

# Introduction

## 1.1 WHAT IS PENSION ECONOMICS?

This book is about pension economics, and it is important to understand both what a pension is and what economics is all about.

What is a pension? A *pension* is a stream of payments that starts when someone retires and continues in payment until they die.<sup>1</sup> In other words, a pension provides lifetime income security in retirement for however long the retiree lives (Bodie, 1990). A pension therefore has two essential purposes. The first is *consumption smoothing* over an individual's lifecycle, i.e., a pension provides an income in retirement when someone is no longer working in exchange for contributions into a pension scheme when they are. The second is *insurance*, especially in respect of longevity risk – the uncertainty attached to an individual's length of life. Public policy might have two additional objectives for a pension scheme. The first is *poverty relief*: a society might wish its pensioners to have a minimum standard of living in retirement. The second is a *distributional objective*: a society might wish to distribute additional resources above the poverty level to certain members of society, such as women bringing up children and other carers (Barr, 2004).

There are only two ways of 'paying' for a pension. In the first case, young workers agree to pay (out of their labour income) the pension of retired people in return for the promise that the next generation of workers pays for their pension. This is called an *unfunded* or *pay-as-you-go* (PAYG) pension scheme or plan. In the second case, each generation of workers saves (out of their labour income) for their pensions in a *funded* pension scheme or plan. There are two key features of both types of pension arrangements: time and risk. Workers must pay now for something that they will get in the future, i.e., the pension provides the economic function of transferring income (and hence consumption) from work years to retirement years. There is some risk that the actual pension payments received will be less than those expected when the

---

<sup>1</sup> This is also the definition of a life annuity, so a pension is an example of a life annuity.

plan was first started. Indeed, there is some chance that the pension might not actually be paid at all on account of the pension scheme becoming insolvent. This is why people talk about a *pension promise*, rather than a *pension guarantee*.

What is economics? There are three parts to economics: microeconomics, macroeconomics and welfare economics.

*Microeconomics* deals with how individuals and firms allocate scarce resources, both in a single period and over time. It is about optimisation subject to constraints. Optimisation is the process of making decisions that maximise (or possibly minimise) the value of an objective function that is considered to be important to an individual or firm.

Individuals are assumed to maximise utility (their own sense of well-being or welfare) both within each period and over time, subject to their lifetime wealth constraint (which involves a combination of human and financial capital). Firms are assumed to maximise profits (or minimise costs) within each period and over time, subject to a technology constraint (or production function) that involves inputs of so-called factors of production, such as labour, physical capital and possibly land. Microeconomics also deals with government microeconomic policy. The government occasionally intervenes in the decision-making process of individuals and firms in an attempt to influence their behaviour. For example, it might wish to encourage people to save more for their pension, and use tax and other incentives to make pension saving more attractive than other forms of saving.

*Macroeconomics* deals with the collective or aggregate consequences of individual and firm decision making, as well as with the consequences of government macroeconomic policy. Individuals and firms operate in markets, such as the labour market, the capital market and the market for goods and services. If the markets in which individuals and firms operate are fairly competitive, then the actions of utility-maximising individuals and profit-maximising firms lead to the efficient allocation of resources. The government frequently intervenes in the way that the economy operates in order to achieve outcomes that it considers to be socially desirable, for example, promoting full employment or controlling inflation (the increase in the general price level). To do this it uses two key macroeconomic policies: fiscal policy and monetary policy.

Fiscal policy uses government spending (financed by taxes or government borrowing, which is a form of deferred taxation, since the money borrowed must eventually be repaid from future taxes) to try and achieve a macroeconomic objective, such as full employment. The

government might employ directly some unemployed workers or it might buy goods and services from private sector companies who then employ additional workers to meet the increase in demand. Monetary policy involves changes in the interest rate or the money supply to achieve another macroeconomic objective, such as controlling inflation. By restricting the money supply or raising interest rates, the level of aggregate demand in the economy can be reduced to a level that creates excess capacity in the economy, thereby restricting the ability of firms to raise prices and workers to demand pay rises. Macroeconomic policy is not typically used to influence pension decisions.

