Pension plans and retirement incentives

Disney, Richard and Whitehouse, Edward

World Bank, Axia Economics

September 1999

No. 9924

Social Protection Discussion Paper Series

Pension Plans and Retirement Incentives

Richard Disney
Edward Whitehouse

September 1999

Social Protection Unit
Human Development Network
The World Bank

For free copies of this paper, please contact the Social Protection Advisory Service, The World Bank, 1818 H Street, N.W., MSN G8-802, Washington, D.C. 20433 USA. Telephone: (202) 458-5267, Fax: (202) 614-0471, E-mail: socialprotection@worldbank.org. Or visit the Social Protection website at http://www.worldbank.org/sp.

Pension plans and retirement incentives

Richard Disney and Edward Whitehouse*

* Richard Disney is Professor of Economics at the University of Nottingham, a Research Fellow of the Institute for Fiscal Studies and a Director of Axia Economics. Edward Whitehouse is also a Director of Axia Economics. Comments welcomed at Axia Economics, 38 Concanon Road, London SW2 5TA; telephone +44 171 737 5815; e-mail info@axiaecon.com; web: http://www.axiaecon.com. We are grateful to Axel Börsch-Supan and participants at a Learning and Leadership Centre seminar at the World Bank in November 1998 — particularly Estelle James, Robert Palacios, Anita Schwarz and Pat Wiese — for helpful comments and advice. The usual disclaimer applies.

Table of Contents

Table of Tables and Figures

Pension plans and retirement incentives

Richard Disney and Edward Whitehouse

The well-documented decline in the labour-force participation of older women and older men (in particular) is common to most industrialised countries. The proportion of men aged 55 to 64 in employment fell between 1980 and 1996 in all 17 OECD countries for which data are available, by an average of more than ten percentage points. The average employment rate of men in this age group in 1996 was a little under 60 per cent.[1]

The reasons for this are complex, but probably involve both a demand effect — high and persistent unemployment, especially in Europe — and a supply effect — pension benefits and the value of other savings have increased. Many governments are worried about the decline in labour-force participation of older workers. Of 28 countries responding to the OECD's *Caring World* questionnaire, 15 mentioned low effective retirement ages and poor work incentives in the pension system as a matter of policy concern.[2]

The population of most countries is ageing due to a mix of declining fertility and increasing longevity. It is desirable to encourage people to retire later to counterbalance the effect of ageing on the ratio of workers to dependants. Some, such as Chand and Jaeger (1996), have argued that this can be achieved with 'parametric reforms', tinkering with the rules of existing defined-benefit schemes. Many countries, however, have introduced or proposed more radical reforms emphasising the role of privately managed defined-contribution pensions. An obvious question is how these regimes are likely to effect retirement behaviour.

We begin by modelling a simple retirement saving plan and looking at the optimal retirement date. This simple plan looks very similar to a defined-contribution scheme. Optimal retirement depends on prospective earnings and the evolution of the accumulated fund, which, in principle, are separable. We then move on to defined-benefit pension schemes, which are the norm in public and much private provision. Here there are significant interactions and complications. The pension formula is often non-linear, with accrual rates that vary with the number of years of contributions and formulae that depend on a limited number of 'best' or 'final' years of earnings. There are also 'spikes' when early retirement is first permitted, at the

---

1 OECD (1998*b*).

2 These were Belgium, the Czech Republic, Denmark, Finland, Germany, Greece, Hungary, Italy, Korea, the Netherlands, New Zealand, Norway, Poland, the Slovak Republic, Spain and Turkey. Kalisch and Aman (1998), Table 13.

standard retirement age *etc.* Pensions can be actuarially adjusted, depending on the year at which benefits are first drawn. We show that the incentives in a defined-benefit scheme are very different from the defined-contribution retirement saving plan.

Most of the existing literature on retirement focuses on public-sector defined-benefit schemes.[3] Another strand looks at the effect of private defined-benefit schemes, commonly provided by employers.[4] Defined-contribution schemes, however, are playing a bigger part in pension systems through out the world. In the United States, employer-based defined-contribution plans, known as 401(k)s, have tended to substitute for traditional defined-benefit schemes.[5] The trend to defined contribution among employer plans is less pronounced in the United Kingdom, but many employers expect to change their provision in this direction in the future.[6] Most of the growth of defined-contribution plans has been in individual pension accounts, known as personal pensions, which have mainly substituted for the public-sector, defined-benefit scheme. They now cover more than a quarter of employees. In addition, the new stakeholder pensions, announced in November 1998, will be group defined-contribution plans.[7] In the new pension systems of Latin America and Eastern Europe, defined-contribution schemes are also a substitute for the public plan. Australia, Italy and Sweden have also increased the emphasis on privately managed defined-contribution schemes.[8]

Since all these schemes are recent, few people have retired with substantial defined-contribution pensions, so it is not surprising that the issue of retirement incentives in these plans has not yet been addressed.

The object of this paper is to examine the impact of type of pension scheme on retirement behaviour. Trends in labour-force participation of older workers and demand-side issues are addressed in a sister paper (Disney and Whitehouse, 1999*a*).

The structure of the current paper is as follows. The following section describes a simple, theoretical model of optimal retirement. Section 2 introduces an empirical model of a simple retirement-savings plan, or defined-contribution pension scheme. Section 3 compares this with a defined-benefit scheme. Sections 4 and 5 examine the effect of these pension plans on work incentives. The following three sections extend the basic model to introduce 'real-world' features of pension plans. Section 9 concludes, examines the policy implications of our results and sets out an agenda for future research in this area.

---

3 Recent international comparative studies include one of 11 OECD countries coordinated by Gruber and Wise (1997, 1999). Blöndal and Scarpetta (1998) analyse a panel of 15 OECD countries, and draw on microeconometric studies of five countries commissioned by the OECD. Other notable studies include Boskin and Hurd (1978), Burtless (1996), Hurd and Boskin (1984), Mitchell and Fields (1984) on the United States, and Meghir and Whitehouse (1997) on the United Kingdom.

4 Examples include Kotlikoff and Wise (1987), Lumsdaine, Stock and Wise (1990, 1994) on the United States; Disney, Meghir and Whitehouse (1994) on the United Kingdom; Palme and Svenson (1997) on Sweden; and Seike (1989, 1997) on Japan.

5 See Gustman and Steinmeier (1992), Ippolito (1995), and Kruse (1995) on the growth of defined-contribution schemes and the reasons for this trend.

6 Disney (1995).

7 Department of Social Security (1998). See also Disney, Emmerson and Tanner (1999).

8 See Queisser (1998) on Latin America, Palacios and Rocha (1998) on Hungary, Gora and Rutkowski (1998) on Poland, Flanagan (1999) on Australia and Tumbarello (1999) on Italy.

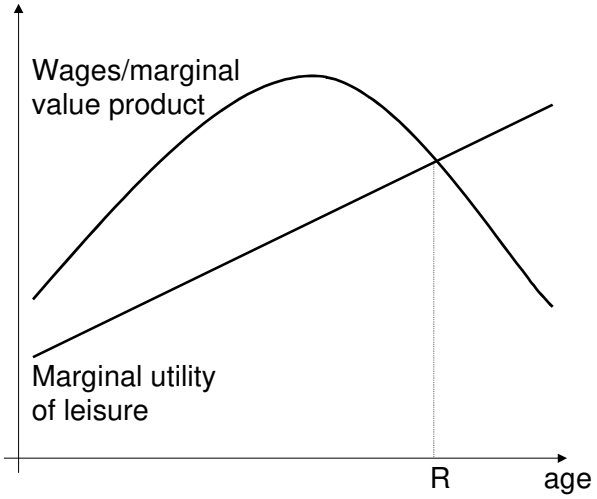
1. A model of optimal retirement

Retirement is often perceived as an 'institutional' decision. Nevertheless, the decline in labour-force participation of 55-64 year olds, usually below the standard pensionable age, suggests at least some element of individual choice in the retirement process. The basic labour-supply model, with individuals maximising utility (defined over leisure and consumption) subject to a budget constraint can be extended to explore retirement. In this model, consumption is financed from income, which in turn comprises both earnings and the return on accumulated assets. In a lifetime model, we can also include the desire to bequeath some of the accumulated assets.

However, this basic model does not in itself provide a rationale for retirement as we know it. If underlying wages and the utility of leisure are constant over the lifetime, there is no necessary reason for someone to work continuously until a particular age and then leave work for the rest of their life. The optimum would probably be reduced, but continuous, employment throughout the lifetime. We need further structural assumptions to identify an economic motive for retirement.

A straightforward explanation of retirement relies on systematic changes with age either in wages (assumed to reflect age-related changes in productivity) or in the utility of leisure or both.[9] Figure 1 illustrates this story. Wages are assumed to follow an inverted-U pattern (see the discussion in section 8.2.2 below) and the marginal value of leisure to rise with age. In this model, individuals will work until the age, R, when the curves cross. R is a unique point. Note also that R is not the point at which either wages or the marginal utility of leisure are at their maximum.

Figure 1. **A static model of the retirement decision**



Note too the importance of the assumption that changes in the marginal product and utility of leisure are smooth, continuous and are characterised by simple functional forms. In more complex models there may be local equilibria, emphasising the need not for a static model but a *dynamic* model of the retirement decision. In particular, non-linearities may arise because

[9] See Lazear (1986) and Disney (1996), pp. 201-203.

pension plans contain complex accrual structures. In this case, the individual should appraise the prospective gain in net utility (leisure less access to extra consumption) from retiring now relative to any point in the future. This is a more complex problem to analyse[10] but intrinsically evaluates the continued 'return to working' at all points in time. To show how pension schemes differentially affect this return to continued working, the next sections examine a number of stylised cases.

2. A simple retirement savings plan

We first consider a mandatory defined-contribution plan with a 10 per cent contribution rate. We assume the pension earns an investment return of 5 per cent a year. When the individual retires, he or she converts the fund to an annuity. We calculate the annuity rate using the 'riskless' interest rate, which we assume initially to be 2 per cent.

To calculate pension benefits, we need the individual's lifetime earnings (and so contribution) profile. Initially, we assume a simple linear growth in earnings of 3 per cent a year and that the individual contributes from age 20.[11]

Figure 2 shows the assumed earnings profile and the model's calculations of pension benefits. Figure 3 shows the gross replacement rate: the ratio of the annual pension to (current) earnings. The replacement rate at age 50 is very small: around 12 per cent. However, the pension grows rapidly, at around 12 per cent a year. The two lines move closer together in Figure 2, and the replacement rate in Figure 3 rises quickly.

Each extra year of work adds to the accrued pension in three ways. First, an extra year's contributions are made. Secondly, the accumulated fund earns an additional year's investment returns, assumed to be 5 per cent. Thirdly, the year's delay in annuitising the pension means that the benefit increases in line with annuity rates. Figure 4 shows these annuity rates, calculated using mortality data from Thailand.[12] These are actuarial, not market annuity rates.[13] We have so far modelled pension benefits only for men since they are most affected by early retirement.

---

10 Stock and Wise (1990, 1991).

11 The impact of more complex earnings profiles is examined below.

12 The annuity rate is the inverse of the discounted present value of the product of one minus the mortality rate.

13 Market rates will tend to be lower, because of administrative charges and adverse selection. See Piggott and Doyle (1999), Friedman and Warshawsky (1988, 1990), Brugiavini (1993) and Dilnot *et al.* (1994), pp. 148-151 for a discussion.

Figure 2. **Earnings and defined-contribution pension by age**

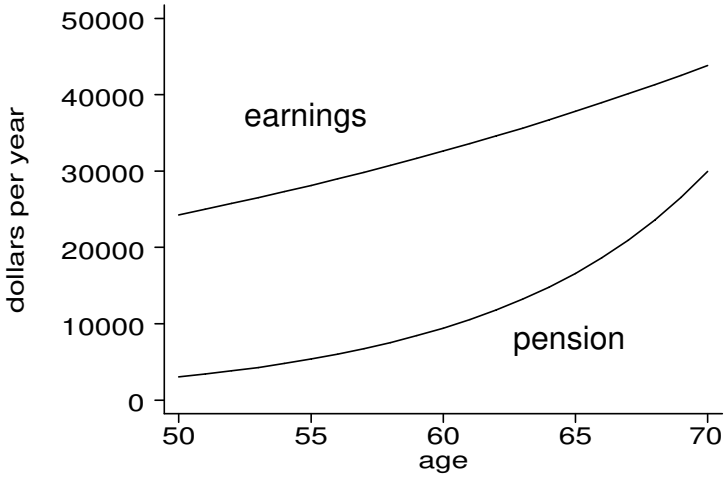


Figure 3. **Gross replacement rate by age, defined-contribution plan**

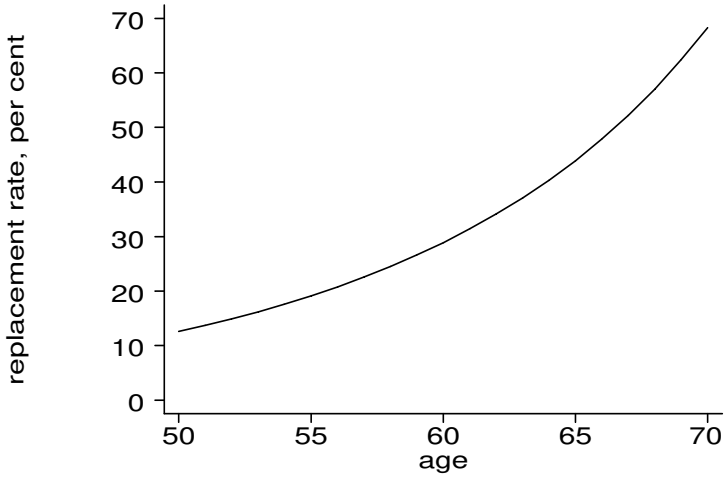
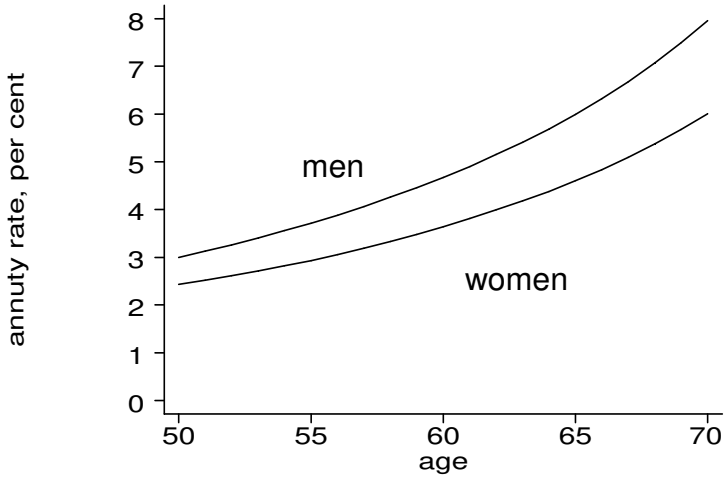


Figure 4. **Annuity rates by age and sex**



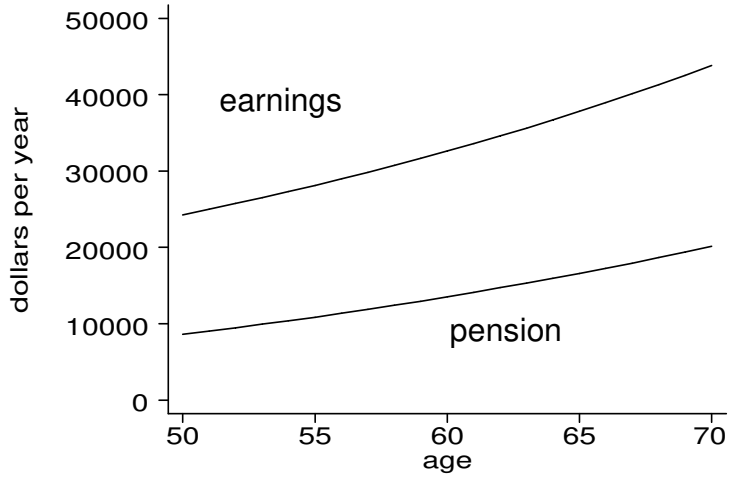
3. A simple defined-benefit plan

The initial defined-benefit scheme is based on average lifetime earnings.[14] Early years' earnings are uprated in line with prices. To allow direct, fair comparisons of retirement incentives between the defined-benefit and defined-contribution plans we equalise the resulting pension value at age 65. This gives an accrual rate of 1.7 per cent in the basic defined-benefit scheme. Again, for equivalence with the defined-contribution plan, we assume a 10 per cent contribution rate to this plan.[15]

Figure 5 shows the pension value by age (which is comparable to Figure 2). The defined benefit pension is much flatter across the lifecycle than the defined contribution scheme, increasing by around 5 per cent a year compared with 12 per cent in the latter. Each additional year of work increases the pension in two ways. First, an extra year's contribution adds to the number of years in the defined-benefit formula. Secondly, the base for the defined benefit is increasing. Since we assume that real earnings grow continuously by 3 per cent a year, average lifetime earnings are about 1½ per cent higher after each extra year of work.

