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Does it Matter What Type of Pension Scheme You Have?

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DOES IT MATTER WHAT TYPE OF PENSION SCHEME YOU HAVE?*

David Blake

If you are concerned about your pension, then the type of pension scheme you have matters considerably. Because of demographic imbalances, unfunded state pension schemes are unlikely to be sustainable, unless the real growth rate in pensions is severely constrained or the effective working life is increased substantially. In contrast, high real returns available in the world's capital markets make it more likely that funded pension schemes will be able to deliver the pension promise. But there is an important choice to make between the two key types of funded pension scheme: defined benefit and defined contribution. There are both costs and benefits to each type of scheme. Defined benefit schemes can provide a reasonable replacement ratio for those who stay with one scheme for their whole career, but frequent job changers can experience large portability losses from these schemes. Most schemes being established today in the UK and elsewhere are defined contribution. Although these schemes are portable between jobs, they are often associated with high charges, a wide dispersion in investment performance and annuities that are poor value for money. When choosing your pension scheme, you have a difficult set of choices to make.

The combined values of the claims[1] against the four main types of British pension scheme are enormous: in 1994 they were valued at (with the ratio to GDP given in parentheses): basic state pensions £703bn (105%), SERPS[2] £202bn (30%), occupational pensions £743bn (111%) and personal pensions £140bn (21%). Collectively, the value of pension rights accounted for 49% of total personal sector wealth in 1994[3]. In this article we ask: Who is in the best position to operate your pension scheme? The state or the private sector? Is it better for the scheme to be funded or unfunded? What are the costs of switching between the two types of scheme? If the scheme is funded, how should the accumulating financial assets be managed? Is it better for the scheme to be defined benefit (as in the state schemes and most occupational schemes) or defined contribution (as with personal pension schemes and an increasing number of company schemes)? What are the different risks associated with the different types of scheme and how are those risks shared?

Retirement income is an extremely important component of every individual's life cycle. It can come from one of the four key pillars of support in old age: unfunded state pensions (that is, transfers from the current working population via the tax system), funded private pensions (that is, from savings accumulated in private sector pension schemes), direct private savings, and

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[1] By claims we mean either the expected discounted value of accrued rights in defined benefit schemes (whether funded or unfunded) or the value of accumulated financial assets in funded defined contribution schemes.

[2] The State Earnings Related Pension Scheme.

[3] Blake and Orszag (1999, Table 12).

post-retirement work. For most people in developed countries, the key sources of retirement income are state and private pension schemes. Individuals will therefore be concerned with the ability of these schemes to deliver the pension promise that they make. This will depend on a range of factors, the most important of which are the ratio between the number of people in retirement and the number of people in work (the so-called dependency ratio), the productivity of those in work, and the rate of return generated on assets accumulated in pension funds. The relationship between these factors will determine which type of pension scheme, funded or unfunded, is likely to be more effective in delivering pensions; indeed they will affect the very viability of each type of scheme. Other factors are also important. The capital markets will be important for determining the efficiency of the two main types of funded scheme: the defined benefit and the defined contribution scheme. Similarly, changing labour market conditions (which affect the frequency of job changes, for example) will influence the suitability of each type of scheme.

1. How Does Funding Matter?

There are two main types of organised pension arrangement: pay-as-you-go (PAYG) and funded. A pension scheme can be thought of as a long term savings programme to transfer resources from the young to the old (in the case of an unfunded or PAYG scheme) or from youth to old age (in the case of a funded scheme).

1.1. *Unfunded Schemes*

Most state pension schemes are financed on a PAYG basis. The pensions of the retired generation are paid from the contributions of the current working population. To be viable over the long run, they require sufficient people in work, making sufficient contributions to pay for those who have retired. Technically, we need the sum of the growth rates in the working population and labour productivity (i.e., output per worker) to exceed the sum of the growth rates in the retired population and real pensions (for contribution rates not to rise)[4]. This is equivalent to saying that the real growth rate in the national wage bill must exceed the real growth rate in the national pension bill. But in the United Kingdom, as in the rest of Europe, the population growth rate is slowing down (and in some countries is actually negative) and, due to advances in medical science, people are living longer. Thus the population is ageing dramatically, resulting in the so-called demographic timebomb, the inter-generational risk that there will insufficient younger workers to pay the pensions of the large numbers of pensioners.

In 1990, there was one pensioner in the United Kingdom for every four workers. By 2030, there is projected to be nearly two pensioners for every five

[4] Samuelson (1975).

workers.[5] It is worse elsewhere in Europe. The worst case is Germany where the ratio is projected to rise from one-in-five to one-in-two between 1990 and 2030. While, in all developed countries, there is a net transfer of resources from the young to the old, the required increase in resources flowing between these generations is likely to be too large to be politically or socially sustainable. For example, in the case of Germany, contribution rates to the state pension scheme would have to rise from 23% of workers' incomes in 1995 to 42% by 2050, while the corresponding increase in the case of Italy would be from 43% to 68%.[6] The United Kingdom is the only major country that has so far made any significant attempt to reduce its state pension costs: in her case by linking increases in state pensions to the retail price inflation rate rather than to the (on average) higher wage inflation rate, by reducing the benefit accrual rate for SERPS (both these factors induce the replacement ratio to fall over time) and also by raising the state retirement age of women.[7]

While the share of state pension costs as a proportion of GDP has been contained in the case of the United Kingdom over the next half century and is expected to fall in the case of Ireland, it is projected to grow substantially in other parts of Europe, rising by 61% in Italy, by 66% in Germany and more than doubling in the case of the Netherlands and Portugal. Estimates have been made of the size of unfunded state pension liabilities in Europe (calculated as the difference between the present values of promised future pension payments and expected future contributions).[8] Ireland has the lowest net liability (at 19% of GDP), closely followed by the United Kingdom (at 24%), while Sweden and Belgium have the highest net liabilities (at 132% and 153% respectively). If these liabilities had been recognised as part of the national debt of each country and added to the official measure of national debt, then *no* member state of the EU would have satisfied one of the Maastricht criteria for participating in the euro currency (namely that national debt must not exceed 60% of GDP)!

Labour productivity is not making up the shortfall caused by the declining population growth rate. There are a number of reasons for this. High labour productivity requires high capital per worker, but net investment (additions to the capital stock after taking depreciation into account) in the United Kingdom and in many other parts of Europe has been inadequate: it has typically been considerably less than gross investment, and, indeed, net investment by public sector corporations has frequently been negative.[9] The long-term consequences of inadequate investment is illustrated by the decline of the coal, steel and shipbuilding industries across Europe. On top of this, and despite the headline stories of inward direct investment from abroad, capital is flowing

[5] World Bank (1994*a*); see also OECD (1996), Disney (1996) and Blake (1997*a*).
[6] Chand and Jaeger (1996).
[7] See also World Bank (1994*b*).
[8] Roseveare *et al.* (1996).
[9] For example, between 1980 and 1996, gross investment in the UK averaged 17.1% of GDP, while net investment averaged just 5.7%. During the 1980s, net investment by United Kingdom public corporations averaged −0.02% of GDP (ONS (1998*a*, Table 14.1), and ONS (1998*b*, Tables 3.2.1 and 3.2.7)).

out of Europe to the low-wage parts of the globe, such as the Far East and Latin America: during the 1980s outward direct investment from Europe was occurring at more than twice the rate of inward direct investment into Europe (as a proportion of GDP).[10]

Also European unit labour costs are the highest in the world: they average US$20 per hour (of which US$8 per hour covers the provision of social benefits). In China, unit labour costs are US$1 per hour, while in Africa, they are US$1 *per day*.[11] Workers in European and many other advanced economies appear to be pricing themselves out of the formal labour market. The OECD (1998) estimated that the number of people out of work in OECD countries in 1997 was about 35m, up from 25m in 1990. There was also estimated to be another 11m 'discouraged workers' who no longer register. The worst situation is in Europe where 23m people or 12% of the workforce are officially out of work, compared with 6.7m in the United States and 2.3m in Japan. Furthermore, there has been a steady increase in unemployment in Europe over the last 40 years: 2% in the 1960s, 4% in the 1970s, 10% in the 1980s and 12% in the 1990s. The OECD's explanation for this is that the service sector has failed to take up the workers released by the decline in manufacturing industry; indeed, within the European Economic Area, the net growth in employment has been entirely confined to the public sector, with no net additional private sector jobs created since 1973. Even worse is the duration of unemployment: 45% of those who are unemployed in Europe have been out of work for more than a year, compared with 20% in Japan and only 10% in the United States.

There is, therefore, a potentially catastrophic combination in Europe, with the dependency ratio increasing inexorably but unemployment at unprecedented levels and rising. At the same time, Europe's relative competitiveness is declining. This is reflected in Europe's share of world markets: her share of high technology export markets, which accounts for most of the growth in world trade, is now less than half that of the US or Japan.[12]

Table 1 shows that unfunded pension schemes are *not* viable in the long run

[10] Eltis (1994). Total gross investment in the Far Eastern economies of Japan, Korea, Taiwan, Singapore, Hong Kong, Indonesia, Malaysia, and Thailand averaged 35% of GDP in 1990 compared with only 20% in the OECD economies; the growth rate in real GDP per capita averaged 5.5% in the Far Eastern economies between 1965 and 1990, and only 2.5% in the OECD economies (see World Bank (1993)). Asia receives 60% of world capital flows, Latin America 20%, Africa and the Middle East 4%, and Europe and North America between them just 16% (see *Financial Times*, 6 March 1997). Recent research has concluded that the 'Golden Age' of European economic growth between the early 1950s and mid-1970s, when per capita real incomes grew by an average of 3.8% p.a., will never be repeated. This growth was stimulated by a range of factors, such as post-war reconstruction, technology transfers from the United States (causing 'catch up' growth), structural change (as a result of a new accommodation between workers and employers), and an investment boom. The subsequent slowdown began with the oil crises of the 1970s, and continued with the rise of newly industrialising countries in the Far East and Latin America, the effect of technological change on unskilled labour, and the impact of information technology and international communications on the location of service industries, all factors leading to a permanent shift in comparative advantage away from Europe (see Crafts and Toniolo (1996) and van Ark and Crafts (1996)).

[11] DRI McGraw Hill/Morgan Stanley Research and ILO (1998). It should be noted that these striking differences in nominal unit labour costs do not allow for differences in either local price levels or local productivity levels.