*Welfare economics* deals with the economic wellbeing of different members of society. This will depend on the distribution of resources (i.e., income and wealth) to different members of society and on the ability of society to share risks between different members of society. Welfare economics therefore deals with issues of equity as opposed to efficiency, and with the consequences of different economic policies for equity and risk sharing. Different types of pension scheme have different risk and distributional implications.

So what is pension economics? *Pension economics* deals with the allocation of scarce resources over the lifecycle between the time an individual is in work and the time he is in retirement. There are microeconomic, macroeconomic and welfare implications of this.

## 1.2 TYPES OF PENSION SCHEME

It is worth making the point at the outset that pensions and retirement are inventions of the late nineteenth and early twentieth centuries in developed economies. Before this, people in what are now developed economies did not retire; they continued working until they dropped, often ending their lives in the 'poor house'. Bismarck created the world's first state pension system in Germany in the 1880s. During the twentieth century, state and occupational pension schemes developed in the other countries of Europe and in developed economies as far apart as the USA and Australia. However, in many parts of Africa, Asia and Latin America, even today the idea of retirement and pensions remains a dream. The history of state and occupational pension schemes in the UK is explained in Blake (2003a, ch. 1–3) and Hannah (1986).

For those people living in developed countries, it is conventional to talk of *three pillars* of support in old age.

The *first pillar* is provided by the state as part of its *social security system*. There are two main types of social security system, Beveridgean and

Bismarckian. A *Beveridgean system* provides just sufficient support to keep people off the breadline; if people want to enjoy a higher standard of living, they are expected to make their own alternative arrangements. The UK and USA have Beveridgean social security systems. A *Bismarckian system* provides much more generous support, often at a level that does not require individuals to make additional arrangements. Germany, Italy and France have Bismarckian social security systems. The first pillar is financed by collecting tax (part of the social security tax that the government raises) from workers and paying it out immediately to pensioners. In other words, it is known as an unfunded system, since no fund of pension assets is accumulated. Clearly the level of social security tax collected will be lower in the former than the latter systems.

Most first pillar schemes are (non-financial) defined benefit in nature. Recently, countries such as Sweden and Poland have experimented with *non-financial (or notional) defined contribution (NDC)* schemes for their first pillar (see Holzmann and Palmer, 2006). These are unfunded schemes in which members have individual defined contribution (DC) accounts in which the returns that are credited to the contributions are not related to the returns on financial assets, but to some non-financial variable, such as the growth rate in the country's GDP or the growth rate in national average earnings (denoted  $g$  below). The contribution rate is a fixed proportion of earnings. At retirement, the notional capital in the member's account is converted to a life annuity, using an *annuity factor*<sup>2</sup> that reflects both the cohort life expectancy of the member and the rate of return on the scheme over the expected term of the annuity.

The system is kept in financial balance to ensure that the present value of system assets ( $PV(A)$ ), i.e., the accruing notional capital, always equals the present value of system liabilities ( $PV(L)$ ), i.e., the expected pension payments. This is achieved by using an adjusted rate of return  $g + \rho$ , where  $\rho = [(PV(A)/PV(L)) - 1]$ . The effects of demographic and economic shocks are therefore accommodated endogenously within the scheme and within each cohort, since the credited return on the scheme,  $g + \rho$ , adjusts the member's notional capital during both the

---

<sup>2</sup> An annuity factor shows the present value of one unit of pension payable annually for the life of the pensioner. The discount rate for calculating this present value is related to return on the non-financial variable used by the scheme during the accrual stage, such as the growth rate in the country's GDP or the growth rate in national average earnings. The estimated length of life of the pensioner is set equal to the life expectancy of the member's birth cohort (i.e., all people born in the same year as the pensioner). The annuity factor is divided into the notional capital to get the total annual pension. Present values are explained Box 1.1.

accrual and payment stages and the annuity paid at retirement reflects changes in birth cohort life expectancy.

### **Box 1.1 The Time Value of Money**

A unit of money (say \$1) is more valuable today than it will be if it is received in one year's time and \$1 in one year's time is more valuable than it will be if it is received in two years' time. Money becomes less and less valuable, the further into the future it will be received. So if we are to receive \$1 today, \$1 in a year's time and \$1 in two years' time, we cannot just add the three dollars together and say we have \$3. We have less than this in present value terms.

