

ESTIMATING PENSION LIABILITIES: A METHODOLOGICAL FRAMEWORK

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Why care about posterity?
What has posterity ever
done for me?
Groucho Marx

INTRODUCTION

There is increasing concern that public finances will be subjected to substantial pressure from the scale and financing requirements of public pension schemes – in particular in the light of ageing populations projected for most OECD countries. The aim of this paper is to present a methodology for evaluating the likely size of public pension liabilities in the major seven OECD economies and analysing ways by which these liabilities might be financed.¹ While the results are only indicative, in particular because many simplifying assumptions have had to be made, they strongly support the conclusion that financing of public pension systems may well increasingly complicate the achievement of sound public finances.

After a brief review of the public pension systems in the countries under consideration, the methodology used shows that the size of the estimated liabilities strongly depends on the assumed formula determining the level of pensions. It also shows how liabilities can be split into different components: *i*) pension rights accrued up to 1990; *ii*) new rights accruing to the workforce; and *iii*) the rights new entrants will acquire in later years. Next, four ways to finance the liabilities are considered: *i*) continuing or re-introducing Pay-As-You-Go financing (matching future flows of pension contributions and pension expenditures on a year-by-year basis); *ii*) a once-and-for-all increase in pension contribution rates; *iii*) partial rather than full uprating of assessed past earnings (on which individual pension rates are based): and *iv*) an increase in the minimum pensionable age.

I. THE BASIC FEATURES OF PUBLIC PENSION SCHEMES

A. Coverage and financing

Countries typically employ a mixture of various types of public pension schemes (Table 1). Basic coverage for all residents is provided by general schemes, with the same rules applying to all, irrespective of the industry of employment or the employment status (salaried worker, self-employed, etc.). Pensions under general schemes may be either earnings-related or flat-rate, or a combination of the two, and may be means-tested or supplemented by means-

Table 1. Public pension expenditure and beneficiaries in the main seven countries¹

	United States	Japan	Germany	France	Italy	United Kingdom	Canada
	Per cent of GDP						
Expenditure	5.1	5.7	6.9	9.0	10.6	6.6	3.9
Earnings-related schemes	5.1	3.4	6.4	8.4	8.9	1.6	1.4
Flat-rate schemes	0.0	2.3	0.0	0.0	0.0	4.2	1.9
Means-tested schemes	0.0	0.0	0.0	0.5	0.4	0.8	0.6
Others	0.0	0.0	0.5	0.1	1.3	0.0	0.0
	Per cent of employed labour force						
Beneficiaries	26.4	35.0	31.8	55.9	52.6	38.4	24.9

1. In 1990 in the United States and Canada, 1989 in Germany and 1988 elsewhere (fiscal year 1988 in Japan). Figures for Japan include survivors and disability pensions; earnings-related civil servants' pensions and other categorical pensions are comprised in flat-rate schemes. Social security contributions paid by the government in Germany are in "others".

tested benefits. The retirement age is fixed in all countries, but there typically exist provisions for early or deferred retirement at actuarially adjusted pension rates, conditional upon a maximum pensionable age and a minimum number of contribution years. Other schemes, with less comprehensive participation than the general scheme, may provide additional coverage to specific sectors of the population or the labour force. The financing and administration of these schemes may be separate from the government, even though participation is mandatory and financial transfers across the various schemes sometimes occur.

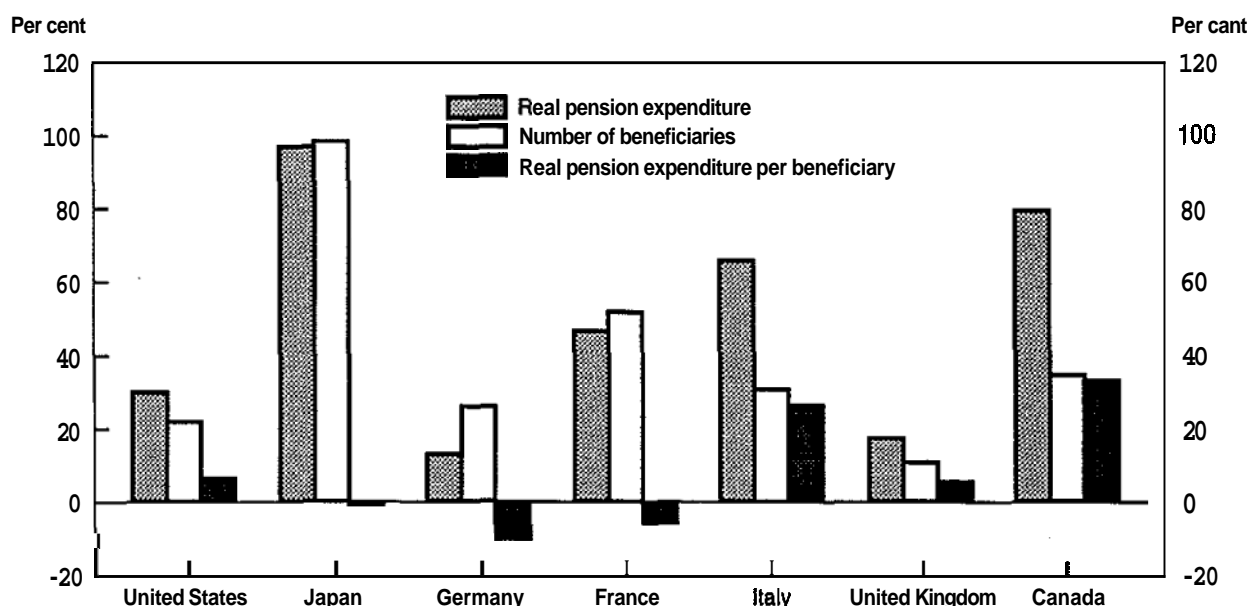
The pension benefit granted when an individual claimant enters retirement is usually fixed according to some legal formula, defining his/her assessed past earnings on which the pension is based (where the pension is earnings-related), the number of contribution years that are taken into account and the way in which entitlements cumulate per year of contribution (or per year of employment). The assessed earnings to which the replacement rate is applied when a person enters retirement cover the best ten years in France (to be gradually increased to the best 25 years under the recent reform, see below) and the last five years (ten years after a recent reform) in Italy and longer periods in the other countries. Assessed earnings are usually uprated in line with the increase in economy-wide average earnings over a worker's career. In subsequent years of retirement, the pension rate is normally adjusted for overall increases in the cost of living. In flat-rate schemes, the pension rate is independent of past earnings, but may nonetheless vary with the number of contribution years, and for various types of beneficiaries (family heads, dependent spouses, etc.). Two countries (Japan and Canada) have a mixture of both flat-rate and earnings-related schemes, and in the United Kingdom flat-rate benefits are predominant.*

Government expenditure for public retirement pension schemes is financed on a pure **Pay-As-You-Go** (PAYG) basis for four of the major seven countries, the United States, Japan and Canada being exceptions. This mode of finance implies that pension expenditure and pension contributions (including tax-financed transfers from the government to pension schemes) in any (fiscal) year have to balance, requiring present contributions to match the pension benefits of those currently retired. PAYG has been adopted in the post-war period because it allowed governments to build up public pension systems without the typical phasing-in lags involved in fully-funded schemes. In (partially) **funded systems**, of the kind the United States, Japan and Canada have implemented, expenditure and receipts have to be matched for a given period but not necessarily within one (fiscal) year. When a pension fund is created, all members are working and contributing. As a result, financial assets are gradually built up, until the payment of benefits equals the sum of contributions and the return on the fund's assets. The return on the fund's assets reduces the total required amount of contributions relative to what would have been involved in PAYG.³

