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Microsimulation of Social Security Reforms in Belgium

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1.1 Introduction

The various Belgian social security schemes are facing an uncertain future. The general trend toward demographic aging across all of the developed world and large parts of the developing world has not left Belgium unaffected. Demographic aging is the result of a combination of two trends. First, there has been a substantial decrease in fertility rates of women over the last few decades. Second, we have observed a strong increase in life expectancy across most categories in the population. Unfortunately, these trends have a strongly negative financial impact on a variety of social insurance and social protection programs, ranging from child support payments, the health care sector, to questions of retirement income and long-term care arrangements. While the problem can be approached in a myriad of ways, we approach it from the perspective of the social security system, thus largely leaving aside the question of health care and long-term care costs. While it is true that this focus inhibits a truly global view of the financial consequences of aging for government budgets, it is also true that introducing them would cause tremendous problems in terms of modeling

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the evolution of health care costs, as well as in terms of a loss of international comparability.

For the social security systems to survive this demographic process, higher contribution levels and/or lower benefits will have to be introduced, given the outright pay-as-you-go (PAYG) nature of these systems. Indeed, a straight increase in the public debt financing of the demographic transition is not truly an option in Belgium, as it would be totally incompatible with the Maastricht criterion of the European Economic Monetary Union (EMU) relating to the level of GDP.[1] But even beyond this purely institutional limit, a further increase in public debt levels is also financially unsustainable, as it would quickly cause a snowball effect like the one observed in Belgium in the 1980s.

Leaving aside these purely demographic considerations, other factors are challenging the way the Belgian social security institutions and systems are organized. First, there is the potential for increased labor mobility. At present, mobility between jobs in the public sector, the private sector, and in self-employment is rather limited, at least partly because of the way the three systems work. The needs of the labor market of the future, with its increased degree of flexibility, may thus induce large changes in the way the three corresponding social security systems work. International job mobility is also becoming more and more important, particularly for a small, open economy in the heart of Europe like Belgium. Jousten and Pestieau (2002) argue that both levels of intra- and intergenerational redistribution will be heavily affected by increased international labor mobility, even if the phenomenon is limited to some subgroups of the population.

The second and biggest nondemographic challenge is the widespread use of a variety of early retirement programs. In fact, Belgium excels in the use of these programs, as the world-leading low average retirement age of approximately 57 for men clearly illustrates.[2] Originally these systems were motivated by several objectives. Faced with an environment of industrial restructuring, early retirement seemed to be the royal route out of the problem for all partners involved. First, it allowed companies to lay off old workers and, if needed, hire cheaper young workers, while the government supported a large chunk of the costs.[3] Second, older workers were also encouraged by the trade unions to leave so as to free up space for younger ones. To the present day, many older workers believe that they make a decision that is beneficial to their younger counterparts. Third, successive governments since the 1970s were also political gainers, though financial

1. Belgian national debt currently hovers at a level of approximately 110 percent of GDP.

2. The average age of retirement of 57.6 for men was estimated by Blöndal and Scarpetta (1998) on the basis of Labor Force Surveys. In this study we estimated an average retirement age of 58.4 for men and 57.4 for women.

3. Belgium is a country where the age profile of wages is steeply increasing, with the length of the working career making older workers quite expensive.

losers, in this consensus toward early retirement, because it allowed the government to show a better performance in terms of unemployment (particularly youth unemployment) and guaranteed a social peace. Lately, however, these early retirement schemes have undergone some scrutiny. Not surprisingly, the beneficial labor market effects have been rather modest if not completely absent.[4] Recent discussions and decisions at the government level clearly move toward the direction of lifting the effective early retirement age, and hence also the sector-specific mandatory retirement ages. Financial costs of early retirement programs to the federal government have been huge, both on the income (contributions, taxes) and on the expenditure side (early retirement benefits).

The goal of this chapter is to simulate the impact of reforms of retirement income systems. The impact we are interested in resides on two levels. First, we consider the financial and behavioral impact on individuals and families. Second, we consider the financial impact on the federal government budget. We do not restrict our attention to the budgetary impact on the social security systems, but rather on all of the federal government's finances. Such reforms will have both an automatic effect on fiscal contributions, by changing contributions and benefits for a given work history (the *mechanical* effect), and an additional effect through labor supply responses to the reform (the *behavioral* effect). We will estimate the fiscal implications of both the mechanical and the behavioral effect, using our retirement probit models derived in Dellis et al. (2004) to predict labor supply responses. The result will be an estimate of the steady-state impact of the reforms on the financial balance sheet of retirement income systems.

The structure of the chapter is as follows. Section 1.2 describes the essential features of the various public retirement and early retirement systems in Belgium. In section 1.3 we explain the different components of our administrative dataset, as well as the key results of Dellis et al. (2004), which we heavily rely upon. The following section (1.4) describes the simulation methodology used. The approach can be qualified as being of a steady-state type. Our methodology implicitly assumes that there is a time-invariant social security program and time-invariant behavior, though this has obviously not been the case for the systems and the people analyzed in our sample, where both behaviors and system characteristics have evolved over time. Section 1.5 describes the simulation results obtained. Again, it is important to stress that these results have to be interpreted with due diligence because of the limitations inherent in our simulation approach. Though the results might be rather accurate for the cohort of 50-year-old workers, this might not be the case for the more general population at other ages or for other cohorts. Section 1.6 is devoted to the conclusions.

4. See Sneesens et al. (2003).

1.2 Social Security Schemes

The Belgian retirement income system relies on three very unequal pillars.[5] First, there are the dominant public social security programs, which represent the largest part of pension income for a wide majority in the population. A second pillar consists of company pension schemes, which play only a minor role as a source of income for the average Belgian worker. Essentially, they are currently confined to the higher-income individuals in the private sector and to the self-employed, a finding that is at least in part due to their tax treatment. A third type of retirement income comes from individual retirement savings. These take multiple forms: there are tax-favored individual pension savings accounts with a maximum annual contribution of €580 per person,[6] or under the form of more traditional savings vehicles, such as the tax-favored savings accounts, investments in trust funds, life insurance, and so on.

The first pillar, public retirement programs, essentially consists of four components. There are three large sectoral social security programs, one for the public sector, one for the private sector wage earners, and one for the self-employed. Some special categories of workers, such as coal mine workers and military personnel, have special retirement systems that we will not explicitly model in the present chapter. A fourth large category of public retirement income consists of the guaranteed minimum pension system, which operates on a means-tested basis.

1.2.1 Wage Earner's Scheme

The wage earner's scheme is by far the largest one, based on the number of people affiliated with the program. The program allows for retirement starting at age 60, with a normal retirement age (NRA) fixed at 65. The choice of retirement age does not induce any actuarial adjustment under current rules.

However, in the case of most workers, the choice of retirement age is not completely neutral with respect to the benefit amount, because a full earnings history consists of forty-five years of work for men, a condition that many people do not satisfy at the age of 60. For those having more than forty-five working years, a dropout-year provision operates, replacing low-income years by higher ones. The situation has so far been slightly different for women, who only needed forty years to complete a career. A transition (between 1997 and 2009) is under way to progressively increase the complete career requirement to forty-five years of work. Hence, for most women included in our dataset, a full career still consists of forty years of work.

5. The present section describes the system as in place in the late 1990s. It relies heavily on Dellis et al. (2004).

6. All financial data are presented in EUR of 31/12/2001. Administrative parameters cited in absolute EUR amounts are those applicable to the year 2001, unless specified otherwise.

Benefits are computed based on earnings during periods of affiliation. The benefit formula, which is subject to floors and ceilings, can be represented as follows:

$$\text{Benefits} = \frac{n}{N} \times \textit{average wage} \times k,$$

where n represents the number of years of affiliation with the wage earner's scheme, N the number of years required for a full career (in our case either forty or forty-five) and k is a replacement rate, which takes on the value of 0.6 or 0.75, depending on whether the social security recipient claims benefits as a single person or as a household. The variable *average wage* corresponds to indexed average wages over the period of affiliation, with indexation on the price index combined with additional discretionary adjustments for the evolution of growth. A peculiar feature of the Belgian wage earners' scheme is that periods of one's life spent on replacement income (unemployment benefits, disability benefits, workers compensation) fully count as years worked in the computation of the average wage, and hence of the social security benefit. For any such periods, fictive wages are inserted into the average wage computation. In line with the general philosophy of the Belgian social insurance system—that any such spell on a replacement income system is purely involuntary—imputed wages are set equal in real terms to those that the workers earned before entering these replacement income programs.

Wage earners' pensions are shielded against inflation through an automatic consumer price index (CPI) adjustment and are subject to an earnings test. Currently, the earnings limit is approximately €7,450 per year. For earnings above this limit, pension entitlement is suspended. Benefits are also paid to surviving spouses, or more generally, surviving dependents of deceased wage earners.

The wage earner system is essentially based on the PAYG principle, and financed through payroll taxes that are levied both on the employers and the employees, with a combined tax rate of 16.36 percent (no earnings limit). The system also receives annual subsidies and transfers from the Belgian federal budget that amount to approximately 10 percent of overall benefits for the period considered.

Next to the official wage earner scheme, several forms of early retirement programs have been developed: mandatory collective early retirement and individual early retirement. During the 1980s and the 1990s, an arsenal of mandatory early retirement schemes was put in place. All of these arrangements were and are based on collective agreements, which are negotiated with the active involvement of employees and employers, sometimes at the sector level, sometimes at the level of an individual company or production site. For some companies in a difficult economic position, mandatory retirement ages as low as 50 were introduced. Individual early retirement

differentiates itself from its collective counterpart by the fact that it is based on an individual's decision to retire from work. During the years analyzed in our sample, the most prevalent way to do this is to pass through the unemployment system, in which the unemployed aged 50 or more are considered "aged unemployed" and are no longer subject to show up at the unemployment office on a regular basis.[7] Further, there is no control on availability to work, nor are there benefit cuts due to long-term unemployment.[8] Therefore, people unwilling to continue to work can ask their employer to lay them off. Similarly, employers can use the system to shed older, more expensive workers. The latter are often willing to do so because of a lack of experience rating in the unemployment insurance system. In the early years of the new millennium, a new technique has even reinforced the use of the unemployment insurance system as a retirement route. The technique, called *canadry dry* pensions, consists in a lump-sum transfer from the employer at the time the company lays off its worker. This lump sum is not formally a retirement pension, but clearly looks like one.

1.2.2 Public Sector Employees

Public sector pensions are paid out of the general federal budget and are officially considered as deferred income rather than old-age insurance. The only official insurance element is a coverage for survivor benefits, which is financed through a 7.5 percent payroll tax. No spousal benefits are available. Civil servants face compulsory retirement at the latest at age 65, for both men and women. However, for the private sector, there is a multitude of ways of retiring earlier than this normal age of 65.[9] There is disability protection, which is a much more plausible route to retirement than in the private-sector system, as the screening is considered to be much less severe. Most importantly however, it is possible to opt for an incomplete career and retire at 60. For some particular categories of workers, the normal retirement age is lower than 65, and early retirement provisions are sometimes extremely generous (military servicemen, teachers). Public sector pensions are based on the income earned by an individual during the last five years before retirement. Benefits are computed according to a rather complicated formula but can never exceed 75 percent of the average wages over the last five years. The benefit formula can be represented as follows:

7. Disability is not a major route toward early retirement, due to rather stringent qualifying conditions and rather advanced screening.