#### **Present value**

The present or current value of a sum of money to be received in the future is found by discounting. To do this we need to know the interest rate or discount rate. Suppose it is possible to borrow or lend at a riskless rate of interest of 10%. Then \$1 to be received in one year's time has a present value of:

$$\frac{\$1}{(1.1)} = \$0.91$$

This is because if we had \$0.91 today, we could save it for one year, earning 10% interest, and have exactly \$1 in a year's time:

$$\$0.91 + 0.1 \times \$0.91 = \$1$$

Similarly, the present value of \$1 to be received in two years' time is:

$$\frac{\$1}{(1.1)^2} = \$0.83$$

This is because if we had \$0.83 today and saved it for a year, we would have \$0.91 in a year's time and if we then saved the \$0.91 for another year we would have exactly \$1 in two years' time.

The present value of the three dollars is therefore \$2.74.

NDC schemes therefore have four properties (Palmer, 2006):

- At any time, the present value of an individual's lifetime benefit equals the individual's account balance.

- To maintain a fixed contribution rate, total NDC system assets must equal or be greater than total liabilities.
- The NDC benefit is constructed as a life annuity, reflecting life expectancy at retirement.
- Financial balance requires the accounts be valued at the rate  $g + \rho$ .

NDC schemes can be interpreted as exhibiting intergenerational fairness, since each generation pays the same contribution rate as a proportion of earnings and receives a pension based on its own economic performance over its lifecycle and its own mortality prospects.

The *second pillar* is provided by the companies in the form of *occupational pension schemes* or *plans*. Companies are said to *sponsor* such schemes. Typically, occupational pension schemes are funded, i.e., a fund of pension assets accrues from the contributions or premiums paid by the employer (the scheme sponsor) and worker (the scheme member) and from the investment returns on these contributions. The pension is paid from the accrued fund once the member retires. Sometimes (and this is more common in smaller companies than larger companies), the accrued fund is given to a life assurance company which then provides a life annuity to the retiree.

There are three classes of pension scheme member: the *active member*, who still works for the company and is still making contributions; the *retired member*, who has retired from the company and is drawing a pension; and the *deferred member*, a worker who is no longer working for the company and has not yet retired, but has accrued rights to a pension on the basis of his previous service for the firm and associated membership of the scheme – the pension then becomes payable when the deferred member retires from his last job.

Although most occupational pension schemes are funded, the calculation of the pension benefits can differ widely between different types of scheme. There are three main types of occupational scheme: *defined benefit* (DB), *defined contribution* (DC) and *hybrid*.

Until recently, the most common type of scheme was a DB scheme. In such a scheme it is the benefit that is defined and the scheme promises to pay a pension, based on this defined benefit, whatever the size of the fund backing this promise. The simplest DB scheme offers a fixed monetary pension at retirement, irrespective of earnings or subsequent inflation. Such schemes are common in Germany and the USA (where they are known as *fixed benefit* or *fixed amount plans*).

**Table 1.1** Value of pension benefits as a proportion of salary

Year of employment	Present value of new benefits earned (%)	Value of accrued benefits (%)
1	0.32	0.32
10	0.98	6.88
20	3.10	32.58
30	9.18	115.68
40	26.08	365.14

*Assumptions:* The plan pays a benefit equal to 1% of final salary per year of service. Plan participants enter the plan at age 25, retire at age 65, and live until age 85. The employee's salary grows at the rate of inflation, which is 5% per year. The interest rate used for discounting nominal annuities is 9% per year.

*Source:* Bodie (1990, table 1).

However, the most common type of DB scheme is a *salary-related scheme*. The most common of these is the *final salary scheme*, in which the pension paid is related to the salary earned in the final year of employment (or the average of the final three or five years of employment) of the scheme member. The actual pension is some fraction of the final salary, where the fraction is calculated as the product of the accrual rate (e.g., 1%) and the number of years of service.

Table 1.1 shows the value of pension benefits as a proportion of final salary. The table shows that benefits are *backloaded*: the present value of benefits earned in each year is greater in later years than earlier years. For example, the present value of benefits earned in the 10th year of membership is 0.98% of final salary, while that earned in the 40th year is equal to 26.08%. The backloading is caused by two factors: the time value of money and inflation. An older worker is closer to retirement than a younger worker and so the present value of an additional unit of pension benefit is higher for the older worker.