Figure 6 compares the gross replacement rate in the two baseline plans. As noted above, we have ensured that the pensions are equally generous at age 65, so differences between the curves reflect only intrinsic structural variation between the two types of plan. The curves therefore intersect at age 65. The defined-benefit plan gives a much larger prospective replacement rate at early ages and is relatively flat. The defined-contribution pension increases close to exponentially with age.

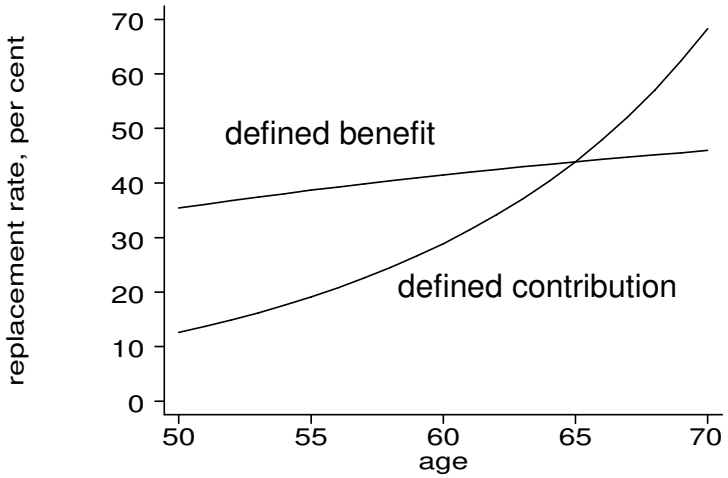
Figure 5 **Earnings and defined-benefit pension by age**



14 Schemes based on fewer years of earnings (*e.g.* final) are discussed below.

15 This essentially assumes that the real return on individuals' contributions to the defined-benefit plan is equal to the funded defined contribution plan. But revenues to the defined benefit scheme are the total wage bill multiplied by the contribution rate. If real returns exceed wage-bill growth, there will tend to be a deficit in the defined-benefit plan that must be financed from general revenues.

Figure 6. **Gross replacement rate by pension type and age**



4. The effect of the pension system on the return to working

The gross replacement rates in Figure 5 give some indication of retirement incentives. In a static framework, we would expect to see fewer people working the higher the replacement rate, both because of a substitution effect and an income effect (the higher the replacement rate, *ceteris paribus*, the higher is lifetime income).

However, this ignores the dynamic nature of the retirement problem because it fails to capture all of the financial returns to continued work versus retirement. Working an additional year not only brings in earnings, but will also alter the value of the pension. The pension system can be thought of as an implicit tax or subsidy to continued working. Therefore, the change in pension wealth needs to be added to earnings to show the true, total reward for working.[16]

As noted above, working an additional year increases a defined-contribution pension in three different ways. We can ignore the contributions made in the year in question when measuring the reward to work, because they will be converted into an annuity next year. This is not the case in the defined-benefit plan, where contributions are not directly related to benefits. However, the other two sources of increased pension value — the additional year's investment returns and the higher annuity rate from delaying annuitisation for a year — do increase pension wealth. However, the higher annuity rate in a year's time partly reflects the risk of dying within the year. This mortality risk (slightly) reduces the value of continuing work and deferring the pension, reflecting the odds of dying before receiving any pension.[17]

4.1 The effect of a defined-contribution plan on the return to working

Figure 6 shows how the change in pension wealth varies with age and, through the profile of earnings plus change in pension wealth, the impact on the return to working. At younger ages, the rate of growth of pension wealth is only slightly increasing or flat, because the value of the fund increases with each extra year's contributions. But at older ages, this is overtaken by the mortality risk (again, taken from the Thai data), and delaying retirement a year then reduces

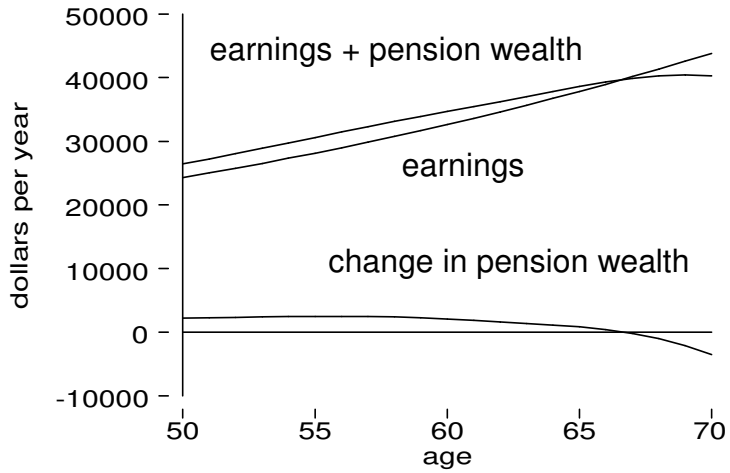
---

16 Lazear (1986).

17 This effect was not included in Figure 5. See Gruber and Wise (1997, 1999) for a discussion of this issue.

pension wealth. The top line of the Figure shows the total reward to continued working: wages plus the increment to pension wealth.

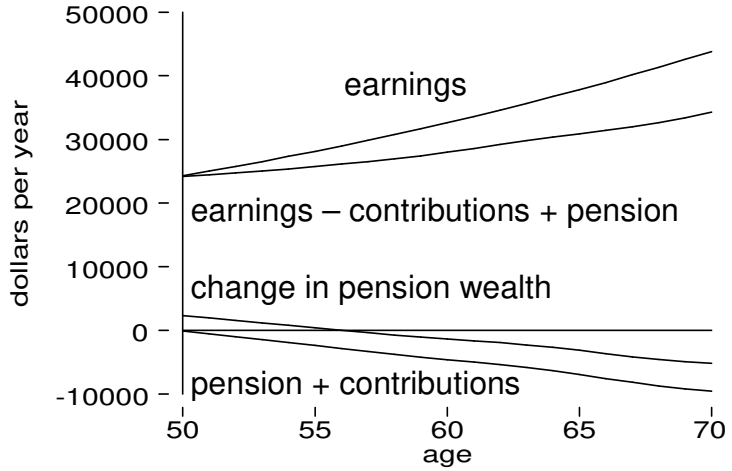
Figure 7. **Earnings and change in pension wealth by age, defined-contribution plan**



4.2 The effect of a defined-benefit plan on the return to working

Figure 7 gives a similar picture for the stylised defined-benefit pension. Pension wealth increases from an extra year's work through the additional year in the defined-benefit formula and through the increase in the earnings base (since real pay is assumed to grow each year). Working in the opposite direction, deferring drawing the benefit reduces pension wealth. Delaying the pension by one year also incurs mortality risk over the year, increasing the odds that the person might die without drawing any benefits. Finally, contributions are neutral in the defined-contribution scheme because the pension value equals contributions plus their associated investment return. In the defined-benefit plan, the pension benefit earned from a year's contributions can be greater or less than the value of the contributions paid (but is never equal). We therefore need to deduct contributions from the change in pension wealth and from earnings, to give the net return to working. These are the lower lines of each pair in Figure 7.

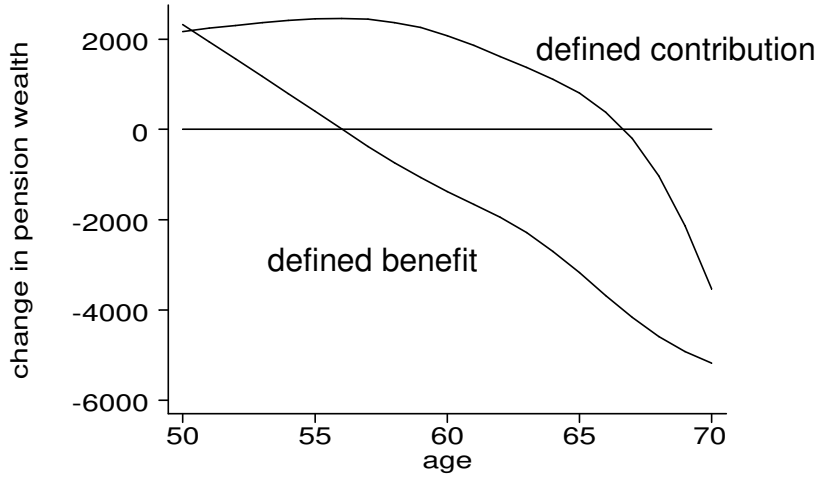
Figure 7. **Earnings and change in pension wealth by age, defined-benefit plan**



4.3 Defined-benefit and defined-contribution plans compared

Figure 8 shows the change in pension wealth alone for the two types of scheme. The difference in the pattern between the two plans is much clearer in this Figure. The change in pension wealth is broadly linear and downward sloping for the defined-benefit scheme[18], while the defined-contribution scheme is at first flat and then falls exponentially. This again implies a very different pattern of retirement incentives in the two plans.

Figure 8. **Change in pension wealth by age and type of plan**



[18] Other studies, such as Kotlikoff and Wise (1985, 1989), have similar findings.

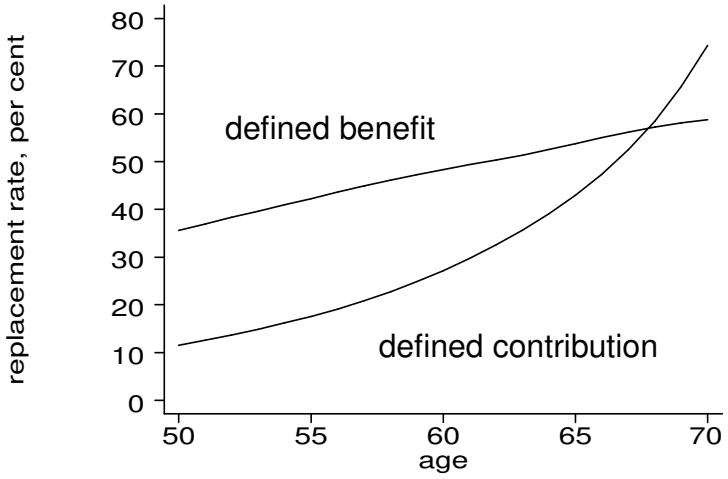
5. Measuring work incentives

We use two simple measures of work incentives: the replacement rate and the effective tax rate. Static studies, such as the OECD analysis of tax and benefit systems and work incentives for prime-age workers (OECD, 1996*a*, 1997*a*), often use measures of replacement rates. We can adjust the static, gross replacement rates shown in Figure 5 to take account of the effects of working on pension contributions and the pension value. The replacement rate becomes:

pension/(gross earnings + change in pension wealth)

Figure 9 shows the results for the two different plan types. The pattern is similar to Figure 5, but the results are more pronounced. The replacement rate of the defined-benefit plan increases more rapidly when account is taken of the fall in pension wealth and contributions which (it is assumed) continue to be levied.

Figure 9. **Adjusted replacement rate by age and type of plan**



5.1 Effective tax rates

A second measure of work incentives is the effective tax rate. This was used in the international study, led by Gruber and Wise (1997, 1999), of the impact of social security programmes on retirement behaviour. In the simplest cases, this measure is the same as the replacement rate.[19] However, taking account of the effect of continued working on pension wealth, this becomes:

1 — (gross earnings + change in pension wealth — pension)/gross earnings

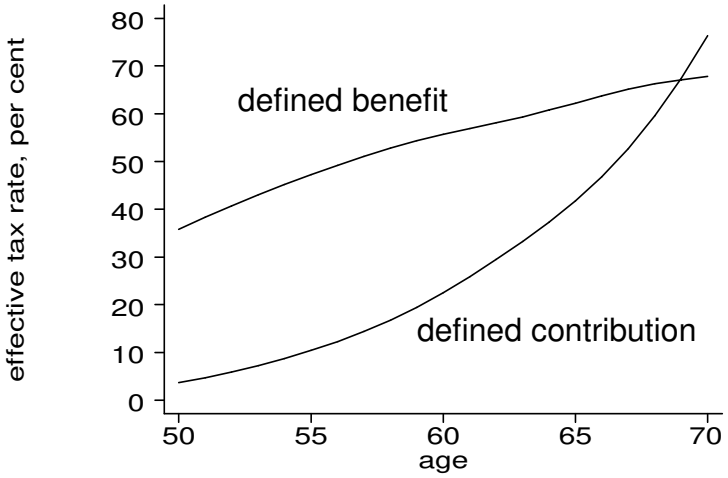
These effective tax rates are the same as *average* effective tax rates in a static model. But when considering a dynamic labour-supply problem, such as retirement, they are best thought of as the *marginal* effective tax rate on an additional year's work.

---

[19] Ignoring taxation and changes in pension wealth, for example, the effective tax rate is 1 - (earnings-pension)/earnings, which can be simplified to pension/earnings. See OECD (1997*a*), Annex B for a discussion.

Figure 10 shows the baseline effective tax rate results. The differences in incentives between the two different types of plan are very clear and are more pronounced than in the replacement rate comparisons in Figures 5 and 9. Defined-benefit schemes give a substantial incentive to retire earlier, and the effective tax rate on continued work from the pension system is only higher in the defined-contribution plan after age 68. This pattern explains why governments need to impose minimum early retirement ages in defined-benefit plans, because workers have a sizeable incentive to retire at the earliest possible date. Defined-contribution schemes, in contrast, give a large incentive to continue working until quite advanced ages.

Figure 10. **Effective tax rate on working by age and type of plan**



6. Extensions to the basic model: taxation

Gruber and Wise stress the importance of other elements of the tax and benefit system on retirement incentives. For instance, progressive personal income tax systems imply a higher average tax rate on (higher) earnings than on (lower) pensions. Thus, net earnings are lower relative to net pensions than to gross pensions.

The tax system can have a more complex effect. In some countries, pensioners are treated more generously than workers are. In the United Kingdom, for example, the tax-free allowance for single pensioners is £5,220-£5,440 (depending on age) or 29-34% greater than for workers.[20] In addition, the tax credit for married pensioners is worth 76 per cent more than for married couples of working age. These allowances apply to all the income of those over state pensionable age, including earnings.