8. The system of the aged unemployed was reformed in July 2002. The rules were tightened for new entrants to the unemployment system, with grandfathering rules applicable to those already in the system. The minimum age for a full waiver of obligations under the unemployment insurance system was raised to 56. A new system of "mini-waiver" was introduced onto the periodic visits to unemployment insurance as of age 50, but the person still needs to be ready to accept a job.

9. Currently, less than 15 percent of civil servants retire at the age of 65.

$$\text{benefit} = \text{average wage over last five years} \times \min(\textit{fract}; 0.75),$$

where *fract* is a fraction with a numerator consisting of the number of years the person worked in the public service, the denominator being a benefit accrual factor. This latter benefit accrual factor, also called *tantième,* depends on the rank the person occupies in the hierarchy. This denominator ranges from 30 to 60, taking the value of 30 for the highest-ranking civil servants (high court judges, university professors) and 60 for the lowest ranks. As in the private sector wage earners' scheme, the system is earnings tested. The system also applies floors and ceilings, which are, however, much more generous than for private sector retirement benefits. Most notably, higher-income individuals get a much better deal in the public sector than in the private sector. This finding is reinforced once we consider indexation rules, as public sector pensions are indexed on average wages (*péréquation*). Public servants therefore enjoy the benefits of productivity increases in the economy even beyond the moment when they actively contribute to them as workers.

1.2.3 Self-Employed

The self-employed retirement scheme is the latest one to have been introduced, as it has only existed since 1956. It is also the least generous of the three big social security systems, with retirement benefits close to the level of the guaranteed minimum income (see the following). The self-employed are not entitled to unemployment benefits, nor to early retirement benefits. Disability benefits exist, but both qualifying conditions and financial characteristics of the system make it a most unlikely exit route to retirement. For a very long time, old-age pensions have been independent of earnings levels. However, since 1984, the system is progressively being transformed to allow for a stronger link between contributions and benefits. Additional earnings past 1984 enter the pension computation formula at their correct value, instead of some fictive amount. Full benefits are available at age 65 for men with a complete earnings history of forty-five years. However, anticipated retirement is possible as early as age 60, with an actuarial reduction of 5 percent per year of anticipation. As for the wage earners' scheme, women are in a transitory phase, with the complete career requirement shifting from forty years of work to forty-five, and normal retirement age from 60 to 65.

The social security system of the self-employed is financed through two broad categories of income. First, there are direct social insurance contributions levied under the form of a tax of 16.7 percent on the first €46,035 of income, and 12.27 percent on the income in the bracket between €46,035 and €67,352. Income above the latter threshold is not subject to social insurance taxation. More than 75 percent of the contributions raised using

this social insurance taxation are used for the pension system of the self-employed; the remainder serves to cover health care and other social insurance benefits for the self-employed. Second, the federal government pays a large subsidy to the system, which amounted to more than a third of benefits in the years 2003 and 2004.

1.2.4 Guaranteed Minimum Income

The guaranteed minimum income pensions are fully paid for by general government revenue, and are means tested. This type of pension is only available after the legal retirement age.

1.3 The Model

We opt for an approach of microsimulation relying on the data and estimates used in Dellis et al. (2004). The underlying data stem from five different sources, most of which are of administrative origin. The different data were merged using the national identification number, which is the Belgian equivalent to the U.S. Social Security number.

The first component of the data is the SFR (Fiscal Revenue Statistics) files, which are collected by the Finance Ministry and then processed by the INS (National Statistics Office). We use the SFR files for the years 1989 to 1996 to extract all the information relevant for the computation of individual tax liabilities. Variables available include wage income and income from other professional activities, household size and type, number of dependents in the household, age and income of spouse, social insurance transfers and private pension receipt, house ownership status (owner, renter), taxable real estate income, and contributions to second- and third-pillar pensions. The second component is the CIP (Individual Pension Account), which includes all career information relevant for the wage earner pension computation: gross wages, days of work, days on social insurance programs, and so forth. The third and fourth components are the equivalent datasets for the self-employed and civil servants, both of whose files are less detailed than the one for wage earners. Finally, information from the census (1991) is merged in to determine education levels, so as to be able to use survival tables that are education-level specific.

Dellis et al. (2004) used a multistep sample selection procedure to obtain a sample of households where at least one member of the household is in the 50 to 64 age bracket and has not yet retired. A total of 21,818 households was used to separately analyze retirement decisions of men and women. Using the data, the authors estimated the parameters of retirement probit models. Among the explanatory variables in the estimation, the authors paid particular attention to financial incentive measures. We use several different indicators to measure the impact of the social security systems' incentives. First is the concept of household social security wealth

(SSW), which is the present discounted value of all future benefit flows from a given social security system. Discounting is done allowing for both time preference and mortality adjustments. Further, SSW also has to allow for the possibility of people being subject to different retirement income systems. The authors apply the official rules that exist for cumulating benefits from the three main public systems. Hence, the total SSW is the weighted sum of the different pathways to retirement available to the individual or to the couple. The weights on the early-retirement routes and the unemployment/disability routes correspond to the sum of observed frequencies of these routes among all people of any given age up to age 65, when the public retirement system takes the residual weight. For wage earners, we group the unemployment insurance and disability insurance paths, as the two systems produce very similar benefit structures. Doing so, we give an upper bound on incentives for people to retire, as we render all disability voluntary. Given the lack of information for the public sector, we consider as early retirees all persons retiring before the age of 60.

The next two incentive indicators are forward-looking measures. *Peak value* (PV) represents the difference between SSW at its peak and SSW today. The other forward-looking measure is the concept of *option value* (OV), such as defined by Stock and Wise (1990), which is based on a utility maximization framework. The utility function V_t underlying the computation of the option value process can be summarized by the following mathematical expression:

$$V_t(r) = \sum_{s=t}^{r-1} \beta^{s-t} Y_s^{\gamma} + \sum_{s=r}^{S} \beta^{s-t} [kB_s(r)]^{\gamma},$$

where the first expression on the right-hand side represents the utility derived from labor income Y, and the second expression represents utility derived from retirement income $B_s(r)$; β is the time-preference rate, which we assume to be approximately 0.97, which corresponds to a discount rate of 3 percent; γ corresponds to a parameter of concavity and is set to $\gamma = 0.75$. Finally, $k = 1.5$ expresses the relative weight of utility of retirement income as compared to wage income. It reflects the fact that the income without effort generates more utility than income with effort.

The concept of option value $G_t(r^*)$ is then defined as the difference in utility terms between retiring at the best point in the future (r^*) and now (t).

$$G_t(r^*) = V_t(r^*) - V_t(t)$$

The key estimates of the authors are summarized in tables 1.1 and 1.2.

1.4 Simulation Methodology

For our simulations purposes, we restrict our attention to a subsample of the previously discussed dataset. We use a cross-section of individuals

Table 1.1 **Retirement probits for men**

	Peak value				Option value			
	Age		Age dummies		Age		Age dummies	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Intercept	–7.5957	0.2698	–2.4346	0.1690	–7.5110	0.3387	–2.2976	0.1709
Incentive measures								
SSW (in thousands)	–0.0008	0.0003	–0.0008	0.0003	–0.0001	0.0003	–0.0001	0.0003
Probability effect	(–0.0079)		(–0.0082)		(–0.0008)		(–0.0001)	
PV, OV (in thousands)	–0.0380	0.0016	–0.0364	0.0017	–0.0392	0.0054	–0.0327	0.0054
	(–0.3769)		(–0.3505)		(–0.4111)		(–0.3383)	
Demographic variables								
Age	0.1049	0.0039			0.1050	0.0053		
Married	0.1027	0.0499	0.1026	0.0505	0.0294	0.0488	0.0342	0.0495
Active spouse	–0.0501	0.0394	–0.0515	0.0399	–0.0857	0.0383	–0.0839	0.0388
Age difference	–0.0003	0.0039	–0.0001	0.0039	–0.0009	0.0038	–0.0015	0.0039
Dependent	–0.0999	0.0361	–0.0911	0.0364	–0.0729	0.0352	–0.0754	0.0355
Income earnings variables								
Life cycle earnings	0.0138	0.0066	0.0151	0.0068	0.0155	0.0066	0.0180	0.0068
Earnings (in thousands)	–0.0084	0.0012	–0.0084	0.0012	0.0014	0.0018	–0.0002	0.0018
Spouse earnings (in thousands)	0.0043	0.0024	0.0044	0.0024	0.0037	0.0024	0.0031	0.0024

Age and schemes dummies								
Age51			0.0523	0.0827			0.0134	0.0808
Age52			0.2779	0.0779			0.2289	0.0763
Age53			0.3191	0.0788			0.2087	0.0773
Age54			0.4516	0.0773			0.2871	0.0760
Age55			0.6751	0.0720			0.5664	0.0718
Age56			0.6429	0.0740			0.5003	0.0745
Age57			0.8546	0.0723			0.7359	0.0738
Age58			1.0048	0.0734			0.8659	0.0760
Age59			0.7310	0.0833			0.4475	0.0869
Age60			1.4439	0.0745			1.4456	0.0816
Age61			1.4396	0.0806			1.4302	0.0876
Age62			0.9767	0.0958			0.9868	0.1028
Age63			1.0380	0.1023			1.0364	0.1097
Age64			0.9208	0.1129			0.9320	0.1198
Age65			1.9180	0.1083			1.9801	0.1191
Civil servant	0.6314	0.1258	0.6177	0.1277	0.3850	0.1254	0.3858	0.1281
Self-employed	–0.0328	0.1235	–0.0216	0.1254	–0.0408	0.1244	–0.0396	0.1271
Pseudo R^2		0.1901		0.2067		0.1512		0.1741

Source: Dellis et alii (2004).

Note: Financial values in US$ at the exchange rate of 0.942 EUR/US$ as of 31/12/1999.