Inflation increases backloading for two reasons. First, by increasing the nominal interest rate, it magnifies the time value effect. Second, by increasing nominal wages, it will magnify the uprating component of the benefit earned each year. With each additional year of employment, an additional year of service is earned and the nominal salary is higher.

More recently, *average salary schemes* have been introduced: the pension is based on the average salary earned during the member's career. A number of industry-wide schemes in Holland, for example, have switched from final salary to career average. In career average revalued

earnings (CARE) schemes, the average salary calculation corrects for general price or wage inflation that occurred over the member's career. CARE schemes therefore lie in between average salary and final salary schemes in terms of the generosity of pension benefits.

Another type of DB scheme is the *retirement balance scheme*. The benefit is defined in terms of a lump sum rather than a pension and it is typically measured as the multiple of an accrual amount (a specified percentage of career average salary) and years of service. If final rather than average salary is used, such schemes are known as *final salary lump sum* or *pension equity schemes*. They are common in Japan and Australia. They are not proper pension schemes, however, unless the lump sum is used to buy an annuity, and hence provide lifetime income security.

A DB scheme will show a *surplus* if the value of the assets in the pension fund exceeds the value of the liabilities, namely the present value of the future promised pension payments. A DB scheme will show a *deficit* if the value of the liabilities exceeds the assets. Pension regulators or supervisors (appointed by the government) generally impose strict rules on the elimination of both surpluses and deficits. Surpluses are typically eliminated through *sponsor contribution holidays*, i.e., the sponsor stops making contributions to the fund until the surplus has been eliminated. Deficits are eliminated through a series of deficiency payments, i.e., additional contributions from the sponsor, that extinguish the deficit within a specified recovery period, such as 5–10 years or the average remaining service life of the company's workforce (typically around 15 years).

Increasingly, DB schemes are being replaced with DC schemes. In such schemes, it is the rate of contributions into the scheme that is defined. The contributions might be a fixed annual amount or they might be a fixed percentage of salary. The pension will depend on the value of the fund accrued by the time of retirement. No particular level of pension is promised with a DC scheme. If the value of the fund is low, either as a result of low contributions or poor investment performance, then the pension will be low as well. If, on the other hand, the value of the pension is high, the pension will be correspondingly high. By definition, DC schemes show neither surpluses nor deficits.

Hybrid schemes have a mixture of DB and DC components. The main examples are as follows (Wesbroom and Reay, 2005):

- *Sequential hybrid scheme*. The scheme might have a DC element (commonly called a *nursery DC scheme*) for those below a certain age (e.g., 45) and a DB element for those above it. Such a scheme offers

good portability for younger workers who tend to be more mobile and a more predictable pension for older workers.

- *Combination hybrid scheme.* The scheme offers a DB pension in relation to salary up to a limit (which might be the basic salary) and a DC pension in respect of salary above this limit (which might be the variable element of salary).
- *Underpinning arrangements.* There are two main types. The first is a DC scheme with a DB underpin. Such a scheme provides a minimum pension, based on what a corresponding DB scheme with the same salary experience and service would have paid, in case the investment performance is very poor. The second is a DB scheme with a DC underpin. This type of scheme is intended to provide a 'value-for-money' guarantee for early leavers. The value of the final salary benefit is guaranteed not to be less than a DC benefit calculated on the basis of a multiple of the member's contributions accumulated with interest.
- *Cash balance scheme.* This is a defined benefit scheme in which the benefit is defined as an individual account within the scheme. The scheme specifies the rate of contribution and the rate of investment return (independent of the performance of the underlying assets in the scheme, but typically linked to the return on bonds) that will be credited to the member's account. The accumulated lump sum at retirement is used to buy an annuity. To the member, a cash balance scheme resembles a DC scheme. It is the most common hybrid arrangement in the USA (see Rappaport *et al.*, 1997). It is also sometimes known as a *shared risk scheme*.
- *Targeted benefit scheme.* This is a DC scheme but the aim is to deliver a target pension, so the contributions will have to be adjusted over time if the fund falls short of or exceeds the target.

