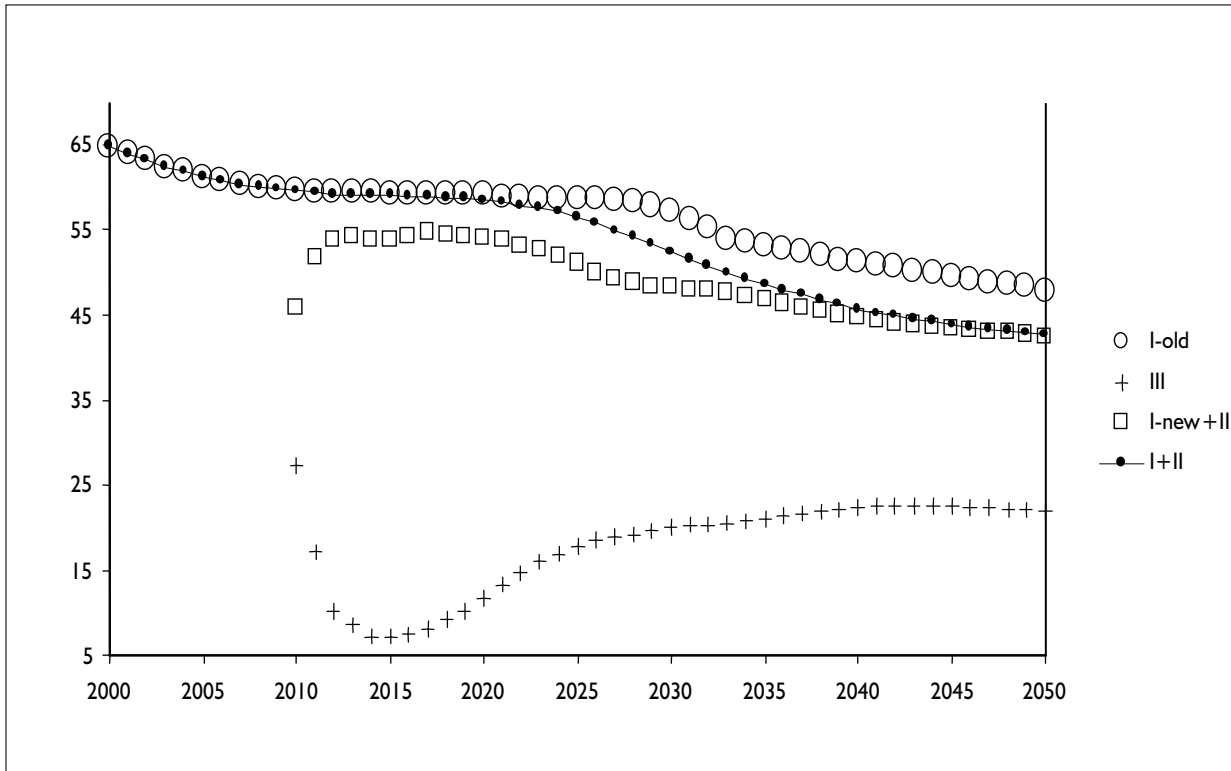


Figure 3D. $\mu=0.4$

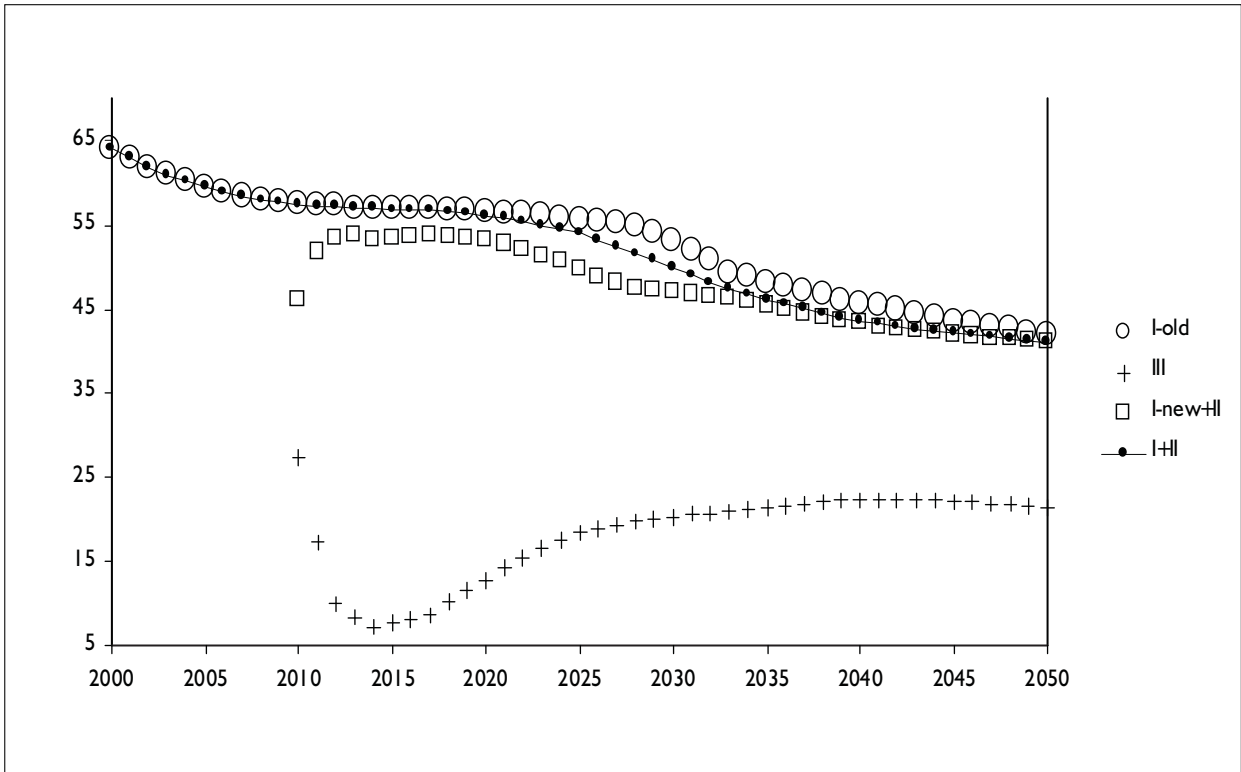


Figure 3E. Average total retirement pensions, under the old system, without reform as proportions of average wage, $\mu=0.9$

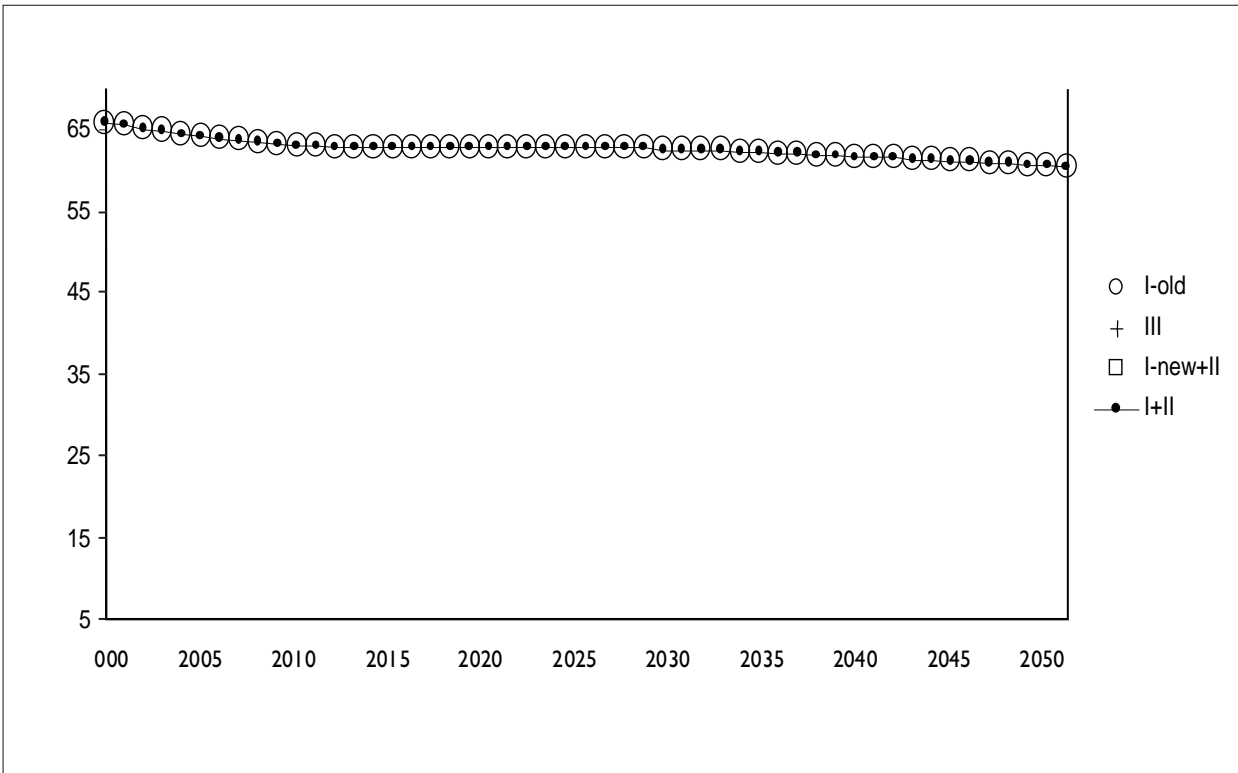


Figure 3F. Average total retirement pensions, under the old system, without reform as proportions of average wage, $\mu=0.2$

