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Securing Employer- Based Pensions

An International Perspective

Edited by Zvi Bodie, Olivia S. Mitchell,
and John A. Turner

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Chapter 8

An International Comparison of the Financing of Occupational Pensions

E. Philip Davis

This chapter analyzes the diverse scope of private pension funding, pension investments, and the risks and returns obtained in the capital markets in 12 major industrial countries—the United States, the United Kingdom, Germany, Japan, Canada, France, Italy, the Netherlands, Denmark, Sweden, Australia, and Switzerland.¹ The marked differences in national experience raise a number of economic issues, which I seek to address. For example, it aims to consider the role of private funding in retirement financing relative to social security, the role of government regulation of pension funds' financing; and appropriate contribution rates to private pensions. There are clear links between these issues: for example, regulations may influence appropriate contribution rates (via asset returns), and they may also influence the scope of funding itself. This chapter seeks to illustrate the varying choices made in this field by the countries concerned, their benefits and costs, and their consequences for the scope and efficiency of the privately funded sector. In this discussion I first consider the arguments for and against private pension funding per se, before outlining the differences in the scope of funding between the major countries and their determinants. I then assess the differing regulation of pension fund financing and the performance of funds in capital markets; together these enable an assessment to be made of appropriate contribution rates.

Before commencing, I offer four key definitions. In a funded pension plan, pension commitments are covered in advance by accumulation of real or financial assets. In pay-as-you-go plans, by contrast, contributions of employers and current employees are relied on to pay pensions directly. Social security systems are pay-as-you-go in most countries, while private pension plans tend to be funded. In a defined benefit pension

plan the pension formula is defined in advance by the sponsor, independently of the contributions and asset returns. In contrast, in defined contribution pension plans only contributions are fixed, and benefits therefore depend solely on the returns on the assets of the fund. The key difference between defined benefit and defined contribution plans is that with defined benefit plans there can be risk sharing between worker and company as well as between younger and older members.² These risk-sharing features are absent with defined contribution plans.

Why Fund Pensions?

The costs and benefits of funded occupational pensions can be shown in the context of the economic issues raised by the overall choice between funding and pay-as-you-go. Under the simplifying "steady state" assumptions of a constant population and population distribution, with pension contributions proportionate to salary, and benefits proportionate to contributions,³ the transfers received by pensioners under pay-as-you-go relative to their contributions earlier in their working lives depend on the growth of average earnings (which determines the growth in total contributions by the workforce). Meanwhile the corresponding growth of receipts under funding depends on the rate of return on the assets accumulated during the working life. In other words, the "rate of return" to pay-as-you-go is indicated by earnings growth, and that of funding by the return on physical and financial assets (Aaron 1966).⁴ The actual pension received per annum under pay-as-you-go also depends on the ratio of contributing workers to pensioners (the dependency ratio), while that received in the case of funding varies with the number of years of retirement relative to working age (the passivity ratio).⁵ Allowing for population growth, the steady state rate of return to pay-as-you-go increases to the growth rate of average earnings plus population growth (i.e., total earnings).

The reasoning above implies, *ceteris paribus*, that funding can offer higher total benefits to retirees for the same outlay if asset returns exceed the growth rate of average earnings (or, with constant factor shares, that of productivity and real GDP). Historical experience and economic theory suggest this will generally be the case.⁶ Data in Table 1 indeed suggest that, in most of the countries studied, asset returns over 1970–90 did exceed growth in average earnings; hence underlying economic conditions favored funding even in a steady state, particularly if international diversification of investment is permitted where domestic returns are relatively low. Risk may be a partially offsetting factor favoring pay-as-you-go relative to funding, if asset returns are more volatile than growth in the wage bill and the dependency ratio. Risk is particularly important to

TABLE I Indicators of the Comparative Advantage of Pay-as-You-Go versus Funding (percentage)

<i>Country</i>	<i>Average Population Growth (1970-90)</i>	<i>Growth Rate of Real Average Earnings</i>	<i>Real Return to Pay-as-You-Go in Steady State¹</i>	<i>Real Return on Balanced Portfolio²</i>	<i>Real Return from Pension Funds³</i>	<i>Real Return on Equity⁴</i>	<i>Ratio of Population over 65/15 to 65 in 1980 and 2050</i>
United Kingdom	0.1	2.6	2.7	3.7	5.8	8.1	23.1/30.4
United States	1.0	0.2	1.2	2.8	2.2	4.7	18.7/31.8
Canada	1.1	1.7	2.8	2.2	1.6	4.5	16.8/36.4
Japan	0.85	4.2	5.05	5.3	4.0	10.9	16.6/37.6
Germany	-0.5	4.0	3.5	6.2	5.1	9.5	22.5/42.3
Netherlands	0.6	2.4	3.0	4.2	4.0	7.9	18.5/38.1
Sweden	0.15	1.5	1.65	3.7	0.2	8.4	27.4/35.8
Denmark	0.2	2.8	3.0	4.6	3.6	7.0	22.7/39.8
Switzerland	0.2	1.9	2.1	2.0	1.5	6.2	25.0/46.0
Australia	1.45	0.7	2.15	2.8	1.6	8.1	16.6/32.0
France	0.5	4.0	4.5	4.9	n/a	9.4	21.0/37.8
Italy	0.35	3.3	3.65	2.0	n/a	4.0	20.3/37.8
Chile	1.65	6.6	8.25	n/a	n/a	n/a	n/a
Singapore	1.3	3.6	4.9	n/a	n/a	n/a	n/a

Source: Davis (1994a).

Notes: ¹Sum of population growth and earnings growth.

²40 percent domestic equities, 40 percent domestic bonds, 10 percent foreign equities, 10 percent foreign bonds.

³Average 1967-90 (see Table 6).

⁴Average 1967-90 (see Table 6).

defined contribution funds as there is no back-up from the sponsor and pensions must typically be taken in a lump sum (to buy an annuity) at the precise point of retirement.

In practice, the calculations in Table 1 are excessively favorable to pay-as-you-go since the key assumption of the steady state—a fixed population distribution—will not be fulfilled in the coming decades. Slower population growth and aging of the population will put increasing strain on pay-as-you-go systems. In terms of the analysis above, the dependency ratio is set to rise sharply relative to the passivity ratio, driving down the rate of return to pay-as-you-go relative to funding, other things being equal.⁷ In line with this, the OECD (1993) calculates that, under pay-as-you-go, contribution ratios in the G-7 countries would have to rise to a peak of 4.4 to 11.9 percent of GDP to eliminate net liabilities of social security, whereas for funding it would have to rise 1.1 to 5.3 percent, and the overall cost would be lower to the extent that the return on financial assets exceeds the growth of average earnings.⁸ Such problems are leading governments to seek to reduce social security promises, thus also showing the “political risks” to which social security is vulnerable when labor market conditions are unfavorable. However, if there were to be crises in the capital market equivalent to this “crisis in the labor market,” funded plans could equally be disadvantaged.⁹

There are also differences in the implications of the alternative approaches for economic efficiency. If pay-as-you-go social security contributions are seen as taxes, they will distort the labor supply decision, which is particularly likely if the rates of contribution are high and there is a great deal of redistribution; this does not occur with funding to such an extent. Again, pay-as-you-go may discourage saving and hence capital formation, notably for the first generation of recipients. This in turn makes labor relatively abundant in relation to capital, reducing the wage and raising the interest rate, thus reducing the welfare of future generations (Kotlikoff 1992). In the context of an aging population, if contribution rates under pay-as-you-go are not adjusted sufficiently to allow for benefits, fiscal deficits will be engendered, which may lead to crowding out of private investment. Even if deficits do not occur, pay-as-you-go with an aging population implies net unfunded government liabilities, which could again have crowding-out effects on investment. Meanwhile, funding tends under certain plausible conditions to increase saving, thus lowering the interest rate and raising the capital stock and hence future output for both workers and pensioners. Indeed, as noted by Estelle James and Dimitri Vittas in Chapter 5, the conditions under which funding will have a positive effect on saving, namely myopia, credit rationing, and lack of credibility of the pension plan, are precisely those whose absence will lead pay-as-you-go to reduce saving. So a switch from pay-as-

you-go to funding is unambiguously likely to raise saving. If higher saving engenders capital investment, which itself raises productivity (e.g., by introducing new working methods), the overall economic growth rate may be endogenously boosted (Romer 1986). Funding can also benefit the capital markets via the composition of saving (in long-term instruments such as equities and bonds), notably if asset allocation is decentralized, as is the case for private pension funds.