In other countries, pensions are treated more generously by the tax system than labour income. For example, in Austria, 75 per cent of pension annuity income is tax-free, and in the United States, 15 per cent. Canada provides a pension income credit at the basic income tax rate on the first slice of annuity income.[21]

Account should also be taken of the impact of social security contributions for benefits other than pensions, such as disability, unemployment insurance *etc.* Again, these are usually

---

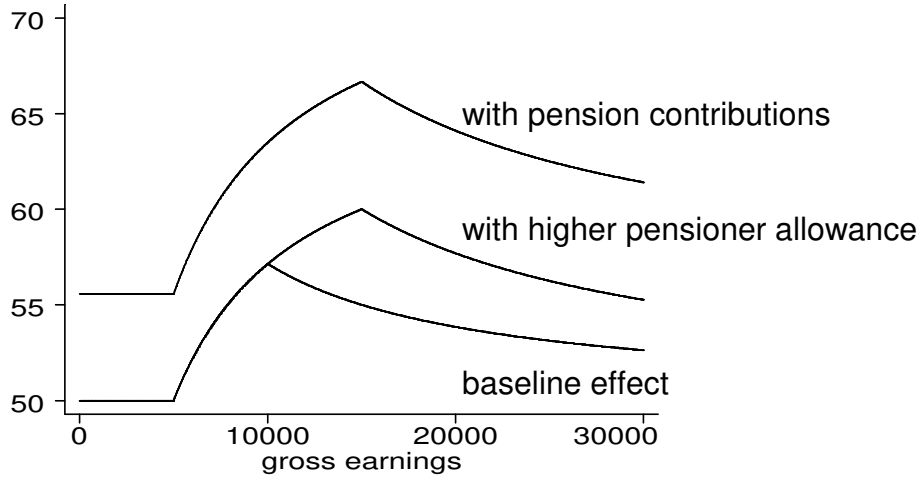
20 See Dilnot *et al.* (1994) and Hemming and Kay (1981) for a discussion of the impact of this tax treatment and a proposal for reform.

21 See Whitehouse (1999).

levied only on earnings and not on pension payments, although some countries, such as France and the Netherlands, have recently moved to broaden the base for social-security contributions.[22]

We explore, first, the effect of a simple personal income tax system, with a zero-rate band of $5 000 and a single rate of 25 per cent thereafter. The pension is assumed to give a gross replacement rate of 50 per cent. The lowest line in Figure 11 shows the net replacement rate at different levels of earnings. Income tax is levied on gross earnings above $5 000, but the pension at this earnings level (of $2 500) would be tax-free. The net replacement rate peaks at gross earnings of $10 000. The pension of 50 per cent of earnings is taxed at higher income levels. At very high levels of earnings, the net replacement rate asymptotes to the gross.

Figure 11. **The impact of a progressive personal income tax on replacement rates**



Moving upwards in Figure 11, the next line shows a system which gives a larger allowance ($7 500) to the pensioner than the worker. Now the net replacement rate peaks later, and at a higher level (60 per cent). Finally, the highest line in Figure 11 adds in a 10 per cent social security contribution. This shifts the line upward at each point. Now, the net replacement rate can exceed 65 per cent, compared with the 50 per cent gross rate.

7. Extensions to the basic model: defined-contribution schemes

Many countries allow drawdown from defined-contribution scheme rather than forcing conversion to an annuity.[23] Drawdown potentially allows people to avoid 'timing risk', the risk that interest rates are low on the date that the pension fund is converted. It also permits those

---

22 These contributions deliver entitlement to these other benefits, but all social-security programmes involve a substantial degree of redistribution. In the absence of actuarially calculated individual contribution rates, it is difficult not to treat these contributions as a tax. See OECD (1998*a*) for a discussion.

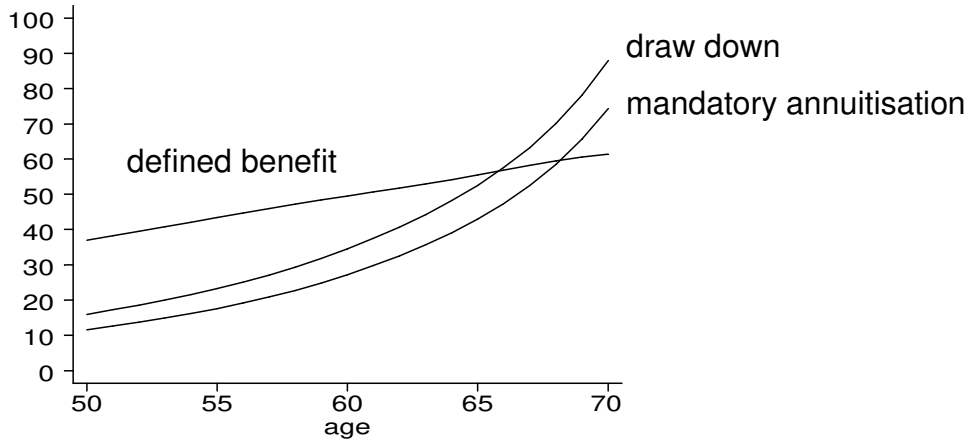
23 See Piggott and Doyle (1999) and Brugiavini (1993).

with a short life expectancy to avoid the losses from annuitisation, and either to enjoy a higher pension or leave a bequest.[24]

Under drawdown, the fund continues to earn the market investment return. In the model, we assume that this is higher than the riskless interest rate, which underlies the calculation of the annuity rate. The only way of continuing to earn the market return on accumulated pension in the basic model is to continue in work. However, if drawdown is allowed, the individual can retire and still earn this higher return. Figure 12 shows the impact of drawdown.

Draw down allows a pension around 50 per cent higher than mandatory annuitisation (assuming the individual follows a rational rule for taking out the funds).

Figure 12. **The impact of voluntary annuitisation on incentives in defined-contribution plans**



7.1 Retirement rules in defined-contribution schemes in practice

Table 0. **Retirement rules in mandatory defined-contribution systems**

	Normal age	*Minimum replacement rate*	*Minimum pension*
Argentina	58/63	—	—
Bolivia	65	70	—
Chile	60/65	50	110
Colombia	55/60	—	110
El Salvador	55/60	70	160
Peru	65	50	110

[24] Given the correlation between income and longevity, compulsory annuitisation is regressive. See Kotlikoff (198x) for a discussion.

8. Extensions to the basic model: defined-benefit schemes

The simple, stylised defined-benefit model ignores many of the complexities of 'real-world' plans. Many of these are likely to have substantial effects on retirement incentives. We have assumed that the plan's formula uses lifetime average earnings, and that each extra contribution delivers additional pension benefit. Many plans, however, have non-linear accrual structures, with floors and/or ceilings to contributions and/or benefits. This means schemes deliver different returns for people with different levels of earnings.

Secondly, many plans have higher accrual factors for early years of contributions. As later years deliver a lower return to working in the form of extra pension entitlement, this can be a disincentive to continue working. Other schemes have maximum pension levels or maximum years of accrual in the plan. The additional pension accrual is zero above these limits, but often, contributions continue to be levied.

Thirdly, only a limited number of years of earnings count in mots schemes, which use either 'final' or 'best' years in the plan. The effects of these rules are extremely complex. Assuming that earnings continue to increase (as in the basic model, see Figure 1 or 4) then plans based on either final or best years increase the return to working relative to an average-pay scheme. This is because the earnings base used in the pension formula is growing more quickly. If, however, earnings decline at older ages, then the pension value falls with each year of extra contributions in a final earnings plan. A best-years scheme has marginally lower returns to working than an average-salary scheme.

Finally, the simple defined-benefit formula does not allow for adjustments to the pension depending on the age at which it is drawn. In some countries, pensions drawn at the earliest possible age are 'actuarially' reduced. In others, deferring drawing the pension beyond the normal age attracts an increment to the pension value when, eventually, it is drawn.

8.1 Non-linearities in pension accrual

Figure 13 shows the structure of pension accrual in two public defined-benefit plans. A full 46 countries' profiles are in Annex 1. The horizontal axis shows the number of years of contributions, the vertical, the percentage of the relevant measure of earnings secured in pension for that year of contributions.[25]

We have chosen only the countries with non-linear accrual structures, and in the Annex ranked them from the most non-linear to the least.[26] Iran offers a very high accrual rate of 3.3 per cent, but there is a maximum replacement rate of 100 per cent. This means that after 30 years of contribution, there can be no further increment to the pension. The 'spike' at 10 years indicates that the pension 'vests' at that point. After nine years of contributions the pension

---

[25] These measures of earnings also vary significantly between countries: see Section 7.2 below. Note that we have capped the annual accrual at 4 per cent to make the charts easier to compare. Some countries, *e.g.* Brazil, have higher accrual rates over some ranges.

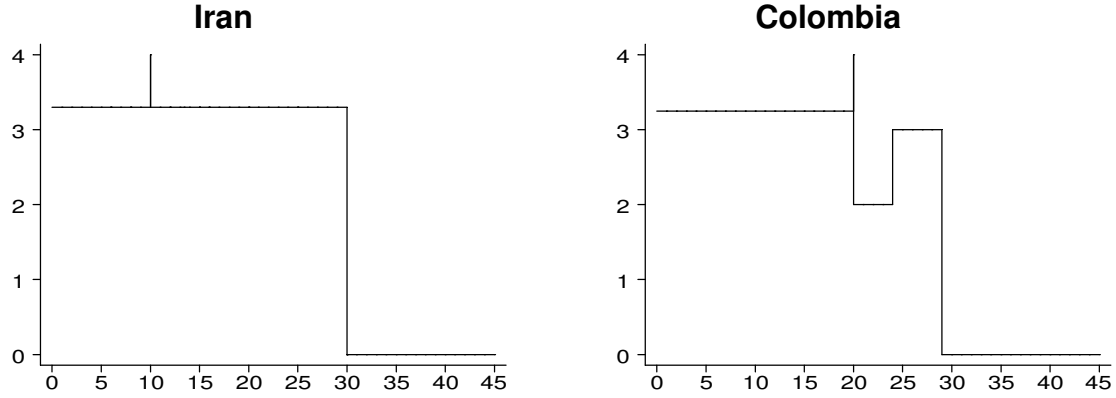
[26] The ranking is based on the coefficient of variation of the annual accrual from zero to 45 years of contribution.

entitlement is still zero. At ten years of contributions, the pension is 33 per cent of earnings. The spike indicates this change.[27]

Colombia's public system, shown in the second panel of Figure 13, is more complex than Iran's. A replacement rate of 65 per cent is given for 1 000 weeks of contributions. Each 50 weeks between 1 000 and 1 200 weeks earns an increment of 2 per cent up to a maximum of 73 per cent of earnings. Between 1 200 and 1 400 weeks, the increment is 3 per cent for each 50 weeks, to a maximum of 85 per cent. A minimum of 1 000 weeks contributions is required for the pension.

Even these charts are a major simplification: they ignore 'sectoral' privileges (giving early retirement or reduced contribution requirements to particular occupations or industries) and credits granted, for example, for periods of unemployment, disability, education or child-rearing.

Figure 13. **Accrual rates by years of contributions**



8.1.1 Effect on work incentives

The pension system acts as a disincentive to work at older ages, even below the normal pension age, in all the countries shown in the Annex. For example, in 12 countries the accrual rate is zero after 40 years' or fewer of contributions (at an average of 34 years). In 40 countries, later years of contribution attract a lower rate than early years.

---

[27] A 'legal-contract' approach (see Bulow, 1982 for an application to private defined-benefit schemes in the United States) would show a zero accrual for the first nine years, and a 33 per cent accrual in the tenth year. This is also called the 'accumulated benefit obligation' (Bodie, 1991). The alternative, used here, is to show the accrual in the first ten years assuming that the individual will make ten years of contributions (see, for example, Kotlikoff and Wise, 1985 on the United States). A final approach is to compute the probability at any point before ten years that the individual will contribute for ten years, also called the 'projected benefit obligation'. This method is discussed in Disney and Whitehouse (1996) and compared with the other two measures for private defined-benefit schemes in the United Kingdom. See also Disney (1996), pp. 116-121.

8.2 Final, average and best salary schemes

Tables 1 and 2 show the formulae used in 80 different countries' public, defined-benefit plans. The Tables rank countries with final and best salary formulae inversely: from the longest to the shortest averaging periods.

OECD countries, shown in Table 1, divide evenly between the three different groups. First, those that average earnings across all or most of the working life. Secondly, those that take a measure of earnings in the final few years of the working life and, thirdly, those that use a number of' 'best' years.

Table 1. **Earnings measure in public, defined-benefit plans: OECD countries**

Average	*Best*	*Final*
Belgium	Norway (20)	Czech Republic (average since 1985)
Germany	Austria (15)	Portugal (best 10 of 15)
United Kingdom	Sweden (15)	Turkey (5-7)
United States (ex worst 5 years)	France (11)	Greece (5)
Canada (ex 15% worse years)		Mexico (5)
		Hungary (best 4 of 5)

Source: Department of Health and Human Services (1997)

In other countries, listed in Table 2, final salary schemes dominate. Only 14 per cent of countries use average pay and 18 per cent use a measure of best earnings. Schemes outside the OECD also tend to consider rather fewer years' earnings. In final pay plans, the average in OECD countries is around 7 years, compared with fewer than 4 years in lower-income countries. There is also rather less variation among OECD countries. Outside the OECD, three countries use only the final month's pay in the pension formula, while six countries average over the last ten years. In best earnings schemes, the OECD average is a 15-year formula, compared with 6 years outside the OECD.

There are two main reasons for adopting short averaging periods in defined-benefit plans. First, they are a simple way to correct the effects of high and volatile inflation. Secondly, they are administratively simpler than tracking work and contribution records right across the working life.

However, they can lead to high costs, strategic manipulation of earnings profiles and disproportionately higher benefits going to higher-income workers, because they tend to have more steeply rising age-earnings profiles (see below and World Bank, 1994, Box 4.8).

Table 2. **Earnings measure used in public, defined-benefit plans: non-OECD countries**

Average	*Final*	*Final* cont.
Albania	Argentina (10)	Niger (best of 3 or 5)
Côte d'Ivoire	Colombia (10)	Rwanda (best of 3 or 5)
Congo (Kinshasa)	El Salvador (10)	Tunisia (best of 3 or 5)
Cyprus	Haiti (10)	Dominica (best 3 of final 10)
Jamaica	Madagascar (10)	Malta (best cons. of 10)
Liberia	Uruguay (10)	Dominican Republic (2)
Mauritius	Guatemala (5)	Egypt (2)
Philippines	Mali (5)	Iran (2)
Trinidad and Tobago	Romania (best cons. 5 of 10)	Jordan (2)
	Cuba (best 5 of 10)	Oman (2)
Best	Slovakia (best 5 of 10)	Saudi Arabia (2)
Poland (6 of final 15)	Nicaragua (3,4,5)	Costa Rica (best 2 of 5)
Croatia (cons. 10)	Peru (3,4,5)	Syria (best of 2 or best cons. 5 in 10)
Serbia (cons. 10)	Brazil (3)	Georgia (best of 1 or 5)
Slovenia (cons. 10)	Ethiopia (3)	Moldova (1)
Panama (7)	Iraq (3)	Pakistan (1)
Belarus (cons. 5 of final 15)	Libya (3)	Kuwait (final month)
Kyrgyzstan (cons. 5 of 15)	Paraguay (3)	Lebanon (final month)
Turkmenistan (cons. 5 of 15)	Cameroon (best of 3 or 5)	Nigeria (final month)
Russia (cons. 5 or final 2)	Central African R. (best of 3 or 5)	
Ukraine (cons. 5 or final 2)	Congo-Brazzaville (best of 3 or 5)	
Ecuador (5)	Gabon (best of 3 or 5)	
Bulgaria (cons. 3 of final 15)	Mauritania (best of 3 or 5)	
Algeria (3)	Morocco (best of 3 or 5)	

Note: cons. = consecutive
Source: Department of Health and Human Services (1997)

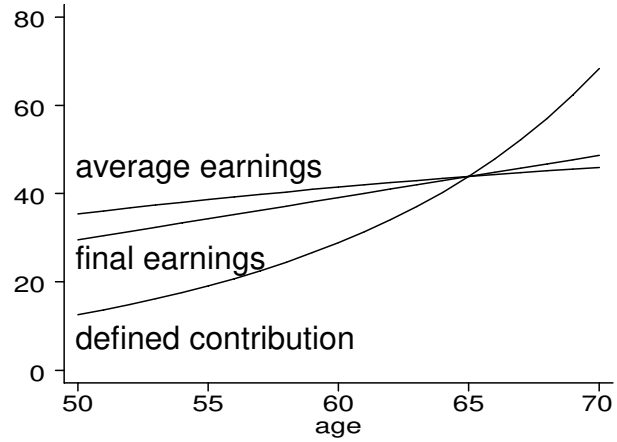
8.2.1 The impact of final salary schemes on work incentives

Our baseline model assumes that earnings grow linearly with age. Final pay, under this assumption, is higher than average pay, and is growing more quickly. Figure 14 shows the pattern of work incentives by age for a final- and an average-salary plan using the measure of replacement rates, adjusted for changes in pension wealth.