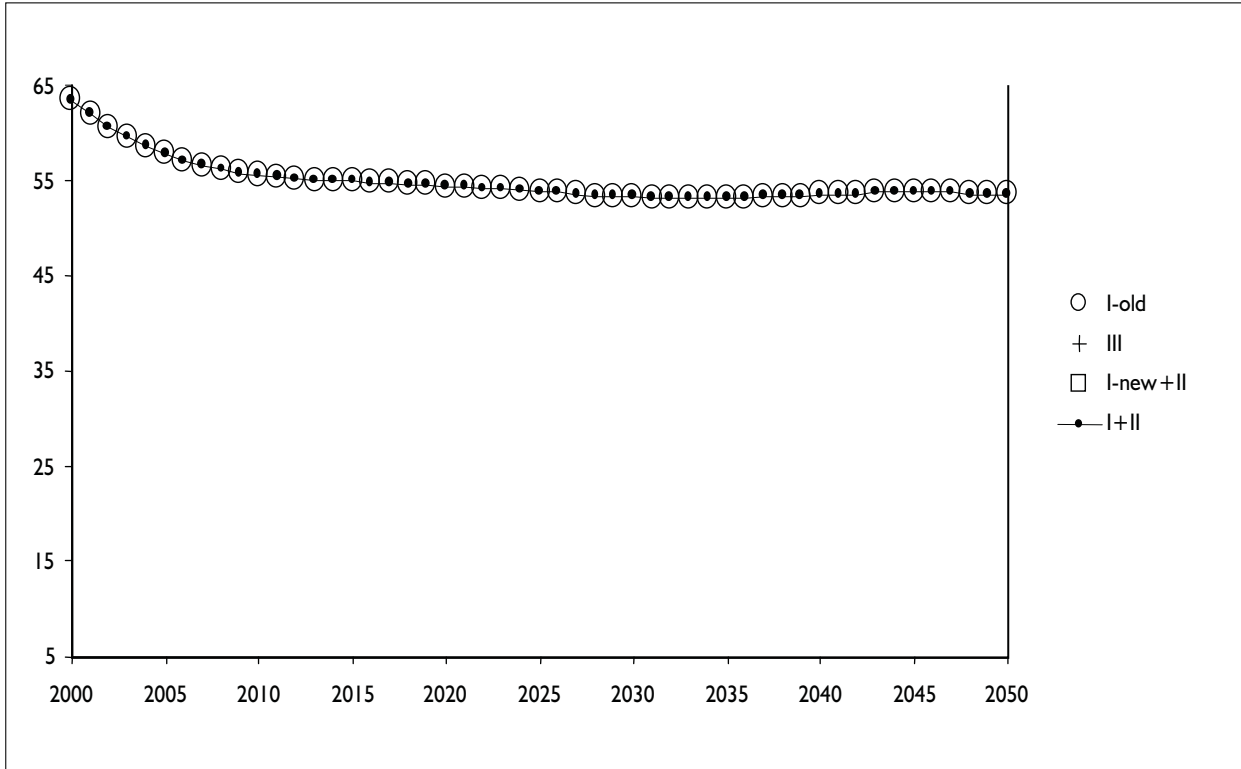


Figure 4. Average retirement pensions under the new system from pillars I and II as proportions of average wage

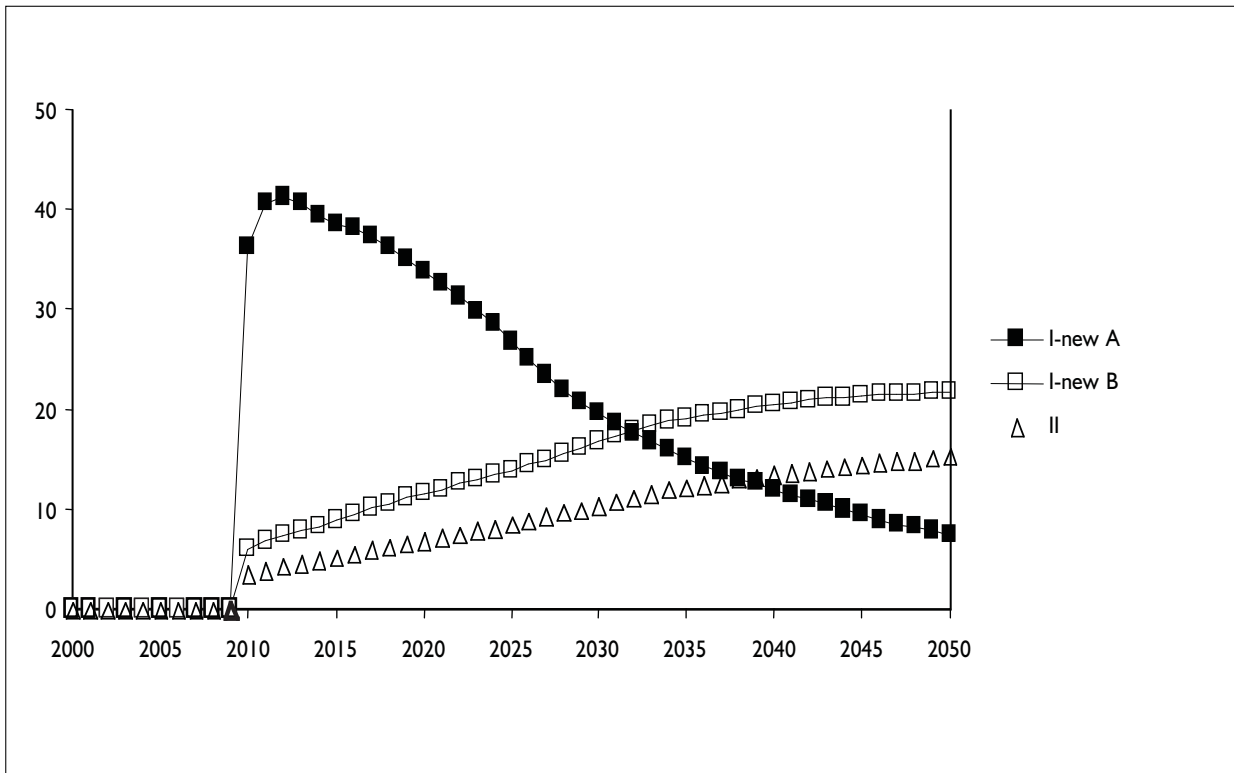


Figure 5. Average total pensions, under the new system and under both systems, as proportions of average wage

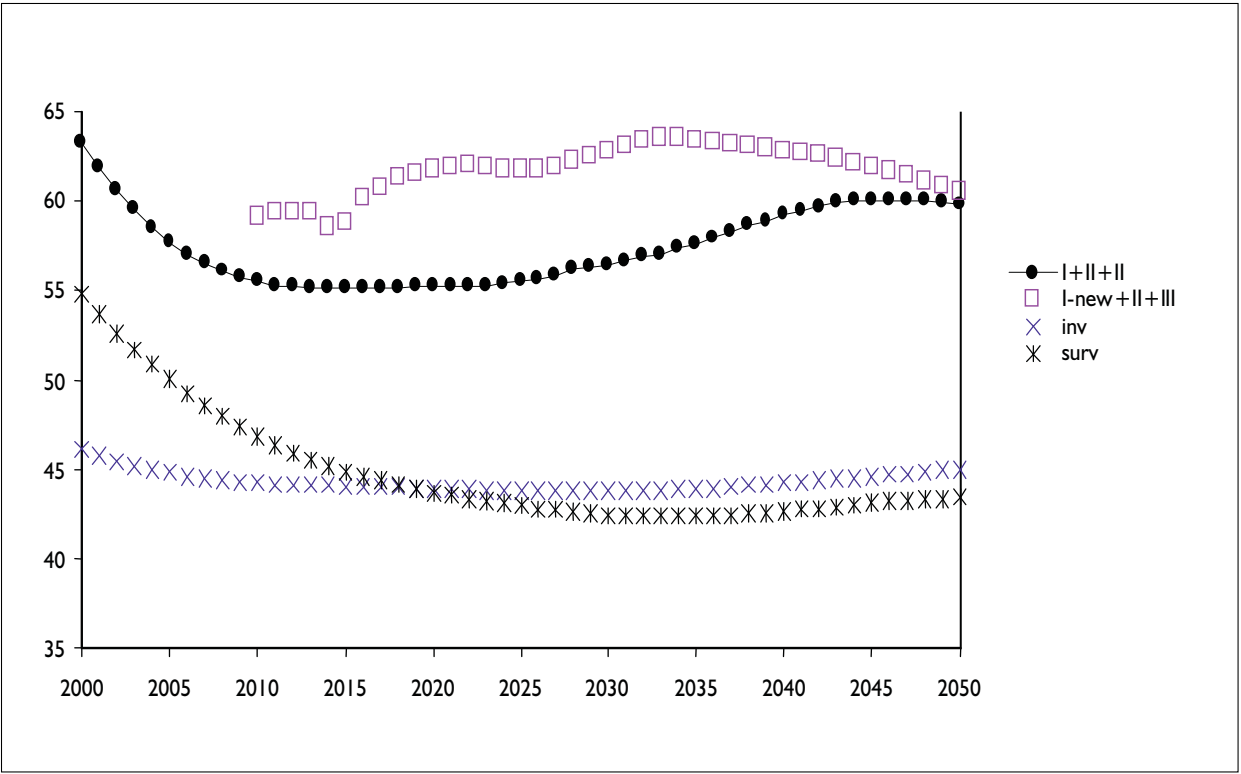


Figure 6. Retirement pensions expenditures by different pillars, as proportions of GDP (in percents)