Table 1

Testing the Viability of the Pension Systems in Different Countries in the Next Century

Country	Growth rate in working population* (%)	Growth rate in labour productivity† (%)	Real rate of return on pension fund assets‡ (%)	Growth rate in retired population§ (%)	Unfunded pension scheme viable:‖		Funded pension scheme viable:**		Funded scheme superior to unfunded scheme?††
					if real pensions grow in line with productivity?	if real pension growth is zero?	if real pensions grow in line with productivity?	if real pension growth is zero?	
UK	0.0	2.1	6.3	0.7	**No**	Yes	Yes	Yes	Yes
Germany	−0.7	2.5	5.5	0.8	**No**	Yes	Yes	Yes	Yes
Netherlands	−0.3	2.1	4.3	1.2	**No**	Yes	Yes	Yes	Yes
Sweden	0.1	1.8	2.8	0.6	**No**	Yes	Yes	Yes	Yes
Denmark	−0.3	1.9	5.8	0.5	**No**	Yes	Yes	Yes	Yes
Switzerland	−0.2	1.5	2.2	1.1	**No**	Yes	Yes	Yes	Yes
USA	0.4	1.6	3.9	1.4	**No**	Yes	Yes	Yes	Yes
Canada	0.4	2.6	4.1	1.7	**No**	Yes	Yes	Yes	Yes
Japan	−0.6	4.1	2.9	1.4	**No**	Yes	**No**	Yes	Yes
Australia	0.5	1.8	4.2	1.9	**No**	Yes	Yes	Yes	Yes

Notes:

* Projected annual average growth rate in working population aged 15 to 64 between 1990 and 2050 (source: World Population Prospects: The 1994 Revision, United Nations, 1995).

† Annual average growth rate in real GDP per capita between 1967 and 1990, assumed to hold over the period 1990–2050 (source: Penn-World Tables, http://www.nber.org/pwt56.html).

‡ Annual average real return between 1967 and 1990, assumed to hold over the period 1990–2050 (source: Davis (1995, Table 6.15))

§ Projected annual average growth rate in population over the age of 65 between 1990 and 2050 (source: World Population Prospects: The 1994 Revision, United Nations, 1995).

‖ Unfunded pension schemes are viable if the sum of the growth rates in the working population and in labour productivity exceeds the sum of the growth rates in the retired population and in real pensions.

** Funded pension schemes are viable if the real return on pension assets exceeds the growth rate in real pensions.

†† Funded schemes are superior to unfunded schemes if the real return on pension assets exceeds the sum of the growth rates in the working population and in labour productivity.

in *any* major country *if* real pensions grow in line with the growth rate in labour productivity. They would be viable in the long run if the real growth rate in pensions was zero (as it is in the UK state pension scheme); but this implies that pensioners would receive a constantly falling share of their country's resources. This led the Pension Provision Group to conclude that, in the United Kingdom at least, state pensions are affordable, but that is because they are now so low. Furthermore, expectations concerning the level of state pension provision are now much lower in Britain than they are in the rest of Europe.[13] Unfunded pension schemes could also be made viable if there was a sufficient increase in the effective working life and a corresponding reduction in the retirement period. However, increasing the normal pension age will do little to increase the average effective working life in an economy where many workers have in reality left the labour force well before the existing normal pension age. To illustrate, male unemployment rates in the 60–64 age range are already above 50% in most major economies (except Japan where the rate is 24%): 83% in France, 81% in Holland, 70% in Italy, 65% in Germany, 50% in the United Kingdom and 47% in the United States.[14]

1.2. *Funded Schemes*

If PAYG state pension schemes are likely to become increasingly unviable (unless state pensions are constrained from growing in real terms or the effective working life is increased), then governments have little alternative but to transfer the burden of pension provision to funded pension schemes; and while these funded schemes could be in the public sector (as in the case of Sweden, for example), they are most likely to be in the private sector. In fact, there is a result in the pension economics literature (first identified by Aaron (1966)) which shows the condition under which, in the long run, funded pension schemes are superior to unfunded schemes. It requires the real rate of return on the assets in funded schemes to exceed the real growth rate in the wage bill (which is equal to the 'rate of return' on a pay-as-you-go system). This condition appears to hold in the case of the United Kingdom and elsewhere (see Table 1), not least because pension funds are able to generate higher returns by investing in the fastest-growing economies of the world, rather than in Europe. There is also a good theoretical reason for supposing that, in long run equilibrium, the average return on assets will exceed the growth rate in the wage bill (which, in turn, equals the growth rate in national income if the share of wages in national income is constant). This has to do with the 'dynamic efficiency' of the economy. Saving via a pension fund helps the

[12] Eltis (1994).

[13] Ross (1998).

[14] Johnson (1999, Table 1.4) – the figures are for the early 1990s. Gruber and Wise (1997) show that generous state disability benefits are being used as early retirement vehicles. The extreme case is Holland where 25% of 60–64 year old men are receiving disability benefits of 70% of previous earnings (up to a maximum of 125% of average earnings). Gruber and Wise conclude that 'social security program provisions have indeed contributed to the decline in the labor force participation of older persons, substantially reducing the productive capacity of the labor force' (p. 26).

process of capital accumulation, which, in turn, improves the productivity of workers. However, it is possible to accumulate so much capital that the rate of return on capital assets falls below the growth rate in national income and the economy becomes 'dynamically inefficient': people could be made better off by saving less and consuming more. Dynamically inefficient economies are unlikely to be sustainable in the long run, since the owners of capital are likely to transfer their capital to economies offering higher returns.[15]

However, funding is not a panacea as argued by economists such as Diamond (1977, 1997). Funded pension arrangements can give an illusion of security which disregards the political risks associated with the presence of a large pool of financial assets that has accumulated on the basis of generous tax breaks: cash-strapped finance ministers can later change the rules of the game (as happened, for example, in 1997 when the Chancellor of the Exchequer removed the right of pension funds to recover the advance corporation tax paid on dividends). Further, individually-funded pension arrangements are subject to the following types of risks: the risk attached to contribution inflows arising from the possibility of unemployment, ill-health, disability or death-in-service during the working lifetime, the risk to the accumulating pension fund arising from the uncertainties attached to asset returns, and the risk related to the provision of pension annuities when lifetimes are uncertain. These are risks that are either expensive or impossible to hedge using private insurance markets: individuals are unable to transfer risks efficiently to the companies operating in these markets. Diamond argues that mandatory unfunded state pensions provide the mechanism for insuring these risks collectively, although there is still the problem that unfunded schemes face a risk from the demographic time-bomb that funded schemes do not. Finally, the individual funding of pension arrangements might not be suitable or, indeed, feasible for the low paid: state-run PAYG systems permit minimum welfare standards to be established via income redistribution in a way which private sector funded schemes do not.

1.3. *The Transition Deficit*

Even if the move from an unfunded to a funded pension system is recognised as being desirable, there is a major transitional problem to solve. Existing pensioners in the unfunded scheme still have to be paid. With an unfunded system, pensions are paid from the contributions of those currently in work. If a funded pension system is introduced, the contributions from those in work will be invested in a fund and will no longer be available to pay the pensions of those who remain in the unfunded system. The introduction of a funded system creates what is known as a 'transition deficit'. This has to be financed by extra taxation or by the issue of 'recognition bonds' by the government (effectively a form of deferred taxation that formally 'recognises' the unfunded liabilities of the state PAYG system). In short, the next generation has to pay twice for its pensions: once in the form of direct contributions into its own

[15] Blanchard and Fischer (1989, chapter 3) and Abel *et al.* (1989).

pension fund and again in the form of extra taxation to pay for the previous generation's pensions.

Some economists question whether, in a democracy, the transition generation would ever agree to make the switch, given that it is made worse off and that the future generations who would benefit from it are not in a position to vote on the matter. The issue boils down to whether the switch is Pareto-improving: could future generations compensate the transition generation for making the switch without making themselves worse off? The answer depends on the assumptions made. For example, Breyer (1989) (see also Geanakoplos *et al.* (1998*a*,*b*)) uses an infinite-horizon overlapping generations (OLG) model in which the labour supply of each worker is fixed exogenously and there is a perfect capital market trading a single financial instrument (essentially a government bond) with a real return (r) that exceeds the growth rate (g) in the population; because the labour supply is fixed, the real wage bill (measured in wage units) also grows at rate g. Suppose the government replaces the PAYG system by issuing recognition bonds equal to the value of the unfunded pension liabilities. Workers start paying into the new funded scheme which invests in government bonds paying r. While this is higher than g, the rate of return in the unfunded scheme, workers also have to pay extra taxes to meet the interest payments on the recognition bonds. The maximum extra taxes that workers can pay is at the rate $(r - g)$, otherwise they would be worse off than under the PAYG system. With tax payments of just $(r - g)$ to pay the interest on the recognition bonds, the recognition bond debt will grow at rate g. But because the population is also growing at rate g, the recognition bond debt per worker will remain constant over time. However, the important point to note is that the recognition bond debt can never be paid off without making future generations worse off, since the tax rate would have to be higher than $(r - g)$ to pay off the debt in finite time. Therefore the switch to funding can never be Pareto-improving if the assumptions of this model are valid.

However, when the assumptions are changed, we can get a different outcome. Breyer and Straub (1993), for example, allow labour supply to be endogenous and respond to net wages. Since the payroll taxes (social security contributions) collected to pay PAYG pensions are usually proportional to earnings, this will distort labour supply decisions to such an extent that PAYG is no longer Pareto-efficient. Breyer and Straub show that switching to lump sum payroll taxes can both remove labour supply distortions and raise sufficient revenue to pay off the recognition bonds in finite time, so that a switch to funding can lead to an intergenerational Pareto-improvement. Similarly, if the capital markets trade not only bonds, but also equity with a higher return than bonds ($r_E > r$), then the switch to funding could also be Pareto-improving, since the tax payments to fund the recognition bond debt could be marginally higher than $(r - g)$ and the debt could be paid off in finite time and all future generations would be better off. Geanakoplos *et al.* (1998*a*,*b*), however, argue that equity is riskier than bonds, and that, appropriately adjusting for risk, the return on equity does not exceed that on bonds. But as we argue in Section 3.2.2 below, the absolute risk attached to a financial instrument is not the

relevant measure of risk when considering a pension fund portfolio. Instead what is relevant is surplus risk, the risk on the assets relative to that on the liabilities, since the assets in an optimal pension fund portfolio are chosen to match as closely as possible the returns and risks on the liabilities. Equity is a natural long-term matching asset for pension liabilities growing at the rate of real wage inflation, for the simple reason that the shares of labour and capital in national income are fairly contant over time (or at least do not trend in a significant way) and equity represents the ownership of capital. In contrast, fixed income bonds are riskier than equity when liabilities grow with wage inflation. Pension funds gain the long run equity risk premium $(r_E - r)$ by investing in equities rather than bonds. Geanakoplos *et al.* (1998*a*,*b*) do concede that when there are capital market imperfections and the poor are constrained from holding equities, the investment of pension fund contributions by the poor in equities could be Pareto-improving. As a final illustration, consider an OLG model with a finite horizon: the burden of paying the transition deficit could be transferred like a hot potato to the last generation alive, since it pays into a pension fund but will not be in a position to draw it down.