B. Expenditure trends in the 1980s

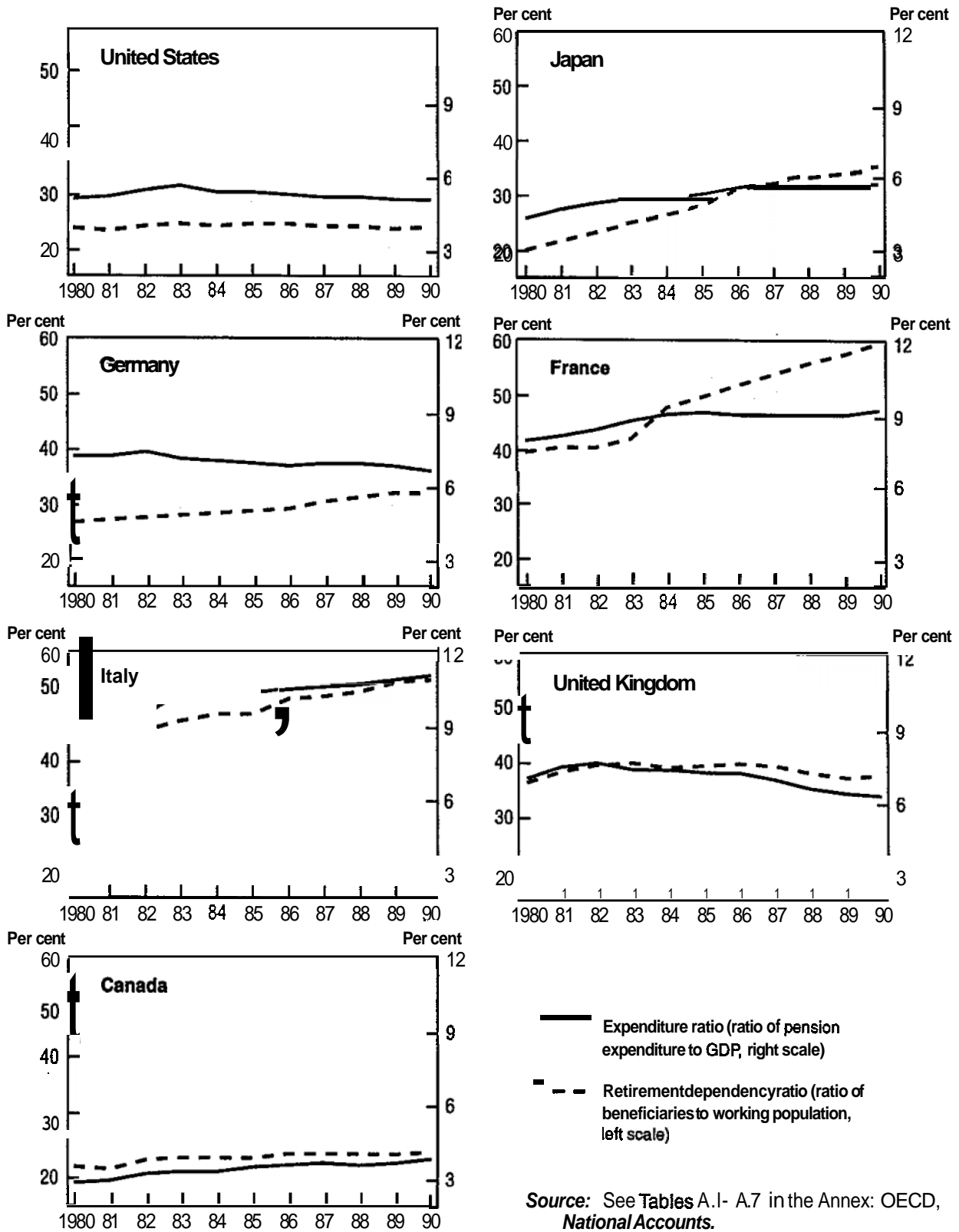
Real pension expenditure has increased steadily since the Second World War; this trend persisted in the **1980s** despite various reforms in public pension schemes (Figure 1).⁴ However, there are important differences across countries. Growth in pension expenditure has been particularly strong in Japan (where it has

Figure 1. Cumulative growth in real pension expenditure and beneficiaries in the period 1980-90



Source: See Tables A.1-A.7 in the Annex: OECD, *National Accounts*.

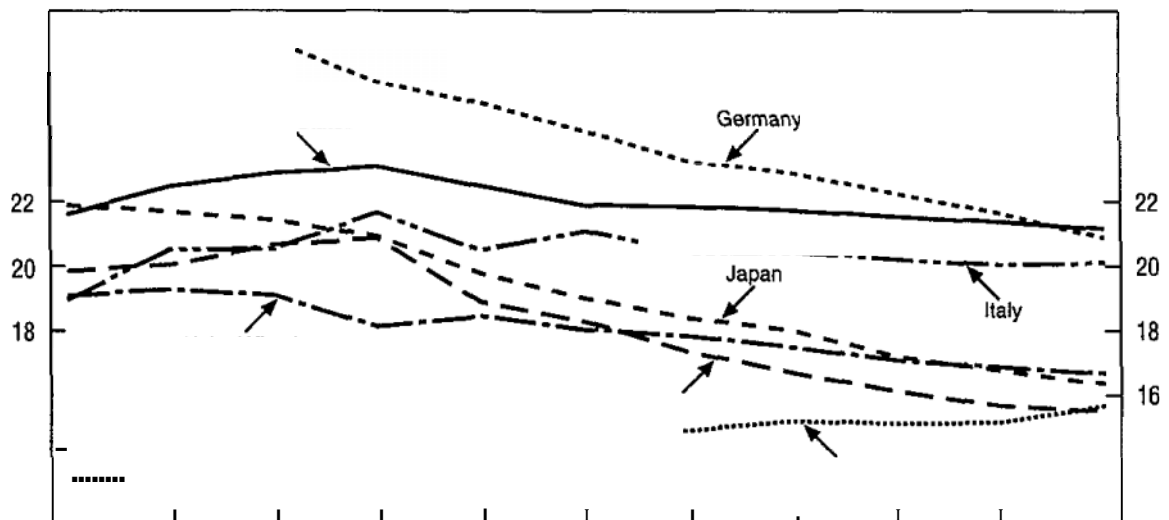
Figure 2. Pension expenditure relative to GDP and pension beneficiaries relative to the working population



almost doubled), in Italy and Canada (where it has risen by over 60 per cent) and in France (where it rose by over **40** per cent). In the United States, Germany and the United Kingdom, on the other hand, real expenditure increased by only around 20 per cent. Such growth has resulted in a ratio of pension expenditure to GDP (Figure 2) that ranges from below 4 per cent in Canada to 9 per cent in France and over 10 per cent in Italy.

The growth in expenditure reflects a variety of factors. In Japan, the rise in pension expenditure is mainly due to enhanced coverage through the introduction of a new basic flat-rate system, which has led to new categories of beneficiaries receiving pensions (see *Annex*). Real pension expenditure per beneficiary in Japan has remained virtually constant (Figure 1). In France, too, the number of beneficiaries has risen substantially, especially due to a greater use of early retirement – even though that has subsequently been partially reversed. Only in Italy and Canada has the rise in pension expenditure been accompanied by a significant jump in average real pension rates, of the order of 25-35 per cent. The situation in Canada, however, has to be judged against the relatively low pension rates at the beginning of the decade and reflects the maturing of recently created earnings-related schemes (see *Annex*). More generally, during the 1980s, the ratio of real pensions to real GDP per worker in the major seven countries has fallen steadily and converged somewhat (Figure 3).

Figure 3. Ratio of pensions per beneficiary to GDP per worker



II. THE VALUATION OF PUBLIC PENSION SCHEMES

A. Methods used in the private sector

The valuation of pension schemes has the purpose of measuring a fund's future liabilities and solvency. However, there appears to be no unique method used for the valuation of pension schemes. The principal methods used in the private sector are:

- *Accrued to date.* This method computes the present value at the date of calculation of pensions to be paid in the future on the basis of accrued rights. It does not take account of possible new obligations or future income from contributions. This present value is then compared with the value of the fund's assets to see if minimum funding requirements are satisfied.
- *Closed system.* This method assumes that the fund continues its existence until the last current contributor dies, while no new entrants are allowed in the scheme. The future contributions of existing members are allowed for, as well as the accrual of new rights of these members, but not the contributions and accruals of future members even when these are certain to be admitted.
- *New entrant method.* The present value of the typical new entrant's future stream of pension receipts is calculated on the basis of an average career assumption. Contributions are then set to ensure that the present value is zero. This system is typically used as a complement to the closed system.
- *Open system.* The present value of all estimated future pension payments – including those of new entrants – is compared with present assets. If the contribution rate is set at the new entrant rate, the relationship between assets and liabilities for the open system and the closed system are exactly the same (as the net present value for new entrants would be zero).

Each of these methods has its own advantages and drawbacks. The “accrued-to-date” method, which is the most widely but not exclusively used, has the advantage that it bases its estimates on available historical information. Indeed, when calculations are made, the existing assets of the fund and the existing accruals are all known. At the same time, however, it falls short of producing a reliable estimate of the contribution rate required to sustain the fund when new accruals and new entrants are allowed for. The “open-system” method – which encompasses the “closed system” and “new entrants” methods – does provide the necessary information to make such an estimate. It would hence seem appropriate for the public sector to adopt an approach comprising various methods, making use of the advantages of each of them. A methodology for the implementation of this approach is discussed below.

B. Implementation in the public sector

A stylised pension scheme

Our methodology attempts to measure the present value of public pensions that will have to be paid in the future, on the basis of the following (simplifying) assumptions:

- The population of each country is broken down into five-year age groups. The pension benefits paid to any age group at pension age at any future point in time is determined by *i)* the size of the population in this age group still alive: *ii)* the proportion of people in this age group eligible for a pension benefit: and *iii)* the average *per capita* pension to which persons in this age group are entitled given their number of years of contribution.
- The standard retirement age is 60, and the number of years of contribution required for a full pension is 40. These rules apply to workers and other persons alike. The pension entitlements accrue at a constant rate of $\frac{1}{8}$ every five years. There is no minimum contribution period required for eligibility. The methodology adopted ensures, though, that the assumed standard retirement age has only a second-order impact on the calculation of net liabilities (see below).
- All public transfers paid to old-aged persons in 1990 – flat-rate, earnings-related and means-tested benefits – have been considered as pension expenditure subject to accruals according to the rules formulated above (A). Similarly, all recipients of these transfers have been considered as persons eligible to this general stylised old-age pension scheme (B). The resulting full pension rate in 1990 is equal to the ratio A/B .⁵
- Given that the actual pension entitlements and ages differ across countries and do not exactly correspond with the stylised system outlined above, the number of recipients of old-age transfers (B above) does not necessarily match the number of people of age 60 and over (C). The ratio B/C in most countries is typically below unity and will henceforth be called the **eligibility ratio**. The eligibility ratio has been calculated for the base year and is held constant over the projection period (1990-2160) for each age group.
- The equivalent of a full pension rate an average beneficiary is entitled to once he enters retirement (the entry level) is projected in two different ways. According to the *first* method, the entry level grows at the same rate as projected real earnings and real output per worker (1 per cent per annum in the United States, 2 per cent per annum in the other countries). This approach is the equivalent of a system where the entry level is based on the assessed past earnings of a retired person, uprated according to the overall growth of earnings during his career. The *second* method assumes equal pension benefits across age groups of retired people at any point in time, which is the equivalent of a pure flat-rate system.
- The movement of the pension after retirement can be either indexed on prices or earnings. In combination with the previous assumptions, this

gives four possible scenarios for the movement of pensions. Only three of the scenarios have been analysed:

Case 1. Earnings-related benefits, indexed on prices.