There are nevertheless some arguments against funding. Funded pension plans may be vulnerable to confiscatory taxation or diversion of investment to unprofitable projects or asset categories for political reasons. Funding may adversely influence the exchange rate and the current account if ex-ante domestic investment is less than the increase in saving. The increase in saving may over the very long term depress the domestic rate of return to capital; in other words the return on assets may be affected by the scope of funding, reducing its advantage relative to pay-as-you-go, although international investment in countries with a younger population can in principle offset this problem.¹⁰

A transition from pay-as-you-go to funding can be difficult because one generation has to "pay twice": once for existing pensioners via pay-as-you-go, and once for their own pensions via funding. Also, in a closed economy, and abstracting from the increase in saving that funding may induce, the problem of competition over domestic resources raised by the intergenerational transfers inherent in pay-as-you-go is not entirely removed by funding. Instead it is switched from pensioners seeking a share of labor income (via taxation) to claims over the returns on the capital stock (Vittas 1992).¹¹ But again international investment can mitigate this problem. Pay-as-you-go plans can offer immediate pensions without waiting for assets to build up, and hence are more favorable to the first generation after their introduction than funded plans. They can remove inflation risk to pensioners by being able to link future benefits to wages (assuming a steady-state in the economy with positive population and productivity growth). Pay-as-you-go may be superior in terms of insurance of risks to labor and capital income (factor share risk), since in its absence workers tend to be wholly dependent on labor income and pensioners on capital income.¹²

From a welfare point of view funding may be objectionable for intergenerational equity where some redistribution may be justified, for example, if the growth rate is rapid and the young are much more productive and therefore have higher incomes than the elderly (Pestieau 1992). This is because, with funding, no transfers are possible between generations to compensate for a changing economic environment. With an actuarially fair funded plan, there can also be problems of equity within generations whereby well-paid workers and those who stay with one firm benefit dis-

proportionately from the fiscal benefits offered, whereas groups with broken work histories may get an inadequate net income.¹³ Only social security is able to redistribute to offset poverty within generations.

As regards methods of funding, a social security trust fund may face particular problems, which makes private funding relatively attractive (Thompson 1992). A large trust fund may induce higher government consumption or even fiscal deficits, thus defeating the object of the exercise, and its management could be subject to political interference (although it could be privatized or devolved). Investment in government bonds, which is typical of such funds in the United States, Japan, and Singapore, has ambiguous consequences. As pointed out by Bodie and Merton (1993), it is not clear that governments' willingness to repay bonds (or at least, not to devalue them by a bout of inflation) should be any more reliable than the promise to pay pensions, unless the funds are used for productive capital investment, with revenues hypothecated to pay pensions. Even if used to fund investment, finance may be diverted to unprofitable projects for political reasons. Also, lack of international investment, which is typical of such funds, leaves them dependent on the performance of the domestic economy. Investment performance of one such public trust fund, the ATP fund in Sweden, is examined below.

To summarize, these arguments suggest that funding is superior in terms of economic efficiency (e.g., less distortion of incentives to work and save), so a shift from pay-as-you-go to funding may raise work incentives and saving. Also the rate of return to funded plans tends to exceed that on pay-as-you-go plans. However, funding has some disadvantages in terms of equity that suggest that a wholesale switch to funding would be inappropriate. Diversification reasons (the differing risks to which funded and pay-as-you-go plans are exposed) are also a point in favor of retaining pay-as-you-go. The ability of social security to redistribute suggests a role for pay-as-you-go in providing basic needs, while funding caters for transfer of saving to old age. And international investment may be needed to mitigate some of the difficulties that funding may entail with an aging population. With these considerations as background, we go on to examine the actual determinants of private funding in 12 countries.

What Determines the Scale of Private Pension Funding?

The data in Table 2 show pension fund assets in the twelve countries studied, first on a narrow definition of funded non-insured company plans, and secondly on a broader definition including pension funds managed by life insurers and certain other funded plans. For each measure, a contrast is apparent between the role of pension funds in the

TABLE 2 Assets of Pension Funds End of 1991 (US\$ billion)

Country	Narrow Definition ¹			Broad Definition ²		
	Stock of Assets (end of 1991)	% of Personal Sector Assets	% of GDP	Stock of Assets (end of 1991)	% of Personal Sector Assets	% of GDP
United States	2,915	22	51	3,780	29	66
United Kingdom	643	27	60	786	33	73
Germany	59	3	3	80 ³	4	4
Japan	182	2	5	303 ³	3	8
Canada	187	17	32	205	19	35
Netherlands	145	26	46	242	43	76
Sweden	87	n/a	33	—	—	—
Denmark	22	n/a	16	82	n/a	60
Switzerland	173	n/a	70	—	—	—
Australia	62	19	22	110	34	39

Source: Davis (1994a).

Notes: ¹Includes only independent (private and public sector) funded pension schemes, except Sweden — public ATP scheme.

²For the United States, Australia, Canada and Denmark includes data for pension reserves of life insurers; for the United Kingdom and Japan includes estimates of life insurance companies' pension fund reserves; for Denmark includes funds managed by banks; for the Netherlands includes the Civil Service Pension Fund (ABP).

³In Germany and Japan there are large reserve funded (or "booked") pension plans with assets held directly on the sponsoring firm's balance sheet. The value of these in 1991 was US\$ 150 billion in Germany and an estimated US\$ 120 billion in Japan.

Anglo-Saxon countries (the United Kingdom, the United States, Australia, and Canada), the Netherlands, Denmark, and Switzerland, where they account for a sizable part of personal sector wealth and GDP, versus that role in other continental European countries such as Germany. Japan occupies an intermediate position, with sizable total assets but low ratios to personal wealth or GDP. Note the Swedish data are for the funded earnings-related social security system (ATP); private funded plans exist, but their assets are relatively small.

Taking the asset/GDP ratio as an imperfect proxy for the size of the funded sector, what types of influences could account for the differences in the importance of funded sectors in the provision of pensions? The most crucial point is that private funded plans cannot usefully be viewed in isolation; the principal alternative to a private pension fund is the state social security pension system. Not surprisingly, the growth of private plans can be related to the scale of social security pension provision, which imposes limits on private sector plans, particularly if there is generous provision for individuals at higher income levels. Second, where provision is voluntary, taxation and regulatory provisions make it more or less attractive for the firm to offer a pension fund. For example, exemption of funds from taxation, "prudent man" rules for asset management,

and flexible funding rules will increase funds' attractiveness. However, in some countries these factors may be overridden, imposing compulsory pension plans on employers. Since accrued rights within occupational pension plans comprise assets of the employee, it is natural also to consider their motivations. For example, high marginal tax rates may increase the attraction to employees of tax deferral via pension funds. Employees will also be attracted by the quality of retirement income insurance that is on offer, which differs between defined benefit and defined contribution plans and varies with factors such as indexation of pensions to prices or wages (Bodie 1990). But note that regulations making funds attractive to employees, such as compulsory indexation and short vesting periods, may make them less attractive to employers.

Of course not all funds are company-based. Personal pensions, which are invariably defined contribution plans, have grown in importance in a number of countries in recent years, the main aims being to provide the tax incentives of pension plans to those not in company plans, to enable company plans to be supplemented, and/or to offer greater portability than is available from company plans. A further factor influencing the size of pension funds is the maturity of the plans, that is, whether they have a stable long-run ratio of contributing to benefiting members. Coverage is obviously also important (i.e., the proportion of employees covered by pension plans). However, this is a consequence of the economic features as discussed below, rather than a separate cause of growth in itself.