Table 1.2 **Retirement probits for women**

	Peak value				Option value			
	Age		Age dummies		Age		Age dummies	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Intercept	–6.2897	0.4100	–1.8504	0.2497	–4.7976	0.5161	–1.5951	0.2554
Incentive measures								
SSW (in thousands)	–0.0003	0.0003	–0.0001	0.0004	–0.0007	0.0004	–0.0004	0.0004
Probability effect	(–0.0042)		(–0.0001)		(–0.0089)		(–0.0048)	
PV, OV (in thousands)	–0.0307	0.0023	–0.0222	0.0024	–0.0793	0.0089	–0.0651	0.0091
Probability effect	(–0.3940)		(–0.2868)		(–1.0341)		(–0.8434)	
Demographic variables								
Age	0.0887	0.0060			0.0641	0.0080		
Married	0.2222	0.0708	0.2030	0.0725	0.2269	0.0709	0.2079	0.0729
Active spouse	–0.0367	0.0552	–0.0606	0.0566	–0.0784	0.0544	–0.0920	0.0560
Age difference	0.0206	0.0063	0.0145	0.0064	0.0288	0.0066	0.0226	0.0068
Dependent	–0.1539	0.0586	–0.1687	0.0590	–0.1346	0.0580	–0.1575	0.0587
Income earnings variables								
Life cycle earnings	0.0081	0.0104	0.0062	0.0106	0.0069	0.0106	0.0053	0.0107
Earnings (in thousands)	–0.0090	0.0027	–0.0084	0.0027	0.0125	0.0038	0.0102	0.0039
Spouse earnings (in thousands)	–0.0021	0.0020	–0.0017	0.0020	–0.0011	0.0020	–0.0010	0.0021

Age and schemes dummies								
Age51			0.0094	0.0923			–0.0462	0.0922
Age52			0.2391	0.0877			0.1767	0.0876
Age53			0.3247	0.0897			0.2195	0.0899
Age54			0.2192	0.0951			0.0871	0.0955
Age55			0.4942	0.0888			0.3306	0.0906
Age56			0.3489	0.0942			0.1500	0.0973
Age57			0.5099	0.0951			0.2681	0.1001
Age58			0.3334	0.1060			0.0456	0.1128
Age59			0.2208	0.1161			–0.1246	0.1261
Age60			1.4579	0.0973			1.2533	0.1123
Age61			1.6646	0.1124			1.4447	0.1243
Age62			0.5275	0.1795			0.2841	0.1881
Age63			0.4805	0.1976			0.2177	0.2072
Age64			0.9965	0.1988			0.6746	0.2108
Age65			1.3057	0.2116			1.0055	0.2218
Civil servant	0.2851	0.1224	0.2128	0.1248	0.1541	0.1228	0.1287	0.1252
Self-employed	–0.2508	0.1292	–0.2766	0.1319	–0.2041	0.1300	–0.2281	0.1330
Pseudo R^2		0.1536		0.1918		0.1365		0.1860

Source: Dellis et alii (2004).

Note: Financial values in US$ at the exchange rate of 0.942 EUR/US$ as of 31/12/1999.

instead of the entire age range (50 to 64). More specifically, we consider preretirement-age workers (male and female) aged 50 and then age them forward. We also include their spouses in our analysis. More specifically, we select all 50-year-old men and 50-year-old single females of the sample. Married 50-year-old females are excluded from the sample to avoid double counting, as our sample will account for the fiscal impact of all married females. This way, the cohort can be defined as a representative sample of Belgian 50-year-old workers and their spouses. To ensure a sufficient sample size, we use a synthetic age-50 cohort made up of individuals aged 50 in 1993, 1994, or 1995. This gives us a total sample size of 4,927 individuals, 2,515 men, 2,020 dependent women, and 392 working women.

We first estimate the probability that each worker will exit the labor force via death or retirement at each future age. Exit probabilities are computed using the estimates of tables 1.1 and 1.2 under the baseline setting with regard to all variables, including the SSW and peak and option value indicators. Spouses are supposed to retire at the early retirement age of the corresponding retirement scheme. In a second step, all these probabilities then serve as weights in the computation of the present discounted value (PDV) of the in- and outflows from the government budget. The financial flows considered are all flows from age 50 up until death.[10] This marks a difference with respect to Dellis et al. (2004), as we consider the full budgetary costs and benefits of the synthetic cohort as it ages. The total impact of individuals on the government's budget is measured as the difference between the outflows from the budget as measured by the flow of social security and other social insurance program benefits (unemployment and early retirement) and inflows as measured by payroll, income, and consumption taxes. Payroll taxes include health, retirement, unemployment, disability, professional sickness, and workers' compensation contributions.

Next to the previously mentioned payroll taxes, we include income taxes on labor and pension income as well as consumption taxes under the form of value added tax (VAT). We incorporate direct taxes in accordance with the Belgian Personal Income Tax Code IPP (Personal Income Tax), thus also including the favorable tax treatment of pension income. However, to render the computation feasible, we have fully individualized the tax accounts of husbands and wives, while the tax code only allows a partial splitting of incomes of spouses. Further, we decided to ignore some other tax code provisions. For example, we left aside the possibility of itemizing deductions in favor of the standard flat-rate deduction, and we ignored taxation of private annuity income. The likely impact of these simplifications is difficult to assign, as these omissions are to some degree offsetting. Regarding consumption taxes, we rely on consumption data by income quar-

10. To ensure international comparability across the different countries considered, we discount all financial variables back to the age of 55, using a 3 percent real discount rate.

tiles from the Household Budget Survey of the INS. Using the expenditure shares of different products in the typical household consumption basket by income quartile and weighting the corresponding VAT rates accordingly, the INS data imply an average VAT rate by income of 10.65 percent for the lowest income quartile, 10.60 for the second, 10.04 for the third and 9.14 for the top income quartile. We apply these average rates for all age groups in a uniform way.

The concept of PDV is the basis for comparison among different policy reform scenarios. We do so by reestimating the exit probabilities, benefits, contributions, and taxes under several reform proposals for both spouses so as to obtain new PDV estimates. We even break down the total effect of a reform on the PDV into its components: the mechanical budgetary effect (with unchanged retirement probabilities with respect to the prereform situation) and the fiscal implications of the behavioral effect. We use the terminology *fiscal implications of the behavioral effect* to measure the budgetary impact of the labor supply reactions (which is, properly speaking, the change in the behavior of the individual). Indeed, this distinction is rather important, as it is quite imaginable to have a strong labor supply reaction while at the same time having a very limited budgetary impact thereof due to a high degree of actuarial neutrality.

1.5 Simulation Results

We consider four different reforms. The first three share a common feature in that they are not intended as policy recommendations, but rather are to allow for international comparisons. The fourth simulation is an interesting country-specific reform of the retirement system, whose only aim is to illustrate the impact of a partial reform within the Belgian institutional setting. None of the four reforms, however, pursues an objective of budget neutrality with respect to the baseline, which corresponds to the current institutional setting and hence not necessarily to one that is viable in the long run. Nor do any of these reforms aim at establishing a balanced and viable budget in the long run.[11] The first two reforms have already been explored in Dellis et al. (2004) with respect to their impact on the SSW and accrual variables. However, the present exercise clearly distinguishes itself from the previous results as it incorporates a complete analysis of all budgetary implications of a retirement-system change.

The first reform is called the Three-Year Reform, and consists of a simple increase within three years of all key parameters in all retirement and early retirement systems in the country. Thus, the early and the normal entitlement ages are increased by three years, as is the length of a normal career—from forty-five to forty-eight years. All other system characteristics remain

11. Hopefully they are more viable than the status quo.

unchanged. Implicitly, this approach includes the rather implausible condition that unemployment benefits are totally absent from the landscape between the ages of 50 and 53.

The second reform, the so-called Common Reform, creates a system that is identical across all countries. The Common Reform has a benefit equal to 60 percent of average real lifetime earnings at normal retirement age, which is defined to be at age 65. Past wages are deflated using real-wage indexing. Average lifetime earnings are supposed to correspond to the highest forty years of indexed earnings during an individual's working life. In case a worker has less than forty years of earnings, zeros are averaged in, while a career longer than forty years has an impact on the real average lifetime wage through a dropout-year provision. Early retirement is available as of the age of 60 (ERA), with an actuarial adjustment of 6 percent per year of anticipation. Benefits thus defined are capped at the 90th percentile of the wage distribution for men. Benefits are subject to income taxation under the same rules as in the prereform world. Survivor benefits are paid out at a rate of 100 percent of workers benefits, but are reduced one for one for every euro of benefits the recipients receives on his or her own earnings history. No other benefits are available, which thus represents a rather dramatic change in benefit availability before the age of 60 in a country like Belgium.

The third reform is called the Actuarial Reform. The approach can be situated midway between the previous two reforms; hence its results will be presented in second place in the tables and figures that follow. The reform keeps the structure of the sectoral social security schemes unchanged with respect to the present, including eligibility ages, minimum contribution periods, as well as formulae for the computation of the basic benefits. However, the reform introduces an actuarial adjustment factor to vary the benefit flow as a function of the age of exit from the labor force, or expressed differently, the entry age into retirement. The linear adjustment factor is 6 percent per year of deviation from the normal retirement age, which is currently 65 under all three major Belgian sectoral pension schemes. Means-tested programs as well as survivor and spousal benefits are kept unchanged in their generosity with respect to the baseline situation, unless they are directly linked to the worker's own benefits. The age-dependent nature of workers' retirement benefits thus implies a relative increase in the attractiveness of means-tested programs for younger retirees.

The last reform considered is a Belgian Reform. We consider a reform where the government reforms the current wage earner scheme by no longer crediting years spent on all kinds of social insurance programs, such as unemployment insurance, disability insurance, and early retirement in the individual's pension record. All other system characteristics are supposed to remain unchanged, thus leaving the early retirement and unemployment paths into retirement intact. Thus, people will be confronted

with incomplete careers at the end of their working life. There is thus a smaller buffering effect against income shocks on a lifetime basis. Another way of looking at the problem is to notice that the reform introduces a stronger link between contributions and benefits, and hence reinforces the pure insurance aspect of the system.

For evaluating the results of the first three simulations, we use simulation methods S1, S2, and S3 of Dellis et al. (2004). Method S1 relies on estimates using a linear age trend, which is unchanged by the reform. It adjusts the eligibility probabilities for unemployment or early retirement benefit receipt and applies the postreform incentive and PDV measures. Method S2 is based on the age-dummy model without a shift of the dummies. It is essentially the same as S1. However, the age-dummy effects are far from linear, and hence it is possible that these dummies better pick up the nonlinearities in the various retirement and early retirement systems, or alternatively, that tastes for leisure are not a linear function of age. Method S3 is based on the age-dummy models and considers a shift of dummies to perform the simulations in a specific way for each one of the reforms. For the first reform, all age dummies are shifted upward by three years. This also applies to those dummies at ages lower than the earliest eligibility age, so that the entire retirement hazard shifts forward. For the Common Reform we proceed in a similar way, but the impact of age dummies is modified in a different way. On the one hand, given that in this policy simulation alternative retirement pathways are assumed out, we apply the age-51 dummy to all ages up to age 59, just prior to the early retirement age, both for men and women. On the other hand, we keep the effect of age-60 and age-65 dummies unchanged, assuming that the Common Reform will not affect individual behavior at these particular ages. Finally, using these two dummy values, we imputed the values of the intermediary dummies, from age 61 to age 64, assuming a smooth path trend. As for the Actuarial Reform and the Belgian Reform, methods S2 and S3 are equivalent, as there is no change in the key early and normal retirement ages from the base case to the reform situation.