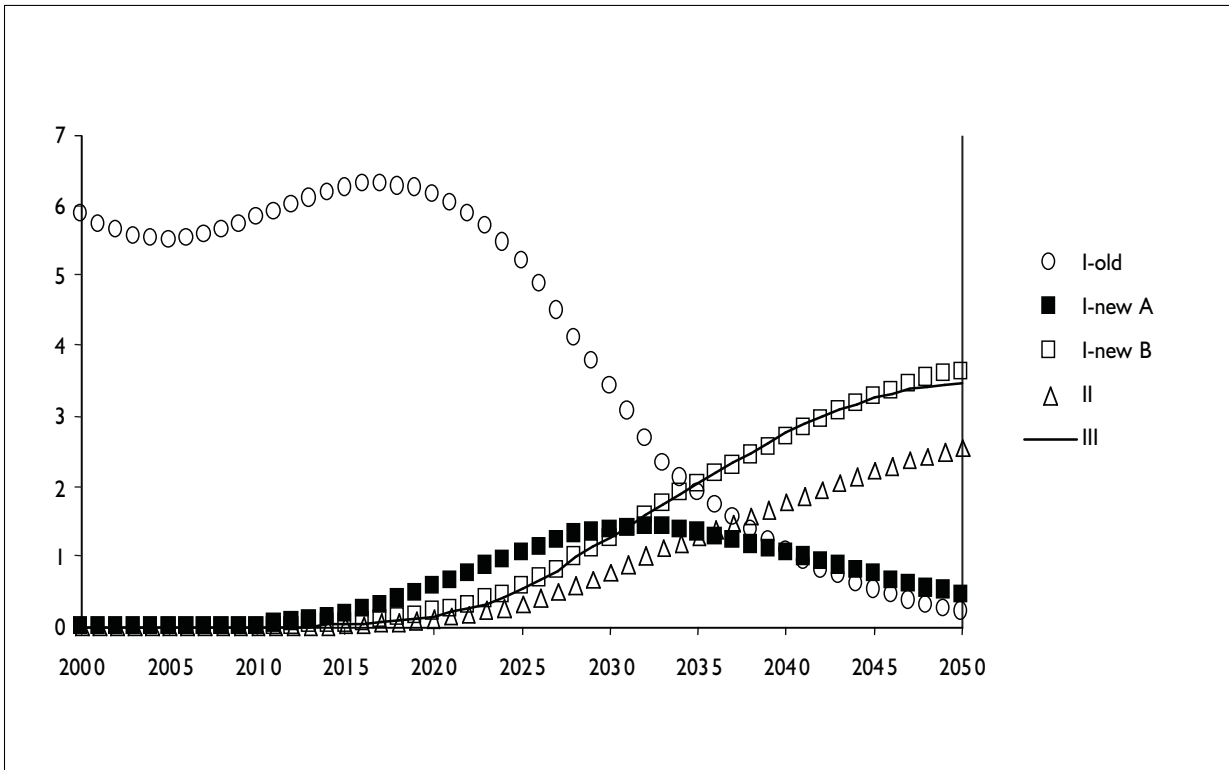


Figure 7. Total expenditures by different pillars, as proportions of GDP (in percents)

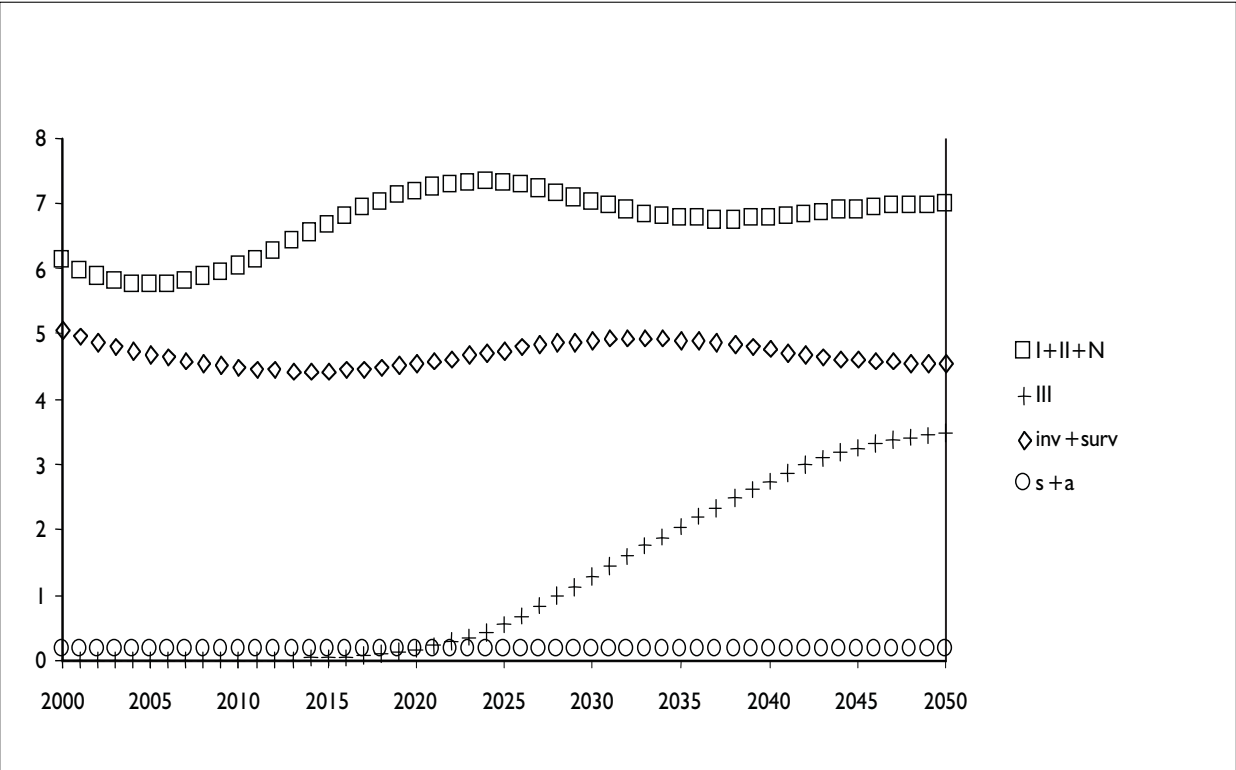


Figure 8. Total expenditures for all kinds of benefits, as proportions of GDP (in percents)

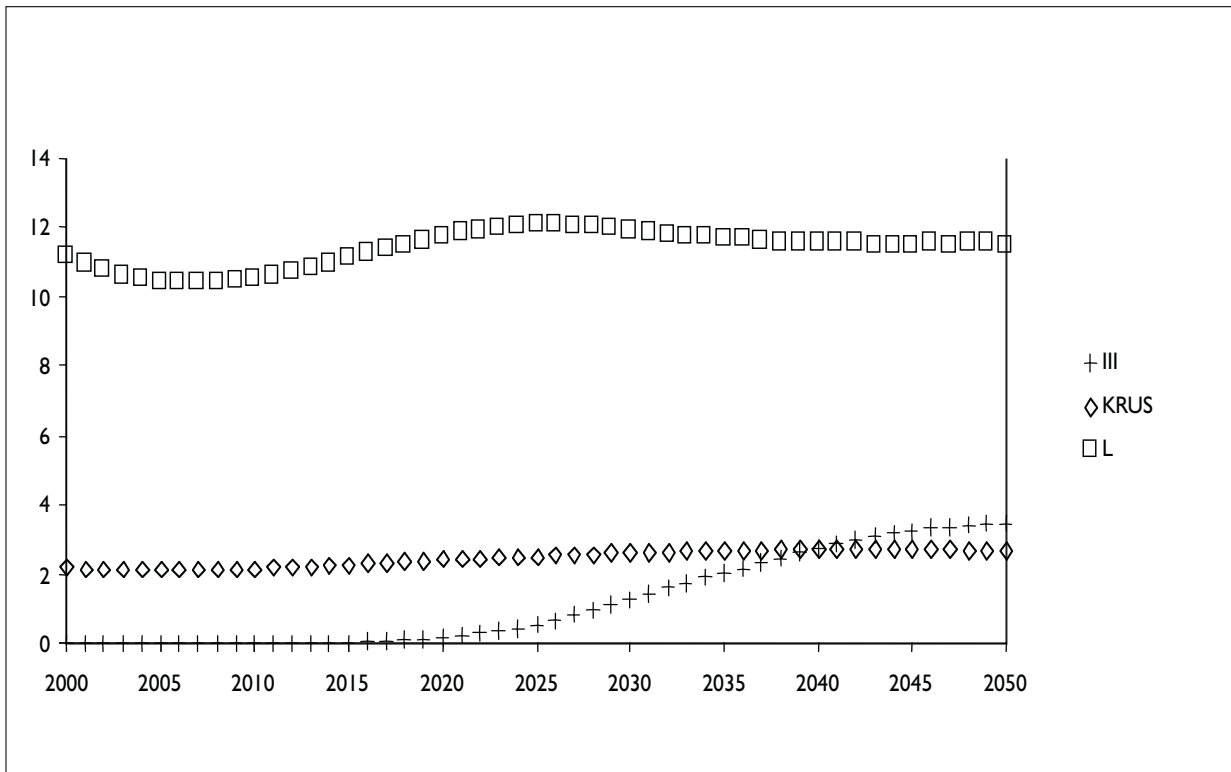


Figure 9. Contributions to different pillars as fractions of GDP (in percents)