Accrual of pension rights in a defined contribution plan is synonymous with accumulation of assets, which will thus be larger the higher the contribution rate, coverage of the workforce, and rates of return. But a defined benefit plan is not necessarily synonymous with a fund; rather it is a way to collateralize the firm's benefit promise. In order for assets to be built up, it is essential for fiscal or regulatory provisions to encourage funding of defined benefits; otherwise defined benefit plans may be unfunded. Only if external funding is encouraged, as opposed to "booking" of pension liabilities on the balance sheet, will funds be available in the form of assets of the capital market intermediated via pension funds. And only then one can also assert for defined benefit funds that the more generous the benefits offered and the wider the coverage, the more financial assets funds will require.

Table 3 offers a summary of the way these various features stand in the twelve countries studied. To summarize, the influence on the development of private plans of the scale of social security, compulsion, the tax regime, and maturity can be discerned in each country. Key regulatory features that may also influence funding, notably funding rules per se, are assessed in more detail in the next section.

TABLE 3 Determinants of the Size of Funded Sectors

<i>Country</i>	<i>Social Security Replacement Rate 1992 (%)</i> ¹	<i>Form of Taxation</i> ²	<i>Coverage of Funded Schemes (%)</i>	<i>Maturity of Funded Schemes</i>
United States	65-40	EET — Contributions and asset returns tax free. Benefits taxed.	46 (voluntary)	Mature
United Kingdom	50-26 ³	EET — Contributions and asset returns tax free. Benefits taxed, except for tax free lump sum.	50 (company) 25 (personal); (voluntary)	Mature
Germany	70-59	TET — Employers' contributions taxed as wages; employees' contributions and asset returns tax free. Benefits taxed at low rate. (For booked benefits, employers contributions tax free, benefits taxed at normal rate.)	42 (voluntary)	Immature
Japan	54 ⁴	ETT — Contributions tax free. Tax on asset returns. Benefits taxed, except for tax free lump sum. (Partial tax exemption of contributions to booked benefits.)	50 (voluntary)	Immature
Canada	34 ⁴	EET — Contributions and asset returns tax free. Benefits taxed.	41 (voluntary)	Mature

Netherlands	66-26	EET — Contributions and asset returns tax free. Benefits taxed.	83 (voluntary)	Mature
Sweden	69-49	ETT — Contributions to ATP tax free; contributions to ITP/STP subject to social security tax. Tax on asset returns of ITP/STP. Benefits taxed at low rate.	90 (ATP compulsory; ITP/STP voluntary)	Mature
Denmark	83-33	ETT — Contributions tax free. Tax on real asset returns. Benefits taxed, including 40% of lump sum payments.	50 (voluntary)	Mature
Switzerland	82-47	EET — Contributions and asset returns tax free. Benefits taxed.	90 (compulsory)	Mature (pre-BVG) Immature (post-BVG)
Australia	28-11	TTT — Contributions, asset returns and benefits taxed.	92 (compulsory)	Immature
France	67-45 ⁵	E(E)T — Contributions to ARRCO/AGIRC tax free; separate funded schemes forbidden; insured pension contributions tax free.	100 (compulsory)	Mature
Italy	77-73	EET — Contributions and asset returns tax free, benefits taxed.	5 (voluntary)	Immature

Source: Davis (1994a).

Notes: ¹Based on final salary of US\$ 20,000 and US\$ 50,000, for married man; source Wyatt (1993).

²The abbreviations refer to taxation of contributions, returns and benefits, hence EET means contributions and returns are exempt and benefits are taxed.

³Includes state earnings related pension scheme (SERPs). For those contracted out, the ratios are 35% and 14%.

⁴Ratio to average earnings in 1986.

⁵Includes ARRCO.

As regards social security, replacement ratios are shown to be relatively low in Australia, which is a country that relies heavily on private pensions even for low earners, but comparable for those on low incomes in other countries. In such cases, the shape of the relation of replacement ratio to final earnings is a crucial determinant of the scope of private funds; if social security provides high replacement ratios to high earners, there will be little incentive to develop private funded plans at all. In line with this suggestion, the replacement ratio declines rapidly with earnings in Denmark, the Netherlands, the United States, and the United Kingdom — countries with large funded sectors. Italy and Germany, by contrast, are notable for comparable replacement ratios to those retiring on earnings equivalent to US\$ 20,000 and US\$ 50,000. Their private funded sectors are much less important.

As regards taxation, the Netherlands, the United Kingdom, Switzerland, the United States, and Canada offer generous treatment (exemption of contributions and asset returns from tax, while pensions in payment are taxed, denoted EET in Table 3). "Booking" is discouraged in these countries by withholding tax privileges from reserve-funded plans (or outright bans, as in the United States and Canada). High general tax rates of up to 68 percent, as in Denmark, can encourage private funding even if their fiscal treatment is less generous (a tax is imposed on real asset returns to pension funds above a certain level). In Germany and Japan, tax incentives to "booking" of corporate pension liabilities and some tax disadvantages to pension funds have, at least until recently, accompanied smaller funded plans.

Compulsion is a feature of the Swedish public and the Swiss and Australian private national funded systems, all of which are designed in the light of demographic concerns to provide a sizable proportion of retirement benefits. Coverage is hence extremely high: only in the Netherlands do voluntary plans reach similar levels of coverage. Because the plans are compulsory, the tax regime is less important; in particular, the Australian fiscal treatment of taxation of contributions, returns, and benefits would be unlikely to encourage voluntary pension provision. The French supplementary plans are also compulsory, but pay-as-you-go financing is enforced.

Funded sectors differ in terms of maturity, which also influences the current and prospective asset/GDP ratio. In the United States, the United Kingdom, Canada, Sweden, and the Netherlands, defined benefit plans are largely mature and hence the asset/GDP ratio is near a peak, although personal and defined contribution funds could spur further growth in the United Kingdom, Canada, and the United States. In Denmark, Japan, and Germany, immaturity of company plans indicates further growth is likely. In Australia and Switzerland, the relatively recent

introduction of mandatory pension funds means that a significant proportion of pension funds will again be immature.

A simple regression analysis was carried out to test the main influences on the "broad" pension asset/GDP ratio, using as independent variables the key factors identified above, namely the scope of social security, the tax regime, whether the scheme is mandatory, and maturity of the scheme. Of course, such a regression cannot prove causality. Subject to this caveat, the equation does indicate the importance of these factors in discriminating between countries with small and large private funded sectors. It suggests that every one percentage point increase in the difference between social security replacement ratios at US\$ 20,000 and US\$ 50,000 is associated with a 1.2 percent higher asset/GDP ratio; a deviation from favorable "expenditure tax" treatment of pensions is related to 21 percent lower funding; countries where there is compulsion have a 23 percent higher ratio, *ceteris paribus*, and those with mature systems a 27 percent higher asset/GDP ratio. All variables were significant at the 95 percent level.

Detailed study of national funded sectors (Davis 1994a) suggests that other important factors in the development of occupational pension funds are the ability of employees to opt out of earnings-related social security for an equivalent private pension (as in the United Kingdom and Japan), funding of civil service pensions (Netherlands), widening of coverage via encouragement of personal pensions (United Kingdom, Canada, United States, Switzerland), and encouragement of supplementary defined contribution plans (United States). On the other hand, development can be stopped by simply banning company-based externally funded plans, as in France (Syatt 1993), and funding of social security in Sweden ensures private funds remain small.

A striking feature of this analysis of the determinants of private funding is that it appears to be tenuously related to the underlying fundamentals that were outlined above. This is not surprising, as in most countries social security and private provision have evolved piecemeal, without coordination. Only in Australia (and Chile) does social security provide solely for basic needs. There is little correlation between the wage-interest differential and the size of funded sectors, nor, as yet, to the future aging of the population in the different countries. These should predispose countries such as France, Italy, Japan, and Germany to extend the scope of funding. Retirement system reform has nonetheless been marked in Japan, with a reduction in social security promises, partial funding of social security, and reduction of tax benefits to "booking" (Watanabe, Chapter 4, this volume), but elsewhere it has been slow.¹⁴ Taxation costs and transition problems, as well as preference for the "social solidarity" of comprehensive pay-as-you-go, are among the reasons.