An initial, noticeable finding is that the PDV of benefits minus taxes is negative in all cases considered in table 1.3; thus, the results tell us that our cohort is a net contributor (benefits minus taxes and contributions) to the public finances. At first sight, this result looks rather surprising, as it is contrary to intuition and contrary to the finding that we can observe when purely focusing on the social security system. However, several factors help explain it. First, it is important to note that direct taxation is extremely heavy in Belgium. Second, discounting plays an important role in the results. While taxes are essentially front loaded in the Belgian tax and social insurance system, benefits are rather back loaded from a life-cycle perspective. Third, and last, it is important to notice that we consider only a single outflow of the government budget, while we consider a large array of

Table 1.3 **Total fiscal effect of reform (in euros per worker)**

	Present discounted value					Total change relative to base (%)			
	Base	Three-Year Reform	Actuarial Reform	Common Reform	Belgian Reform	Three-Year Reform	Actuarial Reform	Common Reform	Belgian Reform
				Peak value—S1					
Benefits	146,581	131,131	120,265	114,111	141,371	–10.5	–18.0	–22.2	–3.6
Taxes									
Payroll	58,408	61,934	64,857	63,625	59,312	6.0	11.0	8.9	1.5
Income	80,843	84,908	85,741	76,989	81,004	5.0	6.1	–4.8	0.2
Consumption	19,313	18,744	18,346	18,280	19,056	–2.9	–5.0	–5.4	–1.3
Total	158,564	165,586	168,944	158,893	159,372	4.4	6.5	0.2	0.5
				Peak value—S2					
Benefits	147,557	129,241	120,458	114,115	142,326	–12.5	–18.4	–22.7	–3.6
Taxes									
Payroll	57,307	61,548	63,516	62,234	58,166	7.4	10.8	8.6	1.5
Income	79,472	84,478	83,977	75,300	79,542	6.3	5.7	–5.3	0.1
Consumption	19,339	18,759	18,304	18,250	19,088	–3.0	–5.4	–5.6	–1.3
Total	156,119	164,785	165,797	155,784	156,796	5.6	6.2	–0.2	0.4
				Peak value—S3					
Benefits	147,667	129,248	120,458	114,735	142,326	–12.5	–18.4	–22.3	–3.6
Taxes									
Payroll	57,307	66,872	63,516	65,697	58,166	16.7	10.8	14.6	1.5
Income	79,472	90,849	83,977	79,219	79,542	14.3	5.7	–0.3	0.1
Consumption	19,339	19,264	18,304	18,479	19,088	–0.4	–5.4	–4.5	–1.3
Total	156,119	176,985	165,797	163,394	156,796	13.4	6.2	4.7	0.4

				Option value—S1					
Benefits	145,711	128,967	115,129	112,722	140,496	–11.5	–21.0	–22.6	–3.6
Taxes									
Payroll	58,981	62,731	63,293	62,491	59,439	6.4	7.3	6.0	0.8
Income	82,021	85,663	81,469	76,800	81,702	4.4	–0.7	–6.4	–0.4
Consumption	20,333	19,605	19,034	19,039	20,014	–3.6	–6.4	–6.4	–1.6
Total	161,335	168,000	163,795	158,330	161,155	4.1	1.5	–1.9	–0.1
				Option value—S2					
Benefits	145,529	126,448	115,273	112,682	140,477	–13.1	–20.8	–22.6	–3.4
Taxes									
Payroll	59,882	63,806	63,223	62,574	60,228	6.6	5.6	4.5	0.6
Income	82,656	86,643	80,937	76,560	82,286	4.8	–2.1	–7.4	–0.4
Consumption	20,354	19,549	18,996	19,001	20,043	–4.0	–6.7	–6.6	–1.5
Total	162,891	169,998	163,156	158,136	162,557	4.4	0.2	–2.9	–0.2
				Option value—S3					
Benefits	145,529	127,191	115,273	113,163	140,577	–12.6	–20.8	–22.2	–3.4
Taxes									
Payroll	59,882	68,464	63,223	64,393	60,228	14.3	5.6	7.5	0.6
Income	82,656	92,441	80,937	77,924	82,286	11.8	–2.1	–5.7	–0.4
Consumption	20,354	20,050	18,996	19,312	20,043	–1.5	–6.7	–5.1	–1.5
Total	162,891	180,955	163,156	161,629	162,557	11.1	0.2	–0.8	–0.2

Notes: The first five columns show the PDV of benefits and taxes under the base plan and under each of the four illustrative reforms. The last four columns show the change relative to the base, for benefits and for taxes.

inflows. For example, we consider all tax revenues, even though only some of them help toward financing goods and services for the elderly, while some public subsidies to the old (e.g., more generous reimbursement of health expenditures, nursing home care, long-term care, public transportation) do not appear on the outflow side.

When measuring the impact of the various reforms on the different components reported in table 1.3 as a proportion of the baseline benefits, we find that the Common Reform is the most powerful one in terms of the change in the PDV of benefits, followed by the Actuarial Reform. This finding is not too surprising, given the fact that Belgians leave the workforce rather early in their life cycle, and hence are fully hit by the actuarial adjustments (Actuarial and Common reforms) and the reduced availability of benefits before the early retirement age of the social security system (Common Reform). The same lack of availability of benefits before the age of 60 is also the main cause of the drop in income tax receipt under the Common Reform, with a drop of 5 percent in all but the PV S3 simulation methodology. Overall, it is fair to say that the impact as measured using the PV and OV estimates is rather similar.

As for the Belgian Reform, it only displays a rather modest effect in terms of its impact on the value of the PDV of benefits, while its likely cost in terms of redistribution is rather heavy. Several reasons help explain this result. First of all, the reform only affects the wage earners' schemes, which casts the order of magnitude of the change in a different light. Further, the effect of the changes only affects one particular form of retirement income, and does not affect payments, either through the unemployment or the early retirement systems. Hence, the changes only affect people retiring early through the change of the benefits they receive starting at age 65, as the latter remains the age at which people are switched into the retirement system. Therefore, for a person aged 50, the effect of the changes only apply on income he or she starts receiving in fifteen years' time, and this with an annual 3 percent real discount factor. For a person aged 65, nothing much changes in terms of benefits received, unless (obviously) the person had experienced a longer spell on a social insurance program in the past. Finally, the reform is somewhat buffered by the availability of means-tested minimum benefits, which increasingly become interesting substitutes for people with incomplete earnings histories due to sickness, unemployment, disability, and so forth.

To illustrate the distinction between the behavioral and mechanical effects of a reform, let us focus on the net benefits an individual receives in a world of absolute certainty with respect to his or her life span. We denote them as b, and they depend on a policy parameter x and on the age of retirement z, itself a function of x. We thus have

$$b[x, z(x)].$$

A reform consists of a change from x to x'. The effect (*Diff*) of such a reform is:

$$Diff = b[x', z(x')] - b[x, z(x)]$$

We can decompose *Diff* into two parts, $Diff^m$ and $Diff^b$, corresponding to the mechanical and behavioral effects, with

$$Diff^m = b[x', z(x)] - b[x, z(x)],$$
$$Diff^b = b[x', z(x')] - b(x', z(x)],$$

and $Diff^m + Diff^b = Diff$.

Table 1.4 displays a strong behavioral effect for all scenarios. This is particularly true when considering the first reform using simulation technique S3, where the net behavioral effect of benefits minus contributions as a proportion of base benefits is the most powerful (more than a quarter of base benefits). Table 1.4 shows that the behavioral response for both OV and PV estimations of the latter scenario imply a fiscal impact of the behavioral response that represents more than 50 percent of the total effect, essentially because of the outright shift by three years of all dummies. At first sight it might be curious to have a fiscal implication of the behavioral effect that is negative, that is, that the cohort's contribution to the government budget increases as a reaction to the change in its behavior. However, the finding is less surprising when we notice that another important variable has changed as a consequence of this change in behavior, notably the length of the working life. Hence, the loss of the cohort in terms of net benefits minus taxes has to be seen as a tradeoff for the gain in income due to a higher-than-average working life.

Another puzzling point from table 1.4 is the indetermination in the sign of the behavioral effect on the PDV of benefits. It is positive in most cases, except for the Belgian Reform, as well as for the Three-Year Reform using simulation methodology S2 in the Option Value model. Table 1.5 illustrates the decomposition by age of retirement of the fiscal implication of the behavioral effect on benefits for a median household facing the Actuarial Reform. It appears that the behavioral effect is negative until age 60 and then turns positive, the sign coming from the sign of the probability change. Even with negative probability changes being larger than positive ones in absolute value, as is the case in our example, we can observe that the total behavioral effect for this household is positive. The structure of the postreform PDV of benefits by age of exit from the labor force helps to explain this finding. As the Actuarial Reform is much less penalizing in the age range 61 to 70 than between the ages of 50 and 60, the PDV of benefits is steeply increasing as a function of age of the labor force exit, and hence leads to a positive behavioral effect when aggregating overall possible exit ages. The same reasoning can be applied to the Common Reform and to a

Table 1.4 **Decomposition of the total effect of reforms, change in PDV**

	Change in present discounted value											
	Three-Year Reform			Actuarial Reform			Common Reform			Belgian Reform		
	Mechanical	Behavioral	Total	Mechanical	Behavioral	Total	Mechanical	Behavioral	Total	Mechanical	Behavioral	Total
						Peak value—S1						
Benefits	–19,582	4,132	–15,450	–34,745	8,429	–26,316	–35,323	2,853	–32,470	–5,073	–137	–5,210
Total taxes	–3,592	10,614	7,022	–10,691	21,070	10,379	–12,849	13,177	329	–1,360	2,168	808
Net change	–15,990	–6,482	–22,472	–24,054	–12,642	–36,696	–22,474	–10,325	–32,799	–3,713	–2,305	–6,018
Change as % of base benefits	–10.9	–4.4	–15.3	–16.4	–8.6	–25.0	–15.3	–7.0	–22.4	–2.5	–1.6	–4.1
						Peak value—S2						
Benefits	–20,635	2,210	–18,425	–36,142	8,934	–27,208	–36,498	2,945	–33,552	–5,242	–99	–5,341
Total taxes	–3,787	12,453	8,666	–10,963	20,641	9,678	–13,028	12,692	–335	–1,416	2,092	677
Net change	–16,849	–10,243	–27,092	–25,179	–11,707	–36,886	–23,470	–9,747	–33,217	–3,826	–2,191	–6,018
Change as % of base benefits	–11.4	–6.9	–18.3	–17.1	–7.9	–25.0	–15.9	–6.6	–22.5	–2.6	–1.5	–4.1
						Peak value—S3						
Benefits	–20,635	2,217	–18,418	–36,142	8,934	–27,208	–36,498	3,566	–32,932	–5,242	–99	–5,341
Total taxes	–3,787	24,653	20,866	–10,963	20,641	9,678	–13,028	20,302	7,275	–1,416	2,092	677
Net change	–16,849	–22,436	–39,284	–25,179	–11,707	–36,886	–23,470	–16,737	–40,206	–3,826	–2,191	–6,018
Change as % of base benefits	–11.4	–15.2	–26.6	–17.1	–7.9	–25.0	–15.9	–11.3	–27.2	–2.6	–1.5	–4.1