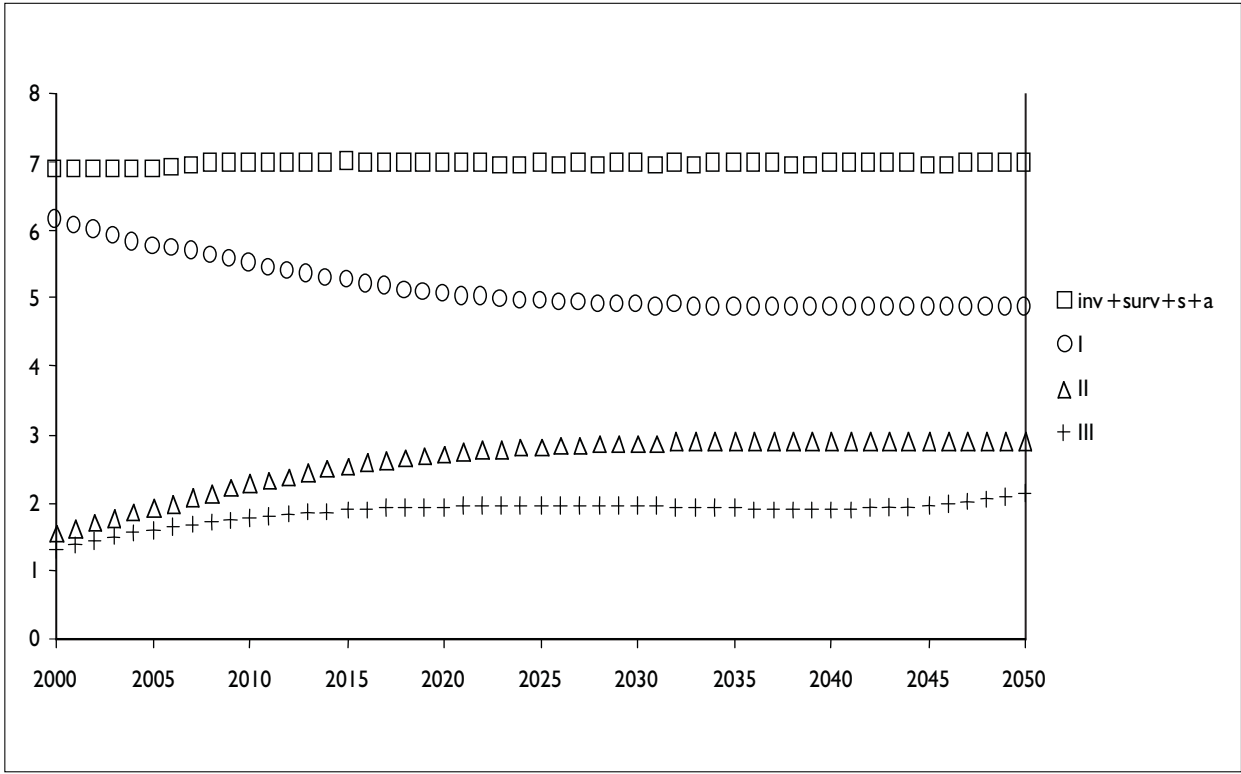


Figure 10. Balances of contributions for pensions over expenditures, by pillars, as fractions of GDP (in percents)

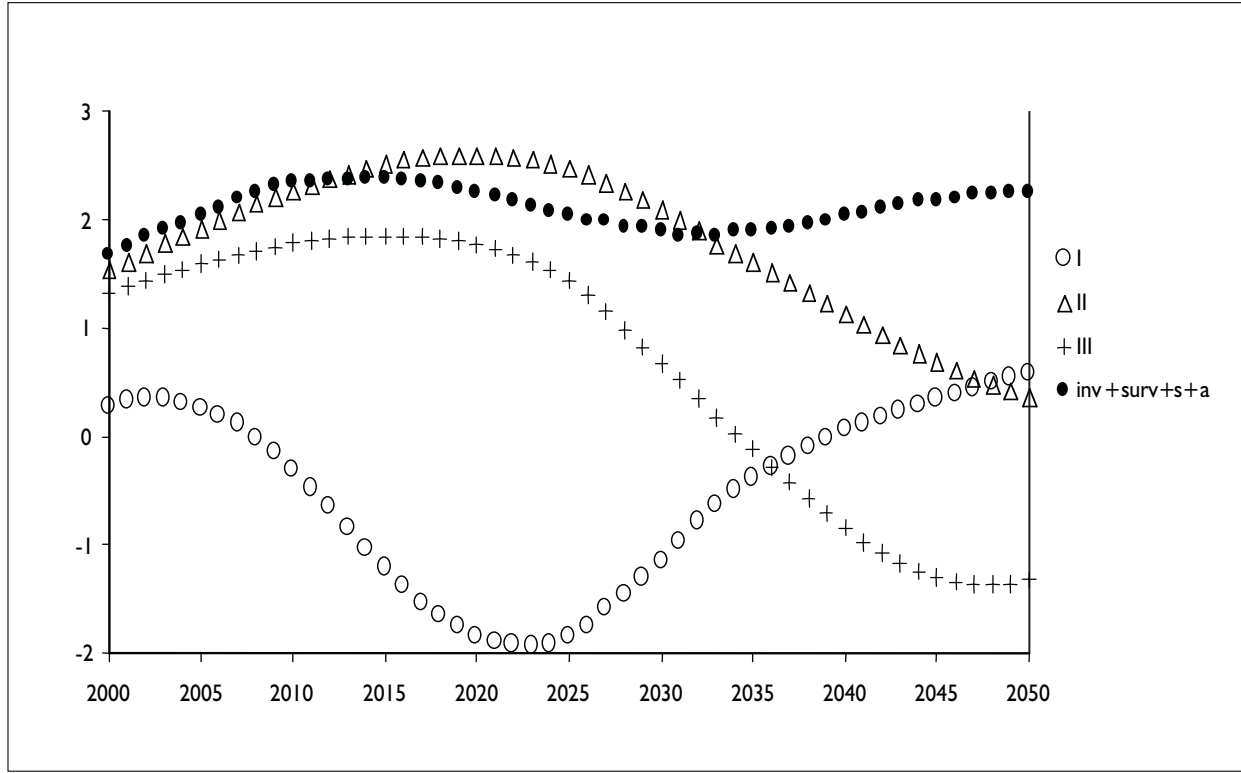
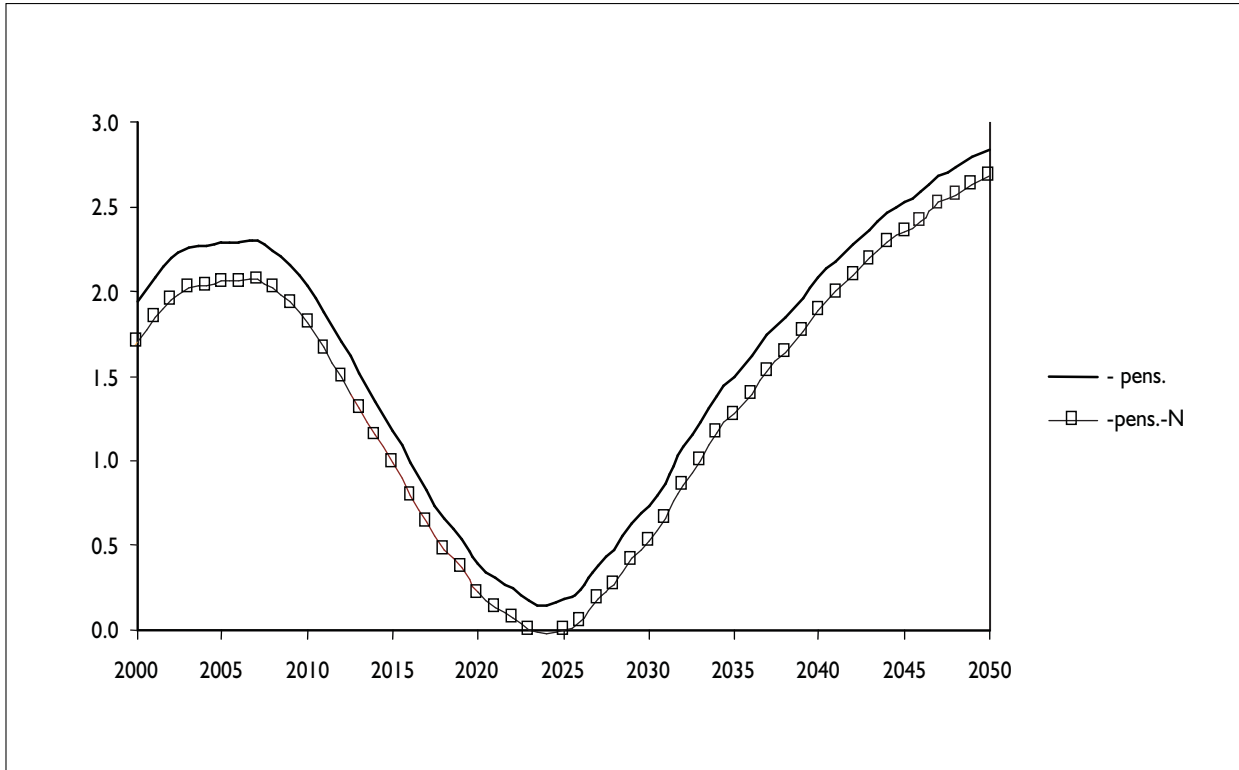


Figure 11. Balance of all contributions to pillar I over expenditures, as function of GDP (in percents)



Figures I IA to I IF. Sensitivity of the pillar I balance of contributions over expenditures, outside agriculture, with respect to the indexation coefficient μ , as fraction of GDP (in percent)