What Are the Principal Pension Regulations Affecting Financing?

A final factor that may influence the size of the funded sector is regulation, by requiring external funding of benefits per se and/or affecting the attractiveness of provision of funds to companies. This section assesses the main regulations affecting pension fund financing, namely regulations of funding and portfolio regulations, and considers their influence, together with other factors, on the portfolio distribution, the returns, and hence the cost of providing a given level of benefits. In terms of the framework set out in the first section, funding rules can be seen as ensuring that assets actually are accumulated to cover benefit promises under funding, while portfolio regulations seek to influence the nature of the return to funding. The basic regulations are summarized in Table 4.

Regulation of the funding of benefits is a key aspect of the regulatory framework for defined benefit pension funds. Note that, by definition, a defined contribution plan is always fully funded, as assets equal liabilities, whereas as noted with defined benefit plans there is a distinction between the pension plan (setting out contractual rights to the parties) and the fund (a pool of assets to provide collateral for the promised benefits). When the fund is worth less than the present value of promised benefits, there is underfunding; when the opposite is the case, there is overfunding. Calculation of appropriate funding levels requires a number of actuarial assumptions, in particular the assumed return on assets, projected future wage growth (for final salary plans), and projected future inflation (if there is indexing of pensions), as well as estimates of death rates and the expected evolution of the relative number of contributors and beneficiaries over time. Minimum funding limits set by regulation seek to protect security of benefits against default risk by the company, given that unfunded benefits are liabilities on the books of the firm and therefore risk is concentrated and pensioners (or pension insurers) may have no better claim in case of bankruptcy than any other creditor.¹⁵ Funding offers a diversified and hence less risky alternative back-up for the benefit promise, as well as offering the possibility of unplanned benefit increases if the plan is in surplus. Extra protection against creditors of a bankrupt firm is afforded when the pension fund is independent of the firm and when self-investment is banned or severely restricted, as is the case in most countries except Germany and Japan. There are usually also upper limits on funding, to prevent abuse of tax privileges (overfunding). Bodie (1990) suggests that the three main reasons why firms fund, besides regulations per se, are because of the tax incentives, in order to provide financial slack (when there is a surplus) that can be used in case of

TABLE 4 Summary of Pension Asset Regulations

<i>Country</i>	<i>Portfolio Regulations</i>	<i>Regulation of Funding¹</i>
United States	Prudent man concept; 10% self investment limit for defined benefit funds.	ABO must be funded. Maximum 50% overfund of the ABO. Higher insurance premiums if underfunded.
United Kingdom	Prudent man concept; five percent self investment limit, concentration limit for defined contribution plans.	Maximum 5% overfund of PBO or IBO. Funding only obligatory for contracted out part of social security.
Germany	Guidelines; maximum 20% equity, five percent property, four percent foreign, 10% self investment limit.	Funding obligatory up to PBO. Option of book-reserve funding.
Japan	Guidelines; maximum 30% equity, 20% property, 30% foreign, 10% in one country; minimum 50% in bonds.	Tax exempt up to ABO only. Option of book-reserve funding.
Canada	Prudent man, tax on foreign assets over 10%, seven percent limit on property.	Maximum 5% overfund of PBO. Funding obligatory.
Netherlands	Prudent man concept, five percent self investment limit.	Funding obligatory for IBO or PBO.
Sweden	Majority to be in listed bonds, debentures and retroverse loans to contributors.	IBO is funded. Contribution rate adjusted 5-yearly to balance fund.
Denmark	Property, shares and investment trust holdings limited to 40%, foreign assets to 20%; 60% to be in domestic debt. No self investment.	Irrelevant as defined contribution; benefits must be funded externally.
Switzerland	50% limit on domestic shares, 50% on property, 20% foreign currency assets.	Funding only obligatory for ABO; PBO usually funded. Four percent to be credited to accounts annually.
Australia	Prudent man rule.	Irrelevant as defined contribution; minimum contribution rate enforced.
France	Assets of supplementary funds to be invested 50% in government bonds and less than 33% in loans to sponsors.	Funded company schemes forbidden; book reserve funding subject to tax discrimination.
Italy	No pension law.	No pension law.

Source: Davis (1994a).

Note: ¹ABO refers to the accrued benefit obligation; PBO to the projected benefit obligation.

financial difficulty, and because pension benefit insurance may not cover the highest-paid employees.

Certain definitions are useful as background to a discussion of funding rules. The "windup" definition of liabilities, the "solvency" level at which the firm can meet all its current obligations absent any projections of salary, is known as the accumulated benefit obligation (ABO).¹⁶ The assumption that rights will continue to accrue, and be indexed up to retirement, as is normal in a final salary plan, gives the projected benefit obligation (PBO).¹⁷ The indexed benefit obligation (IBO) assumes indexation after retirement.¹⁸ An important argument in favor of the PBO/IBO over the ABO is that it ensures advance provision for the burden of maturity of the plan, when there are many pensioners and fewer workers, by spreading costs over the life of the plan (Frijns and Petersen 1992). This may be better for the financial stability of the sponsor.¹⁹

In the United States the ABO must be funded; unfunded plans are forbidden in theory, though in practice some forms are less fully funded. Together with absence of obligatory indexation, this has an important influence on portfolio distributions, since underfunding (shortfall risk) can be avoided, and tax benefits to the firm maximized, by holding bonds, or at least by portfolio insurance strategies; unhedged equities are only suitable for overfunded plans. The United States Pension Benefit Guaranty Corporation (PBGC) guarantees (up to a limit) benefits of defined benefit funds in default, funded by contributions from all defined benefit plans; the funding requirement can be seen partly as a protection for PBGC. Higher PBGC insurance premiums are charged to underfunded plans.

The United States illustrates the interaction of funding rules with accounting standards and tax law in influencing funding. Under the United States accounting standard FASB 87, if pension assets fall below the ABO, the unfunded liability must be reported in the firm's balance sheet, and since they are senior debt, they act as a major problem for the firm in raising funds. However, a surplus cannot be included on the balance sheet, although it can be implicitly recouped by reducing in contributions, as discussed below. The accounting standard requires presentation of the PBO, as well as the ABO, thus ensuring at least partial focus on future liabilities. Again, overfunding in the United States has since 1987 been limited by tax law to 150 percent of the ABO. This implies that a rise in interest rates could prevent further funding, leaving the plan underfunded when interest rates fall. This would not have been the case for a PBO definition, taking projected rises in benefits into account, as long as the Fisher effect holds, that is, interest rates rise with expected inflation.

Other countries show similar interactions. In Germany, various laws or

court decisions have enforced minimum standards of funding for pension funds (while leaving open the choice of a book reserve system) and what amounts to inflation indexing of pensions. These provisions were felt to be particularly burdensome, and have helped blunt the growth rate of externally funded private pension plans as opposed to "booked" benefits (Deutsche Bundesbank 1984). In both Germany and Switzerland, accounting conventions have an impact on funding decisions, as shortfalls (defined at the lower of cost and market value of assets) are included in the company accounts (Hepp 1992). It is suggested that this helps to account for conservative investment strategies, independently of portfolio regulations discussed below. Rules forcing employers in Switzerland to credit at least 4 percent to pension accounts annually may have a similar effect. In Japan, the traditional means of providing retirement benefits was via booked benefits, with a special reserve account on the balance sheet as benefits accrue. Externally funded plans must be funded only up to the ABO, and there is reportedly very little overfunding, partly because contributions that would raise funding levels above the ABO are taxed. In Canada plans must be funded as going concerns, including projections of salary rises (i.e., the PBO); unfunded plans are forbidden, and any unfunded liabilities must be paid off in 15 years.