					Option value—S1							
Benefits	–18,530	1,785	–16,745	–33,796	3,203	–30,583	–34,554	1,565	–32,990	–4,947	–268	–5,216
Total taxes	–3,657	10,323	6,666	–10,882	13,343	2,461	–13,047	10,042	–3,004	–1,389	1,210	–179
Net change	–14,873	–8,538	–23,410	–22,904	–10,140	–33,044	–21,508	–8,478	–29,986	–3,558	–1,478	–5,036
Change as % of base benefits	–10.2	–5.9	–16.1	–15.7	–7.0	–22.7	–14.8	–5.8	–20.6	–2.4	–1.0	–3.5
					Option value—S2							
Benefits	–18,931	–150	–19,081	–33,102	2,846	–30,256	–34,194	1,346	–32,848	–4,729	–223	–4,952
Total taxes	–3,743	10,849	7,107	–10,764	11,029	265	–13,036	8,280	–4,755	–1,307	973	–334
Net change	–15,188	–11,000	–26,188	–22,338	–8,183	–30,521	–21,158	–6,934	–28,092	–3,422	–1,195	–4,618
Change as % of base benefits	–10.4	–7.6	–18.0	–15.3	–5.6	–21.0	–14.5	–4.8	–19.3	–2.4	–0.8	–3.2
					Option value—S3							
Benefits	–18,931	593	–18,338	–33,102	2,846	–30,256	–34,194	1,827	–32,367	–4,729	–223	–4,952
Total taxes	–3,743	21,806	18,064	–10,764	11,029	265	–13,036	11,774	–1,262	–1,307	973	–334
Net change	–15,188	–21,213	–36,401	–22,338	–8,183	–30,521	–21,158	–9,947	–31,105	–3,422	–1,195	–4,618
Change as % of base benefits	–10.4	–14.6	–25.0	–15.3	–5.6	–21.0	–14.5	–6.8	–21.4	–2.4	–0.8	–3.2

Notes: The table shows the total effect of the reform (shown in table 1.3) decomposed into mechanical and behavioral components. The first row shows the change in benefits. The second row shows the change in all taxes. The third row shows the net change (the change in benefits minus the change in taxes). The fourth row shows the net change as a percent of base benefits (table 1.3).

Table 1.5 **Decomposition of the behavioral effect on benefits for a median household (Actuarial Reform—option value—S2)**

	Base case		Actuarial Reform			
Age	PDV of benefits (a)	Probability of exit (%) (b)	PDV of benefits (c)	Probability of exit (%) (d)	Probability change (d) – (b) = (e)	Behavioral effect (e) · (c)
50	329,538	0.82	224,385	0.44	–0.38	–855
51	337,893	0.99	227,271	0.53	–0.47	–1,057
52	347,071	2.02	229,978	1.09	–0.92	–2,122
53	354,961	2.19	233,078	1.17	–1.02	–2,379
54	362,829	2.97	236,653	1.59	–1.38	–3,263
55	369,887	5.84	240,407	3.32	–2.51	–6,043
56	376,577	5.21	243,768	3.01	–2.20	–5,366
57	383,305	8.28	246,404	4.98	–3.30	–8,131
58	388,166	9.85	253,870	6.62	–3.23	–8,198
59	393,696	4.41	266,432	3.14	–1.27	–3,392
60	398,815	19.11	279,171	18.42	–0.69	–1,922
61	389,943	11.52	296,357	14.09	2.57	7,604
62	389,340	4.41	319,259	5.86	1.45	4,619
63	386,618	3.77	340,224	5.56	1.79	6,084
64	383,631	2.58	360,614	4.15	1.58	5,684
65	381,773	6.73	381,773	12.05	5.33	20,332
66	356,814	2.71	356,814	4.86	2.15	7,667
67	333,433	1.09	333,433	1.96	0.86	2,883
68	311,112	0.44	311,112	0.79	0.35	1,081
69	289,168	0.18	289,168	0.32	0.14	404
70	268,414	0.12	268,414	0.21	0.09	254
Total						13,886

certain degree to the Belgian Reform. In this case, as the structure of the postreform PDV of benefits does not greatly change from the base case, the negative probability changes, which typically extends from 50 to 56, creating a larger behavioral effect than the positive one within the age range of 57 to 70. As to the Three-Year Reform, the probability changes are so erratic that no typical rules can be found.

Figure 1A.1, panels A–G, in the appendix illustrate the effects of the Three-Year Reform along several different margins. Figure 1A.1, panel A displays the PDV of benefits per worker at any given age of retirement, as well as the impact thereon by the reform. Figure 1A.1, panel B summarizes the total of taxes paid by age of labor force exit. This figure again illustrates the fact that the elderly are still important contributors to the federal budget. This is particularly true for those working relatively late in their life cycle, as the fiscal pressure on the productive-factor labor is relatively high compared to the pressure on pension benefits. Figure 1A.1, panels C and E display the simulated patterns of labor force exit over the age range 50 to

70, which follow a rather smooth pattern for the S1 simulation methodology and a more erratic one for simulation methodology S3. The role of the shift in the age dummies becomes evident in figure 1A.1, panel E. Figure 1A.1, panels D and F display the age-specific impact of the reform, with a rather modest net change (PDV of benefits minus taxes) at all ages, whereas the change of the PDV of benefits is of varying sign and characterized by larger swings in magnitude. Clearly, the tax system (payroll, income, and consumption) plays an important role in the determination of the sign and magnitude of the net contribution to the federal budget at all possible exit ages. Figure 1A.1, panel G illustrates the power of these fiscal implications as a proportion of GDP. The figure shows that the mechanical effects are approximately of the same size for all possible simulation methodologies, but that the difference between these reforms stems from the behavioral effect.

Figures 1A.2, panels A, B, and C, 1A.3, panels A, B, and C, and 1A.4, panels A, B, and C in the appendix illustrate the key results for the other three reforms in terms of the changes in the PDV of benefits and in the retirement probabilities at the different ages, as well as the fiscal implications as a proportion of GDP. The latter indicator allows for a comparison of the total budgetary effect of the various reforms in terms of a common measure. It appears that—budgetarily speaking—the Actuarial Reform is the most powerful reform in all cases, excluding those relying on the S3 methodology. Even if the Common Reform has the strongest impact on the level of benefits because of its inherent ineligibility to retirement benefits before age 60, it is the Actuarial Reform that creates the strongest incentives for individuals to work longer. Indeed, a comparison of figure 1A.3, panel C and figure 1A.2, panel C shows that the retirement rate is lower for the Actuarial Reform before age 60, and a bit higher after this age.

1.6 Distributional Analysis

Table 1.6 and table 1.7 display the distributional implications of the reforms when splitting the population into five income categories. A common feature of the first three reforms is that the three middle earnings quintiles, hence the middle classes, bear the brunt of the reform. This is particularly true for the Common Reform, where the impact on the two extreme income quintiles is much less pronounced. The results are less extreme for the case of the Three-Year Reform, where the changes of all income quintiles are relatively close to one another as expressed in these relative terms. The Actuarial Reform again is the middle ground. Only the lowest-income quintile loses less in relative terms under this reform proposal.

The Belgian Reform, on the other hand, has a very different redistributive pattern. While income quintiles 3 and 4 again face the largest proportional change, as displayed in tables 1.6 and 1.7, it is now the lowest-income

Table 1.6 **Distributional analysis of the total effect of the reform (change in PDV OV-S1)**

	Present discounted value					Total change relative to base			
	Base	Three-Year Reform	Actuarial Reform	Common Reform	Belgian Reform	Three-Year Reform	Actuarial Reform	Common Reform	Belgian Reform
				Quintile 1 (highest)					
Benefits	178,937	162,404	144,532	139,462	176,790	–16,532	–34,405	–39,475	–2,146
Total taxes	344,551	355,545	348,705	336,867	344,937	10,994	4,154	–7,684	386
Net change						–27,527	–38,559	–31,790	–2,532
Change as % of base benefits						–15.4	–21.5	–17.8	–1.4
				Quintile 2					
Benefits	168,756	148,930	129,998	123,519	163,889	–19,825	–38,757	–45,237	–4,866
Total taxes	179,867	187,627	182,373	174,499	179,591	7,759	2,506	–5,369	–276
Net change						–27,584	–41,263	–39,868	–4,590
Change as % of base benefits						–16.3	–24.5	–23.6	–2.7

				Quintile 3					
Benefits	146,169	128,311	111,982	111,320	138,546	–17,857	–34,187	–34,848	–7,622
Total taxes	129,816	136,579	133,288	129,335	129,193	6,763	3,472	–481	–623
Net change						–24,620	–37,659	–34,368	–7,000
Change as % of base benefits						–16.8	–25.8	–23.5	–4.8
				Quintile 4					
Benefits	128,841	112,534	100,241	100,403	121,227	–16,307	–28,600	–28,438	–7,614
Total taxes	95,886	101,052	98,347	96,358	95,420	5,166	2,461	472	–466
Net change						–21,473	–31,061	–28,910	–7,148
Change as % of base benefits						–16.7	–24.1	–22.4	–5.5
				Quintile 5 (lowest)					
Benefits	107,197	93,953	90,059	89,672	103,394	–13,243	–17,137	–17,525	–3,803
Total taxes	62,1412	65,154	62,181	60,100	62,525	2,743	–230	–2,312	113
Net change						–15,896	–16,907	–15,213	–3,916
Change as % of base benefits						–14.9	–15.8	–14.2	–3.7

Notes: The table shows the distributional impact of reform decomposed by income quintile using OV-S1 estimates. The first five columns show the PDV of benefits and taxes under the base plan and under each of the four illustrative reforms. The last four columns show the change relative to the base, for benefits and for taxes. For each quintile, the first row shows the change in benefits.