Case 2. Earnings-related benefits, indexed on average earnings growth.

Case 3. Flat-rate benefits, indexed on prices.

- The fourth possible case (flat-rate benefits, indexed on average earnings growth) has not been considered, as it would yield the same results as Case 2 – due to the fact that the average benefits per beneficiary would be identical across age groups and grow at exactly the same rate in both cases.
- In order to estimate future **pension contributions**, an assumption has been made on the development of earnings per cohort over time, in line with some typical career-earnings pattern, and the average contribution rate. For the sake of simplicity, the same career-earnings pattern has been assumed for all countries and for all times. Real earnings are assumed to grow by 2 per cent per year between the ages of 20 and 50 and are kept constant thereafter until retirement age is reached. Real pension contributions are assumed to develop proportionally to this earnings pattern. Assuming that overall earnings grow in line with output per worker, the contributions to be attached to each cohort at each point in time are determined. The method adopted ensures, moreover, that the contributions in the base year (1990) correspond to total pension expenditure (A) for countries applying a PAYG system, and to total actual contributions in the other countries.

The methodology discussed above allows for an evaluation of the distribution of new pension entitlements and contributions across generations of beneficiaries. Four generations are distinguished here: the currently retired in 1990, the present workforce (with a further breakdown into accruals after and accruals before 1990), the children that were living in 1990, and those to be born after 1990 (and dying before 2160). For each of these generations estimates are made of the present values of their entitlements, their contributions (if applicable) and their resulting net entitlements. This type of presentation is known as a **generational account**. A positive number in such an account implies a net transfer of wealth to a specific generation. Similarly, a negative number represents a net transfer of wealth from that generation. Generational accounts differ fundamentally from cash accounts in that they measure transfers over a life-time rather than at a given point in time. A PAYG pension scheme typically involves transfers between generations at a point in time (as measured by cash accounts) – but this does not automatically generate any net transfer over a generation's life-time (as measured by generational accounts).

Demographic and macroeconomic projections

The **demographic outlook**, which forms a key element of the projections, envisages a stable population in all countries by 2030, after a sustained slowdown

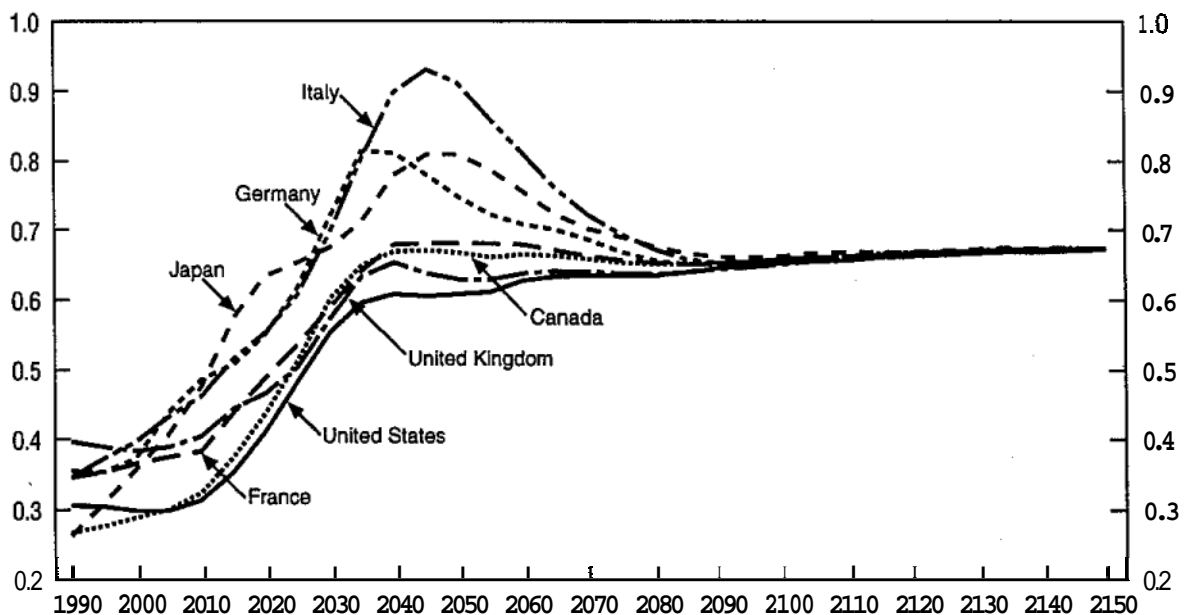
in the rate of population growth in line with the trend since 1965 (Table 2).⁶ International migration rates are based on past and present trends in migration trends and policies, but net migration rates are assumed to reach zero by 2025.⁷ According to the projections, all countries under consideration will show a sharp rise in the old-age dependency ratio in the next 40 years (Figure 4). The situation is particularly serious in Japan, western Germany and Italy, where the old-age dependency ratio is projected to more than double, before declining to a ratio

Table 2. Annual average growth of population
Per cent

	1965-80	1980-90	1990-2000	2000-30	2030-2160	Level in 1990 (millions)
United States	1.0	1.0	0.9	0.6	0.0	252
Japan	1.2	0.6	0.3	0.0	-0.1	124
Germany	0.3	0.3	0.2	-0.1	-0.1	63
France	0.7	0.5	0.4	0.2	0.0	56
Italy	0.5	0.2	0.1	-0.2	-0.1	57
United Kingdom	0.2	0.2	0.3	0.2	0.0	57
Canada	1.3	1.0	1.0	0.5	0.0	27
Total of above	0.8	0.6	0.5	0.3	0.0	636

Sources: World Bank and OECD, *Labour Force Statistics*.

Figure 4. Old age dependency ratios



Source: World Bank.

typical of a stationary population. In the other four countries, the dependency ratio will increase, but is not expected to rise temporarily above its very long-term equilibrium.

The proportion of people of 60 years of age and over who actually qualify for a retirement pension (the eligibility ratio), is based on the historical average in 1990 and varies between 0.69 in Germany (where dependent spouses are not automatically eligible to an old-age pension) and virtually unity in Japan, France and Italy (Table 3, first column),⁸ the eligibility ratios are projected to remain constant. These ratios, which are averages for all retired age groups, may show differences across age brackets. Generally speaking, the eligibility ratio for the age bracket 60 to 64 is lower than for the subsequent age brackets, as people in this bracket may not have yet attained the minimum pensionable age (which may be higher than 60) or may have opted for deferred retirement.

Given that only persons working contribute to the pension system, the **employment ratios** per age bracket determine the inter-generational distribution of contributions to be paid. These ratios have been held constant at their 1990 levels for each of the age brackets, although it is likely that there will be changes in the employment ratios in the future. However, the average employment ratio for the working-age population as a whole may move away somewhat from its initial level – as a result of progressive ageing and the associated change in weights (Table 3, third column).

A crucial assumption concerns the real discount rate, or rather the differential between this rate and the rate of growth of real earnings per worker. The latter are assumed to grow by 2 per cent per annum, except in the United States where

Table 3. **Steady-state eligibility, transfer and employment ratios**

	Eligibility ratio	Transfer ratio ¹	Employment ratio ²
United States	0.75	0.176	0.85
Japan	1.02	0.135	0.90
Germany	0.69	0.168	0.76
France	1.00	0.156	0.73
Italy	0.98	0.163	0.75
United Kingdom	0.89	0.161	0.87
Canada	0.84	0.142	0.82
Average of above countries	0.88	0.157	0.81

Note: The **eligibility** ratio is defined as the ratio between the number of old-age retirement beneficiaries to the number of people of 60 years and over.

The **transfer ratio** is defined as the ratio between the average old-age retirement benefit and GDP per worker.

The **employment ratio** is defined as the ratio between the number of people employed and the population of working age (here between 20 and 60).

1. Weighted average for age brackets 60 to 64, 65 to 69, 70 to 74 and over 75, in the stationary state.

2. Weighted average for age brackets 20 to 24, 25 to 29, 30 to 34, 35 to 39, 40 to 49, 50 to 54 and 55 to 60, in the stationary state.

it is assumed to grow by 1 per cent per annum. Such growth is in line with historical developments.⁹ Real GDP growth then reflects the rate of growth of the working-age population, movements in the employment ratio and the assumed rate of growth of output per worker. The real discount rate is fixed at 4 per cent for the period 1990-2010 – around the 1993 average real long-term interest rate in the major seven countries¹⁰ – and is thereafter allowed to drop stepwise to 3 per cent in 2050. It is thus assumed to persistently exceed real earnings growth per worker, reflecting a positive “pure” rate of time preference. In order to judge the sensitivity of the estimates of net liabilities to changes in the real discount rate, as well as to changes in the movements of benefits, the model was used to evaluate a further scenario (Case 4) in which the real discount rate was raised by 1½ points and in which all other assumptions were the same as in Case 1.