There are other potential benefits from a switch to funding as listed in Valdés-Prieto (1997), such as, positive externalities in the capital markets (e.g., greater capital market deepening), access to international risk diversification, more transparent fiscal accounting and greater (although as indicated above not complete) insulation from political risk.

To illustrate the size of the potential benefits from a switch to funding, the Conservative government in the United Kingdom announced in March 1997 plans to privatise the state pension system from the turn of the century and to end its unfunded nature. All individuals in work would receive rebates on their social security contributions which would be invested in a personalised pension account. The initial costs in terms of additional taxation were estimated to be £160m in the first year, rising to a peak of £7bn a year in 2040. However, the long term savings to the taxpayer from the end of state pension provision were estimated to be £40bn per year (all in 1997 prices).[16] In contrast, in Chile, the government financed the transition from an unfunded to a funded system in the early 1980s by issuing recognition bonds.

2. How does the Structure of Your Pension Scheme Matter?

There are two main types of funded scheme: the defined benefit (DB) scheme and the defined contribution (DC) scheme.[17] With a DB scheme, it is the pension benefit that is defined. In the United Kingdom, for example, most DB schemes are arranged by companies and are known as occupational final salary schemes, since the pension is some proportion of final salary, where the

[16] *Basic Pension Plus*, Conservative Central Office, 5 March 1997. These plans were put on hold as a result of the Conservative government's defeat in the May 1997 general election.

[17] However, there is an increasing number of hybrid schemes being introduced which combine features of both DB and DC schemes. It is also possible to have unfunded DB and DC schemes.

proportion depends on years of service in the scheme. A typical scheme in the United Kingdom has a benefit formula of one-sixtieth of final salary for each year of service up to a maximum of 40 years' service, implying a maximum pension in retirement of two-thirds of final salary, and with the pension indexed to inflation up to a maximum of 5% per annum (this is known as limited price indexation). In contrast, with a DC scheme, what is defined is the contribution rate into the fund, e.g. 10% of earnings. The resulting pension depends solely on the size of the fund accumulated at retirement. Such schemes are also known as money purchase schemes and in the United Kingdom they are better known as personal pension schemes. The accumulated fund must be used to buy a life annuity from an insurance company (although, in the United Kingdom, up to 25% of the fund can be taken as a tax-free lump sum on the retirement date).

2.1. *The Costs and Benefits of DB Schemes*

Defined benefit and defined contribution schemes have different costs and benefits. Defined benefit schemes offer an assured (and in many cases a relatively high) income replacement ratio in retirement. People in retirement can expect to enjoy a standard of living that is related to their standard of living just prior to retirement. But this is the case only for workers who remain with the same employer for their whole career. Fewer than 5% of workers in the United Kingdom do this: the average worker changes jobs about six times in a lifetime.[18]

Every time workers switch jobs they experience a 'portability loss' in respect of their pension entitlement. This is because DB schemes are generally provided by specific employers and when a worker changes jobs they have to move to a new employer's scheme. When they do so, they will either take a transfer value equal to the cash equivalent of their accrued pension benefits with them or leave a deferred pension in the scheme that they are leaving. Accrued benefits are valued less favourably if someone leaves a scheme than if they remain an active member of the scheme. This is because scheme leavers (whether they choose a transfer value or a deferred pension) have their years of service valued in terms of their leaving salary (although this is uprated annually to the retirement date by the lower of the inflation rate or 5%), whereas continuing members will have the same years of service as the early leaver valued in terms of their projected salary at retirement which is likely to be higher. Long stayers are therefore subsidised at the expense of early leavers. In the United Kingdom, the portability loss is more commonly known as a 'cash equivalent loss'.

For a typical worker in the United Kingdom changing jobs six times during their career, Table 2 shows that the portability loss lies between 25 and 30% of the full service pension (i.e., the pension of someone with the same salary

[18] Burgess and Rees (1994), Gregg and Wadsworth (1995), Booth *et al.* (1996), and Disney and Whitehouse (1996).

Table 2

Portability Losses from Defined Benefit Schemes
(Percentage of Full Service Pension Received at Retirement)

Worker type	Job separation assumptions*	Transfer value†	Deferred pension‡	Defined contribution pension (employer-run)§	Personal pension (employer contributions)‖	Personal pension (no employer contributions)**
Average UK worker (MFR assumptions realised)††	A	75	75			
	B	71	71			
	C	84	84	71	61	37
Average UK manual worker	A	75	88			
	B	71	86			
	C	84	96	78	66	45
Average UK non-manual worker	A	75	86			
	B	71	83			
	C	84	94	79	68	44

Notes:
* This table presents estimates of the size of the portability losses experienced by three different types of UK workers (based on typical lifetime earnings profiles) under three different sets of job separation assumptions: A – separates at ages 28, 29, 30, 40 and 57; B – separates at 26, 27, 30, 31, 38, 44 and 55; C – separates at 45. The loss is expressed in the form of a reduced pension compared with what each of the three workers would have received had they remained in a single scheme for their whole career.
† Leaving worker takes transfer value to new scheme.
‡ Leaving worker leaves deferred pension in leaving scheme.
§ Leaving worker transfers into employer-run DC scheme.
‖ Leaving worker transfers into personal pension scheme where the employer also contributes.
** Leaving worker transfers into personal pension scheme where the employer does not contribute.
†† The MFR (Minimum Funding Requirement) assumptions are the assumptions specified in the 1995 Pensions Act concerning future inflation, earnings growth and investment returns that must be used by UK pension funds from April 1997 to determine the minimum contribution level needed to meet projected pension liabilities.
Source: Blake and Orszag (1997, Appendix E, Table 5.8, p. 74).

experience but who remains in the same scheme all their working life). Even someone changing jobs once in mid-career can lose up to 16% of the full service pension. It is possible to reduce portability losses by, for example, indexing leaving salaries between the leaving and retirement dates to the growth in real earnings or by providing full service credits on transfers between jobs, but this is not common in the UK (except on transfers between different public sector occupational pension schemes).

2.2. *The Costs and Benefits of DC Schemes*

With DC schemes, it is important to distinguish between the accumulation and decumulation stages.

2.2.1. *The accumulation stage*

Defined contribution schemes have the advantage of complete portability when changing jobs. However, individual DC schemes (such as personal

pension schemes) tend to have much higher operating costs than occupational DB schemes (although occupational DC schemes may have lower operating costs than occupational DB schemes on account of their much simpler structure). Individual DC schemes in the United Kingdom take around 2.5% of contributions in administration charges and up to 1.5% of the value of the accumulated assets in fund management charges. The Institute of Actuaries has estimated that all these costs are equivalent to a reduction in contributions of between 10 and 20%; in contrast, the equivalent costs of running an occupational scheme work out to between 5 and 7% of annual contributions.[19] On top of this, most of the costs associated with an individual DC scheme relate to the initial marketing and set-up. To reflect this, charges are also frontloaded, i.e. they are extracted at the start-up of a scheme rather than spread evenly over the life of the scheme. In many schemes, much of the first two years of contributions are used to pay sales commissions. This has a dramatic effect in reducing the surrender value of a scheme if contributions cease early on and it is transformed from an ongoing to a paid-up basis. The cumulative effect of these charges in respect of DC schemes is shown in Table 3. Over a 25-year investment horizon, the average scheme with a full contribution record takes around 19% of the fund value in charges, while the worst scheme provider takes around 28%.[20] There is also evidence of a substantial absence of persistency in regular premium personal pension policies: the estimated average lapse rate is 27% after two years, 53% after four years and 84% after 25 years. The lapse rate–adjusted reduction in contributions for a 25-year policy is 88%: the effective contributions into this scheme for a typical policy holder are just 12p in the £.[21]

Table 3

Percentage of DC Fund Value Represented by Charges

	5 years	10 years	15 years	20 years	25 years
Regular premium scheme (£200/month)					
Best commission-free fund	3.1	4.1	7.2	8.5	9.8
Best commission-loaded fund	4.0	4.1	7.4	8.9	10.6
Industry average	11.6	13.0	14.8	17.7	19.0
Worst fund	19.2	22.0	24.6	28.2	27.8
Single premium scheme (£10,000)					
Best commission-free fund	3.8	7.1	9.2	10.6	10.4
Best commission-loaded fund	3.8	7.1	9.2	10.6	10.4
Industry average	9.6	13.3	16.3	19.1	21.9
Worst fund	17.4	20.5	27.0	32.9	38.2

Source: *Money Management* (October 1998).

[19] Blake (1995, sec. 7.34).

[20] It is the high costs associated with individual personal pension schemes in the UK that has led many small companies without the resources to run either occupational DB or occupational DC schemes to establish group personal pension schemes (GPPs) which have lower unit costs than personal pension schemes.

[21] The lapse rates come from Personal Investment Authority (1998), while lapse rate-adjusted reductions in contributions are estimated in Blake and Board (1999).