Table 1.7 **Distributional analysis of the total effect of the reform (change in PDV OV-S3)**

	Present discounted value					Total change relative to base			
	Base	Three-Year Reform	Actuarial Reform	Common Reform	Belgian Reform	Three-Year Reform	Actuarial Reform	Common Reform	Belgian Reform
				Quintile 1 (highest)					
Benefits	178,632	160,507	145,089	141,042	176,857	–18,125	–33,543	–37,590	–1,775
Total taxes	347,617	378,058	348,367	336,839	347,803	30,442	750	–10,777	187
Net change						–48,567	–34,293	–26,813	–1,962
Change as % of base benefits						–27.2	–19.2	–15.0	–1.1
				Quintile 2					
Benefits	168,531	147,322	130,005	124,102	164,006	–21,209	–38,527	–44,429	–4,525
Total taxes	181,871	202,958	181,412	178,730	181,441	21,087	–459	–3,141	–430
Net change						–42,296	–38,068	–41,288	–4,096
Change as % of base benefits						–25.1	–22.6	–24.5	–2.4

				Quintile 3					
Benefits	145,861	126,299	112,007	111,834	138,538	–19,563	–33,854	–34,028	–7,324
Total taxes	131,559	149,047	132,702	134,240	130,749	17,489	1,143	2,681	–810
Net change						–37,051	–34,997	–36,709	–6,514
Change as % of base benefits						–25.4	–24.0	–25.2	–4.5
				Quintile 4					
Benefits	128,618	110,460	100,250	100,573	121,214	–18,158	–28,368	–28,045	–7,405
Total taxes	96,845	110,481	97,713	100,710	96,233	13,635	868	3,864	–612
Net change						–31,793	–29,236	–31,910	–6,793
Change as % of base benefits						–24.7	–22.7	–24.8	–5.3
				Quintile 5 (lowest)					
Benefits	107,308	92,616	90,171	89,036	103,608	–14,692	–17,136	–18,272	–3,699
Total taxes	62,565	70,500	61,603	63,090	62,591	7,934	–962	524	26
Net change						–22,626	–16,174	–18,796	–3,725
Change as % of base benefits						–21.1	–15.1	–17.5	–3.5

Notes: The table shows the distributional impact of reform decomposed by income quintile using OV-S3 estimates. The first five columns show the PDV of benefits and taxes under the base plan and under each of the four illustrative reforms. The last four columns show the change relative to the base, for benefits and for taxes. For each quintile, the first row shows the change in benefits.

quintile that loses out more than the first- and second-income quintiles. The reasons for this finding are multiple. First, they are due to the way the reform only affects those that are on the wage earner scheme. Hence, it does not affect civil servants who have relatively high life cycle earnings, therefore making them relatively more numerous in the upper-income quintiles. Second, the reform only touches those with incomplete careers, and hence essentially touches two categories of people. First, it affects those with unstable and incomplete career patterns due to sickness, invalidity, unemployment, or accident. Second, it changes incentives for those choosing to retire early. Hence, the reform is less important for higher-income white collar workers, who face lower probabilities of layoff, accident, sickness, and invalidity.

To get a better grasp of the distributive implications of these alternative extensions, we have used two standard measures of inequality and poverty: the Gini coefficient and the poverty rate, measured as the fraction of households with lifetime income (starting at age 50) below 50 percent of the average lifetime income.

The results are given in table 1.8 for the baseline and the Three-Year Reform. Not surprisingly, the comparison between these two cases indicates that the reform generates more inequality and more poverty than what we observe in the baseline. The reason is simple: retiring later mostly benefits high-income households that are concentrated in the top income quintiles.

This comparison is, however, only of a very partial relevance. Compared to the baseline, the reform scenario generates additional revenue to the system. By reallocating this additional revenue among households we could easily get a more favorable outcome from the standpoint of both poverty and inequality reduction.

Table 1.8 **Gini indexes and poverty rates**

	Base	Three-Year	Benefits reduction
		Peak value—S1	
Gini index	0.2351	0.2461	0.2550
Poverty rate	2.89	3.82	7.02
		Peak value—S2	
Gini index	0.2327	0.2422	0.2526
Poverty rate	2.79	2.82	6.78
		Option value—S1	
Gini index	0.2360	0.2459	0.2568
Poverty rate	2.99	4.27	6.95
		Option value—S2	
Gini index	0.2363	0.2449	0.2569
Poverty rate	3.06	3.37	7.02

Table 1.9 **Comparison of two reforms with comparable budgetary impact (in € per worker)**

	Change in present discounted value					
	Three-Year			Benefits reduction (–25%)		
	Mechanical	Behavioral	Total	Mechanical	Behavioral	Total
			Peak value—S1			
Benefits	–19,582	4,132	–15,450	–36,979	–693	–37,671
Total taxes	–3,592	10,614	7,022	–12,627	1,407	–11,221
Net change	–15,990	–6,482	–22,472	–24,351	–2,099	–26,451
Change as % of base benefits	–10.9	–4.4	–15.3	–16.6	–1.4	–18.1
			Peak value—S2			
Benefits	–20,635	2,210	–18,425	–37,233	–621	–37,854
Total taxes	–3,787	12,453	8,666	–12,604	1,287	–11,317
Net change	–16,849	–10,243	–27,092	–24,629	–1,909	–26,537
Change as % of base benefits	–11.4	–6.9	–18.4	–16.7	–1.3	–18.0
			Option value—S1			
Benefits	–18,530	1,785	–16,745	–36,753	–834	–37,588
Total taxes	–3,657	10,323	6,666	–12,924	2,624	–10,300
Net change	–14,873	–8,538	–23,410	–23,830	–3,458	–27,288
Change as % of base benefits	–10.2	–5.9	–16.1	–16.4	–2.4	–18.7
			Option value—S2			
Benefits	–18,931	–150	–19,081	–36,724	–731	–37,454
Total taxes	–3,743	10,849	7,107	–12,967	2,281	–10,686
Net change	–15,188	–11,000	–26,188	–23,756	–3,012	–26,768
Change as % of base benefits	–10.4	–7.6	–18.0	–16.3	–2.1	–18.4

However, such a statement is not very precise. To get a sharper comparison, we first observe in table 1.9 that the Three-Year Reform brings additional resources equivalent to about 18 percent of overall benefits.[12] These resources could, for example, be used for financing the costs of the ongoing demographic shift, as illustrated by a drastic increase in the dependency ratio. Suppose that instead of raising the effective age of retirement, as in the Three-Year Reform, we apply a simple linear reduction of benefits to obtain the very same budgetary savings. We can then oppose two comparable or budget-neutral scenarios. Our computations show that the linear benefit reduction needed to get an 18 percent resource saving has to be larger than 18 percent. Indeed, as individuals can have behavioral reactions and as income taxes are paid on benefits, we have to apply a higher

12. This amount is obtained with the S2 simulation method. For simplicity, we refer only to this simulation method in the rest of this comparison.

reduction on gross benefits to finally get an additional revenue of 18 percent. A gross benefit reduction of 25 percent seems to work. In other words, if instead of adopting the Three-Year Reform we cut all benefits by 25 percent, we would end up with an aggregate benefit reduction of 18 percent. This is presented on table 1.9 for different calculations of the reform.

We now study the comparative incidence of these two reforms. As table 1.8 shows, both the poverty rate and the Gini coefficient are higher with the second than with the first reform.[13]

A general conclusion arises from this exercise. The benefit reduction reform represents the policy that would be implemented if nothing is done to limit the problem of financing aging. The Three-Year Reform is such a policy, which decreases the implicit tax on continued work, incites agents to work longer, leads to more revenue, less spending, and hence ultimately to smaller budgetary problems. A third type of parametric reform is an increase in social security contributions. This solution has to be ruled out in the current context of strong fiscal competition. Hence, a reform that is quickly undertaken and that keeps workers in the labor force is better in terms of redistribution than an emergency reform that decreases benefits linearly (for some time).

1.7 Conclusions

The analysis just presented shows the large potential budgetary impact of various hypothetical reforms. These reforms, though clearly selected for comparative and illustrative purposes, indicate the importance of behavioral effects that citizens display when faced with a varying landscape in terms of their social insurance architecture. Different real-life reform alternatives are imaginable in the Belgian context. Any such real-life alternative will have to include—at least to some degree—some elements analyzed in our stylized scenarios; for example, changes in the key retirement ages, the use of actuarial adjustment factors, and a convergence between the three main retirement systems—while at the same time not forgetting the labor-demand side. The Common Reform admittedly looks somewhat unrealistic. In that sense, our Belgian Reform is a first step in the direction of getting these hypothetical simulations closer to the field. By eliminating one particular aspect of our largely Bismarckian system, namely an aspect that is not insurance based, we reestablish a clearer link between contributions and benefits. The results indicate that even such a partial reform might have important consequences, not only in levels but also on the distributional side. The results of the present distributional analysis also illustrate the need to refine the analysis in future research.

However, we would like to insist on the fact that the analysis relies heavily on some assumptions we made—most notably, the limitation to the

13. For more on this, see Cremer and Pestieau (2003).

cohort of 50-year-olds and the steady-state assumption, both of which clearly limit the generality with which one can apply these results to real-world proposals. Hence there is a clear need for further research, to get the reform proposals closer in line with politically feasible and economically viable alternatives over the long run, as well as to check the robustness of our simulation approach.

This chapter shows that the social security system at large (i.e., including unemployment and disability insurance as well as early retirement schemes) induces Belgian workers to retire earlier than they ought to. Most reforms contemplated imply that we bring this comprehensive social security package closer to actuarial fairness. We realize that this is questionable and ought to be viewed as a first step toward a more complete analysis of reforms. Assume, indeed, that a fraction of these early retirees who draw benefits from disability benefits are truly disabled, and a fraction of those drawing benefits from unemployment insurance are truly involuntarily unemployed. A *good* reform should attempt to identify these workers and let them benefit from social insurance. This may imply improving the audit and control procedures, particularly for unemployment. Then, for the remaining voluntary early retirees, we would apply our alternative actuarial reforms.

Appendix

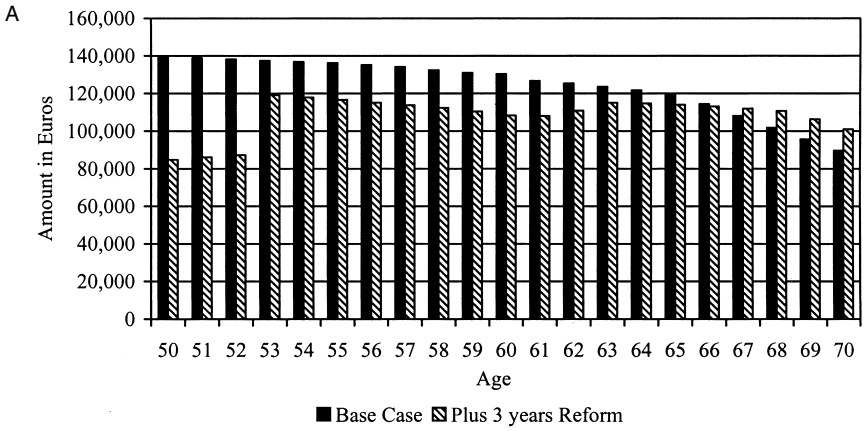


Fig. 1A.1 ***A,*** **PDV of benefits by age of labor force exit (in EUR per worker);** ***B,*** **PDV of taxes by age of labor force exit (in EUR per worker);** ***C,*** **Distribution of age of labor force exit (option value–S1);** ***D,*** **Total effect by age of labor force exit (Three-Year Reform–option value–S1);** ***E,*** **Distribution of age of labor force exit (option value–S3);** ***F,*** **Total effect by age of labor force exit (Three-Year Reform–option value–S3);** ***G,*** **Fiscal implications of the Three-Year Reform as a percent of GDP**