The *third pillar* is any additional savings for retirement that the individual chooses above that provided by the state or the company for whom the individual works. These savings will typically be held in deposit accounts or in mutual funds invested in equities or bonds. If the individual chooses to do this via a formal pension scheme, it will almost invariably be in the form of a DC scheme, known as a *personal pension scheme* or an *individual retirement account*. Other assets can also be used to provide income in retirement. The best example of this is the domestic home. When they retire, individuals sometimes sell their home and buy a smaller one in order to increase their spending power in retirement; this is known as trading down. An alternative is to borrow against the equity

in the home and allow the interest to roll up. The initial loan and the rolled-up interest are repaid at the time of death of the occupant out of the proceeds from selling the home. This is called *home equity release*.

Increasingly there is a *fourth pillar* of support in old age, and that is post-retirement work. Sometimes this is by choice. Some individuals do not like the idea of being fully employed one day and then having no work to do the next. Such individuals prefer a gradual entry into retirement. For other individuals, there might be no choice but to take a part-time job to make ends meet.

A pension is not the only issue that elderly people need to deal with. Health problems, medical expenses and the possible need for *long-term care* are issues that many people need to confront as they get older. In the UK, around 20% of old people need long-term care for up to two years before they die and the average annual cost of this is equal to the average annual salary in the UK. The bulk of a typical person's lifetime medical expenses occur in the last six months of their life. A pension scheme is not designed or intended to cover these costs. Either people rely on the state to pay these costs or, increasingly, they have to sell their other assets, including their home, to pay for their long-term care costs. While insurance policies covering long-term care costs exist, very few people take them out.

### 1.3 CONCLUSIONS

Pension economics is a relatively new branch of economics dealing with the micro, macro and welfare implications of different types of pension scheme. Pensions themselves are a relatively recent innovation and involve the input of the state, companies and individuals. For a discussion of different consequences of different types of scheme, see Blake (2000). For details of the UK pension system, see Blake (2003b). For details of other social security systems, see Gruber and Wise (2004).

### QUESTIONS

1. What is a pension?
2. What is a life annuity?
3. What is pension economics?
4. Explain the differences between Beveridgean and Bismarckian approaches to social security.
5. Explain the four pillars.

6. Explain the difference between DB and DC schemes.
7. Explain the main types of DB scheme.
8. Explain why DB benefits are backloaded.
9. Explain the main types of hybrid scheme.
10. Explain NDC schemes.
11. Explain the time value of money.
12. What other issues apart from their pensions do elderly people have to deal with?

### REFERENCES

- Barr, N. (2004) *The Economics of the Welfare State*, Oxford University Press, Oxford.
- Blake, D. (2000) Does it matter what type of pension scheme you have?, *Economic Journal*, **110**, F46–F81.
- Blake, D. (2003a) *Pension Schemes and Pension Funds in the United Kingdom*, Oxford University Press, Oxford.
- Blake, D. (2003b) The UK pension system: key features, *Pensions*, **8**, 330–375.
- Bodie, Z. (1990) Pensions as retirement income insurance, *Journal of Economic Literature*, **28**, 28–49.
- Gruber, J. and Wise, D. (2004) *Social Security Programs and Retirement around the World*, University of Chicago Press, Chicago.
- Hannah, L. (1986) *Inventing Retirement: The Development of Occupational Pension Schemes in Britain*, Cambridge University Press, Cambridge.
- Holzmann, R. and Palmer, E. (eds) (2006) *Pension Reform: Issues and Prospect for Non-Financial Defined Contribution Schemes*, World Bank, Washington, DC.
- Palmer, E. (2006) What is NDC?, in Holzmann, R. and Palmer, E. (eds), *Pension Reform: Issues and Prospect for Non-Financial Defined Contribution Schemes*, World Bank, Washington, DC, pp. 17–33.
- Rappaport, A., Young, M., Levell, C. and Blalock, B. (1997) Cash balance pension plans, in Gordon, M., Mitchell, O. and Twinney, M. (eds), *Positioning Pensions for the Twenty-First Century*, University of Pennsylvania Press, Philadelphia, pp. 29–44.
- Wesbroom, K. and Reay, T. (2005) *Hybrid Pension Plans: UK and International Experience*, Research Report 271, Department for Work and Pensions, Leeds.

<http://www.pbookshop.com>