To equalise the pension value at age 65, the accrual rate is around 1 per cent of final-pay in that scheme, compared with 1.7 per cent of average earnings. The differences in the incentive structure are not large. But the fact that final pay increases more rapidly with age than average earnings reduces adjusted replacement rates when younger and increases them when older.[28] This result depends critically on the structure of age-earnings profiles, and this issue is considered next.

[28] Lazear (1979) argues that this explains why employers impose mandatory retirement in defined-benefit schemes. A mix of higher, seniority pay and backloaded pension benefits mean that the employer's costs of continuing to employ older workers exceed productivity, meaning it is in their interest for them to leave. See also Burkhauser and Quinn (1983) and Hutchens (1986).

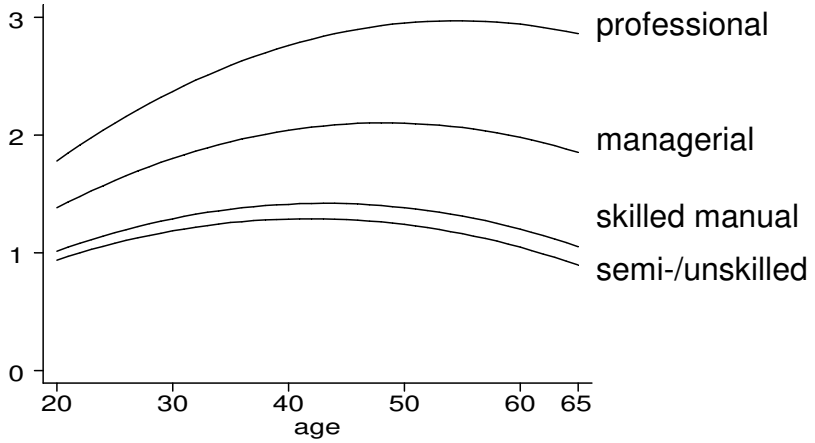
Figure 14. **Defined-benefit pensions under average and final salary formulae with rising earnings**



8.2.2 What do 'true' age-earnings profiles look like?

Simple cross-section analysis of age-earnings profiles generally shows an inverted-U shape, with real earnings falling at older ages. Figure 15 shows this pattern using data on hourly earnings for the United Kingdom.[29] Separate wage equations, including a quadratic term in age, were estimated for each occupational group.

Figure 15. **Age-earnings profiles by occupation, United Kingdom**



Source: Disney and Whitehouse (1991), Tables 2, 5 and 7

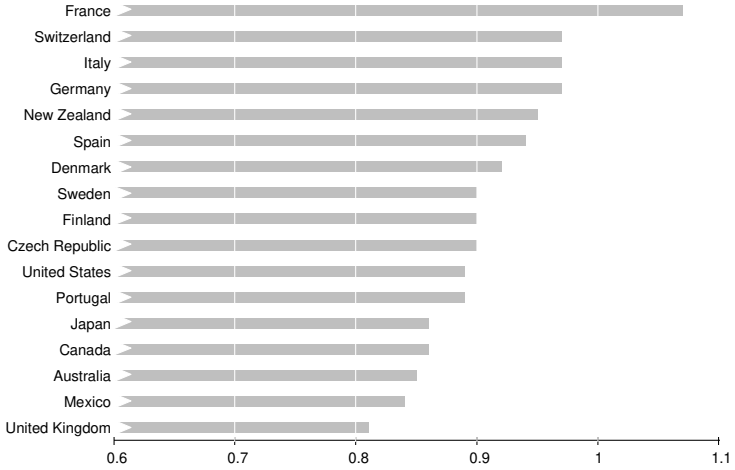
The pay of professional, and to a lesser extent, managerial workers rises steeply with age initially. Professional earnings flatten when workers reach their mid-50s, with a rather earlier peak for managers. In contrast, the profiles for manual workers are much flatter and peak earlier, in the early to mid-40s. The decline in earnings after their peak is also relatively larger, so that

[29] Disney and Whitehouse (1991). The data are drawn from a pool of Family Expenditure Survey cross-sections for 1978 to 1986.

workers from their late 50s onwards earn the same or less than workers in their 20s. This shows that both schemes based on both final ad best earnings are regressive. Professional workers final pay is much higher relative to their average pay than the same ration of manual workers.

Figure 16 shows a simple measure of the slope of age-earnings profiles for a range of OECD countries: the ratio of earnings of 55-64 year olds to that of 45-54 year olds. In Germany, Italy and Switzerland the difference is very small, while in France, the oldest workers earn more than their immediate juniors do. At the other end of the spectrum, wages for the oldest workers in Australia, Canada, Mexico and the United Kingdom are 17 per cent below people aged 45-54. These economies are conventionally classified as those with more flexible labour markets. The decline in Japan, in contrast, reflects the lifetime employment system and the occupational downgrading of older workers within the economic group to which their employer belongs. Interestingly, the oldest workers in the United States (the archetypal flexible labour market) earn only 10 per cent less than their juniors do.

Figure 16. **Relative earnings of older workers**
(ratio of 55-64 year olds' pay to 45-54 year olds)



Source: OECD (1998*c*)

However, these cross-section analyses conflate age and cohort effects. Lower earnings of older workers in cross-section also reflect cohort differences in education, training, labour-market experience *etc.* that cannot be disentangled from the pure age effect.

Following the same cohort over time, other studies have found that age-earnings profiles are close to linear, with pay rising even at older ages.[30] However, earnings are endogenous to the retirement decision, so there is a sample selection problem as the people working at older ages are not representative of the whole cohort. Even cohort-based studies are therefore a biased measure of age-earnings profiles. Attempting to control for this selection raises a problem of simultaneity. We can only know the true nature of this selection process if we know why people retire early. And we can only know why people retire early if we know what true, individual age-earnings profiles look like.

---

30 See, for example, Meghir and Whitehouse (1996) and Gosling, Machin and Meghir (1998). This issue is also explored in Freeman (1979, 1989), Berger (1983), Disney (1996), Chapter 6 and Kotlikoff and Gokhale (1992)

Another important field of literature looks at the effect of job displacement on earnings. This is particularly relevant for the incentives of workers who leave their jobs involuntarily and so face a choice of either retirement or starting a new job. In the United States, for example, earnings of older workers who lose their job and start a new one are 39 per cent lower (for a period of two years) than people who remain in their jobs.[31]

8.2.3 Age-earnings profiles and work incentives

Age-earnings profiles that are flatter or declining at older ages have a number of effects on the measures of incentives compared with our baseline results. First, the denominator of the measures of incentives is lower because of lower pay, increasing replacement rates and effective tax rates for both defined-contribution and defined-benefit schemes. Secondly, the decline in final salary at older ages means the relative effects of final- and average-earnings defined-benefit schemes is reversed from the pattern in Figure 14. Final-salary schemes will give higher replacement rates at younger ages. Overall, the effect of final pay formulae relative to average-pay varies with the relationship between earnings and age. Given the discussion of the previous paragraph, this will be particularly relevant for people who leave a job involuntarily. Final-salary systems will give a powerful disincentive to take another job with lower pay. This, along with the problems raised at the beginning of section 8.2, suggests that defined-benefit schemes should preferably be based on average-salary.

8.3 'Actuarial' adjustments to defined-benefit pensions

Some countries adjust defined-benefit pensions to reflect the fact that they are drawn either early or late. Table 3 shows the size of these adjustments in the 32 countries that have them. It lists countries in inverse order of the size of the adjustment.

Actuarial adjustments are more common in OECD countries than outside: 14 out of the total of 29 OECD members use them. There is little difference between adjustments to early or late pensions. But there is a big difference between OECD and non-OECD countries, with averages of 6½ per cent in the former and a little under 3½ per cent in the latter for each year the pension is drawn early or late.

These adjustments apply over very different age ranges in different countries. In 11, actuarial changes cover only early pension claims (before the 'normal' pension age). In many countries, there is evidence that the majority draw their pension at this 'early' age, despite the reduction in their pension benefit. In 12 countries, increments are only given for deferring the pension, while in six, increments are decrements are applied both to early and late pensions.

Notional-accounts pension systems also adjust the pension according to the age at which it is drawn. The implied adjustment will be 8-9 per cent a year in Poland and around 7 per cent in Latvia.[32]

---

31 Couch (1998). See also Jacobson, LaLonde and Sullivan (1993) and Ruhm (1990).

32 Chlon, Gora and Rutkowski (1999) on Poland and Fox and Palmer (1999) on Latvia. See Disney and Whitehouse (1999*b*) for a discussion of retirement incentives in notional-accounts systems.

Table 3. **'Actuarial' adjustments in defined-benefit plans**

	Age adjustments apply		*Size of adjustment*
Japan	60-70	early & late	12
France??	60-70	late	10
Finland	60-70	early & late	6-12
Liechtenstein	65-70	late	8.4
Spain	60-65	early	8
United Kingdom	65-70	late	7.5
Sweden	60-70	early & late	6-8.4
United States	62-70	early & late	6-6.7
Canada	60-70	early	6
Dominica	60-	late	6
Germany	63-67	early & late	6
Greece	60-65	early	6
Pakistan	55-60	early	6
Côte d'Ivoire	50-55	early	5
Guinea	55-	late	5
Israel	65-70	late	5
Mali	50-55	early	5
Mexico	60-65	early	5
Senegal	53-55	early	5
Albania	60-	late	4
Czech Republic	60-70	late	4
Cuba	60-65	late	1.5-4
Italy	57-65	early & late	3.5
El Salvador	60-	late	3
Honduras	65-	late	3
Hungary	60-70	late	3
Panama	62-	late	2
Sudan	45-60	early	1.2-1.9
Costa Rica	62-65	late	1.5
Croatia	-60	early	1.33
Algeria	-60	early	1
Nicaragua	60-65	late	1
Turkey	55-	late	1

Note: Australia is considering introducing a deferred retirement bonus plan for men working from age 65 to 70 (and 61-66 for women). Ages where adjustments apply are for men where these differ from women. Costa Rica gives 1.5 per cent for first year of deferral, 2 per cent for second year and 2.5 per cent for the third. In Croatia, the reductions only apply for pensions up to normal retirement age (60). New system for Italy applies to contributions since December 1995. Early pensions in Mexico only available if the individual is involuntarily unemployed. Adjustment is based on age coefficient of 4.72 at age 57 and 6.136 at age 65. Sweden is planning to remove the upper age limit for deferral in 1999. The 6 per cent rate applies before 65, 8.4 per cent after 65. The United Kingdom will increase the deferral rate to 10 per cent after 2010 and remove the age 70 ceiling for deferral. The United States will increase its rate to 8 per cent by 2001: see section 8.4.3 below. The Hungarian reform introduced a penalty for retirement below age 62 equivalent to 3.6% per annum in the long run. The Polish reform introduces an increment for delayed retirement equivalent based on the notional interest rate and higher annuity level through the new system of notional accounts for contributors aged 50 or under in 1999.

Source: Department of Health and Human Services (1997), Kalisch and Aman (1998); Palacios and Rocha (1999); Chlon, Gora and Rutkowski (1999).

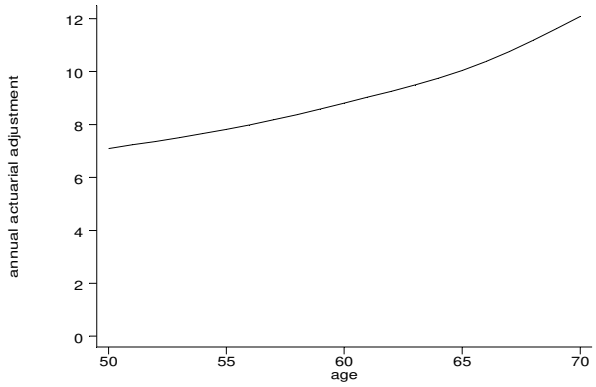
8.3.1 Actuarially neutral adjustments

How do these adjustments compare with the actuarially neutral increment or decrement? We define the actuarially neutral increment or decrement as the change that would keep the net present value of the pension constant. This has three elements. First, the change in the annuity rate between the two relevant ages captures the effect of the one-year delay in claiming the pension. Secondly, account must also be taken of the risk of dying during the year. Thirdly, the net value of the delayed pension must be discounted back to the present.

Figure 17 shows the results for Thai mortality data. The rate increases with age because of the increase in mortality and because, at older ages, one year's delay is a larger proportion of the total expected duration of pension payment. For men, the rate increases from 7 per cent at age 50 to 12 per cent at age 70. For women, the rate will be higher because of their longer life expectancy.

Comparing Figure 17 with the rates in Table 3 shows that the average adjustment is below the actuarially neutral level in most countries, with the (probable[33]) exceptions of Japan, Finland Liechtenstein Spain, the United Kingdom and Sweden.[34]

Figure 17. **Neutral actuarial adjustment to defined-benefit pension by age**



8.3.2 The impact on work incentives

Figure 18 examines the effect of actuarial adjustments on work incentives. We have assumed a 5 per cent change in the pension for each year the pension is drawn before or after age 65, which is approximately the average adjustment in Table 3.

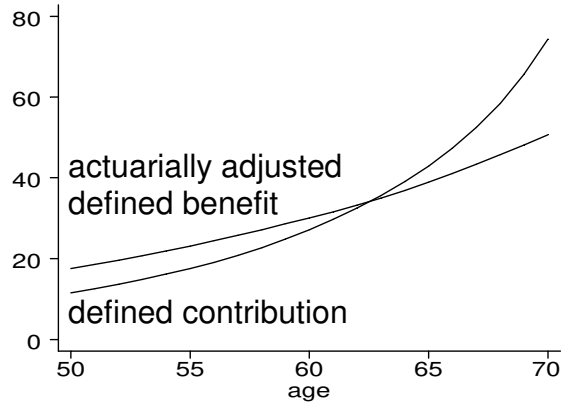
The adjusted replacement rate for the defined-benefit scheme now has a more pronounced upward slope, but not as strong as the defined-contribution plan.

---

33 We do not have life tables for all these countries to be able accurately to assess this claim.

34 Studies have also found that private plans tend to have less than fair actuarial decerements for early retirement. See, for example, Kotlikoff and Smith (1983) and the discussions in Quinn, Burkhauser and Myers (1990) and Kotlikoff and Wise (1985).

Figure 18. **Impact of actuarial adjustments in defined-benefit schemes on replacement rates**



8.4 Earning while drawing pension

Our basic model of retirement incentives assumed that people had to give up work when they claimed their pension. In many countries, working while drawing pension is possible. This complicates the analysis of pension plans and retirement incentives enormously, as most models can only be identified by equating the point of retirement (*i.e.* withdrawing from the labour force) with the point of first drawing the pension.[35]

Table 4 shows the position in OECD countries. Again, policies differ. In Ireland, Portugal and Spain, the pension is paid conditional on withdrawal from paid work. People in France must retire definitively from their usual job, although it is possible to take another job.

In the majority of countries, however, a limited amount of work is compatible with drawing the pension. Canada has the most liberal of these régimes. People can earn up to 160 per cent of average earnings with full pension, and then the pension is withdrawn at 15 cents for each dollar of earnings above that point. In Greece, pensioners may earn up to 116 per cent of average earnings, but then the whole pension is withdrawn.