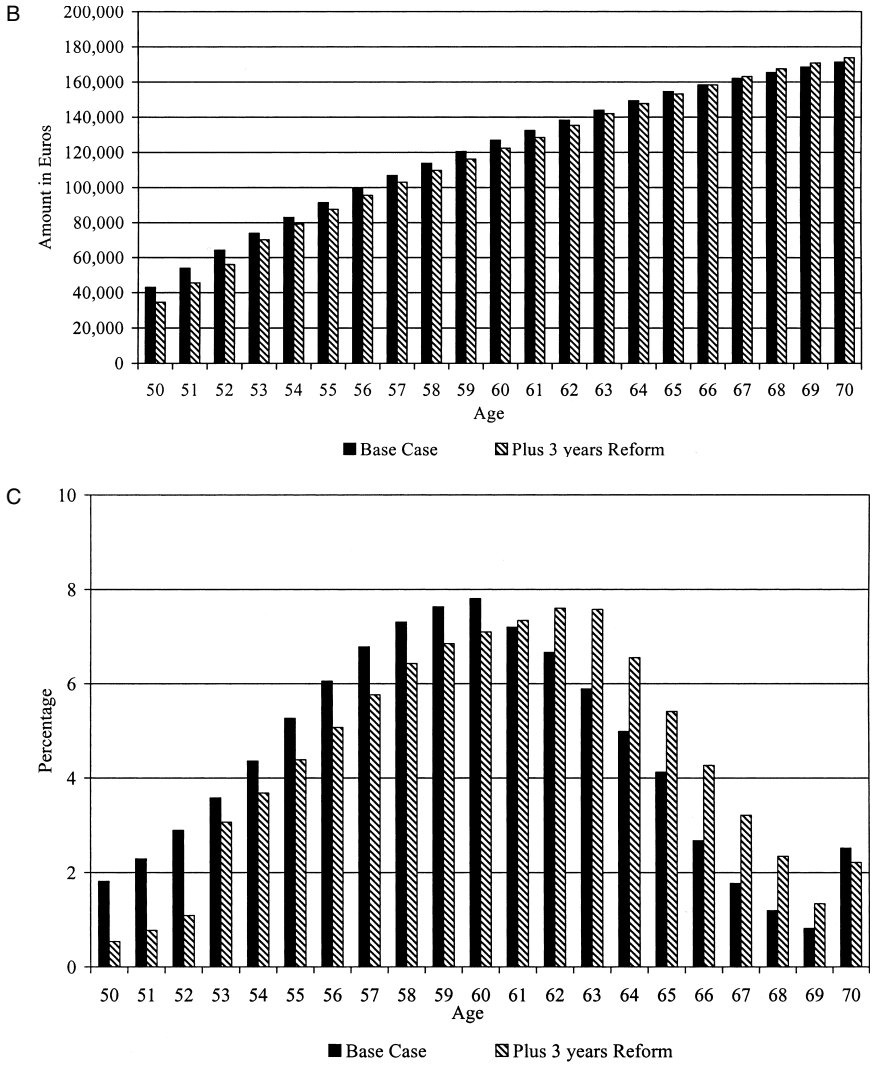
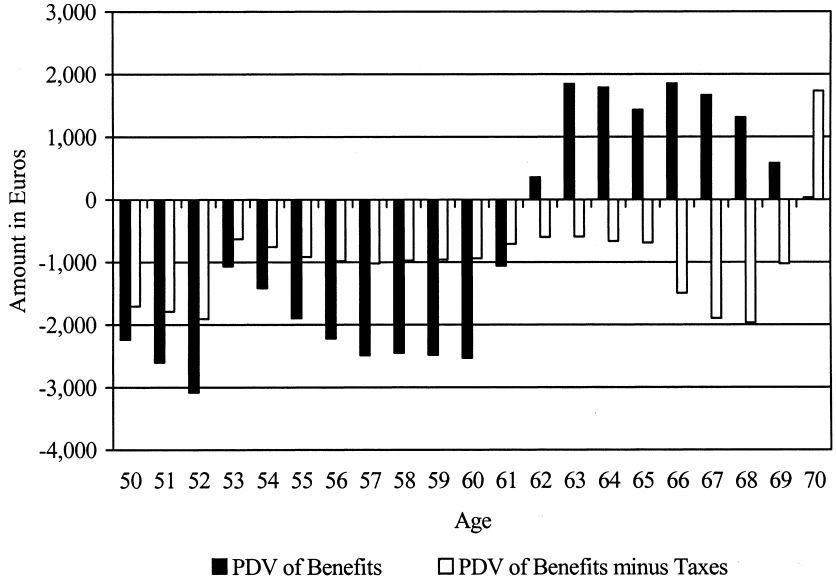


Fig. 1A.1 (cont.) *A,* PDV of benefits by age of labor force exit (in EUR per worker); *B,* PDV of taxes by age of labor force exit (in EUR per worker); *C,* Distribution of age of labor force exit (option value–S1); *D,* Total effect by age of labor force exit (Three-Year Reform–option value–S1); *E,* Distribution of age of labor force exit (option value–S3); *F,* Total effect by age of labor force exit (Three-Year Reform–option value–S3); *G,* Fiscal implications of the Three-Year Reform as a percent of GDP

D



E

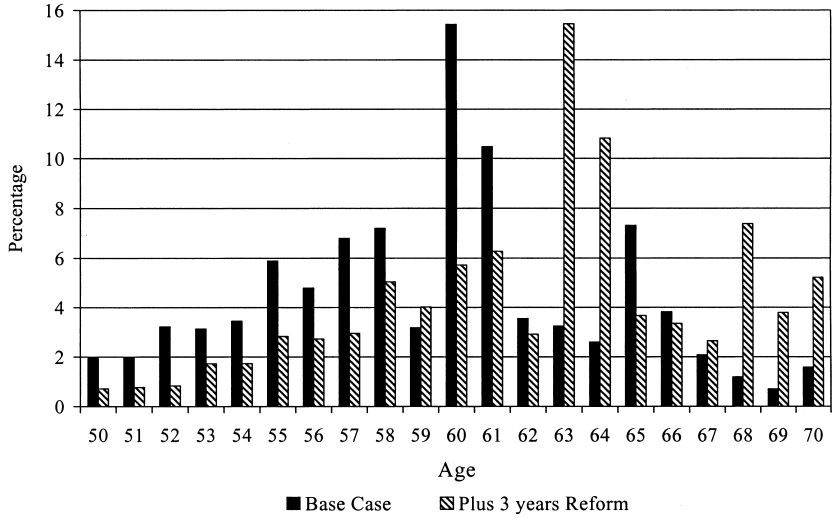


Fig. 1A.1 (cont.) *A*, PDV of benefits by age of labor force exit (in EUR per worker); *B*, PDV of taxes by age of labor force exit (in EUR per worker); *C*, Distribution of age of labor force exit (option value–S1); *D*, Total effect by age of labor force exit (Three-Year Reform–option value–S1); *E*, Distribution of age of labor force exit (option value–S3); *F*, Total effect by age of labor force exit (Three-Year Reform–option value–S3); *G*, Fiscal implications of the Three-Year Reform as a percent of GDP

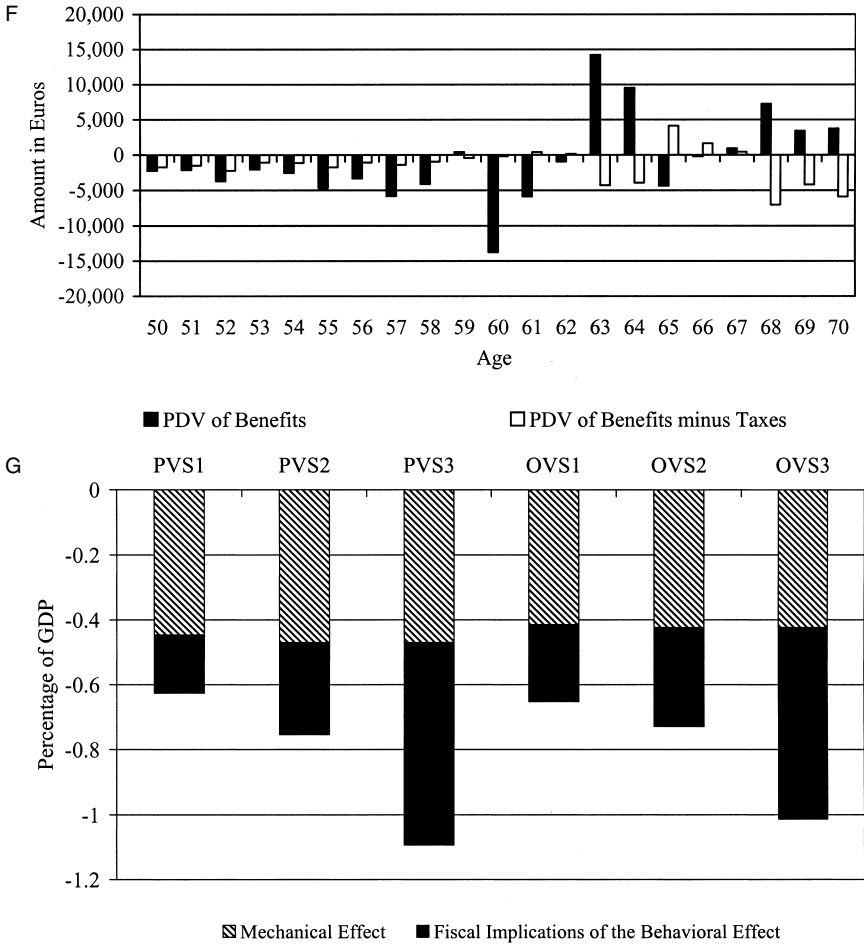


Fig. 1A.1 (cont.) ***A,*** **PDV of benefits by age of labor force exit (in EUR per worker);** ***B,*** **PDV of taxes by age of labor force exit (in EUR per worker);** ***C,*** **Distribution of age of labor force exit (option value–S1);** ***D,*** **Total effect by age of labor force exit (Three-Year Reform–option value–S1);** ***E,*** **Distribution of age of labor force exit (option value–S3);** ***F,*** **Total effect by age of labor force exit (Three-Year Reform–option value–S3);** ***G,*** **Fiscal implications of the Three-Year Reform as a percent of GDP**