C. The results of alternative scenarios

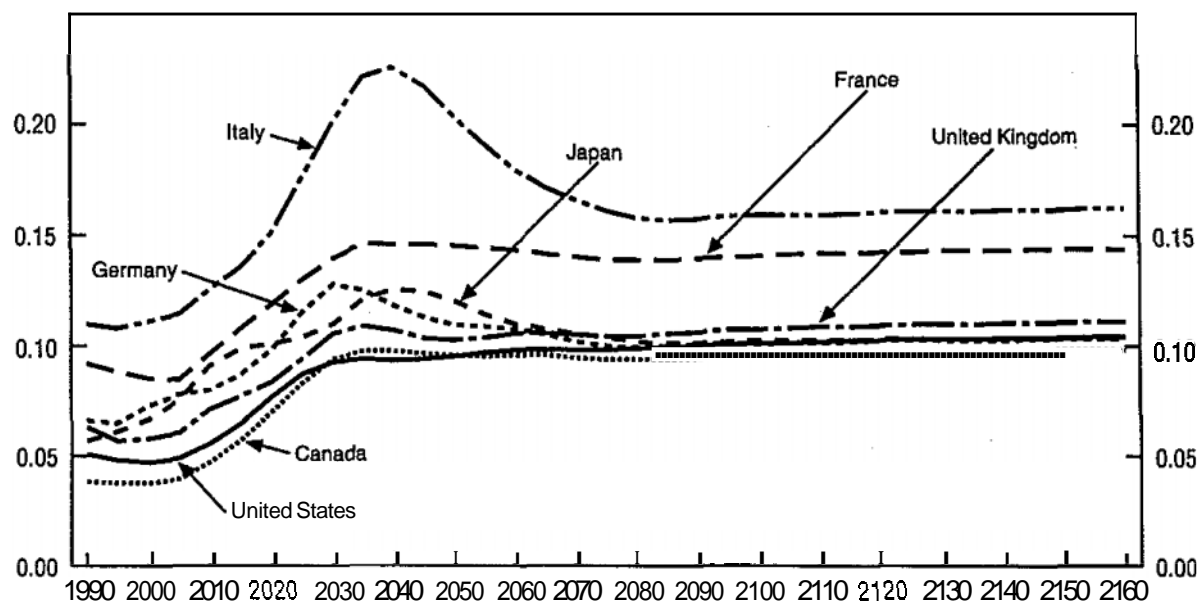
The paragraphs below discuss the results of alternative scenarios with respect to the different pension formulas that can be distinguished – denoted above as Cases 1, 2 and 3. Given that these cases represent stylised descriptions of *possible* methods of operating public pension systems (rather than the *actual* systems), the results are only illustrative.

Case 1. Earnings-related Benefits indexed on prices after retirement

In the scenario where pensions are indexed to prices after retirement (Case 1), pension expenditure as a share of GDP is projected to grow sharply, in all countries, between 1990 and 2040, the year in which the old-age dependency ratio typically reaches a peak (Figure 5). Italy would show the sharpest increase in the expenditure ratio: from 11 per cent of GDP to almost 23 per cent of GDP in 2040. In France, the ratio is calculated to increase from 9 per cent in 1990 to 15 per cent at the peak. In the other countries, the ratio increases from 4 to 6 per cent in 1990 to 10 to 13 per cent in 2040.

Under these assumptions, all systems have large net liabilities. Unfunded liabilities run from less than half 1990 GDP for the United States, reflecting a combination of the favourable demographic outlook and substantial existing funds, to around twice 1990 GDP in Japan, France, Italy and Canada (Table 4), the bulk of which is associated with currently acquired rights and pensions already in payment. The large liability in Japan reflects the early increase in the old-age dependency ratio in that country. For Italy, the unfavourable demographic outlook in the longer run is the main factor. In France it results from the high eligibility ratio for all old-age brackets including the youngest one, relatively generous benefits and a relatively low employment ratio.

Figure 5. Projected ratios of pension expenditure to GDP



Source: OECD Secretariat.

Table 4. Estimates of net pension liabilities under different stylised assumptions
Per cent of 1990 GDP

	United States	Japan	Germany	France	Italy	United Kingdom	Canada
Case 1: Earnings-related benefits indexed on prices after retirement							
Accrued rights ¹	89	145	157	216	259	139	105
New rights	-46	55	4	0	-26	-38	86
Total net liabilities	43	200	160	216	233	100	191
Case 2: Earnings-related benefits indexed on earnings growth after retirement							
Accrued rights ¹	98	171	184	253	304	163	128
New rights	-29	111	70	110	78	40	163
Total net liabilities	69	289	254	363	382	203	291
Case 3: Flat-rate benefits, independent of earnings history, indexed on prices after retirement							
Accrued rights ¹	79	118	132	182	220	118	86
New rights	-129	-166	-201	-349	-340	-254	-135
Total net liabilities	-50	-48	-69	-167	-120	-136	-49
Case 4: Case 1, with real discount rate increased by 1% percentage points							
Accrued rights ¹	66	110	125	171	213	109	79
New rights	-74	-36	-63	-106	-99	-89	-22
Total net liabilities	-8	74	62	65	114	20	57
Memorandum item:							
Financial assets	23	18	0	0	0	0	8

1. Net of financial assets held by public pension funds.

Cases 2 and 3. *The impact of alternative pension formulas*

The assumption that pension rights accrue according to the earnings history of claimants and are indexed on prices after retirement is only a stylised approximation of the pension systems that are actually employed in the countries under consideration. Indeed, public retirement provisions in the major countries comprise sub-systems which are operated along different lines. For example, at least some of the pensions paid are (basic) flat-rate benefits and hence neglect the earnings history of claimants, notably in the United Kingdom, and to a lesser extent in Japan and Canada. In some cases, such as in the German system, earnings-related benefits after retirement are indexed on overall earnings growth rather than on prices.

To give an impression of the impact of different pension formulas, two further estimates of pension liabilities are shown in Table 4. One assumes that all benefits after retirement are indexed on earnings rather than on prices (Case 2). The other one assumes that benefit rates are the same for all age groups at each point in time (flat-rate benefits), while their annual increase is linked to price inflation (Case 3). In both these alternative cases, initial pension expenditure per recipient in 1990 is again (by definition) the same as in Case 1. The results for Case 2 suggest that a switch from indexation on prices to indexation on earnings increases the liability by roughly 50 per cent. Case 3 suggests that a move towards flat-rate price-indexed pensions would result in net transfers of wealth from future generations to present ones, as future contributors would pay in much more than they receive. This occurs because, under the flat-rate system chosen here, the entry pension level grows in line with prices, whereas in Cases 1 and 2 this level pension grows in line with earnings.

Case 4. *The impact of a higher real discount rate*

The choice of the appropriate discount rate is, obviously, not unambiguous, as real rates of return tend to vary over time. Real government bond yields have exceeded the rate of growth of earnings by large amounts in the last decade, after a period in which they were relatively low, bringing real yields more into line with those seen in the nineteenth century.” Our projections are based on the view that long rates will move back to their average since 1800. It could be argued though that this average is biased downwards by the exceptionally low rates between 1930 and 1980,¹² and that one should keep the real discount rate relatively high and more in line with recent returns of private pension funds.¹³ Moreover, the recipients of pension benefits may see future benefits as risk-bearing assets more akin to equities than to government bonds in which case the rate of discount should be slightly above 6 per cent, reflecting the average return on equities.¹⁴ For these reasons, and also in light of the current level of real long-term interest rates of around 5% per cent, it might be useful to examine the impact of a higher real discount rate on the estimated pension liabilities.

In order to judge the sensitivity of estimates to the choice of interest rate, a further set of estimates of net liabilities was calculated using a higher real discount rate (Case 4). An increase in the discount rate of 1½ points relative to Case 1 produces a substantial decline in future liabilities, although it is striking that the present value of *accrued* rights is not much affected (Table 4, Case 4). The higher discount rate in France induces a bigger decline in total liabilities than in Japan, despite virtually equal initial positions. This phenomenon can be explained by a difference in the time profile of the projected financial deficits in the two countries. The Japanese population is rapidly ageing, and, with unchanged pension contribution rates, deficits emerge relatively soon. As a result, changing the discount rate should have a relatively small impact on the present value of these deficits. In France, however, the ageing process is slower than in Japan, and financial deficits peak at a later point in time. Hence, in this country, a change in the discount rate should have a relatively large effect on the present value.