Italy, Japan and the United States also have earnings limits. In Japan, for example, 20 per cent of the pension is withdrawn when earnings are between 17 and 90 per cent of average earnings. Above 90 per cent of average earnings, the whole pension is withdrawn. However, in both these countries, deferral is possible, allowing people to get round the effect of the earnings test. (Section 8.4.3 below discusses the United States' system in more detail.)

At the foot of the Table are eight countries that impose little or no restrictions on combining work with pension payments.

---

35 See *inter alia* Gustman and Steinmeier (1984).

Table 4. **Earning while drawing pension, OECD countries**

	Disregard (% of average earnings)	*Withdrawal rate (%)*
Deferral not possible		
Canada	160	15
Greece	116	full
Iceland	59	25
Denmark	50	60
Austria	30	full
Belgium	33	100
Norway	18	50
Australia	8	50
France	none	full
Ireland	none	full
Portugal	none	full
Spain	none	full
Deferral possible		
Italy	23	100
Japan	17-90	20
	90	full
United States	38	33-50
No restrictions		
Finland		
Germany		
Netherlands		
New Zealand		
Poland		
Sweden		
Switzerland		
United Kingdom		

Note: Pension in Ireland, Portugal and Spain conditional on withdrawal from work. Pension withdrawn at a 100 per cent rate between 29 and 33 per cent of average earnings in Belgium. Italy gives a higher disregard for self-employment incomes (which are an important income source). Australia has a means-tested system and all income sources (including private pensions) are withdrawn against the public pension. Portugal has recently allowed people to work and claim full pension (Kalisch and Aman, 1999, Table 16). The United States has a lower disregard (18 per cent of average earnings) for people aged 62-64; Poland refers to reformed system.
Source: Blöndal and Scarpetta (1998), based on Department of Health and Human Services (1997), European Commission (1996) and OECD (1996*b*); Kalisch and Aman (1998); Chlon, Gora and Rutkowski (1999).

8.4.1 Partial retirement programmes

A small number of countries have partial or phased retirement schemes.[36] These allow people to cut their hours of work while claiming part of their pension. In Denmark, people who reduce their working hours between age 60 and the normal pensionable age of 67 can receive part

[36] See Casey (1998), Laczko (1988) and Naegele (1996) for a discussion of gradual retirement schemes. Gustman and Steinmeier (1984) and Ruhm (1990) discuss 'bridge' jobs as a route to partial retirement in the United States.

of their pension.[37] People must have been employed full-time for 10 of the previous 20 years and cut their hours to between 12 and 30 per week. Germany reimburses employers the cost of paying a 20-per-cent earnings supplement and maintaining 90 per cent of previous pension contributions to people who reduce their hours by half or more. Luxembourg allows people to combine half of their earnings with a one-half pension. Japan pays lower pensions to people aged between 60 and 64 if they reduce work attachment. If the combined pension and lower wage is below $24 000 the pension is cut by 20 per cent. Between $24 000 and $36 000, the pension is reduced at a marginal rate of 50 per cent, with 100 per cent withdrawal against earnings over $36 000. Canada is also considering a partial retirement scheme.

Partial retirement programmes are attractive in theory. They might encourage people to remain in work longer than they would given a binary choice between full-time work or retirement (although they might reduce the labour supply of some workers who otherwise would have remained in full-time work). In particular, they might allow any age-related decline in stamina or capabilities to be accommodated. In practice, however, the take-up of partial retirement schemes has been very limited. In Germany, for example, only 2,000 of an eligible population of 1.2 million availed themselves of this option.

In some countries, such as France and Germany, early retirement (on only marginally lower incomes) proved more attractive than partial retirement. In Germany and the United Kingdom, employer-run defined-benefit programmes dependent on final pay were not co-ordinated with the public programme, so gradual retirement would result in a much lower private pension. Many employers were also unable or reluctant to re-organise work around partial retirees.

8.4.2 Combining work and pensions: reforms in the United Kingdom

The United Kingdom used to have an earnings limit of around a third of average earnings. Above this level, the pension was withdrawn, at 50 per cent over a short range and then at 100 per cent. However, most people who were working and earning above the limit deferred their pension, earning increments in their eventual pension of 7½ per cent per year of deferral (Table 3). Only 2,500 people had their pension capped by the earnings test while 200,000 deferred. A further 200,000 were claiming the pension and working, but did not have their pension reduced because they were below the limit. The rule could have affected them if they would have chosen to work more in the absence of the earnings test.

The United Kingdom abolished the earnings rule in 1989. The effects of this policy are complex.[38] For those who are currently working and either deferring their pension or have deferred, the change is a pure income effect, suggesting reduced labour-supply incentives. For people not working or earning below the earnings limit, there will be a positive substitution effect. Both are likely to be small. The fiscal effect of abolition will also be tiny. Since the actuarial adjustments for deferrals are fairly close to neutral on average, there will be an up-front cost as people claim their pension earlier, with a saving on the adjustments in the future.

Current regulations require members of employer-provided schemes to retire fully from their job before they can draw their pension. People could draw their occupational pension and

---

37 Ministry of Social Affairs (1995).

38 See Whitehouse (1990) for a detailed analysis.

work, but would have to take a different job. The government last year[39] proposed a more flexible régime, including the possibility of partial retirement. People will be able to draw their occupational pension at any age between 50 and 75 irrespective of whether they actually retire. People will be able to draw the benefits from additional voluntary contributions into employer schemes at any age between 50 and 75, irrespective of when the main occupational pension is drawn. These two reforms are designed to allow a more flexible transition from full-time work to retirement — as in the partial retirement programmes described in the previous section — rather than the current 'all-or-nothing' choice.

8.4.3 Combining work and pensions: reforms in the United States

The United States has also altered the rules for earning while drawing social security.[40] The original test, introduced in the 1930s, took away the whole pension once earnings exceeded a fifth of average earnings. There has been a gradual liberalisation in the rules. First, the exempt amount was increased periodically during the 1960s and then indexed to inflation from 1972. Each year from 1978 to 1982, there were above-inflation increases. The limit for 65-69 year olds will increase from $12,500 to $30,000 between 1996 and 2002. Secondly, there have been reductions in the withdrawal rate. In 1960, a schedule of 50 and 100 per cent withdrawal rates replaced the immediate loss of all benefits one the limit was reached. The 100 per cent band was abolished in 1972. The withdrawal rate for 65-69 year olds was cut to 33 per cent in 1990. Finally, the earnings test was abolished completely for people aged 72 and over in 1954 and for 70 and 71 year olds in 1983.

The eventual pension is higher to reflect benefits withdrawn under the earnings test, as in the deferral system in the United Kingdom. This increase, called the delayed retirement credit, was introduced in 1973 at a rate of 1 per cent for each year of deferral between 64 and 69. In 1982, it was increased to 3 per cent. Since 1990, it has increased at half a percentage point a year, and will continue until it reaches 8 per cent. When it reaches this final target level, it will be approximately actuarially neutral.

In 1989, 27 per cent of Americans aged 65-69 were working. Of these, 38 per cent had some benefits withdrawn under the earnings test and 29 per cent were working and not claiming pension benefits.[41] Further evidence of the impact of the earnings test is that 9 per cent had earnings very close to the earnings-test limit.

Most empirical studies of the earnings test's effect on labour supply have found it unimportant.[42] More recent analysis, however, is able to use the 'natural experiment' of changes to the earnings test that affect different age groups in different ways to obtain more accurate estimates of its effect. Friedberg (1998*a*) finds that eliminating the test would increase aggregate hours worked of those currently affected by the rule by 5.3 per cent (taking account of the decline in hours of those with the highest earnings from the income effect). Her study, however, treats the earnings test as a pure tax, despite the eventual increase in the pension benefit when it

---

39 Department of Social Security (1998).

40 See Friedberg (1998).

41 Bondar (1993).

42 See *inter alia,* Bondar (1993), Honig and Reimers (1989), Leonesio (1990, 1993), Packard (1990). Robbins and Robbins (1989) found a substantial effect, but Leonesio (1990) dismisses this work as having 'serious theoretical and methodological shortcomings'.

is finally claimed.[43] She gives four reasons for this treatment. First, people are aware of the earnings test — 73 per cent of pensioners under age 72 told the *New Beneficiary Survey* of 1982 that they knew of it[44] — but are not aware of the link between the test and subsequent pension credits. She cites newspaper and financial magazine descriptions of the earnings test that ignore the credits.[45] Secondly, people are myopic or, thirdly, face borrowing constraints and so under-value the increase in future income. Finally, the current credits are below the actuarially neutral level, especially for men and those with short life expectancy. However, these last three arguments suggest that only part of the earnings test reduction is a tax.

8.4.4 Combining work and pensions: policy conclusions

Our discussion of the United Kingdom and the United States shows that earnings tests have extremely complex interactions with rules for actuarial adjustments.

There is a sizeable dead-weight cost to abolishing earnings tests, as people draw the pension at the earliest possible age and continue to work as before. Poland, for example, has introduced an earnings test in its recent reform. The aim is to prevent people, particularly in occupations with special early retirement provisions, from drawing pension and continuing to work.[46] The government expects this to cut spending by 0.3 per cent of GDP in 2003, around 15 per cent of the total reduction in spending anticipated from the recent reform. The Slovak Republic has drafted similar legislation to prevent people combining work and pensions. Italy is also moving to limit these opportunities.

9. Conclusions, policy implications and future developments

We have presented a simple model of how different types of pension plan affect retirement incentives. The results show a powerful incentive to leave work at the earliest possible age in defined-benefit plans. Defined-contribution plans, in contrast, encourage people to remain in work longer.

Examining 'real-world' defined-benefit schemes, we found many have features that provide more profound disincentives to work, such as

- early retirement programmes that enable people to leave work with no reduction in pension or a decrement that is less than actuarially fair
- non-linear accrual structures or maximum pensions that give a low or zero increment to pension for working at older ages

---

43 There is some empirical evidence to support this claim. Reimers and Honig (1993, 1996) compare the response of labour-market re-entry behaviour of men before and after age 65 to changes in the earnings limit. These are expected to differ, because of the variance in the actuarial adjustments. However, they found very similar effects for both age groups. Friedberg could not find an effect from the credit when she included this in the modelling.

44 Leonesio (1990).

45 Simon (1996) and Kristhof (1997).

46 See Gora and Rutkowski (1998).

- final-salary formulae that encourage people to leave the labour force once earnings reach their peak
- pension systems that still levy employer and/or employee contributions even when no additional pension is earned
- earnings tests that prevent people from combining work and pensions and do not actuarially fair increments for deferring a pension claim

9.1 Policy implications

Addressing these problems should be a central part of any pension reform, and these reforms should be informed, at the minimum, by the types of analysis we have carried out here.

The problems in existing public pensions we outlined previously suggest a number of useful reforms. First early retirement schemes should be curtailed. This might involve moving towards actuarial reductions in early-retirement pensions, increases in the age at which they can be claimed or tighter conditions for entitlement, such as duration of employment or participation in training programmes. We recognise that many of these schemes were a response to genuine labour-market problems faced by older workers. However, problems such as age discrimination[47] and the lack of appropriate skills are best addressed directly.

Secondly, many of the distortions to labour-supply incentives caused by defined-benefit pensions could be mitigated by moving to pensions based on average salary across the working life rather than a limited number of best or final years. Maximum pensions and limits to the number of years of contributions that earn pensions should be removed to give people an incentive to work beyond these limits. Contributions should not be levied at ages or in years when people do not earn a pension entitlement.

Thirdly, while early-retirement schemes do need to enforce earnings tests to avoid abuse, it should be possible to allow people to combine pensions at the standard age with some work. Alternatively, people should be able defer drawing their pension at actuarially fair rates.

We briefly considered partial retirement schemes. These might encourage people who would otherwise leave the workforce retire gradually, by moving to part-time work. However, these programmes have rarely been taken up by a significant proportion of the eligible population. There are reasonable explanations for this failure, which suggests that partial retirement is unlikely to be much of a panacea.

9.2 Recent policy initiatives in OECD countries

We noted in the introduction that more than half of OECD countries mentioned low effective retirement ages and poor work incentives in the pension system as a matter of policy concern. Only problems with the financial viability, mentioned by three-quarters of governments, were the subject of more widespread worry.

Table 5 shows that more than 80 per cent of OECD countries have recently introduced reforms designed to promote the employment of older workers. Nine countries will increase the standard age for state pensions by an average of three years. In addition, Australia will raise the

---

[47] See, *inter alia*, Hutchens (1986, 1988), Hutchens (1986, 1988), Johnson and Neumark (1996), Neumark and Stock (1997), OECD (1998*c*).

age at which people can draw private pensions. Eight other countries will increase the age at which women can draw pensions. In seven, this will equalise women's pensionable age with men's. The average increase is over four years.

In practice, most people retire well before the standard pension age in the vast majority of countries. The effective retirement age is on average five years younger than the 'normal' retirement age. Twelve countries are therefore aiming to restrict eligibility for early retirement, which may be a more potent policy for raising effective retirement ages than changing the standard pension age. Belgium, France, Greece, Hungary, Italy and Portugal will increase the number of contribution years required to qualify for a pension. Finland, Germany, Hungary, Italy and Poland will increase the minimum age to qualify for pensions. Denmark requires local authorities to offer training and labour-market re-integration programmes before an early retirement pension can be granted. Finally, five countries will introduce or have proposed schemes to encourage people to work after normal pension age, as discussed above in sections 8.3 and 8.4.

9.3 Future developments

The model we have developed is a useful tool for examining the financial rewards to working that generates a number of practical policy conclusions.[48] However, it is at the moment simplistic and, although we have examined a number of features of different countries' pension systems, we have not studied any of these programmes as a whole. Our future work on retirement therefore has two main aims. First, to explore how the incentives generated by pension schemes affect labour-supply behaviour. Secondly, to assess the impact on incentives of a number of countries' pension systems and how they might be reformed to reduce labour-market distortions and promote work.