Figure I IA. $\mu=1.0$

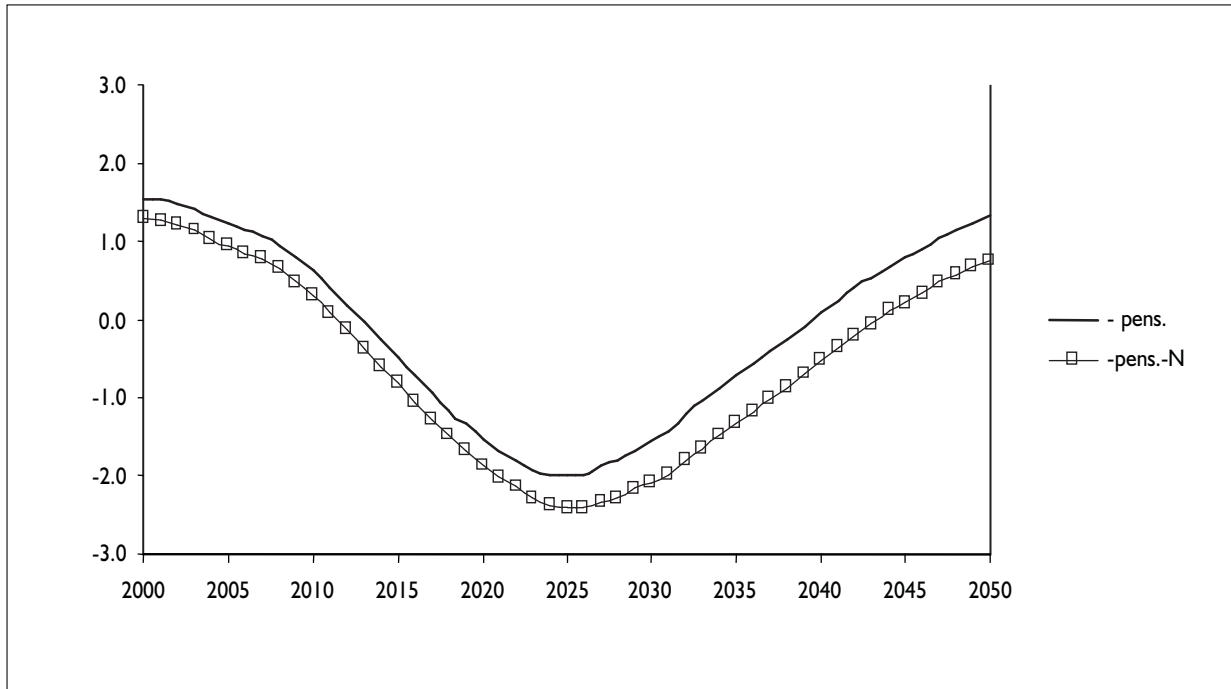


Figure 11B. $\mu=0.8$

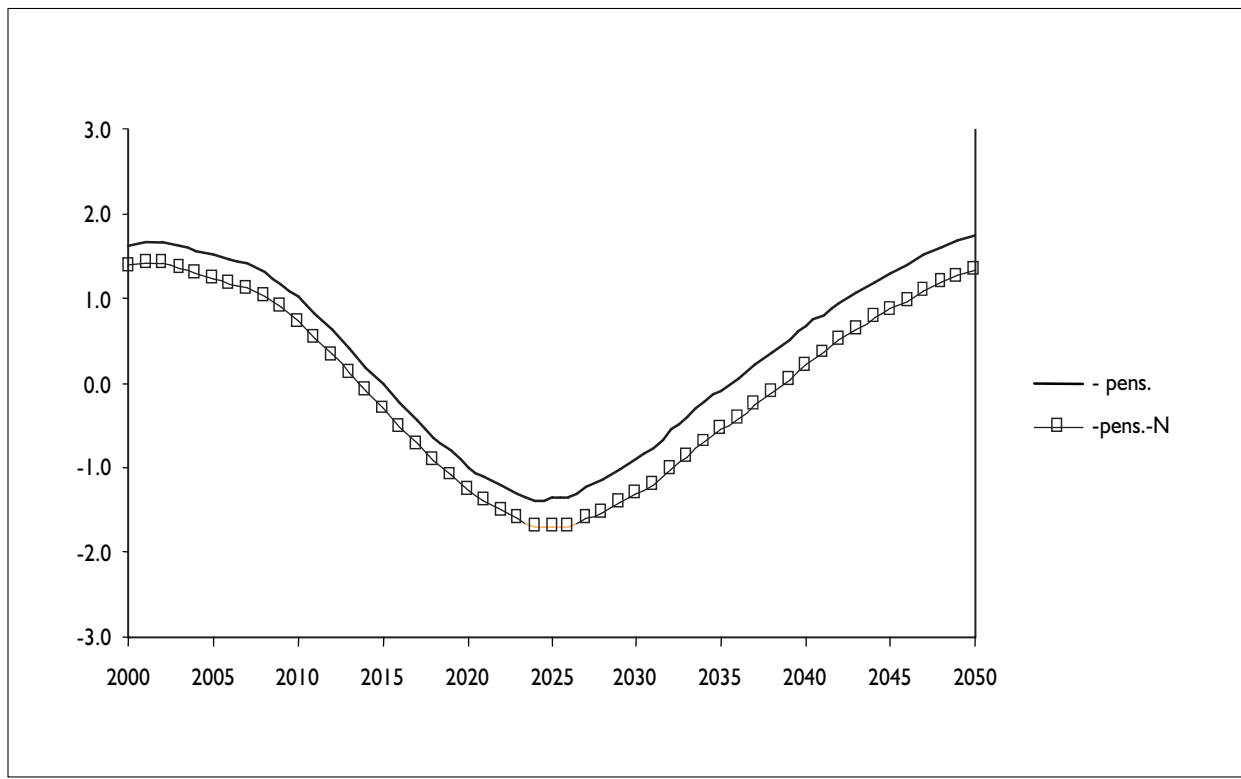


Figure 11C. $\mu=0.6$

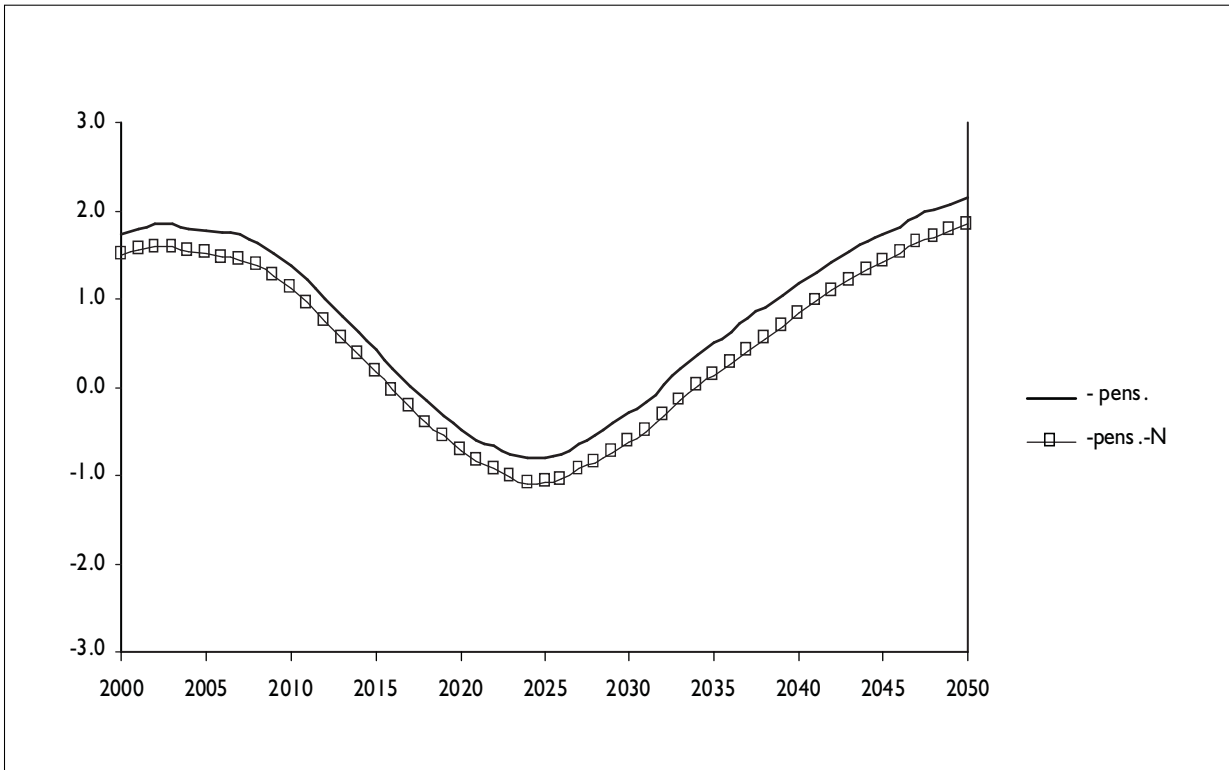


Figure 11D. $\mu=0.4$

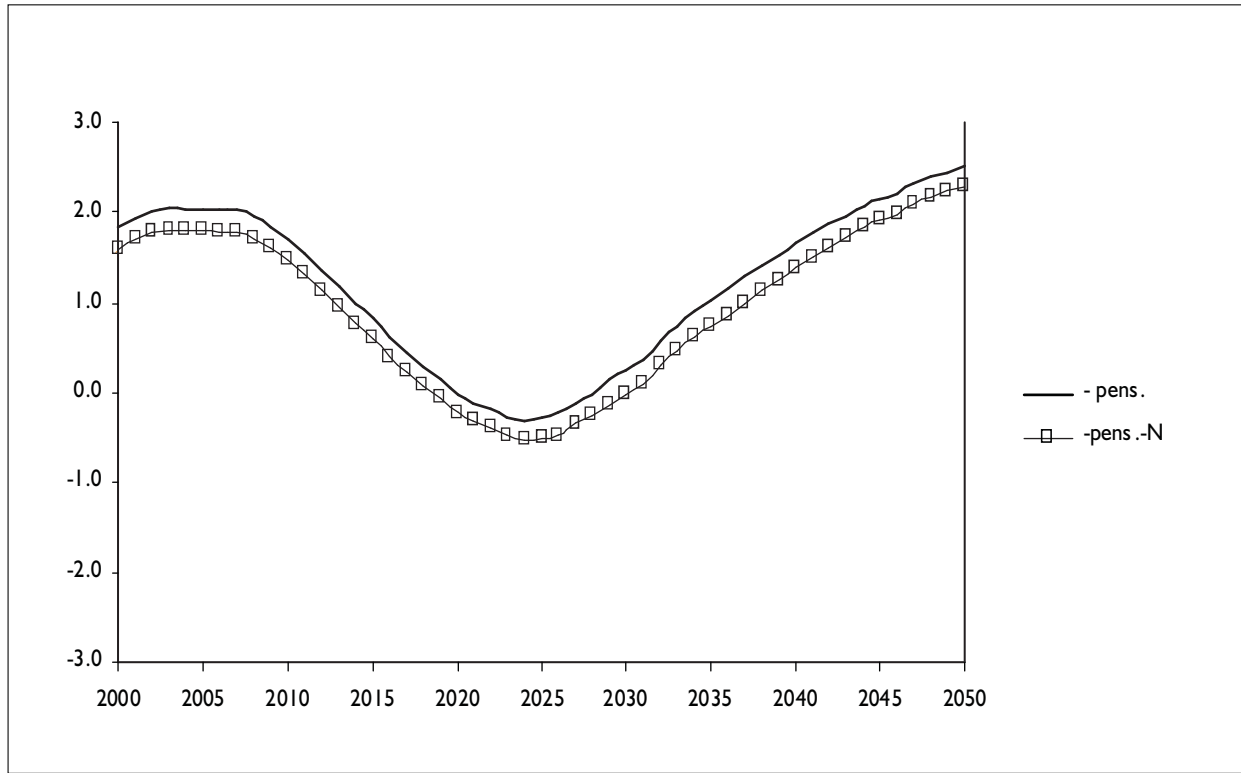


Figure 11E. $\mu=0.9$, without reform

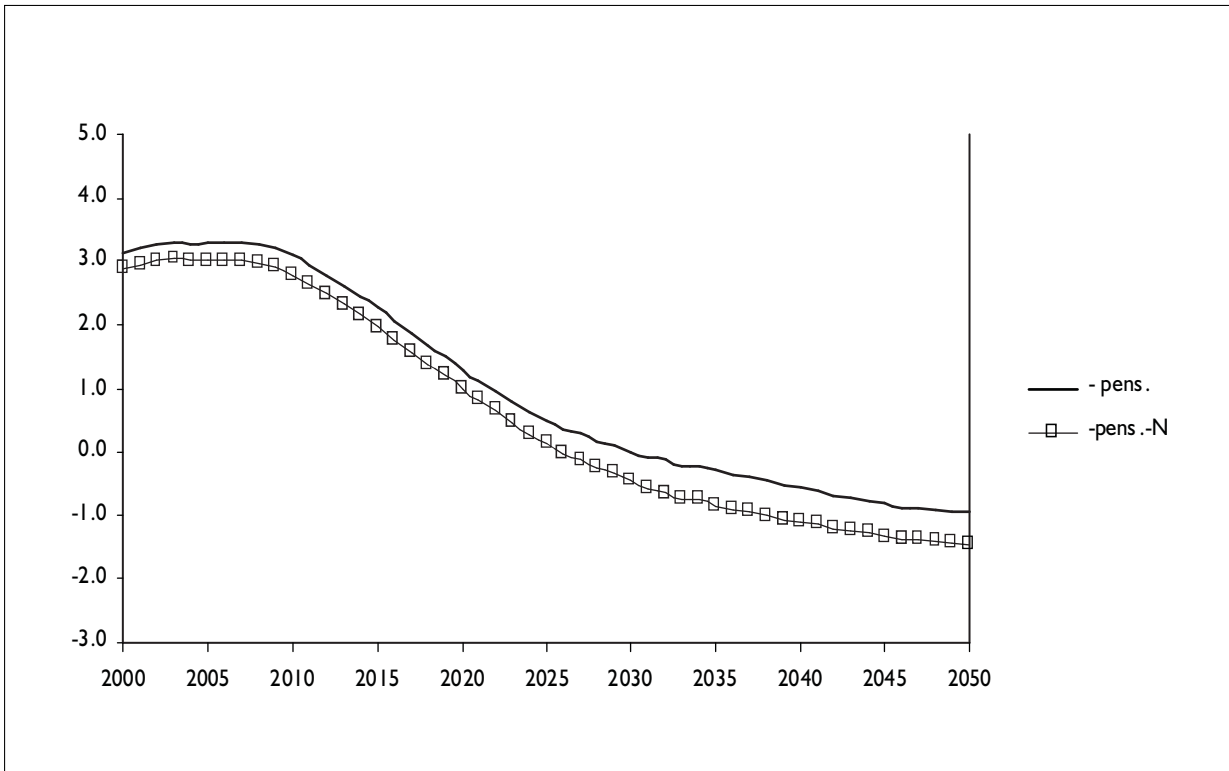
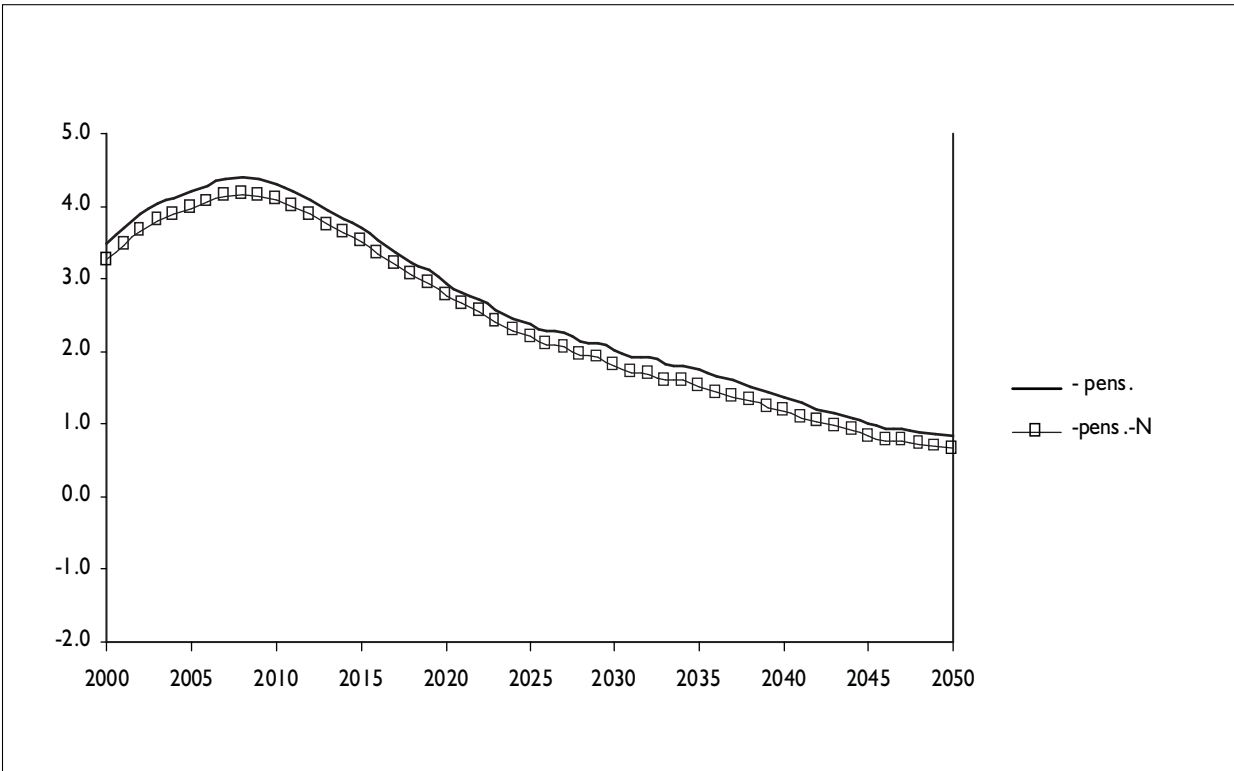


Figure 11F. $\mu=0.2$, without reform



Figures 11G, H. Corrected balance* of all contributions over all expenditures, outside agriculture, without reform, as fraction of GDP (in percent).

*Contributions are corrected by the 'collection coefficient' of 0.82 and expenditures are corrected for the cost of running the system and some residual benefits.