In the United Kingdom, plans that contract out of earnings-related social security must fund sufficiently to provide an equivalent "guaranteed minimum pension" (GMP), but this is far below actual benefit promises. Funding above this level is not legally required — although trustees are bound by their duty of care to ensure funding is in place — nor is there a requirement to include deficits in company balance sheets. In practice a continuance basis such as the PBO or IBO tends to be used, on which overfunding is limited to 5 percent. A crucial difference from other countries is that adequacy of funding is judged by current and projected cash flows from assets and not current market values; this allows volatile assets such as equities to be heavily used. This is reflected in accounting standard SSAP24, which also bases fund valuation on such actuarial valuations and long-run smoothing. Historically, this has not conflicted with the need to cover obligations if the fund is wound up, since the PBO has tended to exceed the ABO. But compulsory indexation, currently being introduced, will increase the ABO and could put the system under threat (Riley 1993).²⁰ Meanwhile, although the government guarantees to pay the GMP if a plan fails, there has to date been no system to guarantee non-GMP pension benefits in the United Kingdom; partly for this reason regulations have historically been less strict than elsewhere, and managers could adopt a high return/high risk portfolio strategy. However, the Goode Committee on United Kingdom pension law — set up to report on regulatory shortcomings in the wake of the

Maxwell scandal, and which reported in 1993—recommended a minimum funding rule based on the ABO, with only a three-month grace period to top up the fund, albeit with a 10 percent shortfall being permitted without the immediate need to top up. Insurance against fraud was also recommended. The government launched a bill in mid-1994 approving these proposals, although funding rules will be less strict for immature funds. This raises issues similar to those outlined above for the United States, and might alter quite significantly the asset mix of United Kingdom funds toward less volatile but also less profitable assets.

The importance of the choice of discount rate in funding calculations is shown by a 1993 United States Department of Labor estimate that a one percent fall in the bond yield would raise pension liabilities by 10 percent for the average fund.²¹ Feldstein and Morck (1983) report that many underfunded plans in the United States tended to use a high rate to discount fund liabilities. One answer to these problems is to take a long-run view of asset returns, or possibly, where inflation is low and stable, a fixed benchmark discount rate. The latter is the case in the Netherlands, where funding of the PBO is compulsory and the government sets a maximum real interest rate assumption of 4 percent, as well as an assumption for wage growth. Since in practice Dutch funds have been able to earn over this level, surpluses estimated at 30 percent were present by 1990; a special tax levy is planned. In the United States, in the light of the tendencies noted above, the Securities and Exchange Commission (SEC) has insisted that interest rate assumptions follow actual bond yields closely. In Japan contributions are set assuming a 5 percent nominal rate of return on fund assets. In Canada a nominal return of 8.5 percent and 5.75 percent wage growth are standard assumptions. In the United Kingdom the government accepts the (varying) judgment of the actuaries, and generally also allows for an assumption of wage growth.

Finally, since most Danish and Australian funds (as well as a proportion of funds in Switzerland and the Anglo-American countries) are defined contribution plans, the issue of funding does not arise. However, the issue of limiting tax privilege does arise, and is dealt with (in Australia) via contribution limits and (in both countries) via taxation of returns.

Quantitative regulation of portfolio distributions is imposed in a number of countries, with the ostensible aim of protecting pension fund beneficiaries, or benefit insurers, although motives such as ensuring a steady demand for government bonds may also play a part. Limits are often imposed on holdings of assets with relatively volatile returns, such as equities and property, as well as foreign assets, even if their mean return is relatively high. There are also often limits on self-investment, to protect against the associated concentration of risk regarding insolvency of the sponsor.²² Apart from the control of self-investment, which is

clearly necessary to ensure that funds are not vulnerable to bankruptcy of the sponsor, the degree to which such regulations actually contribute to benefit security is open to doubt, since pension funds, unlike insurance companies, may face the risk of increasing liabilities as well as the risk of holding assets, and hence need to trade volatility with return. Moreover, appropriate diversification of assets can eliminate any idiosyncratic risk from holding an individual security or type of asset, thus minimizing the increase in risk. Again, if national cycles and markets are imperfectly correlated, international investment will reduce otherwise undiversifiable or "systematic" risk (see Davis 1994b and Table 9 below). Portfolio limits may be particularly inappropriate for defined benefit pensions, given the additional "buffer" of the company guarantee and risk sharing between older and young workers, and if benefits must be indexed. Clearly, in such cases, portfolio regulations may affect the attractiveness to companies of providing pension funds, if it constrains managers in their choice of risk and return, forcing them to hold low-yielding assets and possibly *increasing* their risks by limiting their possibilities for diversification.²³ It will also restrict the benefits to the capital markets from the development of pension funds; in particular, in the case of restrictions that explicitly or implicitly oblige pension funds to invest in government bonds, which must themselves be repaid from taxation, there may be no benefit to capital formation and the "funded" plans may at a macroeconomic level be virtually equivalent to pay-as-you-go.²⁴

Japanese funds face ceilings on holdings of certain assets such as 30 percent for foreign assets and for equities, which Matsuhiko Tamura (1992) suggests (inappropriately) "imitate regulations devised for trust banking and life insurers." German pension funds, besides a 10 percent self investment limit, remain subject to the same panoply of regulation as life insurers (4 percent limit on foreign asset holdings, 20 percent limit on equities, 5 percent on property). It is arguable that these are particularly inappropriate for German pension funds given the indexed nature of their liabilities.²⁵ Note that by offering tax privileges to "booking," Germany and Japan effectively impose no limits on self-investment of book reserves (although the Germans do insist on insurance of such reserves). Swiss limits are similarly structured, but since the end of 1992 have been much less restrictive than the Germans': a 50 percent limit on shares, 50 percent for real estate, and 30 percent on foreign assets (Meier 1993). Scandinavian limits are in many ways even tighter than the Germans', in that minima are also specified. The Swedish ATP, as well as private funds, have historically been obliged to hold the majority of its assets in domestic listed bonds, debentures, and retroverse loans to contributors (although recent deregulations have permitted limited investment in property, equities, and foreign assets, of which some private

plans have reportedly taken advantage). Historically, restrictions on equity investments were justified on the additional ground that for ATP they would involve backdoor nationalization and worker control. Danish funds have to hold 60 percent in domestic debt instruments, although since 1990 they have been allowed to hold 20 percent in foreign assets. Investment in the sponsor is forbidden. Mutual societies providing pensions in France (via group insurance policies) must follow insurance regulations that insist that they invest at least 34 percent in state bonds, and a maximum of 40 percent in property and 5 percent in shares of foreign insurers.

Such limits are not, however, imposed in all the countries studied. For example, pension funds in the United States are subject to a "prudent man rule" that requires managers to diversify portfolios; the primary limit to portfolio distributions is a 10 percent limit on self investment for defined benefit funds and some defined contribution funds.²⁶ United Kingdom pension funds are subject to trust law and implicitly follow the "prudent man" concept; as long as trust deeds are appropriately structured they are not constrained by regulation in their portfolio distribution except for limits on self-investment (5 percent) and concentration.²⁷ Australian funds' investment has been unrestricted since exchange controls were abolished in 1983 and public sector funds were deregulated in 1985, except for a 10 percent limit on exposure to the sponsor. Dutch private funds face no legal restrictions, except for a 5 percent limit on self-investment (Van Loo 1988). In contrast, the Dutch public service fund (ABP) faces strict limits, being able to invest only 10 percent abroad and 20 percent in shares or real estate. Some countries have switched to "prudent man" rules; Canadian funds were strictly regulated until 1987 (when the "prudent man" concept was introduced) and have until recently faced limits on the share of external assets.

To conclude, funding and portfolio regulations differ quite significantly, with some countries using only accrued benefit-based funding and others projected benefits. The division for portfolio regulations, between countries with "prudent man" rules and regulations, is even more stark. In the next sections we probe the consequences of such rules for portfolios.

How Are Pension Assets Invested?

The portfolio distribution and the corresponding return and risk on the assets held are the key determinant of the cost to the company of providing a pension in a defined benefit plan and the replacement ratio obtainable via a defined contribution fund (and hence in each case the yield that can be obtained by funding relative to that of pay-as-you-go). This

section seeks to trace the various influences on portfolio distributions, in particular those of the portfolio and funding regulations outlined above.