Further, although individual DC schemes are portable between jobs, they are not fully portable between scheme providers or even between different investment funds operated by the same provider. Transfers between personal pension scheme providers, for example, can incur charges of between 25 and 33% of the value of the assets transferred. Transfers from DB schemes into DC schemes can cost even more than this. Table 2 shows that even if a worker changes jobs only once in mid-career and moves out of a DB scheme, he would receive a reduced pension of: 71-79% of the full service pension if he moved to an employer-run DC pension (with the same total contribution rate as the DB scheme and no extra charges), 61-68% if he moved to a personal pension scheme (where the employer also contributes), and only 37–44% if he moved to a personal pension scheme (without employer contributions). Moving to a DC scheme involves a 'backloading loss' in addition to the cash equivalent loss incurred when leaving a DB scheme. The backloading loss arises because benefits are backloaded in final salary schemes but not in DC schemes; this follows because salary and therefore accrued benefits generally *increase* with years of service. Individuals transferring to a DC scheme (with age-independent contributions) forego these backloaded benefits: the marginal benefit from an additional year's membership of a DC scheme is simply that year's contributions (plus the investment returns on these) which are usually a *constant* proportion of earnings. If the DC scheme happens to be a personal pension scheme then there are also initial and annual charges to pay, plus the possible loss of the employer's contribution. The impact of these factors can be extensive as the above portability losses indicate.[22]

Another problem with DC schemes, in practice, is that total contributions into them tend to be much lower than with DB schemes. In a typical DB scheme in the United Kingdom, the employee's contribution is about 5–6% of employee earnings, while the employer's contribution is double this at about 10–12%.[23] The size of the employer's contribution is not widely known amongst employees; and, to an extent, the size of the employer's contribution is irrelevant from the employee's viewpoint, since the pension depends on final salary, not on the level of contributions. This is not the case with DC schemes where the size of the pension depends critically on the size of contributions. When personal pension schemes first started in the United Kingdom in 1988, most employers refused to contribute anything towards these schemes and many workers were not fully aware of the penalty in terms

[22] There are other costs which are more difficult to quantify, the most important of which are search and information costs. The Office of Fair Trading's 1997 *Inquiry into Pensions* found (on the basis of a survey it conducted) that most people in the United Kingdom did not regard themselves as being financially literate and also they did not tend to shop around (80% of the survey's respondents had little or no interest in financial matters and 85% of respondents who had sought advice on pensions had used only one source). Traditional providers of pensions (such as insurance companies) were regarded as offering complex products that were difficult to understand and therefore required additional training by sales staff. Newer providers (such as direct-selling pension providers) were regarded as offering pension products that were easy to understand and therefore to sell. The tax rules were also regarded as a major source of confusion.

[23] National Association of Pension Funds (1997), Government Actuary's Department (forthcoming)

of the reduced pension they were incurring as a result of foregoing the employer's contribution.

However, most (about 85%) of the new occupational schemes being established in the United Kingdom are DC schemes.[24] The average employee contribution into such schemes is 3%, while the average employer contribution is again double at 6% (although some employers only match the employee's contribution).[25] Total contributions into occupational DC schemes are therefore around 9% of employee earnings compared with 15–18% for occupational DB schemes. Nevertheless, administration costs are much lower with occupational DC schemes than with personal pension schemes, so even if employers made the same contribution into an employee's personal pension scheme as into their own DC scheme, the final pension would still be lower in the personal pension scheme.

While there appears to be the beginning of a global trend towards DC pension schemes in both the private and public sectors,[26] it is not clear that this trend is consistent, at least in a European context, with the *Community Charter of the Fundamental Social Rights of Workers* (1989). The Charter states that (quoted from Atkinson (1991, p.1)):

> 1 Every worker of the European Community must, at the time of retirement, be able to enjoy resources affording him or her a decent standard of living (para. 24).
>
> 2 Any person who has reached retirement age but who is entitled to a pension or who does not have other means of subsistence, must be entitled to sufficient resources and to medical and social assistance specifically suited to his needs (para. 25).

Atkinson (1991) questions whether personal pensions are compatible with the Charter. He argues that:

> With personal pensions ... there is no guaranteed pension at retirement ... There must be concern about those who are unlucky in their choice of investments: there is no redistribution between those whose investments have performed well and those whose turn out to be less well chosen. A guarantee is replaced by a lottery. The uncertainty surrounds both the capital sum which will be available at retirement and the rate of annuity which it will purchase (p. 20).

Asset risk is not the only risk borne by DC scheme members and their dependants. They also bear some of the other types of risk identified by Diamond (1977) above, namely ill-health, disability and death-in-service. In DB

[24] National Association of Pension Funds (1997); the majority (85%) of existing schemes are still DB, however.

[25] National Association of Pension Funds (1997).

[26] Estimates in Blake and Orszag (1999), for example, show that for the UK, the share in total private sector pension assets accounted for by DC schemes rose from 1% in 1980 to 18% in 1994. In the United States, DC schemes accounted for 43% of total private sector pension assets in 1991 (Gordon *et al.* (1997, p. 3)).

schemes, these risks exist, but are typically carried by the scheme sponsor. In DC schemes, protection against these risks has to be purchased directly by the member as additional insurance policies.

Nevertheless, Table 4 shows that so long as individuals join a DC scheme at a sufficiently early age and maintain their contribution record over a sufficiently long investment horizon (and so get the benefits of compounded returns), a decent pension in retirement can be achieved for a modest contribution rate. The table indicates that a 25-year old male can expect a pension of two-thirds of final salary (the maximum available from a DB scheme in the UK) with a total net contribution rate of just under 11% of earnings. The required contribution rate rises sharply with age, however. Someone joining at 35 would need a contribution rate of around 17%, and by the age of 40, the required contribution rate is above the maximum permissible under the regulations establishing such schemes.

2.2.2. *The decumulation stage: annuities*

As we argued above, the trend towards private sector DC schemes will only be a success if such schemes can deliver adequate pensions in retirement. There is an impediment to this happening in the UK and elsewhere: the annuities market.

The market for immediate annuities is relatively thin: of around 240 authorised life companies in the United Kingdom, only about 10 are serious providers of life annuities at any given time.[27] There are a number of problems facing both annuitants and annuity providers.[28] First, there is an adverse selection bias associated with mortality risk. This is the risk that only individuals who believe that they are likely to live longer than the average for the

Table 4

Contributions Needed to Achieve a Pension of Two-Thirds of Final Salary

Age at commencement (male)	Required contributions (% of salary)	Maximum contributions (% of salary)
25	10.90	17.5
30	13.41	17.5
35	16.81	17.5
40	21.66	20.0
45	28.92	20.0
50	40.81	25.0
55	64.15	30.0
60	129.83	35.0

Assumptions: Male retiring at age 65; no previous contributions into any other pension scheme; salary increases by 3% p.a.; investment return 6% p.a.

[27] Association of British Insurers. The top four providers account for about 60% of sales.
[28] Blake (1999).

population of the same age will wish to purchase annuities. Second, mortality tends to improve over time and there can be severe consequences if insurance companies underestimate mortality improvements. Insurance companies add substantial cost loadings to cover these risks, something of the order of 10–12% of the purchase price.[29] Third, there is inflation risk, the risk that with level annuities, unanticipated high inflation rapidly reduces the real value of the pension. Fourth, there is interest rate risk. Annuity rates vary substantially over the interest rate cycle. They are related to the yields on government bonds of the same expected term; and since these yields vary by up to 150% over the cycle,[30] annuity rates will vary by the same order of magnitude.

Even worse, the market for deferred annuities is extremely thin, particularly at distant starting dates (where the market is virtually non-existent). Where deferred annuities are available, they are very poor value for money. Deferred annuities are particularly important in the case where a DB scheme is wound up, say, as a result of the insolvency of the sponsoring company. The assets of the scheme, which is often in deficit at the time (since the company, recognising its serious financial position, usually ceases making contributions into the scheme some time before the insolvency is formally declared) are insufficient to pay the current and future pension liabilities in full. In the past, the residual assets in the scheme were used to buy non-profit policies for current pensioners and deferred annuities for deferred pensioners. But fewer and fewer insurance companies are willing to sell deferred annuities because of the uncertainties attached to forecasting mortality improvements.

Insurance companies use the government bond market to protect themselves against both interest rate and inflation risk. When an insurance company sells a level annuity it uses the proceeds to buy a fixed-income government bond of the same expected term as the annuity (typically 15 years) and then makes the annuity payments from the coupon payments received on the bond. Similarly, when an insurance company sells an indexed annuity, it buys an index-linked bond of the same expected term as the annuity; few, if any, insurance companies sell indexed annuities with expected maturities beyond that of the most distant trading indexed-linked gilt. As a consequence, interest and inflation risk are transferred to the annuitant. If a DC scheme member retires during an interest rate trough (as happened in the mid 1990s), he can end up with a very low pension. Similarly, if a 65-year old annuitant chooses an indexed annuity, he will receive an initial cash sum that is about 30% lower than a level annuity, and, with inflation at 3% p.a., it would take 11 years for the indexed annuity to exceed the level annuity.[31] Since

[29] MacDonald (1996) found that mortality forecast errors of 15–20% over intervals of 10 years are not uncommon. US studies (e.g., Mitchell *et al.* (forthcoming) and Poterba and Warshawsky (1998)) found that the deduction from the actuarially fair value of an annuity for a 65-year old US male was 15% if the male was a typical member of the population as a whole (calculated using the mortality tables for the whole US male population) and 3% if the male was typical of the population buying annuities voluntarily (calculated using the select mortality tables for male annuity purchasers), implying a 12% deduction for the greater mortality risk. Finkelstein and Poterba (1999), using UK data, estimated cost loadings for 65-year-old males of 10%

[30] BGC (1998).

[31] Khorasanee (1996).

retired people tend to underestimate how long they will continue to live, most prefer to buy a level annuity and thereby retain the inflation risk. In 1995, as a result of falling interest rates, the UK government was pressed into allowing income drawdown: it became possible to delay the purchase of an annuity until annuity rates improved (or until age 75 whichever was sooner) and in the interim take an income from the fund which remained fully invested.

However, until very recently, the insurance industry (especially in Europe) has been reluctant to offer products that help annuitants hedge the risks, especially interest rate risk, that they have been forced to assume. Yet a whole range of financial instruments and strategies is available to enable them do this. The simplest strategy, based on the principle of pound cost averaging, involves a planned programme of phased deferred annuity purchases in the period prior to retirement which must be of sufficient length to cover an interest rate cycle (say, 5–7 years). A more sophisticated solution for the pre-retirement period is protected annuity funds which employ derivative instruments. One example places a fraction (e.g., 95%) of the funds on deposit and the rest in call options on bond futures contracts: if interest rates fall during the life of the option, the profit on the options will compensate for the lower interest rate. Another example places a fraction of the funds in bonds and the rest in call options on an equity index, thereby gaining from any rise in the stock market over the life of the options. However, there are very few providers of these products in the United Kingdom.

A possible solution for the post-retirement period is provided by variable annuities. These were first issued in 1952 in the United States by the TIAA-CREF.[32] In the United Kingdom, they are better known as unitised or with-profit annuities, but only a few insurance companies offer them. A lump sum is used to buy units in a diversified fund of assets (mainly equities) and the size of the annuity depends on the income and growth rate of assets in the fund. The annuity can fall if the value of the assets falls substantially, so there is some volatility to the annuity in contrast with a level annuity. But since the pension from a level annuity is based on the yield on gilts, it is likely that the pension from a variable annuity, based on the return on equities, will generate a higher overall income (assuming that the duration of the annuity is sufficiently great).