D. The distribution of liabilities between generations

Net transfers of wealth mainly flow to the older cohorts of the present workforce and those now retired, for whom no or too small financial assets have been accumulated in the past (only in Japan and Canada are promises to future generations a significant part of current net liabilities) (Table 5). The reason for this, obviously, is that past contributions have been used to finance past pension expenditure, as most schemes have operated on a Pay-As-You-Go basis. These features result in a “dead-weight” indebtedness, which, given its disproportionate size, can only be financed by progressively charging future generations. However, when judging the situation from the point of view of inter-generational equity, the contributions made by existing pensioners and the current work-force should be taken into account. Without a full set of generational accounts, it is not possible to say which generations have benefited most, though in the United States one

Table 5. **Decomposition of net pension liabilities by broad age-groups'**
Per cent of 1990 GDP

	United States	Japan	Germany	France	Italy	United Kingdom	Canada
I. Accrued rights							
Present retired	42	51	55	77	94	58	42
Present workforce	70	112	102	139	165	81	71
Existing assets	-23	-1a	-	-	-	-	-a
II. New rights							
Present workforce	-21	10	-8	-16	-22	-23	16
Present children	-14	a	-2	-7	-11	-12	14
The unborn	-11	38	13	23	a	-3	57

1. Based on Case 1 in Table 4.

author has suggested that it is those who retired in the 1980's who may have received the most benefits relative to their contributions.¹⁵

Looking at the present value of net pension liabilities arising from **new** rights, the methodology, coupled with the assumptions of Case 1, suggests that countries can be split into three distinct groups:

- Those, where if present contribution rates were maintained forever, accruals of contributions would broadly match new accruals of pension rights (while leaving the existing accruals unfinanced). Germany and France were broadly in this situation under the assumptions of the first case.
- There are those countries where rights for new generations were accruing faster than contributions. On certain assumptions about the future growth of pensions, Japan and Canada were in this case, primarily due to the fact that contributions in these countries do not yet reflect the steady state of a maturing pension scheme.
- Finally, there are those countries where future generations are being called upon to transfer wealth to current generations. The United States, Italy and the United Kingdom were in this situation in 1990.

E. A comparison with other studies

To our knowledge, the available studies estimating public-pension liabilities all apply the accrued-to-date method. A comparison of our estimates of accrued rights with two of such studies shows some similarities (Table 6). Hills (1989), estimates the liability for the United Kingdom at 187 per cent of GDP at a real discount rate of 3 per cent, which is in the same range as our highest estimate of 163 per cent at a 3-4 per cent real discount rate (Table 6). Kuné *et al.* (1993)

Table 6. Estimates of accrued rights in public pension systems: comparison with other studies
Per cent of 1990 GDP

	Highest ¹	Lowest ¹	ABP ²	Hills ³
Germany	184	125	122	..
France	253	171	69 ⁴	..
Italy	304	213	107 ⁴	..
United Kingdom	163	109	42	1a7
Memorandum item:				
Real discount rate	3 - 4% ⁵	4% - 5½% ⁵	6%	3%

1. See Table 4.

2. Kuné *et al.* (1993).

3. Hills (1989).

4. Excluding 'means-tested welfare benefits for the elderly and compulsory supplementary earnings-related schemes.

5. See text.

estimate the German liability at 122 per cent of GDP with a 6 per cent real discount rate, which is similar to our 125 per cent estimate in Case 4, but low compared to our highest estimate of 184 per cent. The latter study, which was carried out by the Dutch civil-servants pension fund (ABP), also provides estimates for France and Italy. These estimates, however, exclude means-tested welfare benefits for the elderly and the compulsory complementary earnings-related schemes. The low estimate for these countries (compared to ours) may be due to this.

111. ALTERNATIVE FINANCING OF PUBLIC PENSION SCHEMES

A. Four financing options

The model outlined above can be used to illustrate the consequences of four different financing scenarios each aimed at eliminating net pension liabilities, using the assumption that pensions are earnings-related and linked to prices after retirement (*i.e.* Case 1 shown above). The four financing scenarios are:

- i)* Continuing Pay-As-You-Go financing, ensuring that contributions in any year increase as necessary to match current pension expenditure.
- ii)* Allowing contributions in the short and medium term to exceed pension expenditure in order to create a fund which could be used to help finance future pension entitlements. In the case where pension expenditure is part of overall public expenditure, this is equivalent to a reduction of the current level of borrowing and hence reducing the path of net government debt.
- iii)* Lessening the extent to which the periodical revaluation of past earnings appearing in the pension formula is linked to overall earning trends.
- iv)* Increasing the pensionable age.

A further option which involves a gradual increase in the contribution rate, rather than the step increase used here, has been analysed in an earlier OECD study.¹⁶ The main features of these options are the following.

Pay-As-You-Go

If Pay-As-You-Go financing were to be extended into the future (or re-introduced, as appropriate), contributions and benefits in any year would have to match, even if expenditures would rise to unprecedented heights (as illustrated by Figure 6, upper-left panel). In the case of Italy, for example, this would mean that the contribution ratio would have to increase from around 10 per cent in 1990 to over 20 per cent when the old-age dependency ratio reaches its peak in around 2030-2040. Pay-As-You-Go financing hence requires a massive redistribution of wealth from future to present generations (Table 7).

**Table 7. Net pension liabilities by broad age-groups:
The case of Pay-As-You-Go financing**
Per cent of 1990 GDP

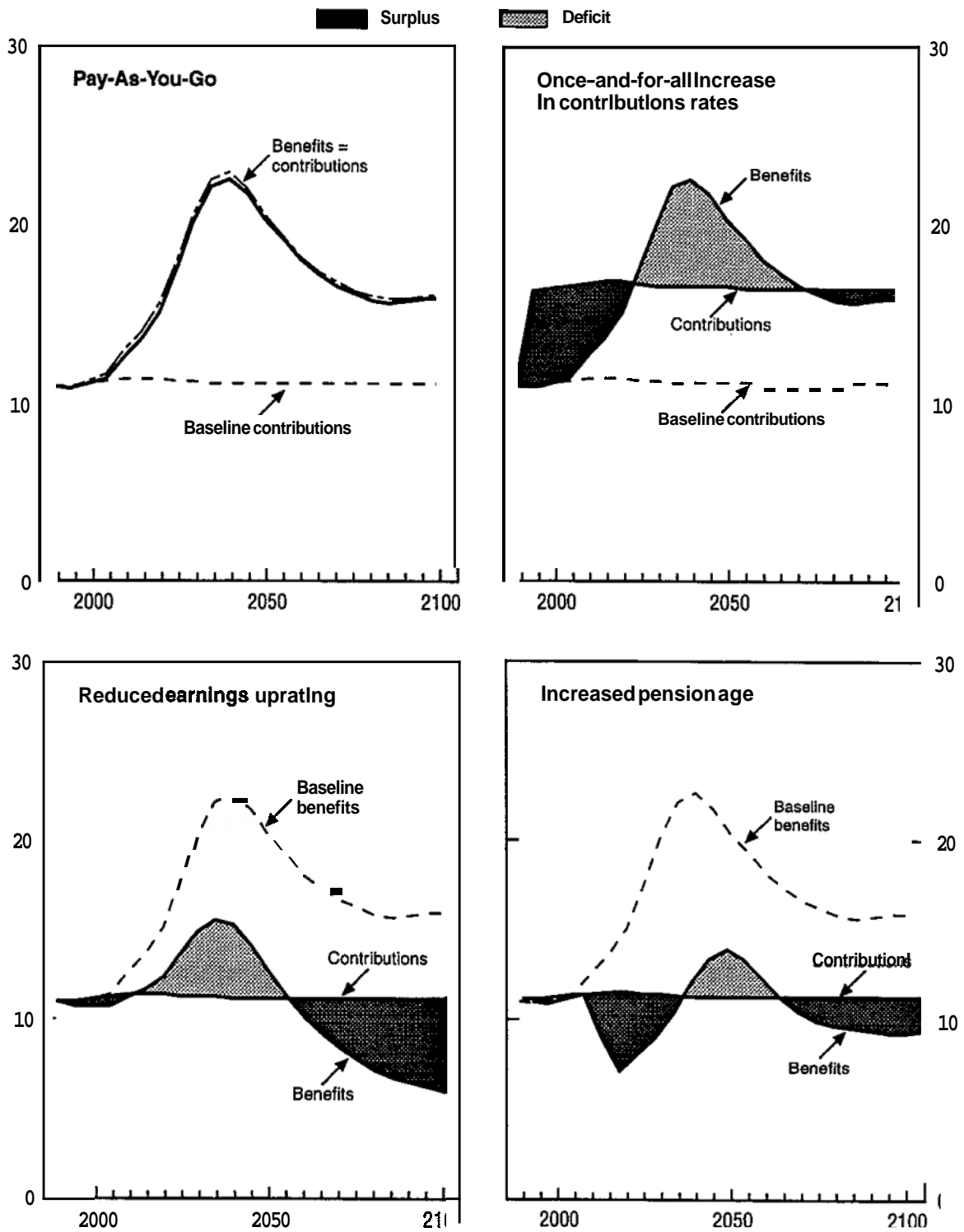
	United States	Japan	Germany	France	Italy	United Kingdom	Canada
I. Accrued rights	89	144	157	216	259	139	105
Present retired	42	51	55	77	94	58	42
Present workforce	70	112	102	139	165	81	71
Existing assets	-23	-18	-	-	-	-	-8
II. New rights	-112	-162	-157	-216	-259	-139	-113
Present workforce	-12	-15	-24	-16	-35	-15	12
Present children	-25	-36	-31	-36	-55	-19	-12
The unborn	-75	-111	-102	-164	-169	-105	-113
I. + II. Total net liabilities ¹	-23	-18	0	0	0	0	-8

1. Equals financial assets held by public pension funds (see Table 4).

Running a temporary surplus

Countries which so far have relied on Pay-As-You-Go financing, could switch to a funded system.¹⁷ One way to do so would be through a once-and-for-all increase in the contribution ratio, allowing a fund to cumulate which is to be depleted subsequently (Figure 6, upper-right panel) or, in the case of countries where there is no separate accounting for public pensions, to reduce current government borrowing and hence net debt which would then rise gradually in the future. The objective of such a policy is to smooth the movement of contribution rates (or tax rates) over time, so minimising the extent of inter-generational transfers. As such, the policy is equally valid for countries which integrate pensions into the general tax/expenditure system as to those countries which have separate social security funds or accounts. Such a fund (or debt reduction) would typically reach its maximum size in the second decade of the next century and then be gradually exhausted. An advantage of funding is that the contribution ratio would rise to a level which is well below the maximum required under Pay-As-You-Go financing, as the government could benefit from interest returns. At the same time, a funded regime would involve significantly less redistribution of wealth from future to present generations than implied by a Pay-As-You-Go regime (Table 8). From a macroeconomic point of view, a switch to funding may have favourable long-run effects, such as an increase in the savings rate and an associated increase in long-run economic growth. Such an effect is, however, not assumed in the projections.