---

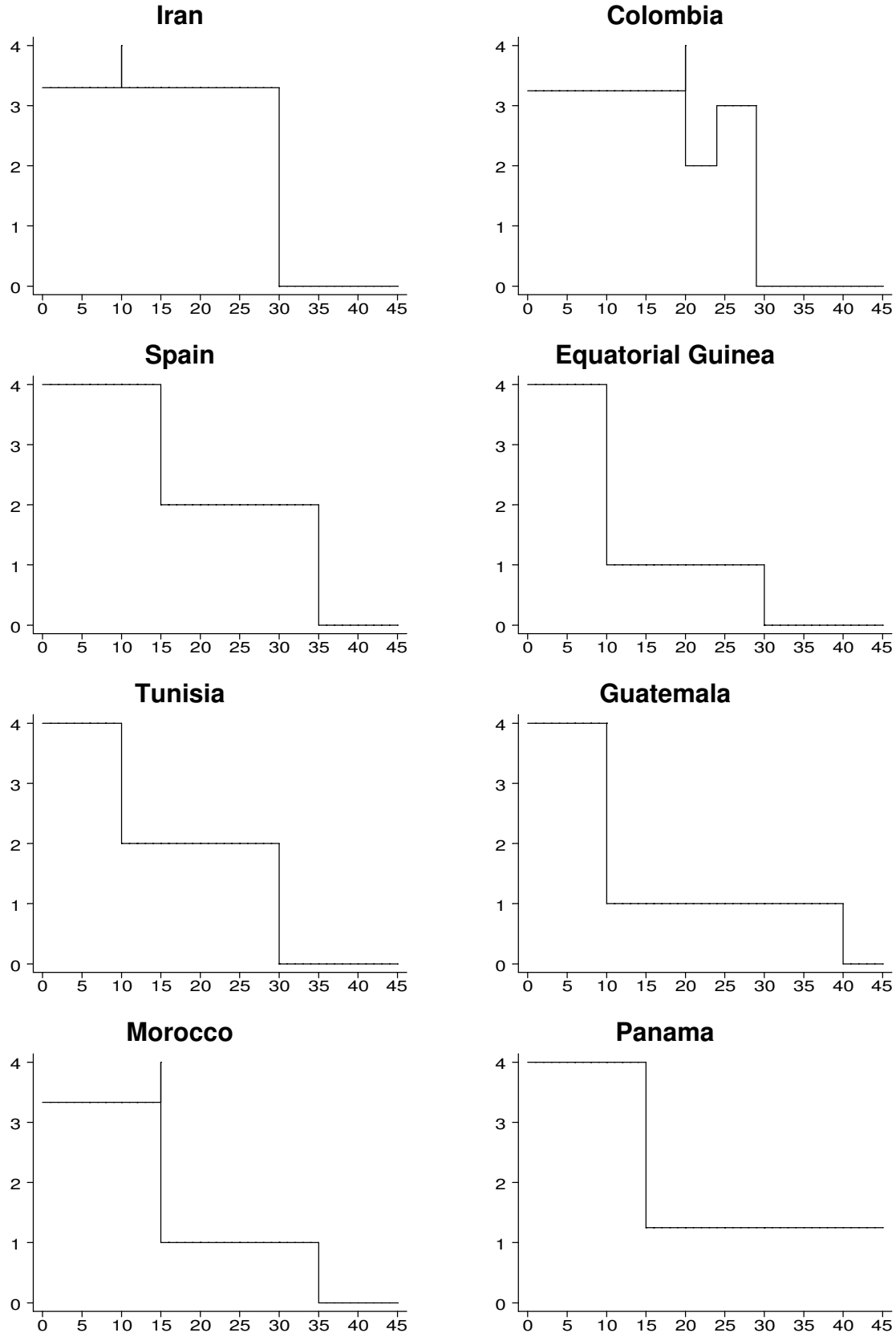
[48] We will provide the model, implemented in the *Stata* statistics and data programming language, on request.

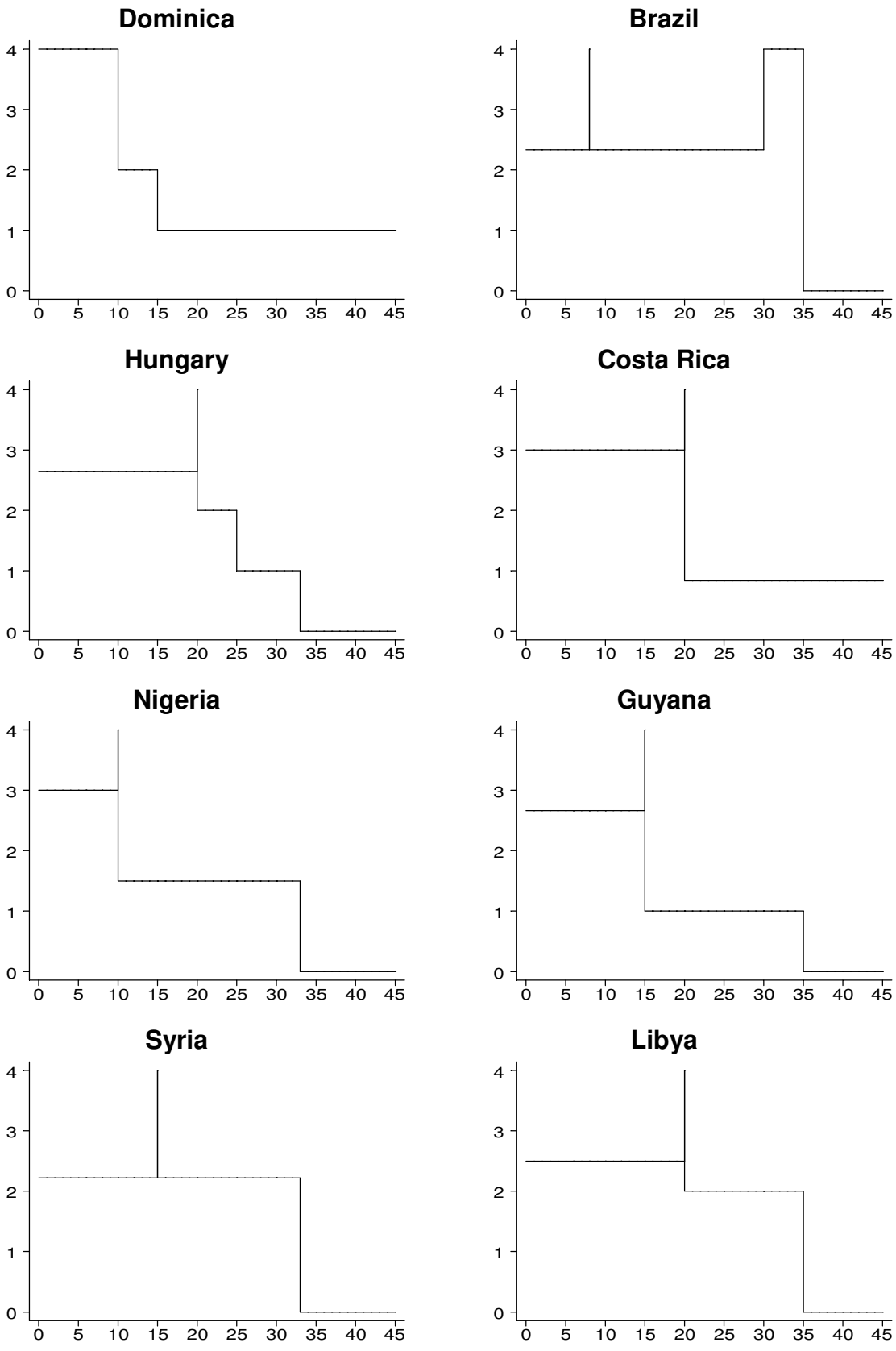
Table 5. **Recent policy initiatives to promote employment of older workers**

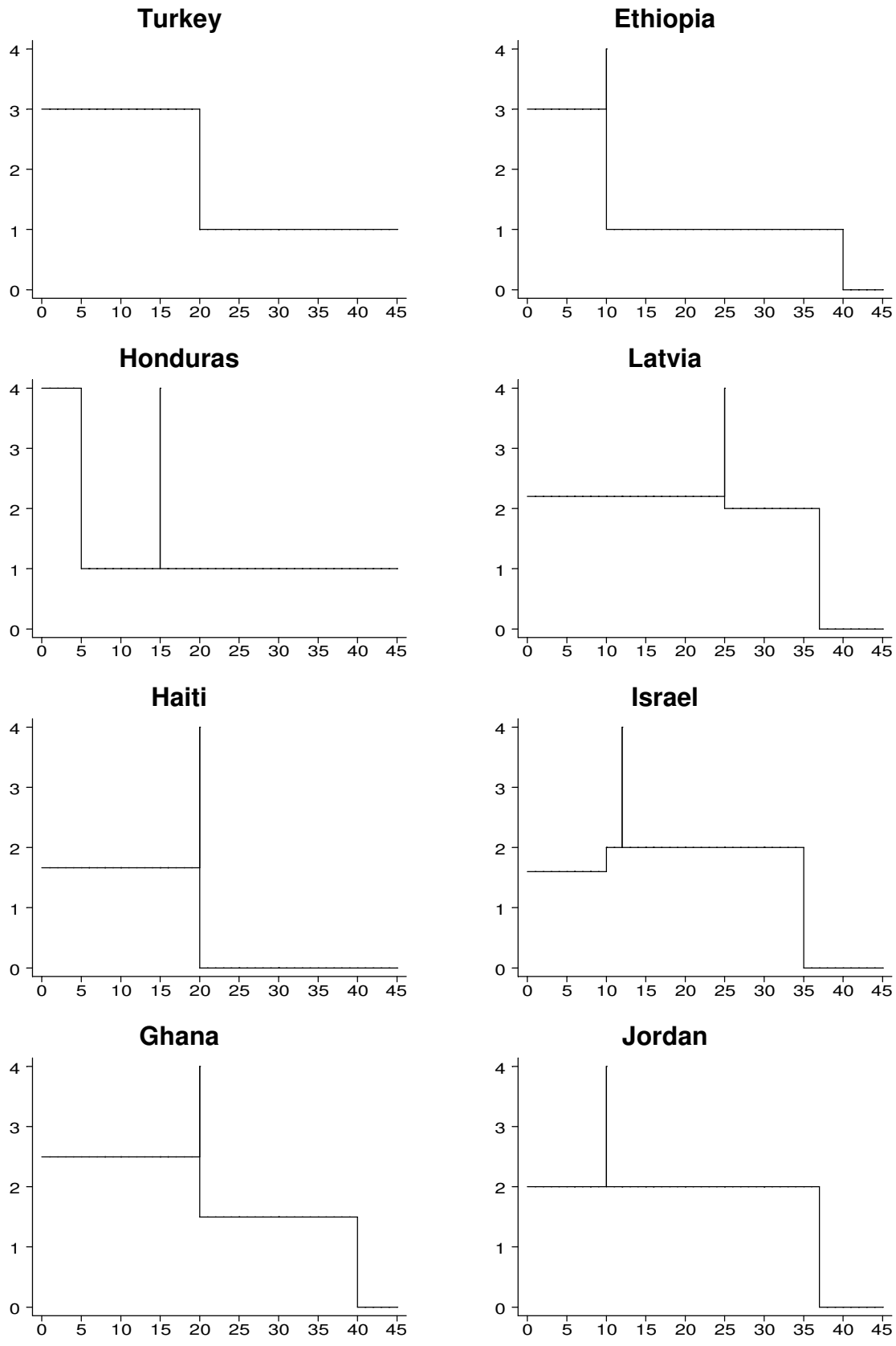
Increase in pension age	*Equalising pension age*	*Discouraging early retirement*	*Encouraging work after pension age*
Australia: from 55 to 60 in age for private pensions (by 2025)	**Australia:** to 65 (by 2013)	**Austria:** reduced access	**Australia:** deferred pension bonus plan proposed (men 65-70 and women 61-66)
Czech Republic: from 60 to 62 for men and 53-57 to 57-61 for women (by 2007)	**Belgium:** to 65 (by 2009)	**Belgium:** contribution years for retirement at 60 from 20 to 35 (by 2005)	**Norway:** smaller reduction for working while drawing pension for ages 67-70
Finland: from 63 to 65	**Germany:** from 60 to 65 (by 2004)	**Denmark:** local authorities to provide training *etc.* before pension can be drawn	**Sweden:** allow actuarial increases for deferral after age 70
Hungary: to 62 for men (by 2001) and for women (by 2009)	**Greece:** from 60 to 65 (post-1993 labour-market entrants)	**Finland:** lower benefit and minimum age from 55 to 58	**United Kingdom:** increased deferral increment; increments for deferral after age 70
Italy: from 63 to 65 for men and 58 to 60 for women (by 2000); 57-65 in new scheme	**Poland:** from 60 to 65 to equalise with men	**France:** contribution years from 37½ to 40	**United States:** higher earnings limit; increased deferral increment
Japan: from 60 to 65 for men (by 20013); from 59 to 65 for women (by 2018)	**Portugal:** to 65 (by 1999)	**Gernany:** minimum age to 62 (from 2012)	
Korea: from 60 to 65 (by 2033)	**Switzerland:** from 62 to 64 (by 2005), remains below men's age of 65	**Greece:** minimum contribution years from 13½ to 15	
New Zealand: from 62 to 65 (by 2001)	**United Kingdom:** from 60 to 65 (by 2020)	**Hungary:** higher age and contribution years	
Spain: from 60 to 65 (people entering the labour market after 1967)		**Ireland:** special scheme for civil servants ceased	
United States: from 65 to 67 (by 2027)		**Italy:** minimum age 52 (from 1997); contribution years increased from 35 to 40 years (from 2008) **Poland:** increase in minimum age from 60 to 62 planned	
		Portugal: increase in minimum contribution years from 10 to 15	

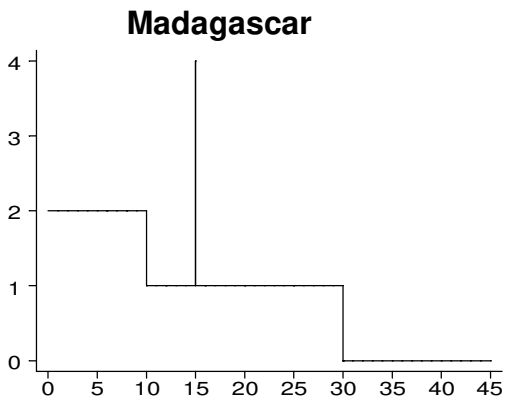
Source: Kalisch and Aman (1998), OECD (1997*b*)

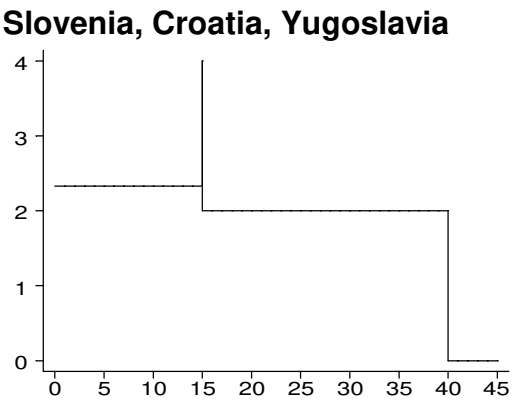
Annex 1. **Accrual rates by years of contributions**

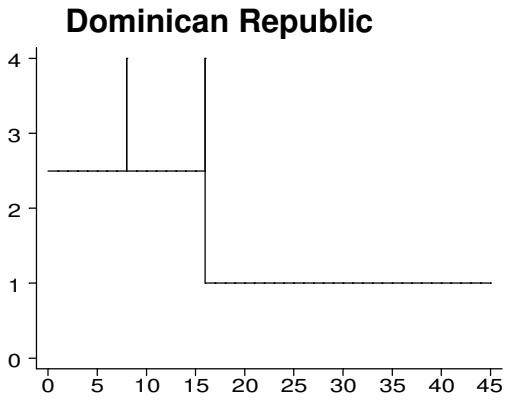


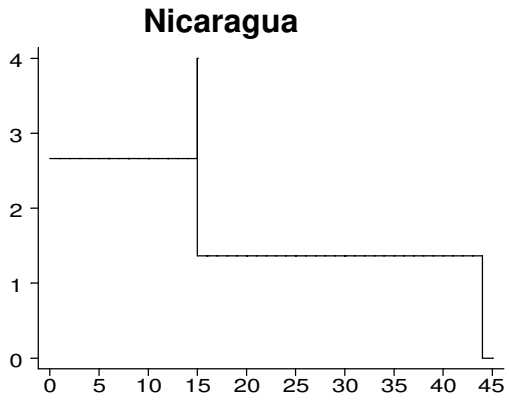

Dominica
Brazil
Hungary
Costa Rica
Nigeria
Guyana
Syria
Libya
0
1
2
3
4
0 5 10 15 20 25 30 35 40 45


Turkey
Ethiopia
Honduras
Latvia
Haiti
Israel
Ghana
Jordan
0
1
2
3
4
0 5 10 15 20 25 30 35 40 45