The government could also do more to ameliorate these market failures in the private provision of annuities which arise, in part, from aggregate risks that are beyond the abilities and resources of private insurance companies to hedge. A number of proposals have been suggested recently. For example, in order to help the private sector hedge against inflation risk more effectively, the Goode Report (1993, sec. 4.4.44) suggested that the government introduce a new type of bond, with income and capital linked to the retail price index, but with payment of income deferred for a period. Such bonds were given the name 'deferred income government securities' (DIGS): they could be introduced with different starting and termination dates and would allow all deferred pensions to be indexed to prices. DIGS were never officially intro-

[32] Teachers Insurance and Annuity Association of America – College Retirement Equity Fund.

duced, but the introduction of the gilt strips market in 1997 could help insurance companies construct them synthetically. Similarly, the introduction of limited price index (LPI) bonds would allow post-retirement inflation risk to be hedged more effectively.

But the main causes of market failure are the risks associated with adverse selection and mortality. Making second pensions mandatory rather than voluntary would do much to remove the adverse selection bias in the demand for annuities.[33] The government could also help insurance companies hedge the risk associated with underestimating mortality improvements by issuing 'survivor bonds', a suggestion made in Blake and Orszag (1998) and Blake, Burrows and Orszag (1999). These are bonds whose future coupon payments depend on the percentage of the population of retirement age on the issue date of each bond who are still alive on the date of each future coupon payment. For a bond issued in 2000, for instance, the coupon in 2010 will be directly proportional to the amount, on average, that an insurance company has to pay out as an annuity at that time. The insurance company which buys such a security bears no aggregate mortality risk and, as a consequence, cost loadings fall. There is therefore much that could be done by both government and the insurance industry to improve the market for annuities which at the moment are the weak tail in DC pension provision.

Although Atkinson's concerns are valid in the sense that there can be a wide variation both in the returns generated by DC pension funds and in the annuity rates that are available over different phases of the interest rate cycle, the most important challenges with DC schemes remain the inadequate contributions that are made into them during the working lifetime and their high charges. Furthermore, there exist fund management techniques available to reduce the volatility in fund values as the retirement date approaches; these will be discussed in Section 3 below.

3. How Does the Management of Your Pension Fund Matter?

In the last section, we examined the costs and benefits of DB and DC schemes without discussing how the two schemes were related. In this section, we demonstrate the relationship between the two types of scheme, using an approach developed in Blake (1998). This will make it easier to understand the different investment management strategies appropriate for DB and DC schemes.

[33] There is a growing body of support for mandatory contributions into second pensions, including Field and Owen (1993), Borrie (1994), World Bank (1994*b*), Dahrendorf (1995), and Anson (1996), as well as surveys of customers conducted by NatWest Bank and Coopers & Lybrand (reported in Field (1996, pp. 52–3)). Compulsory contributions are seen as one way of dealing with individual myopia and the problem of moral hazard. The first issue arises because individuals do not recognise the need to make adequate provision for retirement when they are young. The latter problem arises when individuals deliberately avoid saving for retirement when they are young because they know the state will feel obliged not to let them live in dire poverty in retirement.

3.1. *The Relationship Between DB and DC Schemes*

Fig. 1 shows that the present value of the DC pension on the retirement date depends entirely on the value of the fund's assets on that date. Fig. 2 shows that the present value of the DB pension (L) is independent of the value of the fund's assets. Fig. 3 shows that the DB pension can be replicated using an implicit long put option ($+P$) and an implicit short call option ($-C$) on the underlying assets of the fund (A), both with the same exercise price (L) which equals the present value of the DB pension at the member's retirement age. The put option is held by the scheme member and written by the scheme sponsor, while the call option is written by the member and held by the sponsor. If, on the retirement date of the member, which coincides with the expiry date of the options, one of the options is in-the-money, it will be exercised. If the value of the fund's assets is less than the exercise price, so that the scheme is showing an actuarial deficit, the member will exercise his or her put option against the sponsor who will then be required to make a deficiency payment ($L - A$). If, on the other hand, the value of the assets exceeds the exercise price, so that the scheme is showing an actuarial surplus, the sponsor will exercise his or her call option against the member and recover the surplus ($A - L$). This implies that a DB scheme is, in effect, a risk-free investment from

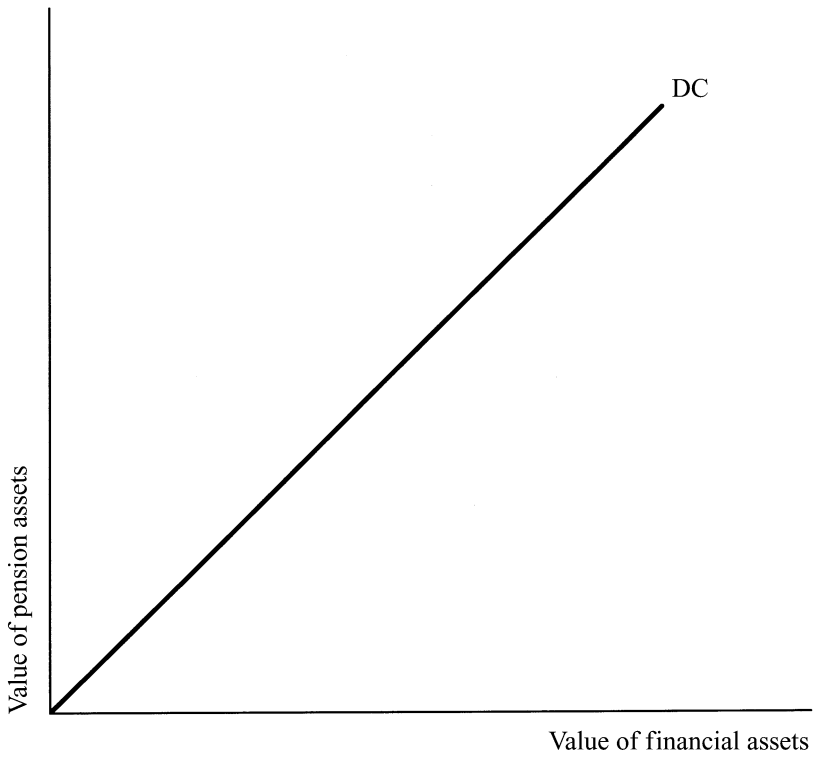

Fig. 1. *A Defined Contribution Pension Scheme*

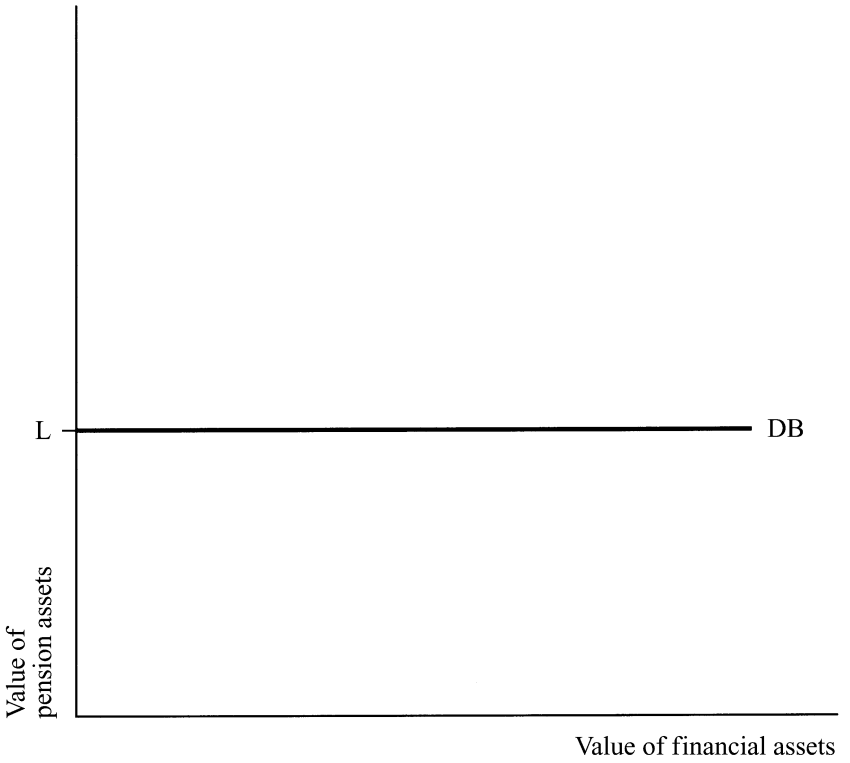

Fig. 2. *A Defined Benefit Pension Scheme*

the member's viewpoint: DB scheme members end up with the same pension whatever the value of the underlying assets.

It is clear from this how DB and DC schemes are related. A DC scheme is invested only in the underlying financial assets. A DB scheme is invested in a portfolio containing: the underlying assets (and so is, in part, a DC scheme) *plus* a put option *minus* a call option on these assets. The actuarial surplus with a DB scheme is defined as the difference between the values of the pension assets and liabilities. The pension assets at any time comprise the financial assets accumulated by that time *plus* the present value of the promised future contributions into the scheme. The pension liabilities at any time are equal to the present value of the future pension payments from the scheme. By definition, the surplus is always zero with a DC scheme. The surplus risk (i.e., the volatility of the surplus) with a DB scheme depends on both the difference between the volatilities of the pension asset and pension liability values and on the correlation between these values. The main sources of these volatilities are uncertainties concerning future investment returns, real earnings growth rates and inflation rates. This is because investment returns determine the rate at which contributions into the pension fund accumulate over time, the growth rate in real earnings determines the size of both contributions into the scheme and the pension liability at the retirement date, and the inflation rate influ-