Figure 11G. $\mu=0.2$, without reform, corrected

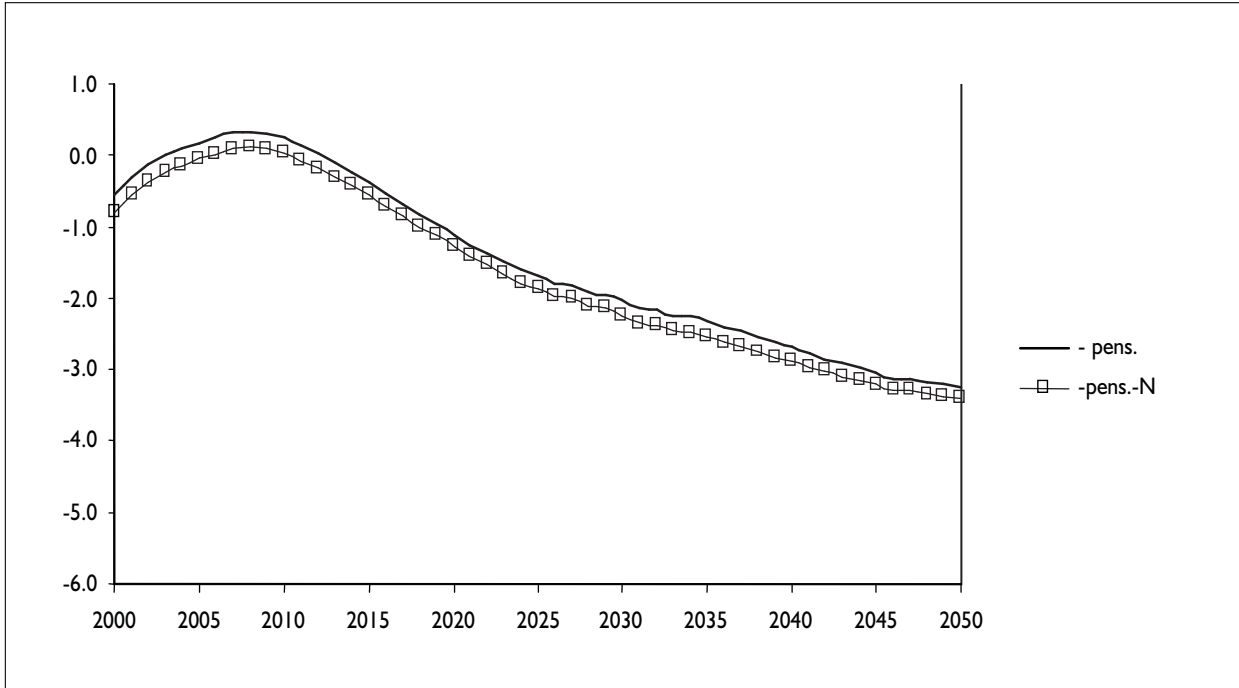


Figure 11H. $\mu=0.9$, without reform, corrected

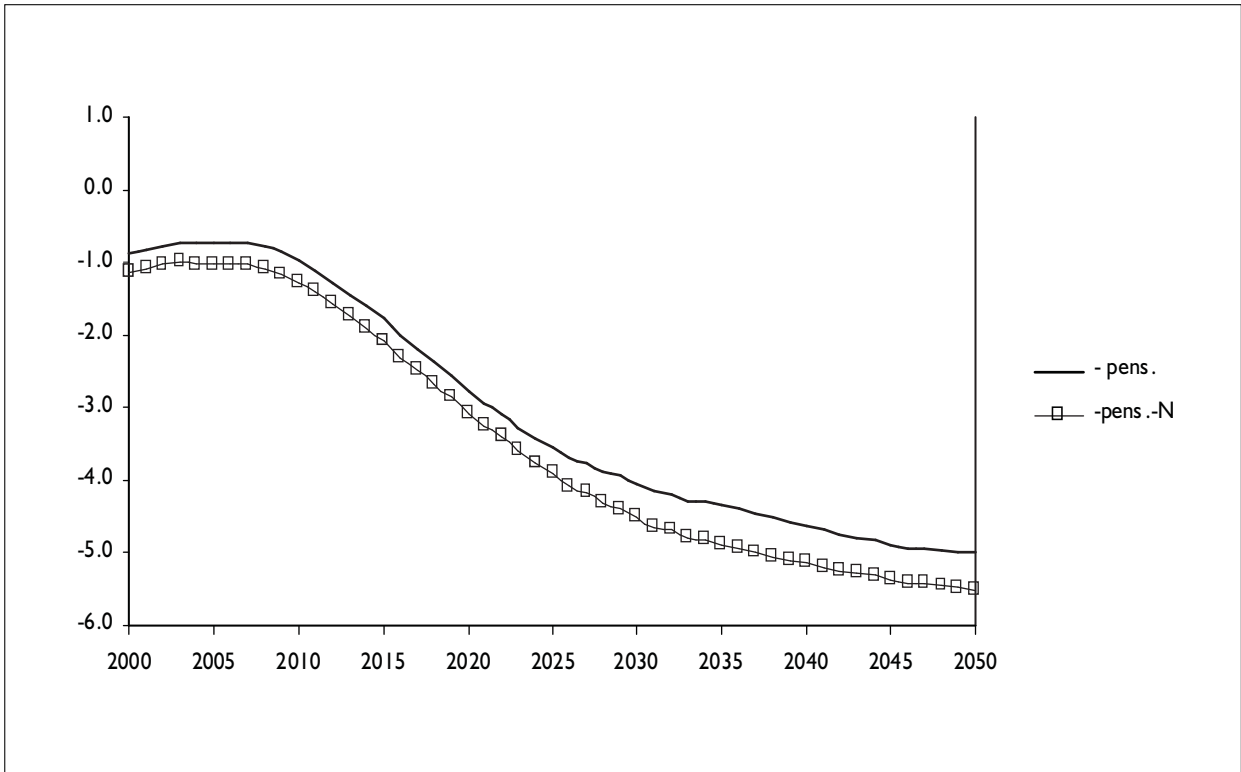


Figure 12. Demographic trends

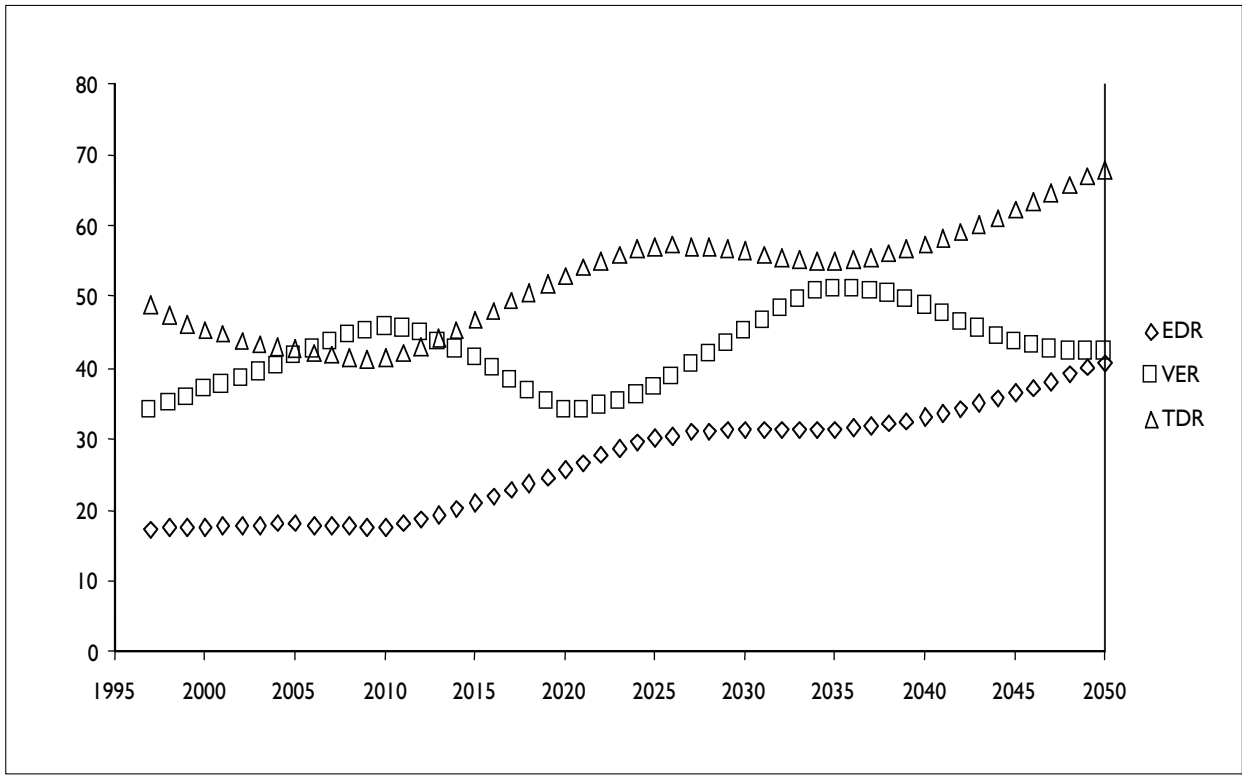


Figure 13. Support ratio and replacement rate

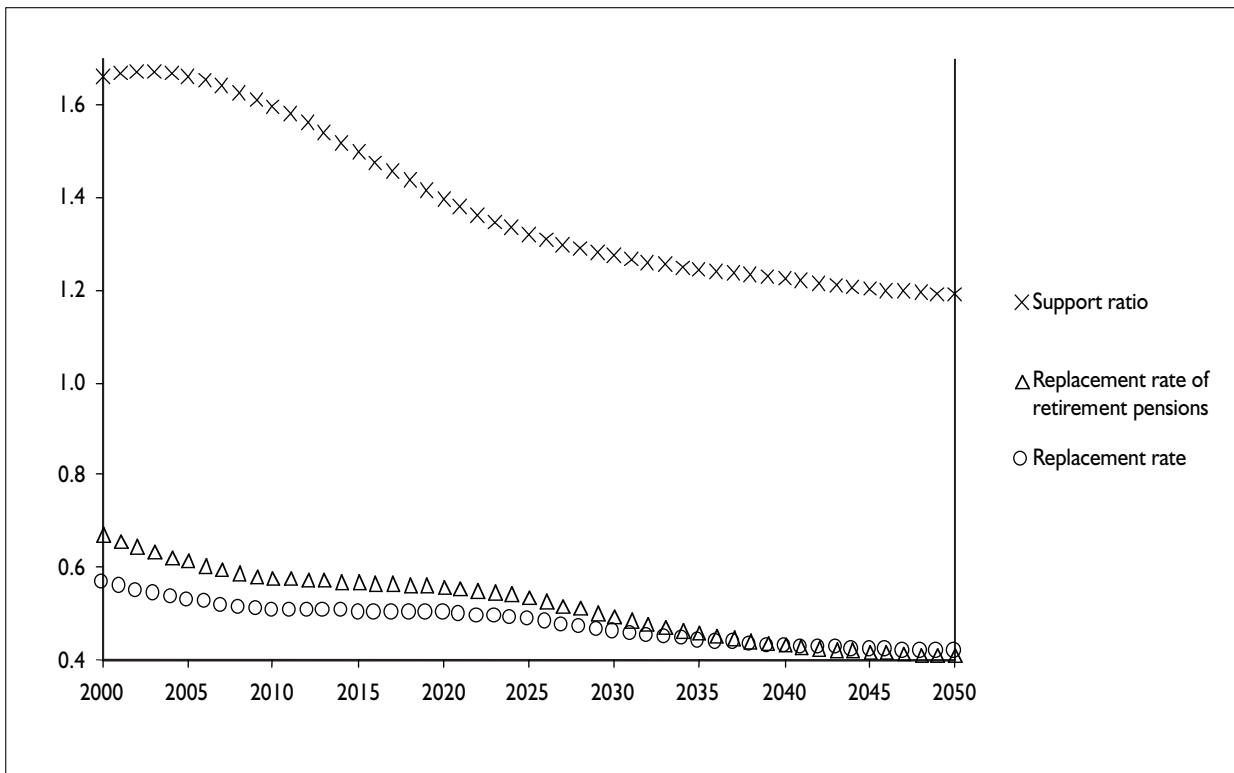


Table 1. Numbers of persons in millions paying contributions in pillars I, II and III

| Year | I | II | III |
|-------------|----------|-----------|------------|
| 2000 | 12.4 | 7.1 | 6.3 |
| 2005 | 13.1 | 9.0 | 8.4 |
| 2010 | 13.5 | 10.7 | 10.0 |
| 2015 | 13.6 | 11.8 | 11.0 |
| 2020 | 13.5 | 12.5 | 11.6 |
| 2025 | 13.4 | 12.9 | 12.0 |
| 2030 | 13.4 | 13.2 | 12.3 |
| 2035 | 13.4 | 13.3 | 12.3 |
| 2040 | 13.3 | 13.2 | 12.1 |
| 2045 | 13.0 | 13.0 | 11.9 |
| 2050 | 12.7 | 12.7 | 11.7 |