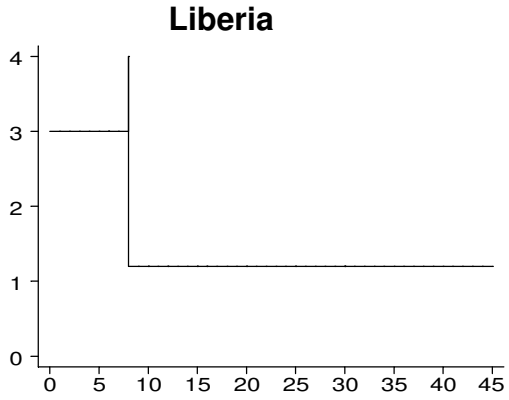

Madagascar
0
1
2
3
4
0 5 10 15 20 25 30 35 40 45

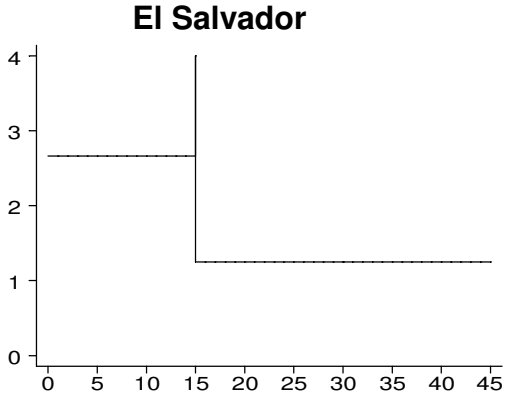

Slovenia, Croatia, Yugoslavia
0
1
2
3
4
0 5 10 15 20 25 30 35 40 45

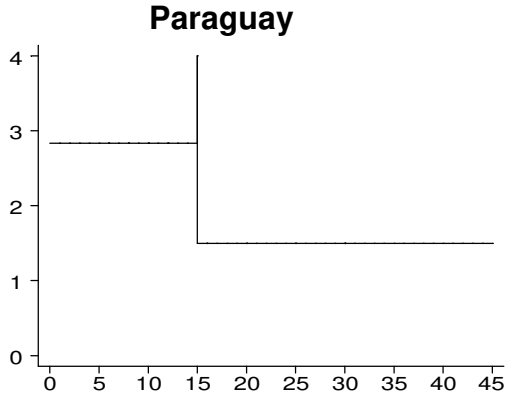

Dominican Republic
0
1
2
3
4
0 5 10 15 20 25 30 35 40 45

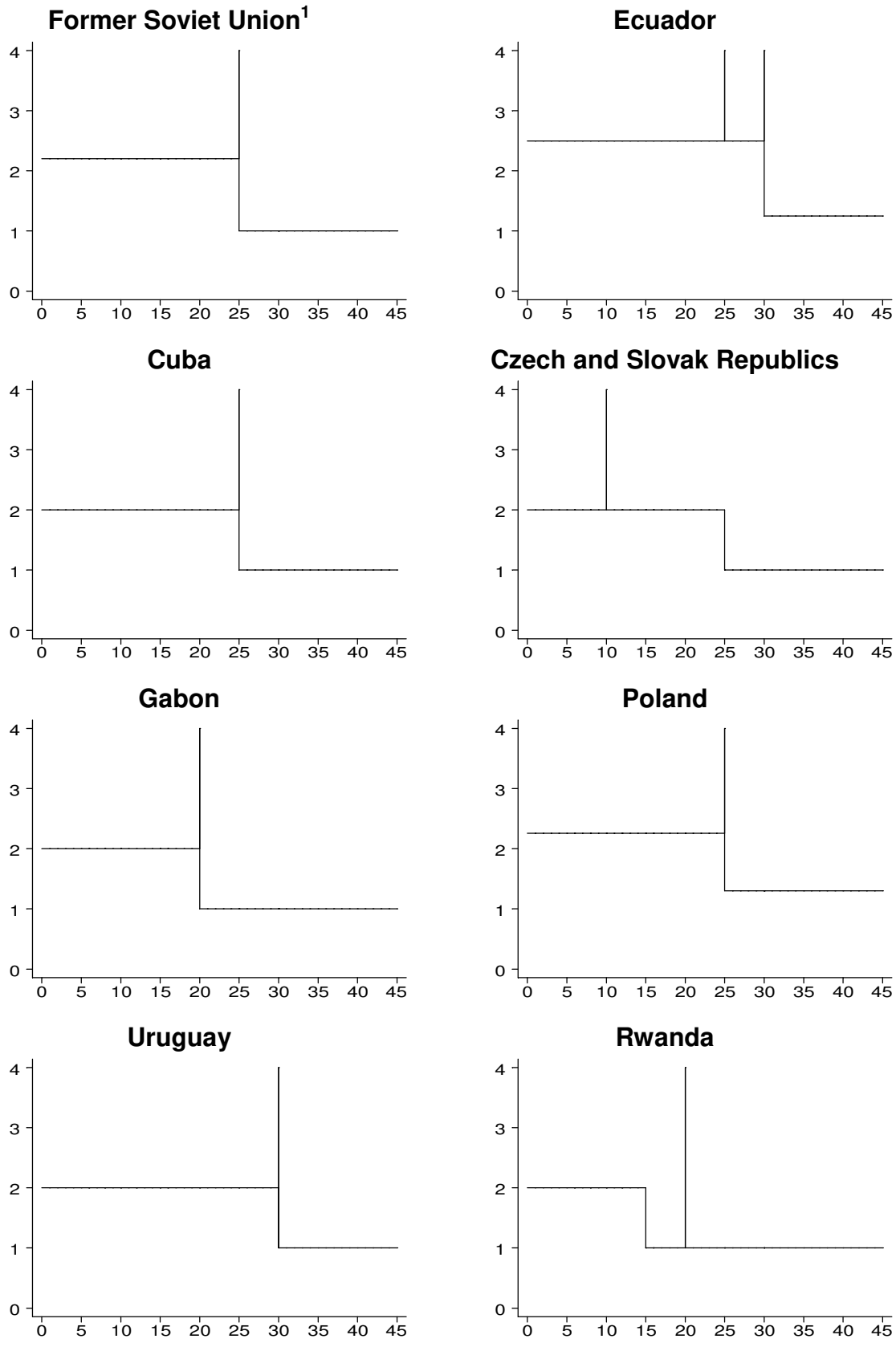

Nicaragua
0
1
2
3
4
0 5 10 15 20 25 30 35 40 45

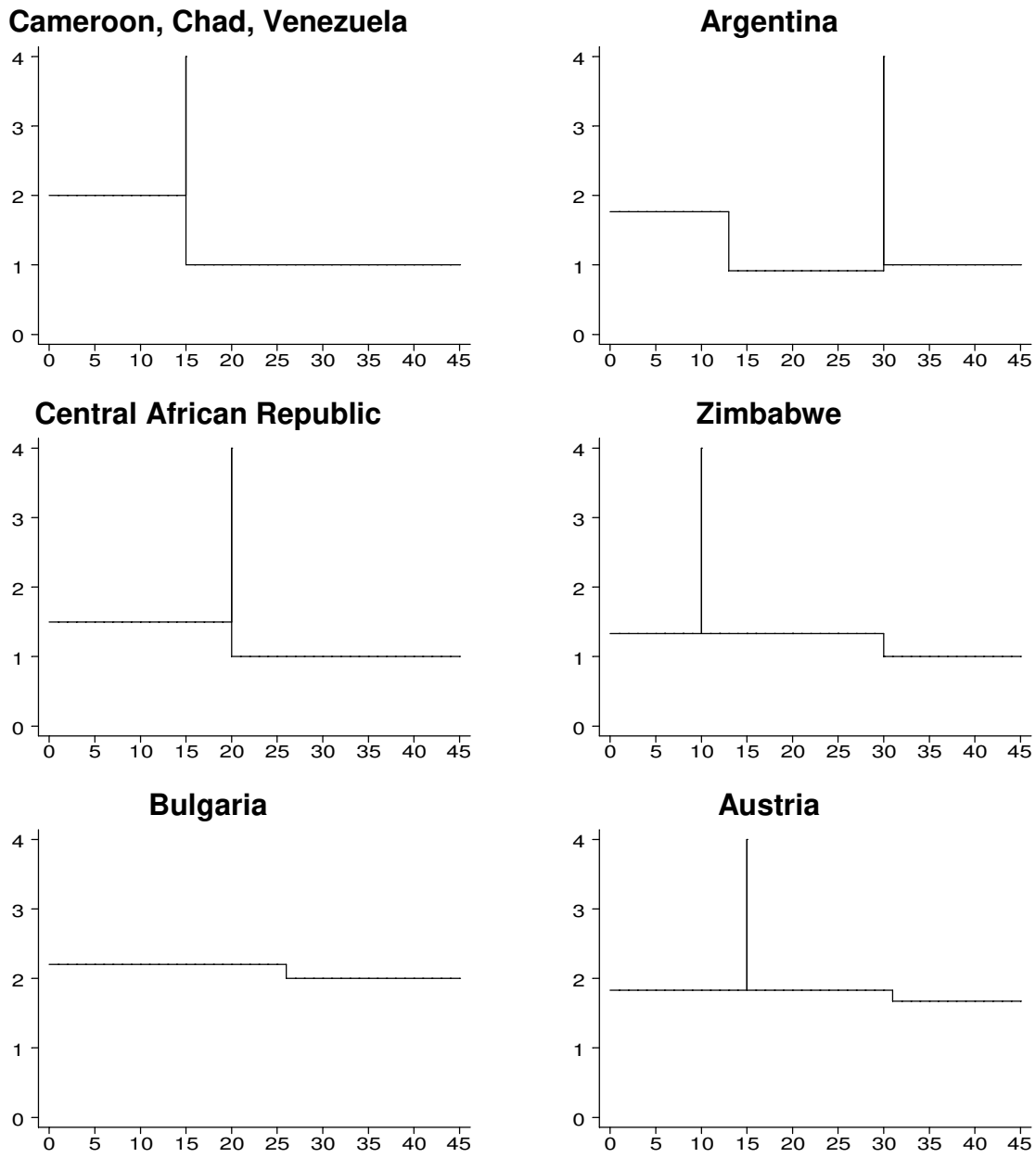

Kazakhstan
0
1
2
3
4
0 5 10 15 20 25 30 35 40 45


Liberia
0
1
2
3
4
0 5 10 15 20 25 30 35 40 45


El Salvador
0
1
2
3
4
0 5 10 15 20 25 30 35 40 45


Paraguay
0
1
2
3
4
0 5 10 15 20 25 30 35 40 45


Former Soviet Union[1]
Ecuador
Cuba
Czech and Slovak Republics
Gabon
Poland
Uruguay
Rwanda
0
1
2
3
4
0 5 10 15 20 25 30 35 40 45



1. Belarus, Georgia, Kyrgyzstan, Moldova, Russia, Turkmenistan, Ukraine, Uzbekistan

10. Bibliography

Anderson, P, Gustman, A.L. and Steimeier, T.L. (1997), 'Trends in male labour force participation and retirement: some evidence on the role of pensions and social security in the 1970s and 1980s', Working Paper no. 6208, National Bureau of Economic Research, Cambridge, Mass.

Bacon, B.R. and Gallagher, P. (1995), 'Early retirees — trends and their use of superannuation benefits and social security payments', Retirement Income Modelling Taskforce, Department of Social Security, Canberra.

Berger, M.C. (1983), 'Changes in labour force composition and male earnings: a production approach', *Journal of Human Resources,* vol. 17, no. 2, pp. 177-196.

Blanchet, D.C., Brousse, C. and Okba, M. (1996), 'Retraite, préretraite, neutralité actuarielle et courverture du risque de chomage en fin carrière', *Economique at Statistique*, pp. 291-292.

— and Pele, L-P. (1999), 'Social security and retirement in France', in Gruber, J. and Wise, D.A. (eds), *Social Security and Retirement around the World,* University of Chicago Press for National Bureau of Economic Research. (Also Working Paper no. 6214, National Bureau of Economic Research, Cambridge, Mass., 1997)

Blinder, A.S, Gordon, R.H. and Wise, D.E. (1980), 'Reconsidering the disincentive effects of social security', *National Tax Journal,* vol. 33, pp. 431-442.

Blöndal, S. and Scarpetta, S. (1998), 'The retirement decision in OECD countries', Ageing Working Paper 1.4, OECD Paris. (Also Economics Department Working Paper no. 202, OECD)

Bodie, Z. (1991), 'Shortfall risk and pension fund asset management', *Financial Analysts' Journal*, May/June.

Boldrin, M., Jimenez-Martini, S. and Peracchi, F. (1999), 'Social security and retirement in Spain', in Gruber, J. and Wise, D.A. (eds), *Social Security and Retirement around the World,* University of Chicago Press for National Bureau of Economic Research. (Also Working Paper no. 6136, National Bureau of Economic Research, Cambridge, Mass.)

Bondar, J. (1993), 'Beneficiaries affected by the annual earnings test, 1989', *Social Security Bulletin*, vol. 56, pp. 20-28.

Börsch-Supan, A. (1992), 'Population ageing, social security design and early retirement', *Journal of Institutional and Theoretical Economics,* vol. 48.

— and Schnabel, R. (1999), 'Social security and retirement in Germany', in Gruber, J. and Wise, D.A. (eds), *Social Security and Retirement around the World,* University of Chicago Press for National Bureau of Economic Research. (Also Working Paper no. 6153, National Bureau of Economic Research, Cambridge, Mass., 1997)

Boskin, M.J. (1977), 'Social security and retirement decisions', *Economic Inquiry*, vol. 15, no. 1, pp. 1-25.

— and Hurd, M.D. (1978), 'The effect of social security on early retirement', *Journal of Public Economics,* vol. 10, pp. 361-377.

Brugiavini, A. (1993), 'Uncertainty resolution and the timing of individual annuity purchases', *Journal of Public Economics,* vol. 50, pp. 31-62.

— (1999), 'Social security and retirement in Italy', in Gruber, J. and Wise, D.A. (eds), *Social Security and Retirement around the World,* University of Chicago Press for National Bureau of Economic Research. (Also Working Paper no. 6155, National Bureau of Economic Research, Cambridge, Mass.)

Bulow, J.I. (1982), 'What are corporate pension liabilities?' *Quarterly Journal of Economics,* vol. 97, pp. 435-450.

Burkhauser, R.V. (1980), 'The early acceptance of social security: an asset maximisation approach', *Industrial and Labour Relations Review*, vol. 33, pp. 484-492.

— and Quinn, J.F. (1983), 'Is mandatory retirement overrated? Evidence from the 1970s', *Journal of Human Resources,* vol. 18, no. 3, pp. 337-358.

Burtless, G. (1986), 'Social security, unanticipated benefit increases and the timing of retirement', *Review of Economic Studies,* vol. 53, pp. 781-805.

Cain, G. (1986), 'The economic analysis of labour-market discrimination: a survey', in Ashenfelter, O. and Layard, P.R.G (eds), *Handbook of Labour Economics,* North Holland, Amsterdam.

Casey, B. (1998), 'Incentives and disincentives to early and late retirement', Ageing Working Paper no. 3.3, OECD, Paris.

Chan, S. and Stevens, A.H. (1999), 'Job loss and retirement behaviour of older men', Working Paper, no. 6920, National Bureau of Economic Research, Cambridge, Mass.

Chand, S.K. and Jaeger, A. (1996), 'Ageing populations and public pension schemes', Occasional Paper no. 147, International Monetary Fund, Washington, D.C.

Chlon, A., Gora, M. and Rutkowski, M. (1999), 'Shaping pension reform in Poland: *Security through Diversity*', Pension Reform Primer country case study, Social Protection Discussion Paper no. 9815, World Bank, Washington, D.C.

Commission of the European Communities (1996), *MISSOC — Social Protection in the Member States of the Community: Situation on 1 July 1995 and Evolution*, Brussels.

Couch, K. (1998), 'Late life job displacement', *The Gerontologist,* vol. 38, pp. 7-17.

Denmark, Ministry of Social Affairs (1995), 'Social policy in Denmark: social pensions and semi-retirement pensions', Copenhagen.

Diamond, P. and Gruber, J. (1999), 'Social security and retirement in the United States', in Gruber, J. and Wise, D.A. (eds), *Social Security and Retirement around the World,* University of Chicago Press for National Bureau of Economic Research. (Also Working Paper no. 6097, National Bureau of Economic Research, Cambridge, Mass., 1997)

— and Hausman, J. (1984), 'Individual retirement and savings behaviour', *Journal of Public Economics,* vol. 8, pp. 275-298.