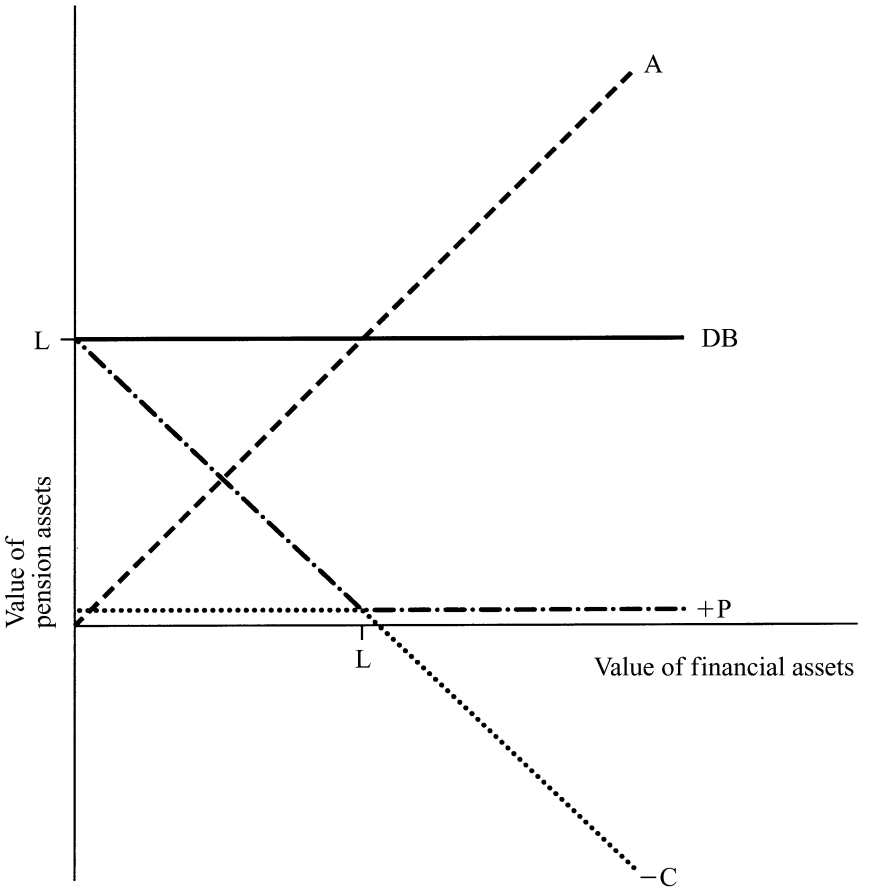

Fig. 3. *The Option Composition of a Defined Benefit Pension Scheme*

ences the growth rate of pensions during retirement. With a DC scheme, the surplus risk is zero by definition.

The options embodied in a DB scheme are known as 'exchange options'. They are a variant of the more familiar Black-Scholes options which recognise that, if exercised, risky assets are exchanged at an exercise price that is indexed to the uncertain value of the pension liabilities, in contrast with the standard model where the exercise price is constant. The value of these options depends on the magnitude of both the surplus and surplus risk. In particular, if both the surplus and surplus risk can be maintained at zero, the call and the put both have zero value. It follows that, if these conditions are satisfied, DB and DC schemes are equivalent in the sense of delivering the same pension in retirement. In other words, it is possible to manage a DC scheme in such a way that it generates the same pension in retirement as a final salary DB scheme: such schemes are known as 'targeted money purchase schemes'.

3.2. *The Optimal Management of DB and DC Schemes*

3.2.1. *DC schemes: maximising risk-adjusted expected value*

The optimal management of a DC scheme is fairly straightforward, once the critical task of determining the attitude to risk of the scheme member has been undertaken. This usually involves assessing the degree of risk tolerance of the scheme member. The greater the degree of risk tolerance, the greater the risk that can be borne by the scheme's assets and hence the greater the expected value of the pension fund at the retirement date. This can be explained in terms of the risk-adjusted expected value of the asset portfolio which is defined as the expected value of the pension assets net of a risk penalty, where the latter equals the ratio of the volatility of the fund's assets to the member's degree of risk tolerance. The higher the asset risk and the lower the risk tolerance, the greater the risk penalty. The fund manager's task is to maximise the risk-adjusted expected value. It is possible to increase the expected value of the pension assets by taking on more risk, but if too much additional risk is taken on, the risk-adjusted expected value will fall, especially if risk tolerance is low. The risk penalty shows the cost of taking on more risk.

Personal pension DC schemes in the United Kingdom are provided by financial institutions such as insurance companies, banks, building societies, unit trusts (i.e., open-ended mutual funds), investment trusts (i.e., close-ended mutual funds), and open-ended investment companies. The scheme provider will offer the scheme member a choice of investment vehicles in which the pension assets will accumulate, ranging from low risk (e.g. a deposit administration scheme), through medium risk (e.g. an endowment scheme from an insurance company) to high risk (e.g. a unit-linked scheme). The deposit administration scheme is targeted at a scheme member with a very low degree of risk tolerance, while the unit-linked scheme is targeted at a scheme member with a high degree of risk tolerance. However, it is arguable whether low-yielding deposits are a suitable investment vehicle for long-horizon investment programmes such as pension schemes. Other asset categories, such as equities, have, in the past, offered much higher long-run returns. Furthermore, equities may have high short-term volatility, but long-run returns have been much more stable. Investing in deposit administration schemes or bonds has been described as a strategy of 'reckless conservatism': these assets, while having stable capital values in nominal terms over short horizons, do not tend to have long-term returns that match the real growth rate in earnings. Despite this, surveys of personal pension scheme members in the United Kingdom and elsewhere tend to show that fear of short-term capital loss drives many individuals towards investment strategies that are recklessly conservative in the long run. Nevertheless, once a scheme member has selected a particular type of scheme, the fund manager's task is to choose the asset mix (between equities, bonds, property etc.) that maximises the risk-adjusted expected value of the assets.[34]

[34] See Blake (1995, Ch.13) or Blake (2000, Ch.14).

3.2.2. *DB schemes: asset-liability management*

The appropriate investment management strategy for pension funds running DB schemes is asset-liability management (ALM) (also called surplus risk management).[35] This involves constructing a portfolio of financial assets that (together with promised future pension contributions) matches the pension liabilities in two key respects: size and volatility.

First, if pension schemes are always fully funded, so that assets are always sufficient to meet liabilities in full, then the surplus will always be zero. This can be achieved by adjusting the contribution rate (especially the employer's contribution rate) into the fund. In practice, there are usually some tolerance limits. In the United Kingdom, for example, it is permissible for the value of assets to vary between 90% and 105% of the value of liabilities. If the value of assets exceeds the 105% limit, the scheme has up to 5 years to reduce the value to 100% of liabilities (Finance Act 1986). The most common means of doing this is the employer's contribution holiday, although other means are available: an employee's contribution holiday, improved pension benefits or selling off financial assets, the proceeds from which are returned to the sponsor subject to a 40% tax. If the value of assets falls below 90% of the value of liabilities, the scheme has one year to raise the value of assets to 90% of liabilities and up to a further 5 years to raise it back to 100% (this is known as the 'minimum funding requirement' of the Pensions Act 1995). The most common means of doing this is additional employer contributions (i.e., deficiency payments), since most DB pension schemes operate on a balance of cost basis.

Second, if the assets in the pension fund are selected in such a way that their aggregate volatility matches that of the liabilities, then the surplus risk can be reduced to zero, which combined with a zero surplus, implies that the implicit options in the DB scheme can be issued free of charge. This requires the assets in the pension fund to have both the same variance as the pension liabilities and to be perfectly correlated with them (although it is unlikely in practice that financial assets with these precise properties exist, unless governments in the near future begin to issue zero-coupon wage-indexed bonds). This, in turn, requires the assets to constitute a 'liability immunising portfolio', that is, a portfolio that immunises (or hedges) the interest rate, real earnings growth rate and inflation rate risks embodied in the pension liabilities.

Structuring the liability immunising portfolio is the most important part of determining the fund's strategic asset allocation (SAA). The SAA is usually determined by the fund manager in collaboration with the fund's sponsor on the advice of the fund's actuary. Given the nature of the fund's liabilities

[35] See, e.g., Fabozzi and Konishi (1991) or Blake (1995, Ch.13). Formally the fund manager's objective with a DB scheme is to minimise surplus risk each period subject to the condition that the surplus is always zero. The control variables in this dynamic programming exercise are the contribution rate into the fund and the composition of the assets in the funds (i.e. the portfolio weights or the asset allocation). See Blake (1992) for an analysis of UK pension fund investment behaviour over a period when DB schemes were broadly unconstrained by their liabilities and hence pursued investment strategies more akin to maximising risk-adjusted expected value.

(which are typically indexed to real wage growth), the liability immunising portfolio during the early life (i.e., immature stage) of a pension scheme will contain a high proportion of equities and other 'real' assets such as property, on the grounds that (as we argued above), the shares of factors of production in national income tend to be relatively stable, so that the returns to capital (equity) and land (property) will over the long run match that on labour (real wages). The actuary's advice will be based on an asset-liability modelling (ALM) exercise. ALM is a quantitative technique used to help structure asset portfolios in relation to the maturity structure of liabilities. It begins by making forecasts about how a pension fund's liabilities are going to accrue over a particular time horizon, that might be 5, 10 or 15 years ahead. To do this, assumptions concerning salary growth rates, staff turnover, and the age distribution and sex composition of the workforce have to be made. Then forecasts concerning the funding position of the pension scheme have to be generated. This involves making projections of future contribution rates and also assessing the value of assets in relation to accrued liabilities. These forecasts and projections are made under different scenarios concerning likely outcomes. Typically three scenarios are adopted: most likely, best-case and worst-case. This provides a realistic range of possible outcomes, and, in the latter case, spells out the extent of the risks that the pension fund sponsor faces.

There are two main uses of ALM. The first is to indicate the consequences of adopting any particular investment strategy. The second is to discover alternative strategies that increase the likelihood of meeting the fund's objectives. Proponents of asset-liability modelling argue that the strategy allows pension funds to generate higher returns without any consequential increase in risk. The modelling exercise might indicate, for example, that if current investment returns are sustained, there would be no need to change the employer contribution rate into the pension fund over the next 5 years. However, the worst-case scenario might indicate the employer contribution rate might have to rise by 10% over the next 5 years. The exercise therefore allows the scheme sponsor to plan for this possibility. As another illustration, the modelling exercise might indicate that because a pension fund is maturing, it should switch systematically out of equities into fixed-income bonds (in the five or so years prior to retirement), which are more likely to meet pension liabilities with lower risk of employer deficiency payments; this is known as 'lifestyle' fund management (or 'age phasing').

Some fund managers are concerned that ALM gives an unwarranted role to outsiders, such as actuaries, in designing the strategic asset allocation. Actuaries have always had a role in determining the value of a pension scheme's liabilities. But with the advent of ALM, actuaries have begun to have a role in setting the long-term or strategic asset allocation over, say, a 10-year horizon. Some fund managers claim they are being reduced to the subsidiary role of determining tactical asset allocation (or market timing) and stock selection relative to this new long-term strategic asset allocation benchmark. However, not all fund managers are critical of the redefinition of their respective roles.