How might funds be invested in the absence of portfolio regulation? As shown by Black (1980), for both defined benefit and defined contribution funds, there is an incentive to maximize the tax advantage of pension funds by investing in assets with the highest possible spread between pre-tax and post-tax returns. In 1980 in the United States this was bonds, but some analysts suggest that since 1986 the relative tax advantage of equities has declined sharply, making them candidates for pension fund investment on this basis (Chen and Reichenstein 1993).²⁸ Apart from this a defined contribution pension plan would seek to diversify, seeking to maximize return for a given risk, and shift to lower risk assets for older workers as they approach retirement.

More complex considerations arise for defined benefit funds. First, there is an incentive to overfund to maximize the tax benefits, as well as to provide a larger contingency fund, which as noted is usually counteracted by government-imposed limits on funding. Meanwhile, appropriate investment strategies will also depend on the nature of the obligation incurred. If it is the ABO and is purely nominal, with penalties for shortfalls, it will be appropriate in theory to match (or "immunize") the liabilities with bonds of the same duration to hedge the interest rate risk of these liabilities, or at least to hedge against the risk of shortfall when holding more volatile securities. With a projected benefit obligation target, an investment policy based on diversification may be most appropriate, in the belief that risk reduction depends on a maximum diversification of the pension fund relative to the firm's operating investments (Ambachtsheer 1988).²⁹ Moreover, if the projected liability includes an element of indexation, then fund managers and actuaries typically assume that it may be appropriate to include a proportion of equities and property in the portfolio as well as bonds (Christopher Daykin, this volume). This should minimize the risk of longer-term shortfall of assets relative to liabilities, implicitly diversifying between investment risk and liability risk (which are largely risks of inflation).³⁰

An essential counterpart to such an approach is that regulators allow gradual amortization of shortfalls, or even focus in solvency calculations on income from assets rather than market values as in the United Kingdom. Allowing inflation indexation of pension to be discretionary, as is the case in most countries other than the United Kingdom and Germany, is another way to reduce the risk of shortfall; implicitly it is a form of risk sharing between firm and workers. Maturity will also affect optimal portfolios. For example Blake (1994) suggests that given the varying duration of liabilities it is rational for immature defined benefit funds having "real" liabilities to invest mainly in equities (long duration), for mature

funds to invest in a mix of equities and bonds, and for funds that are winding up mainly in bonds (short duration).

It is important to note that many financial economists disagree with the implicit assumptions that may underlie a strategy of equity investment, namely that equity is a hedge against inflation, and that raising the share of equity reduces costs, as opposed to merely raising expected returns, and offering benefits of diversification (Bodie 1990). We do not seek to take sides in this debate in this chapter. Suffice to note here that Tepper (1992) suggests that the debate hinges on whether returns on equity are statistically independent from year to year. If they are, it is quite conceivable that a long series of bad returns could lead to significant real losses from equities even over a long time horizon relevant to pension funds. But proponents of the view that equities outperform bonds over long time horizons would maintain that there are reversals in trends in returns to ensure that owners of capital are compensated over the long term. They suggest that although underperformance of equities is quite common in the short term, long-term underperformance would entail economic collapse, which governments would seek to resist. Also of interest in this context is the suggestion that the premium in returns of equities over bonds is more than can be explained by relative risk (Mehra and Prescott 1985), which if correct implies that risk-neutral investors such as pension funds can gain from holding equities.

The actual patterns of portfolio distributions over the past two decades are shown in Table 5. Marked differences emerge: for example, in 1990 equity holdings varied from one percent in Sweden to 63 percent in the United Kingdom, and foreign assets from one percent in Denmark to 18 percent in the United Kingdom. As background, estimates of real total returns and their standard deviations for 1967 to 1990 are shown in Table 6. Davis (1994a) offers a detailed analysis of these patterns of portfolio distributions and their determinants. So here I offer an overview of certain key determinants, grouping by type of influence.

In line with the discussion above, liabilities are a major influence, for example affecting the share of bonds. In countries such as Canada, with a high share of bonds, only nominal returns have historically been promised after retirement, while in the United Kingdom, where bond holding is low, a degree of inflation protection both before and after retirement is expected. Similar indexation promises are made by the Swedish supplementary national plan, despite which the bond share is extremely high, suggesting an inefficient portfolio allocation.

Historically the higher taxation on bonds than on equities made the former an attractive investment to tax-exempt investors such as pension funds, but as noted recent analyses suggest that equities are now less advantaged in the United States, and hence should be more attractive,

TABLE 5 Pension Fund Portfolio Distributions (percentage)

Country		Equities	Bonds	Loans and Mortgages	Property	Liquidity and Deposits	Of Which Foreign Assets ¹
United Kingdom	1970	49	32	0	10	4	2
	1980	52	24	0	18	5	9
	1990	63	14	0	9	7	18
United States	1970	45	45	6	0	1	0
	1980	41	41	2	0	8	1
	1990	46	36	2	0	9	4
Germany	1970	4	19	50	12	3	0
	1980	9	24	52	9	2	0
	1990	18	25	45	6	2	1
Japan	1970	6	12	52	27	2	0
	1980	9	51	33	6	2	1
	1990	27	47	14	2	3	7
Canada	1970	27	53	11	1	5	0
	1980	26	50	12	2	9	4
	1990	33	47	4	3	11	6
Netherlands	1970	11	15	54	16	3	7
	1980	5	10	69	14	2	4
	1990	20	23	43	11	3	15
Sweden	1970	0	76	22	0	1	0
	1980	0	74	26	0	1	0
	1990	1	84	10	1	3	0
Switzerland	1970	3	25	48	16	7	0
	1980	9	28	37	18	6	0
	1990	16	29	22	17	12	3
Denmark	1970	0	72	7	0	3	0
	1980	3	63	7	0	2	0
	1990	7	67	7	0	1	1
Australia	1970	15	51	0	2	n/a	0
	1980	15	33	0	13	n/a	0
	1990	27	20	0	16	23	13

Source: National flow-of-funds data.

Note: ¹Foreign assets are included in the categories to the left.

and indeed bond shares in the United States have declined somewhat. Often portfolio regulations force funds to hold tax-disadvantaged assets, as in Denmark, where funds must hold 60 percent fixed interest assets, despite the real interest tax on such assets.

Asset returns, both absolute and relative to other assets, are a key influence on the structure of any portfolio. This is confirmed by econometric analysis of the portfolio distributions of pension funds, which shows they are strongly influenced by relative asset returns, particularly where there are few regulations governing portfolio distributions and low transactions costs, as in the United Kingdom and the United States (Davis

TABLE 6 Returns on Pension Fund Portfolios, 1967-90: Mean (and Standard Deviation) of Annual Real Total Returns (percentage, domestic currency)

	<i>United States</i>	<i>United Kingdom</i>	<i>Germany</i>	<i>Japan</i>	<i>Canada</i>	<i>Netherlands</i>	<i>Sweden</i>	<i>Denmark</i>
Estimated portfolio return ¹	2.2 (11.9)	5.8 (12.5)	5.1 (4.4)	4.0 (9.4)	1.6 (9.8)	4.0 (6.0)	0.2 (7.6)	3.6 (12.0)
Average earnings growth	0.2 (2.1)	2.6 (2.5)	4.0 (3.1)	4.2 (4.2)	1.7 (2.8)	2.4 (3.2)	1.5 (3.5)	2.8 (3.0)
Portfolio return less average earnings	2.0	3.2	1.1	-0.2	-0.1	1.6	-1.3	0.8
Inflation (CPI)	5.8 (3.0)	8.9 (5.3)	3.5 (2.1)	5.5 (5.3)	6.4 (3.0)	4.9 (3.1)	8.1 (2.7)	7.7 (3.0)
<i>Returns on</i>								
Loans	3.5 (2.9)	1.4 (5.0)	5.3 (1.9)	0.9 (4.3)	4.0 (3.7)	3.8 (3.6)	3.4 (3.1)	6.1 (3.0)
Mortgages	2.0 (13.4)	2.0 (5.2)	4.7 (1.4)	3.0 (4.9)	2.4 (12.3)	4.3 (2.6)	2.6 (3.0)	5.8 (3.0)
Equities	4.7 (14.4)	8.1 (20.3)	9.5 (20.3)	10.9 (19.4)	4.5 (16.5)	7.9 (28.2)	8.4 (23.3)	7.0 (27.0)
Bonds	-0.5 (14.3)	-0.5 (13.0)	2.7 (14.9)	0.2 (12.8)	0.0 (12.1)	1.0 (13.1)	-0.9 (8.5)	3.4 (16.0)
Short-term assets	2.0 (2.5)	1.7 (4.9)	3.1 (2.1)	-0.5 (4.6)	2.5 (3.3)	1.6 (4.0)	1.3 (3.5)	1.6 (1.0)
Property	3.4 (6.4)	6.7 (11.4)	4.5 (2.9)	7.2 (6.8)	4.6 (6.2)	4.6 (15.0)	n/a n/a	n/a n/a
Foreign bonds	1.6 (14.9)	-0.1 (15.0)	3.0 (11.2)	1.3 (14.6)	-1.7 (12.7)	-0.7 (11.2)	-0.2 (12.6)	-2.0 (11.0)
Foreign equities	9.9 (17.2)	7.0 (16.2)	10.4 (13.5)	7.8 (18.7)	5.8 (14.3)	6.6 (14.4)	7.1 (14.0)	5.5 (14.0)
Memo: portfolio return ²	3.9 (7.6)	6.3 (10.7)	5.5 (3.0)	2.9 (5.7)	4.1 (5.0)	4.3 (5.5)	2.8 (2.9)	5.8 (3.0)