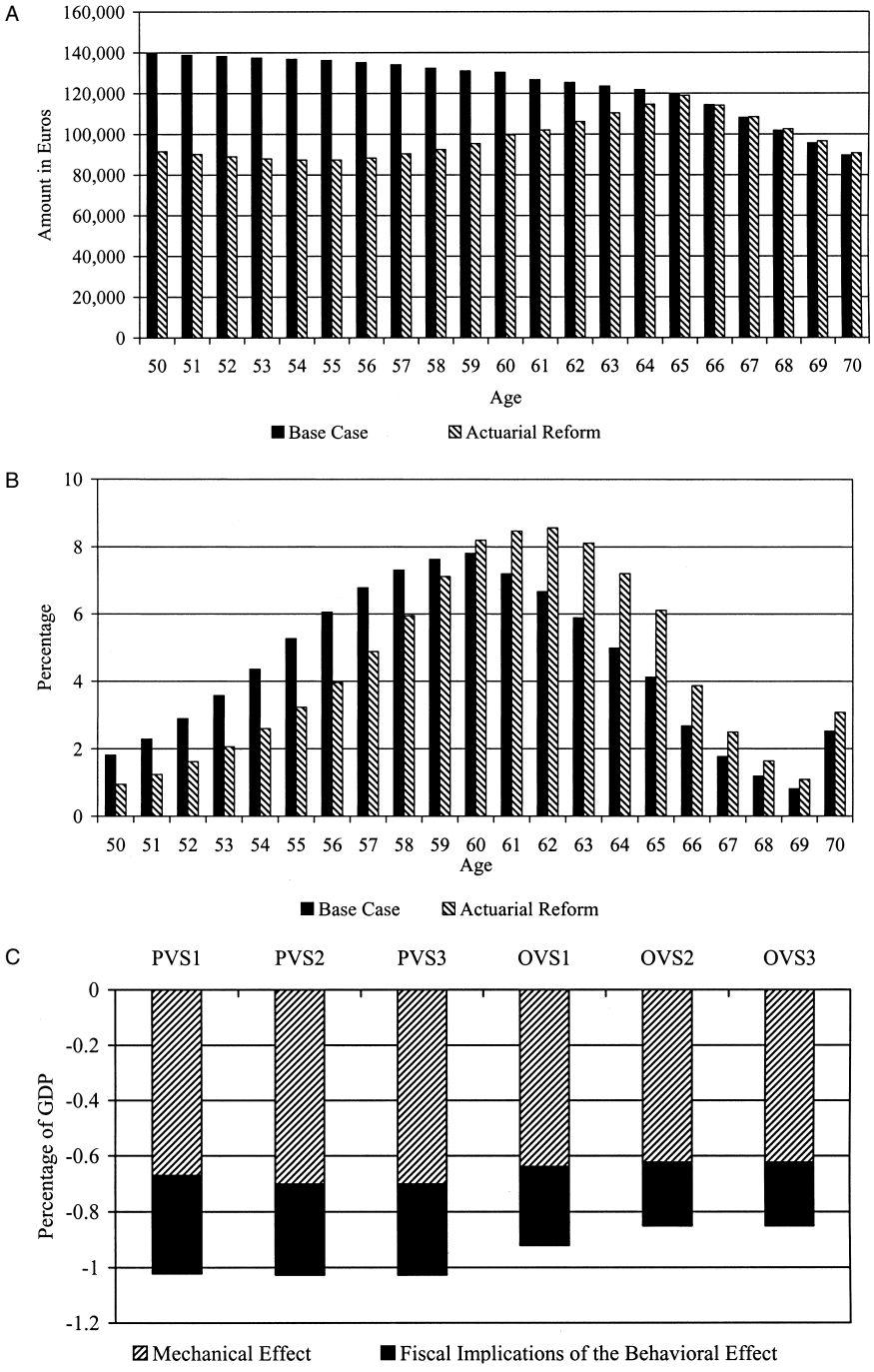


Fig. 1A.2 *A,* **PDV of benefits by age of labor force exit (in EUR per worker);** *B,* **Distribution of age of labor force exit (option value–S1);** *C,* **Fiscal implications of the Actuarial Reform as a percent of GDP**

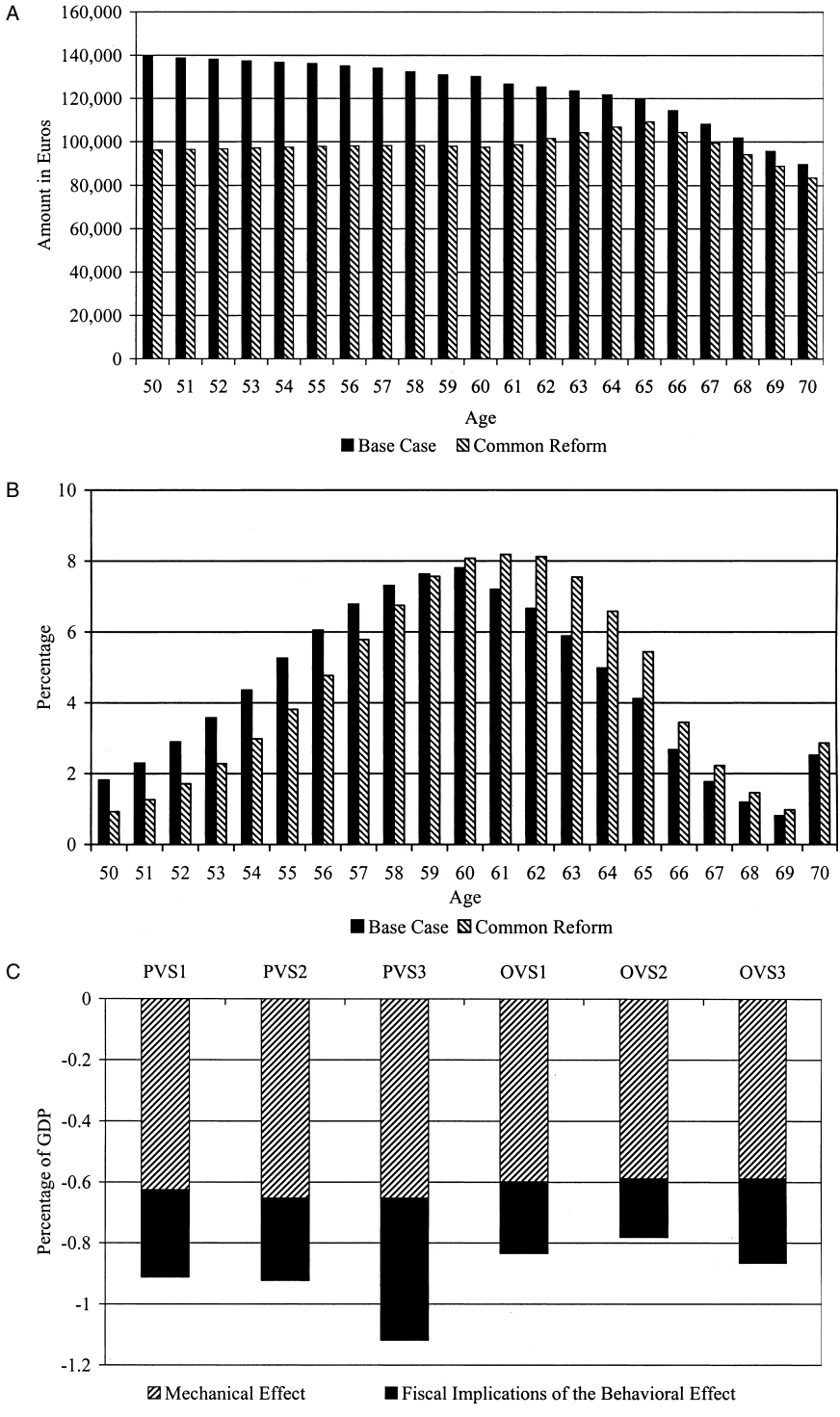


Fig. 1A.3 ***A,*** **PDV of benefits by age of labor force exit (in EUR per worker);** ***B,*** **Distribution of age of labor force exit (option value–S1);** ***C,*** **Fiscal implications of the Common Reform as a percent of GDP**

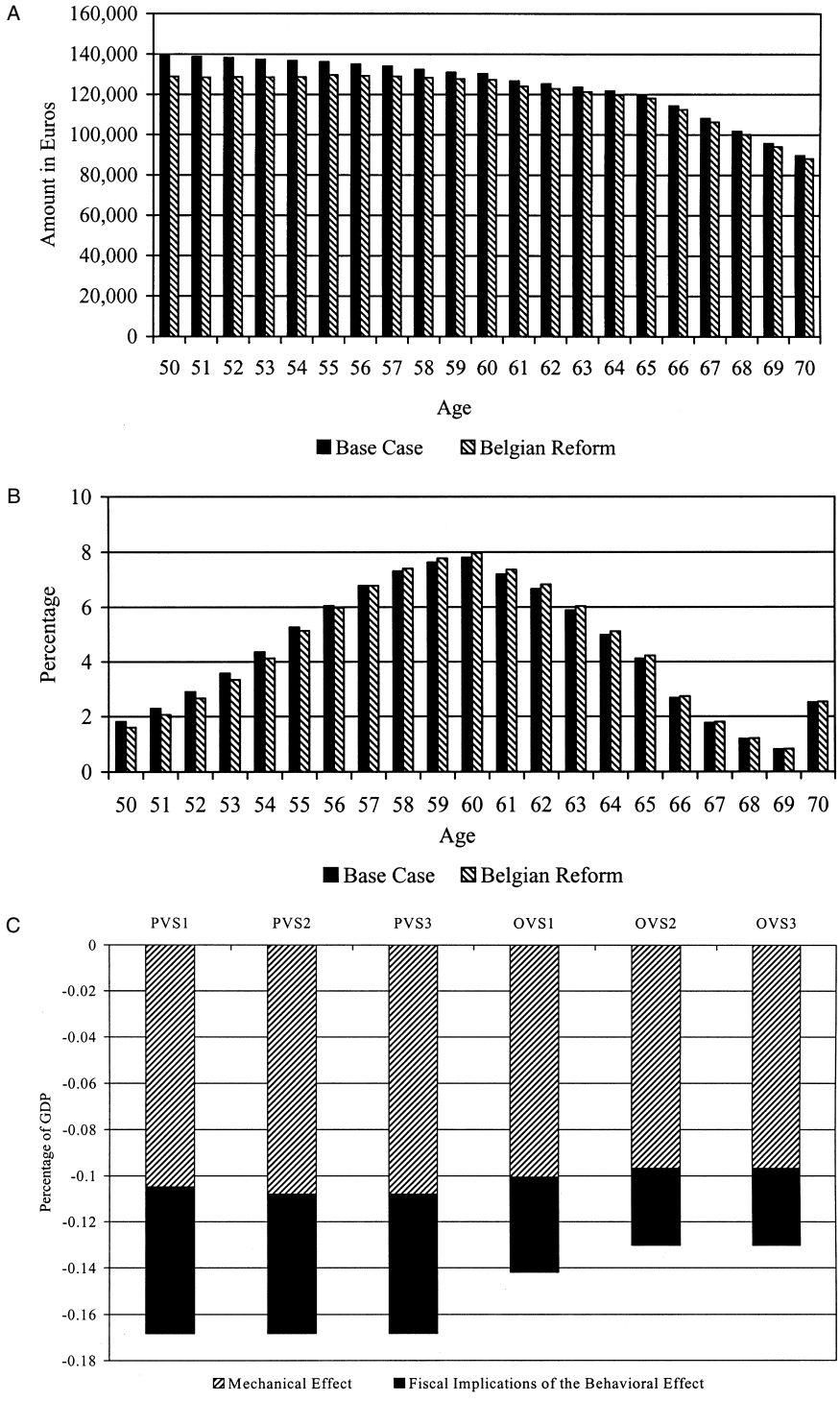


Fig. 1A.4 *A*, **PDV of benefits by age of labor force exit (in EUR per worker);** *B*, **Distribution of age of labor force exit (option value–S1);** *C*, **Fiscal implications of the Belgian Reform as a percent of GDP**

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