Dilnot, A.W., Disney, R.F., Johnson, P.G. and Whitehouse, E.R. (1994), *Pensions Policy in the UK: An Economic Analysis*, Institute for Fiscal Studies, London.

Disney, R.F. (1995), 'Occupational pension schemes: prospects and reform in the UK', Fiscal Studies, vol. 16, pp. 19-39.

— (1996), *Can We Afford to Grow Older? A Perspective on the Economics of Ageing,* MIT Press, Cambridge, Mass.

—, Emmerson, C. and Tanner, S. (1999), Partnership in Pensions: An Assessment, Institute for Fiscal Studies, London.

—, Meghir, C.H.D. and Whitehouse, E.R. (1994), 'Retirement behaviour in Britain', *Fiscal Studies,* vol. 15, no. 1, pp. 24-43.

— and Whitehouse, E.R. (1991), 'Occupational and industrial earnings over time: the use of pooled cross-section data', Working Paper no. 91/7, Institute for Fiscal Studies, London.

— and — (1996), 'How much are occupational pension entitlements worth in Britain?', *Economica*, vol. 63, pp. 213-238.

— and — (1999*a*), 'Retirement: the demand side', Social Protection Discussion Paper, World Bank, Washington, D.C., forthcoming.

— and — (1999*b*), 'Notional accounts pensions: microeconomic and macroeconomic aspects', Social Protection Discussion Paper, World Bank, Washington, D.C., forthcoming.

Flanagan, K. (1999), 'Pension reform in Australia', Pension Reform Primer country case study, Social Protection Discussion Paper, World Bank, Washington, D.C., forthcoming.

Freeman, R.B. (1979), 'The effect of demographic factors on age-earnings profiles', *Journal of Human Resources,* vol. 14, pp. 289-319.

— (1989), *Labour Markets in Action: Essays in Empirical Economics,* Harvester Wheatsheaf.

Friedberg, L. (1998*a*), 'The social security earnings test and labour supply of older men, in Poterba, J.M (ed.), *Tax Policy and the Economy,* vol. 12, MIT Press for National Bureau of Economic Research, Cambridge, Mass.

— (1998*b*), 'The effect of old-age assistance on retirement', Working Paper no. 6548, National Bureau of Economic Research, Cambridge, Mass.

Friedman, B. and Warshawsky, M. (1988), 'Annuity prices and savings behaviour in the US', in Bodie, Z., Shoven, J.B. and Wise, D.A. (eds), *Pensions in the US Economy*, University of Chicago Press for National Bureau of Economic Research.

— and — (1990), 'The cost of annuities: implications for savings behaviour and bequests', *Quarterly Journal of Economics,* vol. 105, pp. 135-154.

Gosling, A. Machin, S. and Meghir, C.H.D. (1998), 'The changing distribution of male wages in the UK', Working Paper no. 98/9, Institute for Fiscal Studies, London.

Gruber, J. (1999), 'Social security and retirement in Canada', in Gruber, J. and Wise, D.A. (eds), *Social Security and Retirement around the World,* University of Chicago Press for National Bureau of Economic Research. (Also Working Paper no. 6308, National Bureau of Economic Research, Cambridge, Mass., 1997)

— and Wise, D.A. (1997), 'Social security programs and retirement around the world', Working Paper no. 6134, National Bureau of Economic Research, Cambridge, Mass.

— and — (1999), *Social Security Programs and Retirement around the World,* University of Chicago Press for National Bureau of Economic Research.

Gustman, A.L and Steinmeier, T.L. (1984), 'Partial retirement and the analysis of retirement behaviour', *Industrial and Labour Relations Review*, vol. 37, no. 3, pp. 403-415.

— and — (1986), 'A structural retirement model', *Econometrica*, vol. 54, no. 3, pp. 555-584.

— and — (1992), 'The stampede towards defined-contribution pension plans: fact or fiction?', *Industrial Relations*, vol. 31, no. 2, pp. 361-369.

Honig, M. and Reimers, C. (1989), 'Is it worth eliminating the earnings test?' *American Economic Review, Papers and Proceedings,* vol.79, pp. 103-107.

Hurd, M.D. and Boskin, M.J. (1984), 'The effect of social security on retirement in the early 1970s', *Quarterly Journal of Economics,* vol. 94.

Hutchens, R. (1986), 'Delayed payments contracts and a firm's propensity to hire older workers', *Journal of Labour Economics*, vol. 4, pp. 439-475.

— (1988), 'Do job opportunities decline with age?' *Industrial and labour Relations Review*, vol. 41, pp. 89-99.

Ippolito, R.A. (1990), 'Towards explaining earlier retirement after 1970', *Industrial and Labour Relations Review*, vol. 43, no. 5, pp. 556-569.

— (1995), 'Toward explaining the growth of defined-contribution plans', *Industrial Relations*, l. 34, no. 1, pp. 1-20.

Jacobson, L., LaLonde, R. and Sullivan, D. (1993), 'Earnings losses of displaced workers', *American Economic Review*, September, pp. 685-709.

Johnson, R.W. and Neumark, D. (1996), 'Age discrimination, job separation and employment status of older workers: evidence from self reports', Working Paper no. 5619, National Bureau of Economic Research, Cambridge, Mass.

Kalisch, D.W. and Aman, T. (1998), 'Retirement income systems: the reform process across OECD countries', Ageing Working Paper no. 3.4, OECD, Paris.

Kapteyn, A. and de Vos, K. (1999), 'Social security and retirement in the Netherlands', in Gruber, J. and Wise, D.A. (eds), *Social Security and Retirement around the World,* University of Chicago Press for National Bureau of Economic Research. (Also Working Paper no. 6135, National Bureau of Economic Research, Cambridge, Mass.)

Kotlikoff, L.J. and Gokhale, J. (1992), 'Estimating a firm's age-productivity profile using the present value of workers' earnings', *Quarterly Journal of Economics,* vol. 107, pp. 1215-1242.

— and Smith, D.E. (1983), *Pensions in the American Economy,* University of Chicago Press for the National Bureau of Economic Research.

— and Wise, D.A. (1985), 'Labour compensation and the structure of private pension plans: evidence for contractual versus spot labour markets', in Wise, D.A. (ed.), *Pensions, Labour and Individual Choice,* University of Chicago Press for the National Bureau of Economic Research.

— and — (1987), 'The incentive effects of private pension plans', in Bodie, Z., Shoven, J.B. and Wise, D.A. (eds), *Issues in Pension Economics,* University of Chicago Press for the National Bureau of Economic Research.

— and — (1989), 'Employee retirement and a firm's pension plan', in Wise, D.A. (ed.), *The Economics of Ageing,* University of Chicago Press for the National Bureau of Economic Research.

Kristhof, K. (1997), 'Personal finance, *Los Angeles Times,* September 5.

Kruse, D.L. (1995), 'Pension substitution in the 1980s: why the shift to defined contribution?' *Industrial Relations*, vol. 34, no. 2, pp. 218-240.

Lazear, E.P. (1979), 'Why is there mandatory retirement?' *Journal of Political Economy,* vol. 87, no. 6, pp. 1261-84.

— (1986), 'Retirement from the labour force', in Ashenfelter, O. and Layard, P.R.G. (eds), *Handbook of Labour Economics,* North Holland, Amsterdam.

Leonesio, M.V. (1990), 'Effects of the social security earnings test on the labour-market activity of elderly Americans: a review of the evidence', *Social Security Bulletin*, vol. 53, pp. 2-21.

— (1993), 'Social security and older workers', in Mitchell, O.S. (ed.), *As the Workforce Ages,* ILR Press.

Lindeboom, M. (1998), 'Microeconometric analysis of the retirement decision: the Netherlands', Ageing Working Paper no. xx, OECD, Paris. (Also Working Paper no. 207, Economics Department, OECD)

Lumsdaine, R.L. (1995), 'Factors affecting labour supply decisions and retirement income' in Hanushek, E. and Mariato, N. (eds), *Assessing Knowledge of Retirement Behaviour*, National Academy Press, Washington, D.C.

—, Stock, J.H. and Wise, D.A. (1990), 'Efficient windows and labour force reduction', *Journal of Public Economics,* vol. 43, pp. 131-159.

—, — and — (1992), 'Three models of retirement: computational complexity versus predictive validity', in Wise, D.A. (ed.), *Topics in the Economics of Ageing,* University of Chicago Press for National Bureau of Economic Research.

—, — and — (1994), 'Pension plan provisions and retirement: men and women, Medicare and models', in Wise, D.A. (ed.), *Studies in the Economics of Ageing,* University of Chicago Press for National Bureau of Economic Research.

Meghir, C.H.D. and Whitehouse, E.R. (1996), 'The evolution of wages in the UK: evidence from micro data', *Journal of Labour Economics*.

— and — (1997), 'Labour-market transitions and retirement of men in the UK', *Journal of Econometrics,* vol. 79, pp. 327-354.

Miniaci, R. (1998), 'Microeconometric analysis of the retirement decision: Italy', Ageing Working Paper no. xx, OECD, Paris. (Also Working Paper no. 205, Economics Department, OECD)

Miniaci, R. and Strancelli, E. (1998), 'Microeconometric analysis of the retirement decision: the United Kingdom, Ageing Working Paper no. xx, OECD, Paris. (Also Working Paper no. 206, Economics Department, OECD)

Mitchell, O.S. and Fields, G. (1984), 'The economics of retirement behaviour', *Journal of Labour Economics,* vol. 2, pp. 84-105.

Morris, C.N. (1981), 'The age allowance', *Fiscal Studies,* vol. 2., no. 3.

Naegele, G. (1996), 'New trends in gradual retirement in Germany', *Geneva Papers on Risk and Insurance*, no. 81, pp. 524-533.

Nemark, D. and Stock, W.A. (1997), 'Age discrimination laws and labour market efficiency', Working Paper no. 6088, National Bureau of Economic Research, Cambridge, Mass.

OECD (1995*a*), *The Transition from Work to Retirement,* Social Policy Studies no. 16, Paris.

— (1995*b*), *The Labour Market and Older Workers*, Social Policy Studies no. 17, Paris.

— (1996*a*), 'Making work pay', *Employment Outlook*, July.

— (1996*b*), *Economic Surveys — Canada,* Paris.

— (1997*a*), *The OECD Jobs Strategy: Making Work Pay: Taxation, Benefits, Employment and Unemployment,* Paris.

— (1997*b*), *The OECD Jobs Strategy: Member Countries' Experience*, Paris.

— (1998*a*), *The Tax-Benefit Position of Employees: 1998 Edition,* Paris.

— (1998*b*), *Labour Force Statistics, 1975-96,* Paris.

— (1998*c*), 'Work-force ageing in OECD countries', *Employment Outlook*, pp. 123-151, Paris. (Also Ageing Working Paper no. 4.1)

Oshio, T. and Yashiro, N. (1999), 'Social security and retirement in Japan', in Gruber, J. and Wise, D.A. (eds), *Social Security and Retirement around the World,* University of Chicago Press for National Bureau of Economic Research. (Also Working Paper no. 6156, National Bureau of Economic Research, Cambridge, Mass., 1997)

Packard, M.D. (1990), 'The earnings test and the short-run work response to its elimination', *Social Security Bulletin,* vol. 53, pp. 2-16.

Palacios, R. and Rocha, R. (1998), 'The Hungarian pension system in transition', Pension Reform Primer working paper series, Social Protection Discussion paper no. 9805, World Bank, Washington, D.C.

Palme, M. and Svenson, I. (1999), 'Social security, occupational pensions and retirement in Sweden', in Gruber, J. and Wise, D.A. (eds), *Social Security Programs and Retirement around the World,* University of Chicago Press for National Bureau of Economic Research. (Also Working Paper no. 184, Stockholm School of Economics and Working Paper no. 6137, National Bureau of Economic Research, Cambridge, Mass., 1997)

Pestieau, P. and Stijns, J-P. (1999), 'Social security and retirement in Belgium', in Gruber, J. and Wise, D.A. (eds), *Social Security and Retirement around the World,* University of Chicago Press for National Bureau of Economic Research. (Also Working Paper no. 6169, National Bureau of Economic Research, Cambridge, Mass., 1997)

Piggott, J. and Doyle, S. (1999), 'Annuitising mandated retirement accumulations: a primer', Social Protection Discussion Paper, World Bank, forthcoming.

Podgursky, M. and Swaim, P. (1987), 'Job displacement earnings loss: evidence from the displaced worker survey', *Industrial and Labour Relations Review*, vol. 40, pp. 17-29.

Queisser, M. (1998), 'The second-generation pension reforms in Latin America', Ageing Working Paper no. 5.4, OECD, Paris.

Quinn, J.F., Burkhauser, R.V. and Myers, D.A. (1990), *Passing the Torch: The Influence of Economic Incentives on Work and Retirement,* W.E. Upjohn Institute for Employment Research, Kalamazoo, Mich.

—, —, Cahill, K. and Weather, R. (1998), Miniaci, R. (1998), 'Microeconometric analysis of the retirement decision: the United States', Ageing Working Paper no. xx, OECD, Paris. (Also Working Paper no. 203, Economics Department, OECD)

Reimers, C. and Honig, M. (1993), 'The perceived budget constraint under social security: evidence from re-entry behaviour', *Journal of Labour Economics,* vol. 11, no. 1, pp. 184-204.

— and — (1996), 'Responses to social security by men and women: myopic and far-sighted behaviour?', *Journal of Human Resources,* vol. 31, pp. 359-382.

Robbins, A. and Robbins, G. (1989), 'Paying people not to work: the economic costs of the social security retirement earnings limit', Report no. 142, National Centre for Policy Analysis.

Ruhm, C.J. (1990), 'Bridge jobs and partial retirement', *Journal of Labour Economics,* vol. 8, pp. 482-501.

— (1995), 'Secular changes in the work and retirement patterns of older men', *Journal of Human Resources*, vol. 30, pp. 362-385.

— (1996), 'Do pensions increase the labour supply of older men?' *Journal of Public Economics,* vol. 59, no. 2, pp. 157.175.

Samwick, A.A. (1998), 'New evidence on pension, social security and the timing of retirement', Working Paper no. 6534, National Bureau of Economic Research, Cambridge, Mass.

Seike, A. (1989), 'The effects of the employee pension on the labour supply of the Japanese elderly, Note no. 2862, Rand Corporation, Santa Monica, Cal.

— (1997), 'Labour-market implications of social security: company pension plans, public pensions and retirement behaviour of the elderly in Japan', in Hurd, M.D. and Yashiro, N. (eds), *The Economic Effects of Ageing in the United States and Japan,* University of Chicago Press.

Simon, R. (1996), 'How to be sure you never go broke', *Money*, October.

Stock, J.H. and Wise, D.A. (1990*a*), 'Pensions, the option value of work and retirement', *Econometrica,* vol. 58, pp. 1151-1180.

— and — (1990*b*), 'The pension inducement to retire: an option value analysis', in Wise, D.A. (ed), *Issues in the Economics of Ageing*, University of Chicago Press for National Bureau of Economic Research.

Tumbarello, P. (1999), 'Pension reform in Italy', Social Protection Discussion Paper, World Bank, Washington, D.C., forthcoming.

United Kingdom, Department of Social Security (1998), *A New Contract for Welfare: Partnership in Pensions*, London.

United States, Department of Health and Human Services (1997), *Social Security Programs throughout the World,* Washington, D.C.

Whitehouse, E.R. (1990), 'The abolition of the pensions "earnings rule"', *Fiscal Studies,* vol. 11, no. 3, pp. 55-70.

— (1999), 'The tax treatment of funded pensions', Social Protection Discussion Paper, World Bank, Washington, D.C., forthcoming.

World Bank (1994), *Averting the Old-Age Crisis: Policies to Protect the Old and Promote Growth*, Oxford University Press for the World Bank.