Source: Davis (1994a), using national flow of funds data (for portfolio distribution see Table 5) and BIS macroeconomic database (for asset returns).

Notes: ¹Using holding period returns on bonds (all countries) and on fixed-rate mortgages (United States and Canada).

²Using redemption yields on fixed rate instruments.

1988). Adjustment to a change in such returns is generally rapid. Assuming adequate information and appropriate incentives to fund managers, this should imply an efficient allocation of funds and correct valuation of securities. In my research, these results did not all hold where transactions costs are high and regulations are strict, as in Germany, Japan, and Canada. In these countries adjustment to a change in returns is somewhat slower and allocation of funds less efficient. The results also contrast with those for households and companies, where adjustment to changes in returns tends to be slow, due to higher transactions costs and poorer information. Examples in Table 6 of responses to relative returns include the high levels of liquidity held temporarily after stock market collapses in the United Kingdom in the mid-1970s, and in the longer term due to structural changes in yields arising from deregulation and expansion of short-term markets in the United States and Canada. Inter-country differences in bond holding may also relate to asset returns; partly owing to low and stable inflation, real returns on bonds and other fixed interest assets are relatively high in Germany, Denmark, and the Netherlands, thus motivating a high portfolio share. But in Sweden and Switzerland, bonds have a high portfolio share due to portfolio regulations despite poor returns.

Risk reduction is the main motivation for portfolio diversification, as well as being required by "prudent man" rules. For example, the fall in the United Kingdom bond share since 1980 partly reflects alternative means of diversification; after abolition of exchange controls United Kingdom funds sold bonds to buy foreign assets (although the contraction in the supply of public debt in the late 1980s also played a role). Portfolio regulations may operate contrary to this; Swedish and Danish funds have considerable exposure to housing markets via mortgage-related bonds and loans to housing credit institutions. Together with mortgages, these amounted to no less than 57 percent of Swedish funds' assets in 1990, while Danish funds had 63 percent of assets in mortgages or mortgage association bonds. These imply an enormous exposure to potential effects of recession and falling house prices. Meanwhile, as discussed below, the United Kingdom funds may have portfolios excessively concentrated on equities.

As noted, international diversification can offer to fund managers a better trade-off of risk to return by reducing the systematic risk of investing in domestic markets arising from the cycle or medium-term shifts in the profit share. In the longer term, international investment in countries with a relatively young population may be essential to prevent battles over resources between workers and pensioners in countries with an aging population (Davis 1994b). Table 6 shows that foreign asset holdings have grown sharply over the 1980s in the United Kingdom, Australia,

and Japan. In all three countries, this pattern followed abolition of exchange controls, at a time particularly in the United Kingdom and Japan when the economies were generating current account surpluses and overseas investment returns looked attractive. In Japan, portfolio restrictions on overseas investment were also progressively eased over the 1980s. Meanwhile Dutch funds have long held a significant proportion of assets abroad, partly due to the large volume of pension fund assets compared with domestic security and real estate markets. Growth has been much less marked in the other countries; in Germany, Switzerland, Denmark, Sweden, and Canada this is partly due to portfolio restrictions.

Risk aversion of trustees or managers may limit portfolio distributions, and at times appears directly counterproductive. In the Netherlands equity holding remains low—20 percent—despite absence of portfolio restrictions. Van Loo (1988) suggests that this may relate to risk aversion of pension fund trustees.³¹ Partly reflecting portfolio regulations, although probably also due to conservatism of managers (since the limits do not currently bind) the equity share in countries such as Sweden and Denmark is exceptionally low, despite the Danish tax on real returns to debt instruments, which encourages substitution of equities for bonds. Risk aversion may also play a role in many countries in limiting international investment, whereas it actually reduces risk over a time horizon relevant for pension funds. Risk aversion appears particularly marked for defined contribution funds; this is partly rational, given the lack of risk sharing and because workers nearing retirement will be anxious for low risk assets to be held.³² But this risk aversion may be excessive. Indeed, evidence from the United States suggests that when employees have control over investment, as is often the case for defined contribution funds, the vast majority goes into fixed interest bonds; when equities are held and their value declines, dissatisfaction is often expressed (Rappaport 1992). Even for defined benefit funds, pressures to hold low risk assets may be sizable with an aging membership and employee trustees. But such pressures also seem to occur when the fund is composed of younger workers.³³ Again, for personal pensions, there is anecdotal evidence in the United Kingdom that persons free to choose their asset backing often select highly cautious combinations of assets. In the United States only 25 percent of 401(k) plan assets are invested in equity, where individuals are free to choose their portfolio allocations (Frijns and Petersen 1992). Mitchell (1994) expresses concern that, because of conservative approaches to investment, future retirees may find their pensions inadequate.

Portfolio regulations have a clear and widespread influence on portfolios, a number of which have already been mentioned. Bonds constitute over two-thirds of pension fund assets in Sweden and Denmark, largely because of portfolio regulations and the nature of the domestic

financial markets, which require that 60 percent of Danish assets be invested in domestic debt instruments, while the majority of Swedish assets be in listed bonds, debentures, and retroverse loans. The fact that a fifth of the Swedish quasi-public funds' assets are invested in government bonds casts some doubt on their efficacy as a means to protect against future risks to social security, given the bonds are to be repaid by the taxpayer in the same way as they would if they were to be used to finance future social security burdens via pay-as-you-go. Similar comments can be made about the Dutch civil servants' pension fund (ABP), which is subject to such severe portfolio restrictions that at the end of 1991 it held 48 percent of its assets in the form of public sector bonds and loans. The decline in public bond holding in Australia parallels the removal of portfolio requirements that formerly required the majority of assets to be held in government securities. As regards equities, it was noted above that in Germany funds are limited to a maximum of 20 percent by regulation and in Japan to 30 percent; hence at 18 percent and 27 percent respectively in 1990 the German and Japanese ceilings were almost binding. Unlike other sectors, which have decreased holdings of property in recent years, Swiss funds retain around a fifth of their assets in property; one of the few assets that were relatively under their pre-1993 portfolio restrictions. This focus may drive up the price of land, it does not contribute to capital formation, and funds may face decreasing returns on (domestic) property in the future, as the population declines.

Funding rules also have an effect. In the United States, where minimum funding regulations make it optimal to hold a large proportion of bonds to protect against shortfall risk, despite their weakness as an inflation hedge, bonds form around 40 percent of pension funds' portfolios. Bodie (1991) suggests that given such funding rules, it is a paradox that United States defined benefit funds invest in equities, since a drop in market values can cause underfunding which has to be reflected in the employer's profit and loss account. He suggests investment in equities occurs because management sees a plan as a trust for employees, and manages assets as if it were a defined contribution plan (i.e., for employee welfare), with a guaranteed floor given by the benefit formula. Swiss bonds offer low returns, but given the low target yield of 4 percent nominal, fund managers there historically saw little need to diversify into riskier assets.