Figure 6. The profile of pension benefits and contributions under various financing regimes — an illustrative case
As a percentage of GDP



Source: OECD Secretariat.

**Table 8. Net pension liabilities by broad age-groups:
Funding through a once-and-for-all increase in the contribution ratio**
Percent of 1990 GDP

	United States	Japan	Germany	France	Italy	United Kingdom	Canada
I. Accrued rights	89	144	157	216	259	139	105
Present retired	42	51	55	77	94	58	42
Present workforce	70	112	102	139	165	81	71
Existing assets	-23	-18	-	-	-	-	-8
II. New rights	-89	-144	-157	-216	-259	-139	-105
Present workforce	-37	-51	-61	-77	-99	-52	-37
Present children	-25	-39	-35	-56	-66	-33	-28
The unborn	-27	-54	-61	-83	-92	-54	-41
I. + II. Total net liabilities	0	0	0	0	0	0	0

Reduced earnings-related upratings

Governments could decide to limit the degree to which the earnings history of an individual, on which pension rates of pensioners who enter retirement are based, is revalued. Case 1 assumes, in line with the practice of most countries, that past earnings are revalued by the growth of average economy-wide earnings. If the revaluation of the individual's earnings history were limited to about half the growth of real overall earnings, this would typically be broadly sufficient to balance the system. Over the long term, such a regime implies that the ratio of pension benefits to GDP would decline indefinitely (Figure 6, lower-left panel). Moreover, the system would run deficits early on, and surpluses in the very long run to repay the accumulated debt. Hence, a pronounced shift of the pension burden to future generations would occur, comparable to that implied by Pay-As-You-Go financing (Table 9). At the same time, the implicit rate of return on pension savings would become negative.

Increase in the pensionable age

Alternatively, governments could raise the pensionable age to a level where the system is in financial balance. Such a regime would have some characteristics in common with a once-and-for-all increase in contributions. However, as the increase would take time to become fully effective, the surplus in the scheme occurs later. As a result, in the long run, contributions have to exceed benefits by a larger margin than in the case of an increase in contributions (Figure 6, lower-right panel). Initially, the system would run small deficits, as the old-age dependency ratio increases and implementation lags limit the initial effects of the increase in the pensionable age. But once the impact of the increase in retirement age becomes fully effective, a surplus will emerge. The system would run into

**Table 9. Net pension liabilities by broad age-groups:
A once-and-for-all reduction in the earnings elasticity of new pension benefits**
Per cent of 1990 GDP

	United States	Japan	Germany	France	Italy	United Kingdom	Canada
I. Accrued rights	85	125	143	201	238	132	92
Present retired	42	51	55	77	94	58	42
Present workforce	66	92	88	124	413	74	58
Existing assets	-23	-18	-	-	-	-	-8
II. New rights	-85	-125	-143	-201	-238	-132	-92
Present workforce	-29	-20	-54	-63	-62	-35	-10
Present children	-22	-27	-26	-41	-51	-26	-16
The unborn	-34	-78	-83	-117	-125	-71	-65
I. + II. Total net liabilities	0	0	0	0	0	0	0

deficit again, however, when the old-age dependency ratio is in its highest range. Once the impact of the retirement of the baby-boom generation has petered out, a relatively small surplus could be maintained in order to service the debt that has been cumulated in the initial phase. This option, in common with the reduced earnings-related upratings regime, is based on the assumption that the contribution ratios would be maintained at present levels. It would also imply a redistribution of wealth from future to present generations of about the same magnitude as an increase in contributions, but less than under reduced-earnings related uprating or Pay-As-You-Go financing (Table 10).

**Table 10. Net pension liabilities by broad age-groups:
The case of increased pensionable age**
Per cent of 1990 GDP

	United States	Japan	Germany	France	Italy	United Kingdom	Canada
I. Accrued rights	83	85	138	192	230	128	85
Present retired	42	45	55	77	94	58	42
Present workforce	64	59	84	114	136	70	51
Existing assets	-23	-18	-	-	-	-	-8
II. New rights	-83	-85	-138	-192	-230	-128	-85
Present workforce	-35	-35	-53	-68	-88	-47	-29
Present children	-23	-22	-29	-48	-56	-30	-20
The unborn	-25	-28	-56	-76	-86	-51	-36
I. + II. Total net liabilities	0	0	0	0	0	0	0

B. Changing policy

Applying these scenarios suggests that, in most countries and on the basis of pensions being indexed to prices, either substantial increases in the contribution rates will be required, or generosity of the systems will have to be scaled back to a large degree.

Progress so far

In the past four years, several governments have announced policy changes that are designed to lower the future burden of pensions. In France and Italy, the reference period for calculating pension rights has been lengthened – from the last five to the last ten years of employment in Italy and from the best ten years to the best 25 years in France (in the latter country only for the *régime général*, covering around 40 per cent of total pensions) – and the annual uprating of pensions in line with overall earnings growth has been replaced by price indexation. Moreover, the compulsory retirement age in Italy will be gradually raised from 60 to 65 years for men and from 55 to 60 for women, over a ten-year period beginning in 1993, while in France the speed with which pension rights build up has been reduced, implying that 2½ years of extra contributions are required to obtain the maximum pension. In the United States the retirement age will be gradually raised by two years for the contributor to have an unchanged pension. The United Kingdom has announced its intention to legislate a phased increase of the retirement age for women to 65, the same as men, from age 60 at the moment. This country, moreover, decided several years ago that the basic social security pension should be flat-rate and indexed to prices, resulting in a major reduction in the net contingent liability, though introducing a supplementary earnings-related scheme.

Factors influencing further choices

The eventual choice of policies to reduce the net liability will depend on the specific features of each public pension system, together with demographic outlooks. With substantial assets already held by the United States' public pension schemes, that country could continue relying on a funded regime in the future with only a small increase in the contribution rates. It could even be smaller than suggested by our calculations, as the government, as noted, has announced an increase in the pensionable age of two years. The scenarios for Canada illustrate that as contribution rates are at relatively low levels, other policies aimed at eliminating deficits generate extreme results. However, Canada already plans to increase contribution rates in the future, as does Japan. Germany may well have to strike a more complex balance between the various options in developing a suitable policy mix. With contribution rates already relatively high in France and Italy, relatively more attention may have to be given to lowering benefits, increasing the pensionable age (an action recently taken in Italy), or lower assessed earnings (as announced in both countries).

The decision on financing methods may also be influenced by differences in the transfers of wealth between present generations (today's workforce and the retired) and future generations (present and unborn children) implied by different schemes. Pay-As-You-Go (PAYG) financing would necessitate the largest transfer of wealth from future to present generations and retired, of the order of magnitude of one to two times 1990 GDP (more than twice 1990 GDP in Italy, if the reform were not fully implemented), reflecting significant increases in contribution rates to be borne by future generations. Reducing the pass-through of real earnings growth in real pension rates also appears to have particularly large effects on future generations, even though the transfers involved are somewhat lower than those required under a PAYG scenario. As discussed above, this scenario is probably not feasible, as real pension rates would persistently decline relative to overall real earnings.

The introduction of funding, at the other extreme, implies a "front-loading" of future contributions, increasing the cost to present generations and relieving future ones relative to a PAYG scenario. Even in this scenario, however, future generations would still have to make a transfer of wealth to present ones in the range of half to one-and-a-half times 1990 GDP. Increasing the pensionable age would lead to a more balanced outcome from the point of view of inter-generational equity, with transfers of wealth somewhat below what would be required under a funded regime. It should be noted, though, that it has been assumed that contributions are held constant as the retirement age is raised, which generates some funding of the pension scheme. Given these results, a combination of a once-and-for-all increase in the contribution ratio and a five-year increase in the retirement age would also be relatively balanced from the point of view of inter-generational equity.

IV. CONCLUSIONS

Ageing populations will put increasing strain on public finances as expenditure on pensions grows. On the assumption that initial pensions on retirement grow in line with earnings and are indexed to prices thereafter, and without allowance for the future maturity of new systems, the methodology set out in this paper suggests that the present value of future liabilities exceed the present value of future income based on constant contribution and taxation rates.

The methodology and assumptions permit the above liabilities to be split into two parts. *First*, there are the commitments relating to pensions either already in payment or arising from rights that have already accrued. Typically, this accounts for virtually all of the total net liability. *Second*, the government has commitments relating to rights to benefits that have not yet been earned (*i.e.* those which have not yet accrued) and future contributions. Typically, the estimated present values of these two factors are broadly in balance.

The above estimates of liabilities underline the point that pension schemes will put increasing pressure on public finances implying the need to increase contribution rates or reduce pension entitlements over time. The inclusion of the capitalised net pension liabilities in a government balance-sheet would give an early warning of the extent to which such problems might arise. Including the accrual of pension liabilities in a wider definition of debt would also change the assessment of relative debt positions of different countries.