Table 2. Numbers of persons in millions receiving pensions under the old and new systems

| Year | I-old | I-new | II | III | inv+surv |
|-------------|--------------|--------------|-----------|------------|-----------------|
| 2000 | 3.5 | 0.0 | 0.0 | 0.0 | 3.9 |
| 2005 | 3.8 | 0.0 | 0.0 | 0.0 | 4.1 |
| 2010 | 4.3 | 0.0 | 0.0 | 0.0 | 4.1 |
| 2015 | 4.7 | 0.2 | 0.2 | 0.1 | 4.2 |
| 2020 | 4.7 | 0.7 | 0.7 | 0.5 | 4.3 |
| 2025 | 4.0 | 1.6 | 1.6 | 1.1 | 4.5 |
| 2030 | 2.8 | 3.0 | 3.0 | 2.5 | 4.6 |
| 2035 | 1.8 | 4.3 | 4.3 | 3.9 | 4.6 |
| 2040 | 1.1 | 5.3 | 5.3 | 5.1 | 4.4 |
| 2045 | 0.5 | 6.1 | 6.1 | 5.9 | 4.2 |
| 2050 | 0.2 | 6.5 | 6.5 | 6.4 | 4.0 |

Table 3. Average pensions from different pillars as proportions of average wage

| Year | wage index | I-old | I-new+II | III | I-new A | I-new B | II | I+II | I+II+N | inv | surv |
|-------------|-------------------|--------------|-----------------|------------|----------------|----------------|-----------|-------------|---------------|------------|-------------|
| 2000 | 1.00 | 63.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 63.3 | 65.9 | 46.1 | 54.8 |
| 2005 | 1.23 | 57.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 57.7 | 60.1 | 44.8 | 50.0 |
| 2010 | 1.50 | 55.5 | 45.9 | 27.3 | 36.3 | 6.1 | 3.5 | 55.5 | 57.5 | 44.3 | 46.8 |
| 2015 | 1.80 | 55.0 | 52.7 | 8.2 | 38.5 | 8.9 | 5.2 | 54.9 | 56.5 | 44.1 | 44.8 |
| 2020 | 2.14 | 54.3 | 52.1 | 13.9 | 33.9 | 11.7 | 6.9 | 54.0 | 55.3 | 43.9 | 43.7 |
| 2025 | 2.52 | 53.0 | 48.5 | 19.1 | 26.8 | 14.0 | 8.5 | 51.7 | 53.0 | 43.8 | 42.9 |
| 2030 | 2.93 | 49.5 | 45.7 | 20.7 | 19.7 | 16.8 | 10.5 | 47.6 | 49.0 | 43.8 | 42.5 |
| 2035 | 3.36 | 43.7 | 44.1 | 21.3 | 15.1 | 19.1 | 12.2 | 44.0 | 45.4 | 43.9 | 42.4 |
| 2040 | 3.82 | 40.8 | 41.9 | 22.1 | 12.0 | 20.5 | 13.4 | 41.7 | 42.9 | 44.2 | 42.6 |
| 2045 | 4.30 | 38.5 | 40.6 | 21.8 | 9.5 | 21.4 | 14.5 | 40.4 | 41.5 | 44.6 | 43.1 |
| 2050 | 4.78 | 36.6 | 39.7 | 21.0 | 7.5 | 21.8 | 15.3 | 39.6 | 40.5 | 45.0 | 43.4 |

Table 4. Pension expenditures by different pillars, as proportions of GDP (in percents)

| Year | GDP index | I-old | I-new | II | NA | III | inv+surv | s+a | I+II+III+N | inv+surv+s+a | KRUS |
|-------------|------------------|--------------|--------------|-----------|-----------|------------|-----------------|------------|-------------------|---------------------|-------------|
| 2000 | 1.00 | 5.9 | 0.0 | 0.0 | 0.2 | 0.0 | 5.1 | 0.2 | 6.1 | 5.2 | 2.2 |
| 2005 | 1.31 | 5.5 | 0.0 | 0.0 | 0.2 | 0.0 | 4.7 | 0.2 | 5.7 | 4.8 | 2.1 |
| 2010 | 1.64 | 6.0 | 0.0 | 0.0 | 0.2 | 0.0 | 4.5 | 0.2 | 6.0 | 4.6 | 2.2 |
| 2015 | 1.98 | 6.3 | 0.2 | 0.0 | 0.2 | 0.0 | 4.4 | 0.2 | 6.7 | 4.6 | 2.3 |
| 2020 | 2.33 | 5.5 | 0.8 | 0.1 | 0.2 | 0.2 | 4.6 | 0.2 | 7.3 | 4.7 | 2.4 |
| 2025 | 2.73 | 3.4 | 1.6 | 0.3 | 0.2 | 0.5 | 4.8 | 0.2 | 7.8 | 4.9 | 2.5 |
| 2030 | 3.16 | 1.7 | 2.6 | 0.8 | 0.2 | 1.3 | 4.9 | 0.2 | 8.3 | 5.1 | 2.6 |
| 2035 | 3.64 | 0.8 | 3.4 | 1.3 | 0.2 | 2.0 | 4.9 | 0.2 | 8.8 | 5.1 | 2.7 |
| 2040 | 4.11 | 0.3 | 3.7 | 1.8 | 0.2 | 2.8 | 4.8 | 0.2 | 9.5 | 4.9 | 2.7 |
| 2045 | 4.53 | 0.0 | 4.0 | 2.2 | 0.2 | 3.3 | 4.6 | 0.2 | 10.2 | 4.8 | 2.7 |
| 2050 | 4.91 | 0.0 | 4.1 | 2.5 | 0.2 | 3.5 | 4.5 | 0.2 | 10.4 | 4.7 | 2.7 |

Table 5. Contributions to different pillars as fractions of GDP (in percents)

| Year | inv+surv+s+a | I | II | III | Total |
|------|--------------|-----|-----|-----|-------|
| 2000 | 6.9 | 6.1 | 1.5 | 1.3 | 15.9 |
| 2005 | 6.9 | 5.8 | 1.9 | 1.6 | 16.1 |
| 2010 | 7.0 | 5.5 | 2.3 | 1.8 | 16.5 |
| 2015 | 7.0 | 5.2 | 2.5 | 1.9 | 16.6 |
| 2020 | 6.9 | 5.0 | 2.7 | 1.9 | 16.6 |
| 2025 | 6.9 | 4.9 | 2.8 | 2.0 | 16.7 |
| 2030 | 6.9 | 4.9 | 2.9 | 1.9 | 16.7 |
| 2035 | 7.0 | 4.9 | 2.9 | 1.9 | 16.6 |
| 2040 | 6.9 | 4.9 | 2.9 | 1.9 | 16.6 |
| 2045 | 6.9 | 4.8 | 2.9 | 2.0 | 16.7 |
| 2050 | 6.9 | 4.8 | 2.9 | 2.1 | 16.8 |

Table 6. Balances of contributions retirement pensions over expenditures, by pillars, as fractions of GDP (in percents)

| Year | inv+surv+s+a | I | II | III | I+inv+surv+s+a | Total |
|------|--------------|------|-----|------|----------------|-------|
| 2000 | 1.7 | 0.3 | 1.5 | 1.3 | 1.9 | 4.8 |
| 2005 | 2.0 | 0.3 | 1.9 | 1.6 | 2.3 | 5.8 |
| 2010 | 2.3 | -0.3 | 2.3 | 1.8 | 2.0 | 6.1 |
| 2015 | 2.4 | -1.2 | 2.5 | 1.9 | 1.2 | 5.6 |
| 2020 | 2.2 | -1.9 | 2.6 | 1.8 | 0.4 | 4.8 |
| 2025 | 2.0 | -1.8 | 2.5 | 1.4 | 0.2 | 4.1 |
| 2030 | 1.9 | -1.1 | 2.1 | 0.7 | 0.7 | 3.5 |
| 2035 | 1.9 | -0.4 | 1.6 | -0.1 | 1.5 | 3.0 |
| 2040 | 2.0 | 0.1 | 1.1 | -0.9 | 2.1 | 2.4 |
| 2045 | 2.2 | 0.3 | 0.7 | -1.3 | 2.5 | 1.9 |
| 2050 | 2.3 | 0.6 | 0.4 | -1.3 | 2.8 | 1.9 |

Table 7. Balance of all contributions to pillar I over expenditures, as function of GDP (in percents)

| Year | - pens. | -pens.-N | -pens.-N-M |
|-------------|----------------|-----------------|-------------------|
| 2005 | 2.3 | 2.1 | 2.1 |
| 2010 | 2.0 | 1.8 | 1.8 |
| 2015 | 1.2 | 1.0 | 1.0 |
| 2020 | 0.4 | 0.2 | 0.2 |
| 2025 | 0.2 | 0.0 | 0.0 |
| 2030 | 0.7 | 0.5 | 0.5 |
| 2035 | 1.5 | 1.3 | 1.3 |
| 2040 | 2.1 | 1.9 | 1.9 |
| 2045 | 2.5 | 2.4 | 2.4 |
| 2050 | 2.8 | 2.7 | 2.7 |

Table 8. Basic population data

| Year | Population | SR | EDR | VER | TDR |
|-------------|-------------------|-----------|------------|------------|------------|
| 2000 | 100.0 | 1.66 | 17.7 | 36.8 | 45.4 |
| 2005 | 100.6 | 1.66 | 18.1 | 41.5 | 42.7 |
| 2010 | 101.4 | 1.60 | 17.7 | 45.8 | 41.6 |
| 2015 | 102.4 | 1.50 | 21.0 | 41.3 | 46.8 |
| 2020 | 103.0 | 1.40 | 25.7 | 34.0 | 53.0 |
| 2025 | 102.9 | 1.32 | 30.2 | 37.3 | 57.2 |
| 2030 | 102.1 | 1.27 | 31.4 | 45.1 | 56.4 |
| 2035 | 100.7 | 1.25 | 31.5 | 51.1 | 55.2 |
| 2040 | 99.0 | 1.23 | 33.2 | 48.7 | 57.5 |
| 2045 | 96.9 | 1.21 | 36.5 | 43.6 | 62.5 |
| 2050 | 94.6 | 1.19 | 40.9 | 42.2 | 68.0 |

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