Many fund managers have positively welcomed the formal separation of long-term policy decisions from short-term tactical decisions that ALM allows.

Another potential problem concerns the interpretation of measures of investment performance in the light of the technique. ALM justifies different pension funds pursuing different investment policies. For example, small, fast-growing funds might pursue very aggressive investment policies, while large mature funds might adopt more passive investment policies. This makes it very difficult to interpret a single performance league table drawn up on the assumption that all funds are pursuing the same objective of maximising expected returns. Performance measurement services have begun to take this into account by constructing peer-group performance league tables, drawn up for sub-groups of funds following similar objectives. We now discuss performance measurement in more detail.

4. How Does the Investment Performance of Your Pension Fund Matter?

Good or bad investment performance by DB and DC pension schemes have very different consequences for scheme members. With DB schemes, the investment performance of the fund's assets are of no direct relevance to the scheme member, since the pension depends on the final salary and years of service only and not on investment performance. The scheme member can rely on the sponsoring company to bail out the fund with a deficiency payment if assets perform very badly (i.e. the member exercises the implicit put option against the sponsor). In extreme circumstances, however, it is possible for a firm and possibly the scheme to become insolvent. Of course, if the assets perform well, the surplus is retained by the sponsor (who exercises the implicit call option against the member in this case).

However, investment performance is critical to the size of the pension in the case of a DC scheme: scheme members bear all the investment risk in such schemes. Scheme members, especially personal pension scheme members, can find themselves locked into a poorly performing fund, facing very high costs of transferring to a better performing fund. In addition, the type of funds in which personal pension scheme members invest can and do close down and then the assets do have to be transferred to a different fund. In this section, we examine the investment performance of pension scheme assets, beginning with those of DC schemes.

4.1. *Investment Performance of DC Schemes*

The anticipated return in a high-risk investment vehicle must be greater than that in a low-risk investment vehicle, but there can be wide differences in realised returns, even for schemes in the same risk class. Blake and Timmermann (1998) conducted a study of the investment performance of unit trusts in the United Kingdom, one of the key investment vehicles for DC schemes. Table 5 shows the distribution of returns generated by unit trusts operating in

Table 5

Distribution of Returns Generated by UK Unit Trusts, 1972–1995

Sector	Top quartile	Median	Bottom quartile	Ratio of fund sizes
UK equity growth	16.0	13.6	11.9	3.2
UK equity general	14.3	13.4	13.1	1.4
UK equity income	15.4	14.0	12.4	2.3
UK smaller companies	18.7	15.5	12.8	5.3

Note: The first three columns are averages measured in percentages per annum for the sample period 1972–95; the last column gives the ratio of fund sizes after 40 years based on the top and bottom quartile returns. The formula is (assuming the same contribution stream):

$$\frac{(1+r_T)^T - 1}{r_T} \div \frac{(1+r_B)^T - 1}{r_B}$$

where $r_T = 0.160$, $r_B = 0.119$ and $T = 40$ etc.
Source: Blake and Timmermann (1998) and Lunde *et al.* (1999).

the four largest sectors. These figures indicate enormous differences in performance, especially over the long life of a pension scheme. For example, the 4.1 percentage point per annum difference between the best and worst performing unit trusts in the UK Equity Growth sector leads, over a 40-year investment horizon, to the accumulated fund in the top quartile being a factor of 3.2 times larger than the accumulated fund in the bottom quartile for the same pattern of contributions. The 5.9 percentage point per annum difference between the best and worst performing unit trusts in the UK Smaller Companies sector leads to an even larger fund size ratio after 40 years of 5.3.

So personal pension scheme members can find themselves locked into poorly performing funds.[36] But should it not be the case in an efficient capital market that systematically underperforming funds fail to survive and are taken over by more efficient fund managers? Lunde *et al.* (1999) investigated this possibility. They found that underperforming trusts are eventually merged with more successful trusts, but that on average it takes some time for this to occur. Fig. 4 shows the distribution of durations across the whole unit trust industry of trusts that were eventually wound up or merged. The modal duration is 4.25 years (51 months), but the average duration is about 16 years. Across the unit trust industry, the average return on funds that survived the whole period was 13.7% per annum, while the average return on funds that were wound up or merged during the period was 11.3% per annum. This implies that a typical personal pension scheme member might find him or herself locked into an underperforming trust that is eventually wound up or merged into a more successful fund, experiencing an underperformance of 2.4% p.a., over a 16 year period. This translates into a fund value that is 19% lower after 16 years than a fund that is not wound up or merged. So it seems that in practice personal pension scheme members cannot rely on the markets to provide them with a painless way of extricating them from an under-

[36] This is despite the fact that, as we have seen above, there are investment management techniques available to reduce the dispersion of realised returns.

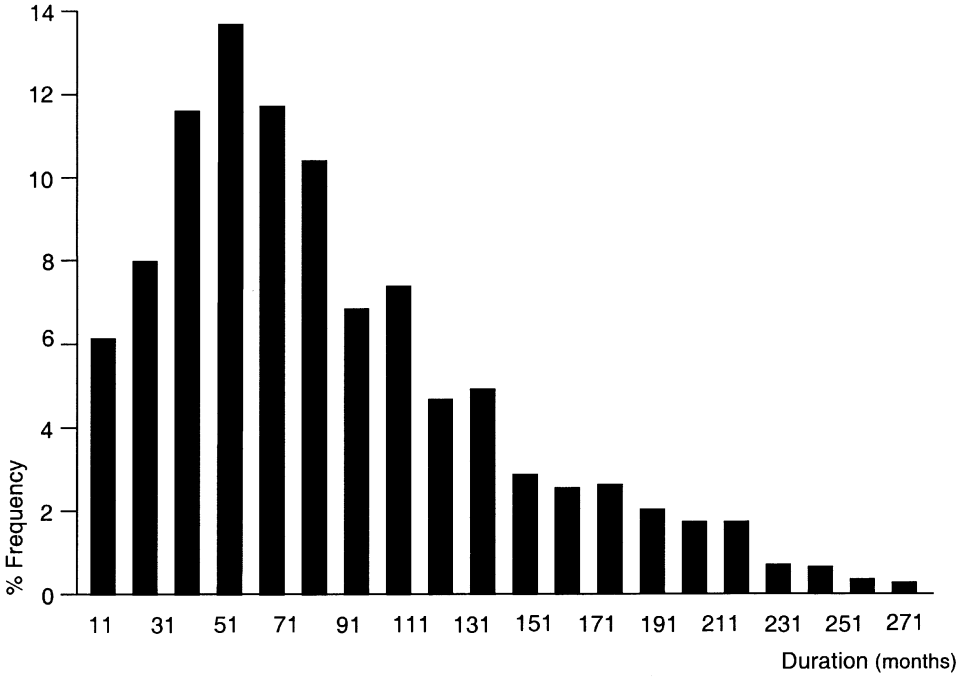

Fig. 4. *Duration of UK Unit Trusts from Inception*
Note: The histogram shows the distribution of lifetimes for the 973 unit trusts that were wound up or merged during the course of the sample period (1972–95)
Source: Blake and Timmerman (1998)

performing fund. They have to do it themselves, paying up to one-third of the value of their accumulated fund in transfer charges.

4.2. *The Investment Performance of DB Schemes*

There are at least 150,000 small defined benefit pension schemes in the United Kingdom, most with fewer than 100 members in each. Virtually all these schemes are managed on a pooled basis by insurance companies. There are about 2,000 large schemes, including 70 or so with assets in excess of £1bn each.[37] As we indicated above, the investment performance of these funds is much more important for the scheme sponsor than for the scheme member. The recent history of the UK pension fund industry embraces a period of substantial deficiency payments in the 1970s (arising from the UK stock market crash in 1974–5), and the build up of huge surpluses during the bull markets of the 1980s and 1990s. These surpluses have enabled sponsors to reduce their contributions into their schemes (i.e. to take employer's contribution holidays). In other words, during the 1980s and 1990s, UK pension scheme sponsors have benefited enormously from the investment successes of their fund managers.

[37] Pension Schemes Registry and Government Actuary's Department (forthcoming).

The investment performance of UK defined benefit pension fund managers between 1986 and 1994 has been investigated in Blake, Lehmann and Timmermann (1998, forthcoming).[38] The data set used covers the externally-appointed active fund managers of more than 300 medium-to-large pension funds with a mandate agreement to 'beat the market'. The UK pension fund industry is highly concentrated and most of these active fund managers come from just four groups of professional fund managers (Mercury Asset Management, Phillips and Drew Fund Management, Schroder Investment Management and Gartmore Pension Fund Managers).

While the average or median performance has been very good over the sample period, important implications concerning the behaviour of fund managers can be derived from an examination of the distribution of this performance about the median. Table 6 shows the cross-sectional distribution of returns realised by the pension funds in the sample over the period 1986–94 in the most important individual asset classes as well as for the total portfolio. The semi-interquartile range is quite tight, below 2 percentage points for most asset classes and only just over 1 percentage point for the total portfolio return. This suggests evidence of a possible herding effect in the behaviour of pension fund managers: fund managers, although their fee is determined by their *absolute* investment performance, are appointed and evaluated on the basis of their *relative* performance against each other and therefore have a very strong incentive not to underperform the peer-group.[39] The fund managers in the sample are active managers who have won mandates on the basis of promises to beat the market: they are not passive managers attempting to match the market. If they were genuinely pursuing active strategies, there would be a wide dispersion in performance as is observed in the United States. We find a tight dispersion of performance about a median. From this we may conclude that the active fund managers are herding to avoid delivering poor relative performance (which puts their mandate at risk). Despite this, the difference between the best and worst performing funds is very large, as the last row of Table 6 indicates.

Table 7 shows how well United Kingdom pension funds have performed in comparison with other participants in the market. The fourth column shows that the average UK pension fund underperformed the market average by 0.45% per annum; and this is before the fund manager's fee is taken into account. Further only 42.8% of funds outperform the market average. The main explanation for this is the relative underperformance in UK equities, the largest single category with an average portfolio weighting of 54% over the sample period; the average underperformance is −0.33% per annum and only 44.8% of UK pension funds beat the average return on UK equities. To be sure, relative performance is better in other asset categories, especially UK and international bonds, but the portfolio weights in these asset categories are not large enough to counteract the relative underperformance in UK equities.

[38] Very similar results have been found for the US, see Lakonishok *et al.* (1992).