For illustrative purposes, a number of policy options for the elimination of the pension liability were investigated (Pay-As-You-Go financing, a reserve fund or an equivalent reduction in government borrowing if the pension scheme is not separate from the rest of government expenditure, raising the retirement age and lowering pension benefits) for the case where earnings-related benefits are indexed to prices after retirement. Relying on Pay-As-You-Go financing would result in a peak contribution rate nearly double current levels in most countries. A once-and-for-all increase in contribution rates with the surplus contributions being placed in a reserve fund would require a 50 per cent increase in current contribution rates. Raising the retirement age can have a substantial impact on the liabilities of a state pension scheme.

These various possible policies would generate markedly different distributions between generations of the financing costs of eliminating the net pension liability. Future generations would make the largest transfer in the case of a Pay-As-You-Go scheme, while the transfer from future generations is the least when the retirement age is increased. An immediate increase in contributions also results in a relief for future generations. The extent to which these considerations are to be taken into account, as always, is a matter of politics.

NOTES

1. Throughout this article data for Germany cover western Germany only. The financing of public pension systems in four countries (the United States, Germany, Japan and Sweden) was analysed in an earlier OECD study (see Hagemann and Nicoletti, **1989** and Auerbach *et al.*, **1989**).
2. The flat-rate basic pension in these three countries accounted for **40**, **49** and **63** per cent, respectively, of total pension expenditure in **1988**.
3. Provided that the rate of return exceeds the rate of growth of earnings and the associated rates of growth of contributions and benefits.
4. For a discussion of long-term trends in pension expenditure, see OECD (**1988**).
5. The data for total pension expenditure and the number of beneficiaries (shown in the **Annex**) may imply some double counting of beneficiaries, as persons could draw on various retirement programmes at the same time. The projection of expenditure will not be affected by this as over-counting beneficiaries lowers the average pension proportionally.
6. See IBRD (**1992**). This projection is based on assumptions regarding fertility, mortality, and international migration, which ensures that the population eventually becomes stationary. In such a situation, the birth rate is constant and equal to the death rate, the age structure is constant, and the growth rate of the population is zero. Mortality is projected by extrapolating recent trends in male and female life expectancy and infant mortality. Countries are assumed to have constant fertility rates until **1995-2000** and then to move up to the replacement level by **2030**.
7. Recent projections by the United States Census Bureau suggest that, due to revised expectations on net immigration, the U.S. population will grow by **50** per cent between **1990** and **2050**, rather than by **30** per cent as implied by the World Bank projections used here.
8. See Note 5.
9. The rate of growth of real GDP per worker in the period **1980-90** has been **0.9** per cent in the United States and **2** per cent on average in the other major countries, with a standard deviation of 0.5 percentage points. Very long time-series show that labour productivity growth rates in the last century or so have been of the same order of magnitude. See Maddison, pp. **649-98**, quoted in Englander and Mittelstadt (**1988**), pp. **7-56**; in particular Table **3** on page **19**.
10. In **1993**, the average real long-term interest rate in the main seven economies is **4.2** per cent.

11. Long-term rates in the United States and the United Kingdom averaged 5.2 per cent in this period. See Siegel (1992), pp. 227-252.
12. Lower real rates between 1930 and 1980 could perhaps be attributed to an over-valuation of non-risk bearing capital, in part reflecting a tendency towards risk aversion in the wake of the fall in share prices in 1929. See Siegel, *op. cit.*
13. The real rates of return of private pension funds have significantly exceeded real rates of interest in the 1970s and 1980s. See Davies (1992), pp. 107-131.
14. Siegel, *op. cit.* Others, though, have argued that discount rates should reflect the growth of earnings (see Hills, 1992). Moreover, the real rate of return of public pension funds may overstate the relevant discount rate, at least from the point of view of future pensioners. A reason for this is that the supply of public pension facilities is effectively rationed by the government given that there is no market for marginal annuities. Hence, pension rights that do accrue within the existing system have a higher valuation (and a lower implicit discount rate) than a hypothetical marginal annuity. See for this argument, Mirer (1992), pp. 377-384.
15. See Steuerle and Bakija (1994).
16. See Hagemann and Nicoletti (1989).
17. The term “quasi-funding” would be more appropriate than “funding” as in truly funded schemes the fund would typically be created before rights accrue and not after they have already accrued.

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Annex

PUBLIC PENSION SYSTEMS IN THE SEVEN MAJOR ECONOMIES

This section provides some country-by-country background information with respect to the scope, the pension formulas and the financing of public pension systems as applied in the early 1990s, against which the standard assumptions underlying the calculations in the main paper can be judged. Data for each of the countries are presented in Tables A.1 to A.7.

United States

Virtually all civilian employed, including self-employed, are covered by the earnings-related Old-Age Survivors and Disability Insurance (OASDI). In addition, a means-tested minimum allowance may be granted. Retired public employees, both at the Federal and the State and Local levels, are entitled to a supplement on top of their basic pension. For veterans and railroad employees, separate pension schemes exist.

Under the OASDI scheme, pension benefits are based on career earnings, with a maximum replacement rate of around 40 per cent. The accrual rate varies inversely with earnings. As concerns the retirement age, in the 1980s two measures were introduced to encourage older workers voluntarily to remain longer in employment. First, additional credits for delayed retirement after the standard retirement age of 65, were increased. Second, means tests after 65 were eased. Moreover, the minimum retirement age for unreduced retirement will be gradually increased to 67.

The OASDI trust fund held \$225 billion of assets at the end of 1990, of which \$204 billion for the financing of future old-age retirement pensions Table A.1. According to official projections, the fund will increase from the present 4 per cent of GDP to 24 per cent in 2018. After that year the scheme will be accumulating deficits and the assets will be gradually run down to zero by 2041.¹ Apart from OASDI, several categorial pension funds held assets worth around \$1 080 billion at the end of 1990, bringing the total at around 23 per cent of GDP.

Japan

The general scheme, the *Kokumin-Nenkin* scheme (KN), provides a basic flat-rate pension to all residents including self-employed and jobless persons. It was created in

1961 and extended to dependent spouses in 1984. Five other schemes, which already existed before 1961, provide supplementary earnings-related pensions. The main programme in this area is the *Kosei-Nenkin-Hoken* (KNH) scheme, which covers all private employees, and which also administers the KN pensions for its members. Special supplementary schemes exist for civil servants of the central government, local government employees, private school teachers and employees and employees in the agricultural sector.

Japan is one of the three countries to combine an earnings-related system with a basic flat-rate scheme (the United Kingdom and Canada are the other two).² The basic scheme (KN, see above) covers all residents of age 20 to 60 and was first put into effect on 2 April 1961. The full pension is payable after 40 years of contributions, a requirement which can only be met by those born 20 years or less before the law became effective, thus after 2 April 1941. But also those born between 2 April 1926 and 2 April 1941 with at least 25 years of coverage are entitled to the full pension, as a transitional arrangement. The benefit is adjusted every year for CPI changes with a one-year lag. The pension may be claimed at any age between 60 and 70 subject to an actuarial reduction before 65 and an increase after 65. In 1988, the flat-rate KN system accounted for 40 per cent of total payments. The earnings-related KNH scheme covering private sector workers, is on an accrual basis, with an accrual rate of 0.75 per cent per year, or 30 per cent over 40 years (of the career average monthly earnings). For those born before 1 April 1946 there is a provisional arrangement, with an accrual rate of 1 per cent for those born before 1927 and varying between 0.986 per cent and 0.75 per cent depending on the date of birth for those born later. The career average monthly earnings are adjusted for general earnings increases every five years, and once retired, the benefit is indexed on the CPI. The full pension is payable from age 60 and a supplement is granted between 60 and 65 to make up for actuarial reductions in the KN system. The typical beneficiary in 1991 receives a benefit of 68 per cent of his earnings excluding bonuses on a gross basis, or 80 per cent on a net basis. Firms with more than 500 workers can contract out the earnings-related portion of KNH pensions by setting up a private fund.

The KNH scheme holds assets of around 18 per cent of GDP. All other schemes are financed on a Pay-As-You-Go basis. However, even under the KNH system present contribution rates match current benefits, while the interest earnings are entirely used to accumulate further assets. Hence, the KNH scheme at present effectively operates on a PAYG basis. This situation is officially projected to persist into the next century. With pension payments gradually increasing, the contribution rates are set to increase by 2 percentage points of earnings every five years (from the present level of 14.5 per cent) until 2015.

Germany

Public pensions in western Germany comprise an earnings-related scheme with general coverage for private-sector employees. Dependent spouses are insured only if they contribute on a voluntary basis. In addition, categorial schemes exist for civil servants, free professions, farmers, miners and former employees residing abroad. Accruals grow with steps of 1.5 per cent of assessed earnings per insurance year with a maximum of 60 per cent of assessed earnings. The standard retirement age is 65, but can be reduced to 63 for those with 35 or more insurance years of which 15 years of contributions paid, 60 for disabled or unemployed under certain conditions regarding unemployment duration and

contributions paid, and 60 for female employees under certain conditions regarding insurance and contribution years. Deferred retirement up to 67 is also possible. The 1989 Pension Reform Act raises the retirement age by two years as of 2001, combined with the introduction of phased retirement.³

France

The general scheme covers most employees in the private sector and has two tiers: the regime **general** providing an earnings-related basic pension and the regime **complémentaire** providing an earnings-related supplement. The supplementary schemes, while compulsory, are managed by the social partners rather than the central government. Categorical systems exist for public employees, miners, seamen, railroad workers, other public companies, farmers and various kinds of self-employed. The system is complemented by a means-tested old-age allowance which guarantees a social minimum for the elderly (*minimum-vieillesse*). Benefits are granted to those over 60, while 37.5 insurance years are required for a full pension. The rate of accrual is equal to 1/150 per insurance-quarter. A full pension under the regime general amounts to 50 per cent of average earnings in the ten best years (after revaluation for general pay increases), subject to a floor and a ceiling. The regimes **complémentaires** provide an additional 20 per cent of earnings. There are also means-tested spouse and child supplements and, as noted earlier, a means-tested minimum provision. The standard retirement age is 60, but early or deferred retirement is possible, and early retirement is widely claimed.

Italy

The general earnings-related scheme provides basic coverage for private sector employees. It is complemented by a means-tested social welfare programme for those who have a pension below a certain minimum or who are not eligible to the earnings-related scheme. There exist a number of categorical schemes for civil servants, railway employees, free professions and self-employed. The standard retirement age of 60 for men and 55 for women is announced to be raised by five years in the framework of a recent cost-cutting package. Pensions are payable conditional upon a minimum of 15 years of contribution. The accrual rate is equal to 2 per cent of average assessed earnings in the last five years multiplied by the number of insurance years up to a maximum of 80 per cent of assessed earnings.

United Kingdom

The general scheme (the National Insurance Scheme) combines flat-rate and earnings-related pensions, both being applicable to all private and public sector workers as well as to voluntary contributors. There is a categorical scheme for civil servants providing supplementary pensions. Both the basic flat-rate and earnings-related schemes are on an accrual basis. The standard flat-rate pension is payable to retired male contributors from age 65 and to female retired contributors from age 60, subject to the contribution conditions being satisfied. People who do not claim their pensions at those ages are awarded higher

pensions when they claim. For the pension to be paid at the full rate, contributions must have been paid for nine-tenths of the working life and no pensions at all are payable where contributions cover less than one quarter of the working life. A dependent spouse receives, broadly speaking, a pension of 60 per cent of her husband's pension as of age 60. In 1988, the flat-rate pension represents 63 per cent of total pension payments.

The earnings-related scheme (SERPS) was started in 1978 and is still in the process of maturing: until 1998 nobody will have full entitlements. The earnings on which the pension is based are revalued in line with the general level of earnings, up to the year before that in which pension age is reached. The revalued earnings are then averaged over the period from age 16, or April 1978 if later, to retirement age. The pension rate will eventually be 20 per cent of average earnings as defined above, and may be regarded as accruing uniformly over the working life between age 16 and pension age. However, for those over age 16 when the scheme took effect in April 1978, the working life for this purpose is taken as the years between April 1978 and pension age subject to a minimum of 20 years. Employers who provide supplementary pensions may choose to contract their staff out to the state scheme in return for lower contributions. Individuals are also able to contract-out to the earnings-related scheme into an approved personal pension plan.

Canada

The general Old Age Security scheme provides a universal flat-rate pension for all resident family heads, including means-tested guaranteed income supplements and spouse's allowances. In 1988, the flat-rate system accounted for 49 per cent of total benefits. Since 1967 two earnings-related schemes exist, the Quebec Pension Plan (QPP) and the Canada Pension Plan (CPP), providing earnings-related pensions to all employed and self-employed. The QPP and CPP schemes are still in the process of phasing in. The standard retirement age is 65 for recipients of the universal pension and (at the earliest) 60 for recipients of the spouse's supplement. In the future, the contribution period required for a full pension under the earnings-related schemes (QPP and CPP, see above), will be 40 years with an accrual factor of 0.5 per cent. For the time being, however, the maximum attainable contribution period is the period between 1966 and the year in which the claimant retires, or around 25 years.

NOTES

1. See Duggan (1991), pp. 382-404.
2. See Takayama (1992).
3. See Schmahl (1992), pp. 39-52.

Table A.1. Public retirement pensions in the United States

	1980	1985	1990
	x million US dollars		
Expenditures			
TOTAL	137 006	214 106	281 232
of which:			
Old age insurance	79 059	130 072	173 588
Railroad retirement	4 769	6 276	7 280
Public employee retirement	41 490	63 044	85 124
Veterans	11 688	14 714	15 241
	x 1 000 persons		
Beneficiaries			
TOTAL ¹	26 432	28 882	31 102
of which:			
Old age insurance	23 243	25 958	28 361
Railroad retirement	685	652	613
Public employee retirement	5 842	6 891	7 974
Veterans	3 189	2 924	2 741

1. Old-age insurance and veterans.

Source: Submission from the United States Social Security Administration.

Table A.2. Public retirement pensions in Japan

	1980	1985	1990
	x billion yen		
Expenditures			
TOTAL ¹	10 470	17 017	22 723 ²
	x 1 000 persons		
Beneficiaries			
TOTAL	11 029	16 221	21 881
of which:			
Self-employed in the Kikumin-Nenkin scheme	6 256	8 837	9 278
Salaried workers in the Kosei-Nenkin scheme	4 773	7 384	10 519
Spouses in the Kokumin-Nenkin scheme	0	0	2 084

1. Including survivors and disability pensions.

2. 1989 instead of 1990.

Source: Ministry of Health and Welfare, Annual Report on Health and Welfare 1997-7992, Tokyo, 1993.

Table A.3. Public retirement pensions in Germany¹

	1980	1985	1989
	x million deutschemarks		
Expenditures			
TOTAL	106 363	126 959	152 688
of which:			
Old age pension (total)	92 698	115 432	142 109
of which: civil servants	20 340	22 883	25 865
Other cash benefit: social security contributions	13 122	10 928	9 913
Other cash benefits: allowance for very high age	5	12	9
Benefits in kind	538	587	657
	x 1 000 persons		
Beneficiaries			
TOTAL	7 197	7 638	8 823
of which:			
General pension insurance	6 097	6 449	7 530
Farmers	369	350	341
Liberal professions	0	28	33
Miners	19	21	17
Former employees residing abroad	170	260	365
Civil servants	542	530	537

1. Western Under.

Source: Eurostat: Digest of statistics on *social* protection Europe: *Volume 1, Old Age Protection*. Preliminary draft, January 1992.

Table A.4. Public retirement pensions in France

	1981	1985	1988
	x million francs		
Expenditures			
TOTAL	257 777	429 510	516 654
of which:			
Old age pension (regime général)	189 092	306 117	379 253
of which: civil servants	46 517	72 131	84 982
Early retirement	1601	13 112	3 930
of which: civil servants	69	360	89
Other cash benefits	2 739	3 767	4 334
Benefits in kind	323	770	642
Compulsory supplementary schemes (régimes complémentaires)	42 432	73 960	98 006
of which: civil servants	1 098	2 159	2 573
Means tested welfare benefits	21 590	31 784	30 489
	x 1 000 persons		
Beneficiaries			
TOTAL ¹	8 851	10 720	12 137
of which: civil servants ²	236	916	952

1. Old age pension only.

2. In 1981 central and local government only.

Source: Eurostat *op. cit.*

Table A.5. Public retirement pensions in Italy

	1980	1985	1988
	x billion lire		
Expenditures			
TOTAL	32 004	83 263	116 004
of which:			
Old age pension	26 886	70 816	97 083
of which: civil servants	3 831	10 806	13 598
Lump sum cash payments	101	388	637
Other cash benefits	3 180	7 847	12 467
supplementary compulsory old age pensions	431	1 113	1 554
Means tested welfare benefits	1 406	3 099	4 263
	x 1 000 persons		
Beneficiaries			
TOTAL	8 849	9 993	10 951
of which:			
General scheme (INPS)	4 780	5 521	6 181
Special schemes other than civil servants and military	2 825	3 148	3 365
Civil servants and military	549	635	676
Social pension	695	689	729

Source: Eurostat *op. cit.*

Table A.6. Public retirement pensions in the United Kingdom

	1980	1985	1988
	x million pounds		
Expenditures			
TOTAL	16 015	25 531	30 930
of which:			
All residents retirement pension	10 753	16 871	19 639
Residents over 80	41	45	39
Other cash benefits	92	101	106
Supplementary pensions civil servants	3 075	5 669	7 176
Means tested welfare benefits	2 054	2 845	3 970
	x 1 000 persons		
Beneficiaries			
TOTAL ¹	9 108	9 732	10 002

¹ All residents retirement pension.
Source: Eurostat *op. cit.*

Table A.7. Public retirement pensions in Canada

	1981	1985	1990
	x million Canadian dollars		
Expenditures			
TOTAL	10 663	16 748	26 035
<i>of which:</i>			
CPP & QPP Retirement Pension	2 070	4 326	9 134
Guaranteed Income Supplement	2 242	3 319	3 976
Old Age Security	6 141	8 858	12 705
Spouses Allowance/Spouses SP	192	223	207
Unemployment Insurance Retirement Benefits	18	22	13
	x 1 000 persons		
Beneficiaries			
TOTAL¹	2 388	2 663	3 133
<i>of which:</i>			
CPP & QPP Retirement Pension	1 680	2 211	3 234
Guaranteed Income Supplement	1 245	1 297	1 359
Old Age Security	2 303	2 569	3 006
Spouses Allowance/Spouses SP	85	93	127
1. Old age security and spouses allowance only. Source: Submission from Statistics Canada/Statistique Canada.			