[39] Davis (1988) reports a survey of UK and US fund managers in which they acknowledge the existence of a herding effect.

Table 6

Fractiles of Total Returns by Asset Class for UK Pension Funds, 1986–1994

(Average annualised percentages)

	UK equities	International equities	UK bonds	International bonds	UK index bonds	Cash/other investments	UK property	**Total**
Minimum	8.59	4.42	6.59	−0.64	5.59	2.67	3.05	7.22
5%	11.43	8.59	9.44	2.18	7.20	5.46	5.07	10.60
10%	11.85	9.03	9.95	7.56	7.81	7.60	6.58	10.96
25%	12.44	9.64	10.43	8.30	7.91	8.97	8.03	11.47
50%	13.13	10.65	10.79	11.37	8.22	10.25	8.75	12.06
75%	13.93	11.76	11.22	13.37	8.45	11.72	9.99	12.59
90%	14.81	12.52	11.70	14.55	8.80	14.20	10.84	13.13
95%	15.46	13.14	12.05	18.15	8.89	16.13	11.36	13.39
Maximum	17.39	14.68	17.23	26.34	10.07	19.73	13.53	15.03
Difference between maximum and minimum	8.80	10.26	10.64	26.98	4.48	17.06	10.48	7.81

Note: The table shows the fractiles of the cross-sectional distribution of returns on individual asset classes as well as on the total portfolio.
Source: Blake, Lehmann and Timmermann (1998, Table 1).

Table 7

Performance of UK Pension Funds in Comparison with the Market, 1986–1994

	Average portfolio weight (%)	Average market return (%)	Average pension fund return (%)	Average outperformance (%)	Percentage of outperformers
UK equities	53.7	13.30	12.97	−0.33	44.8
International equities	19.5	11.11	11.23	0.12	39.8
UK bonds	7.6	10.35	10.76	0.41	77.3
International bonds	2.2	8.64	10.03	1.39	68.8
UK index bonds	2.7	8.22	8.12	−0.10	51.7
Cash/other investments	4.5	9.90	9.01	−0.89	59.5
UK property	8.9	9.00	9.52	0.52	39.1
Total		12.18	11.73	−0.45	42.8

Note: International property is excluded since no market index was available.
Source: Blake, Lehmann and Timmermann (1998; 1999, Table 2).

Tables 6 and 7 together indicate how close the majority of the pension funds are to generating the average market return. The median fund generated an average total return of 12.06% per annum, just 12 basis points short of the average market return, and 80% of the funds are within one percentage point of the average market return. This suggests that, despite their claims to be active fund managers, the vast majority of UK pension fund managers are not only herding together, they are also closet index matchers.

There are some other features of UK pension fund performance worthy of note. First, there is some evidence of short term persistence in performance over time, especially by the best and worst performing fund managers. For example, we found that UK equity fund managers in the top quartile of performance in one year had a 37% chance of being in the top quartile the following year, rather than the 25% that would have been expected if relative performance arose purely by chance. Similarly, there was a 32% chance of the fund managers in the bottom quartile for UK equities for one year being in the bottom quartile the following year. There was also evidence of persistence in performance in the top and bottom quartiles for cash/other investments, with probabilities of remaining in these quartiles the following year of 35% in each case. However, there was no evidence of persistence in performance for any other asset category or for the portfolio as a whole. Nor was there any evidence of persistence in performance over longer horizons than one year in any asset category or for the whole portfolio. This suggests that 'hot hands' in performance is a very short term phenomenon.

Second, there was some evidence of spillover effects in performance, but only between UK and international equities. In other words, the funds that performed well or badly in UK equities also performed well or badly in international equities. This suggests that some fund managers were good at identifying undervalued stocks in different markets. This result is somewhat surprising since the world's equity markets are much less highly integrated

than the world's bond markets, yet there was no evidence of spillover effects in performance across bond markets.

Third, there was evidence of a size effect in performance. Large funds tended to underperform smaller funds. We found that 32% of the quartile containing the largest funds were also in the quartile containing the worst performing funds, whereas only 15% of the quartile containing the smallest funds were also in the quartile of worst performing funds. These results confirm the often-quoted view that 'size is the anchor of performance': because large pension funds are dominant players in the markets, this severely restricts their abilities to outperform the market.

The final result concerns the abilities of UK pension fund managers in active fund management, that is, in their attempts to beat the market in comparison with a passive buy and hold strategy. The most important task of pension fund managers is, as we have seen above, to establish and maintain the strategic asset allocation. This is essentially a passive management strategy. However, fund managers claim that they can 'add value' through the active management of their fund's assets. There are two aspects to active management: security selection and market timing (also known as tactical asset allocation). Security selection involves the search for undervalued securities (i.e. involves the reallocation of funds within sectors) and market timing involves the search for undervalued sectors (i.e. involves the reallocation of funds between sectors). We decomposed the total return generated by fund managers into the following components:

	%
Strategic asset allocation	99.47
Security selection	2.68
Market timing	−1.64
Other	−0.51
Total	100

We found that 99.47% of the total return generated by UK fund managers can be explained by the strategic asset allocation, that is, the long-run asset allocation specified by pension scheme sponsors on the advice of their actuaries following an ALM exercise. This is the passive component of pension fund performance. The active components are security selection and market timing (or TAA). The average pension fund was unsuccessful at market timing, generating a negative contribution to the total return of −1.64%. The average pension fund was, however, more successful in security selection, making a positive contribution to the total return of 2.68%. But the overall contribution of active fund management was just over 1% of the total return (or about 13 basis points), which is *less than the annual fee that active fund managers charge* (which ranges between 20 basis points for a £500m fund to 75 basis points for a £10m fund).[40]

[40] *Pensions Management*, September 1998.

5. Conclusion

Yes it does matter what type of pension scheme you have. It matters whether the scheme is funded or unfunded. As Table 1 showed, in the world in which we now live, funding provides greater potential pension security than PAYG which, given demographic and labour market developments, has become an increasingly unreliable vehicle for delivering the pension promise: there can be no guarantee that future generations will be prepared to pay the increasing burden that PAYG now represents. This is the case even though, as a result of market failure, there is a range of risks (relating to job and asset security and to mortality) that cannot be efficiently insured in the private sector. It also matters whether the scheme is defined benefit or defined contribution. Your preference between the two types of scheme will depend on both your behaviour and your characteristics, for example, how often you change jobs and your attitude to risk . The more frequently you change jobs and the more risk tolerant you are, the more suitable it will be for you to choose a DC scheme. However annuities are a weak tail in DC pension provision.

We have shown that a DB scheme is in reality a DC scheme which is managed in such a way (using asset-liability management techniques) that it generates a target pension benefit. Whether the scheme is DB or DC, the investment performance is critical: it affects the net cost to the sponsor of a DB scheme and the net pension benefit to the member of a DC scheme. We showed that, on average, UK pension funds have under-performed the market, and while there has been a wide dispersion of performance by individual fund managers, most of them appear to herd around the median fund manager. There is little evidence of persistence in performance or spillover effects in performance; there is, however, evidence that large funds underperform small funds. On top of this, we find that fund managers have not been especially successful at active fund management: virtually the same or better returns could have been generated if pension funds had invested passively in index funds. In addition, fund management costs would have been lower and the dispersion in returns across fund managers would have been reduced.

Some important policy conclusions emerge from this analysis. First, if governments wish to preserve a component of the pension system that is PAYG (say, as part of a portfolio of diversified choices), they have a responsibility to ensure its long term viability. This can only be achieved by severely constraining the real growth rate in state pensions or by systematically raising the retirement age in line with increased longevity.

Second, if governments want to see value-for-money pensions in the private sector, they must provide an infrastructure that helps the private sector deliver these. The regulatory framework should be kept as simplified as possible in order to minimise compliance costs, and charging structures should be made simple and transparent to enable consumers identify the most competitive providers more easily. Governments could also help keep costs down or improve benefits in other ways: for instance, by enabling economies of scale to be exploited more fully (eg, establishing a central clearing house to channel

contributions in the case of DC schemes) or by introducing a common set of actuarial assumptions, as in Holland, which would enable full service credits to be transferred between schemes when workers change jobs, thereby improving the portability rights of members of DB schemes. Governments could help the private sector cope with the market failures that prevent or at least make it difficult for individuals to hedge certain risks, e.g., surplus risk could be hedged more effectively through the introduction of zero-coupon wage-indexed bonds and mortality risk could be hedged through the introduction of survivor bonds.

Third, if governments wish to promote the efficient investment management of pension assets, they should encourage the introduction of appropriate incentives, such as greater transparency in published performance data and the adoption of performance-related fund management fees.[41] This would encourage the less talented fund managers to invest in index funds, with consequential benefits in terms of lower fund management charges and a lower dispersion of performance.[42] There is evidence that governments are becoming more aware of at least some of these issues. For example, the UK Green Paper on pensions published in December 1998 (Department of Social Security (1998))[43] proposes that an upper limit is placed on the charges that can be imposed in the new 'stakeholder pension schemes' and this limit will effectively rule out the active management of the assets in such schemes; and, in the United States, the government is considering a range of options for dealing with the growing burden of social security, including the establishment of individual privatised accounts and the investment of part of the Social Security Trust Fund in equities.

However, the greatest impediment to having a decent pension in retirement is inadequate pension savings made during the working lifetime. It seems to me that only with sufficient mandatory minimum contributions into a funded pension scheme (with credits given to those on very low earnings) can a decent pension be achieved, but few governments seem willing to confront this issue: the UK mandatory minimum for the second pension (equal to the contracted-out rebate on National Insurance contributions of 4.6% of earnings) is not sufficient to build to an adequate pension (as Table 4 showed) and the Green Paper explicitly rules out additional compulsory contributions. Yes, the type of pension scheme matters, but the level of pension savings matters most of all.

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[41] The fund manager benefits by sharing some proportion of the outperformance of the benchmark index; there is also a penalty for underperformance, although it comes in the form of a credit against the future fee rather than as a cash refund in the quarter in which the underperformance occurs.

[42] Even though we found no evidence that fund managers could systematically outperform the market, it would be difficult for the government to require pension fund managers to use index matching. There would be no clear consensus on which index to match (the FTSE100 index, the FT A All Share index, a European index or a global index). Also there is a risk that market inefficiencies could emerge if large institutional investors such as pension funds were prevented from searching for under- and over-valued stocks: we found that the only source of value-added in active fund management was security selection.

[43] This developed into the Welfare Reform and Pensions Act.

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