As regards accounting standards, in Japan, assets are held at book value, and a fixed return on the fund (based on interest and capital gains) is targeted for every year. This gives perverse incentives to sell well-performing equities as general share prices fall and retain those showing price declines, as well as to hold more bonds than portfolio optimization would imply (Tamura 1992). In Germany and Switzerland, Hepp (1990),

1992) suggests, application of strict accounting principles, which are more appropriate to banks than to pension funds, restrains equity holdings by funded plans independently of the portfolio regulations in Switzerland, evidenced by the fact that funds' equity holdings are far below the ceilings permitted. These conventions, for example, insist on positive net worth of the fund at all times, carry equities on the balance sheet at the lower of book value and market value, and calculate returns net of unrealized capital gains. In contrast, the United Kingdom accounting standard permits long-run smoothing and focuses on dividends rather than market values, and hence enables funds to accept the volatility of equity returns. The concern of some commentators in the United Kingdom is rather whether equity holdings are *too high* given the risks; however, note that 18 percent of the 63 percent equity share in 1990 was actually in foreign equities, thus reducing risk somewhat. In 1992 the equity share was 80 percent, of which 58 percent were domestic and 22 percent foreign. No other country has anything comparable to this portfolio share of equities. And as noted, new legal proposals may lead funds to reduce their equity shares.

The structure of fund management in countries such as Japan has had counterproductive effects, according to some commentators. There the share of loans has fallen sharply, although these medium-term floating-rate yen loans to firms were consistently the most profitable investment in Japan in the 1970s. It can be argued that this highlights a general point, that protection of fund managers from external competition (as was the case in Japan until recently) may lead to a suboptimal investment strategy from the point of view of plan beneficiaries.

Finally there is administrative fiat. Much of the past growth of Japanese funds' bond holdings may reflect the high share of public bonds purchased under government pressure, a practice that has now been abandoned.

Fund Performance

It is evident from the discussion above that a wide variety of often extraneous influences impinge on pension fund portfolios, which may in turn restrict funds from portfolio optimization, reduce return, and raise risk relative to feasible alternative investment strategies. We suggest that a useful means of judging the cost of these regulations and market imperfections, as well as of devising appropriate contribution rates, is to assess pension fund performance relative both to that in other countries and to that of artificial portfolios. The patterns of portfolio distributions (Table 5) and risks and returns on assets can be used to derive estimates of the returns and risks on portfolios (Table 6), and hence the cost to the firm

of providing a given level of pension benefits (for a defined benefit fund) or the return to the member (for a defined contribution fund).³⁴ The estimates suggest that over the period 1967 to 1990, pension funds in the United Kingdom obtained the highest real return, those in Sweden, Switzerland, Canada, and the United States the lowest.³⁵ The result of course partly reflects risk and the share of equity and property, the United Kingdom having the highest standard deviation of returns (together with Denmark), and by far the highest share of real assets. Meanwhile, Swedish, Swiss, U.S., and Canadian funds held high proportions of bonds, which performed poorly over this period. Note that U.S. funds are also high risk in real terms despite relatively conservative portfolios; this is mainly due to unanticipated inflation in the 1970s, but it may also relate to funding rules and tax incentives. Interestingly, portfolios in Germany and the Netherlands had a high real return and low volatility, despite their focus on bonds and loans. This relates to relatively high returns on fixed-rate instruments in those countries. However, as discussed below, Table 9 shows that real returns for German and Dutch funds could have been boosted significantly by an increased share of equities. Investment in international equities would ensure that the associated increase in risk was mitigated.

Several observations can be made regarding these results. The publicly sponsored Swedish fund does poorly. The low-return Swedish and Swiss (and latterly the Australian system) are also compulsory, thus in principle reducing competitive pressures. In the case of Australian and Danish funds, occupational defined contribution funds imply that those who select the managers (companies themselves) do not bear the high level of portfolio risk. The Japanese, Swiss, and Germans have generally had little competition in fund management (Davis 1994a), and suffer from inappropriate accounting standards. But as shown by the results for Germany, good economic performance (or international diversification) can overcome a number of handicaps. Comparison of the results with (nominally) risk-free yields suggests that the funds generally outperformed government bonds, albeit only narrowly in Denmark (Table 6). However, in Canada and Sweden the portfolio return is below that on market paper (it is open to doubt whether the markets were deep enough to absorb pension funds' size, of course). Returns are generally below those on equities, but at a benefit of much lower risk.

The most crucial test is the ability of a fund to outperform real average earnings, given that liabilities of defined benefit plans are basically indexed to them. Similarly the replacement ratio a defined contribution fund can offer will depend on asset returns relative to earnings growth. Following the discussion in the first section, it also indicates whether in practice the return to funding (the asset return) exceeds that on pay-as-you-go in

TABLE 7 Local Government and Private Pension Fund Returns (1967-90¹): Mean (and Standard Deviation) of Annual Real Total Returns (domestic currency)

<i>Country</i>	<i>Mean</i>	<i>Std. Dev.</i>
United Kingdom		
Local authority funds	4.9	(13.4)
Private funds	5.6	(13.0)
United States		
State and local funds	1.2	(12.6)
Private funds	2.7	(11.7)

Source: Davis (1994a).

Note: ¹1967-1988 for the United Kingdom.

a steady state (the growth rate of average earnings). The margin is sizable (over 2 percent per year) in the United States and United Kingdom, and between one percent and 2 percent in Germany and the Netherlands. Except for Germany, all these countries have "prudent man" rules. The margin remains positive in Denmark and (barely) in Australia. But in Sweden, Japan, Canada, and Switzerland, it is actually negative, implying that the returns on assets need to be constantly topped up to meet their target. It was noted above that this may relate to inefficient asset allocations, often arising from portfolio restrictions. Taking the results at face value, and disregarding demographic issues, pay-as-you-go would have offered a higher rate of return than funding over this time period in these countries.

Risk, measured crudely as the standard deviation of the annual real return, should not be disregarded; as noted, it is quite high in a number of countries. But defined benefit pension funds are well placed to accept a degree of volatility, as there can be risk sharing between worker and company as well as between younger and older members. Risk is more important for defined contribution funds as there is no back-up from the sponsor and pensions must typically be taken in a lump sum (to buy an annuity) at the precise point of retirement. In contrast, annuities from defined benefit funds typically come from the fund itself, or at least the rate is guaranteed. In the light of this, the high levels of risk in Denmark and Australia, where funds are mainly defined contribution, are of potential concern.³⁶

The data for the United Kingdom and United States allow a further comparison of effects of ownership and management methods to be made, this time in the same markets, in that portfolios of public (local government) fund data can be identified separately from those of private sector funds. Estimates of the respective returns are shown in Table 7. In

TABLE 8 Targeted Replacement Rates with Indexed Pensions (percent)

<i>Country</i>	<i>Replacement Ratio Assuming Indexation of Pensions to Prices</i>	<i>Percentage Contribution Rate for 40% Replacement Rate</i>	<i>Replacement Ratio Assuming Indexation of Pensions to Wages</i>
United States	37	10.8	37
United Kingdom	60	6.7	50
Germany	39	10.3	27
Japan	29	13.8	20
Canada	25	16.0	20
Netherlands	44	9.1	37
Sweden	14	28.6	11
Switzerland	25	16.0	20
Denmark	36	11.1	27
Australia	30	13.3	27

Source: Vittas (1992) and estimates of average earnings, inflation, and real returns on pension funds shown in Table 9.

each case, local government funds obtain lower returns than private funds. This can be related to more conservative portfolio distributions and in some cases portfolio regulations. United Kingdom local authority funds held an average of 52 percent equity over the sample, while private funds held 56 percent. For United States funds the difference is more dramatic: 25 percent and 53 percent, according to the Federal Reserve flow-of-funds data. Interestingly, the risks in real terms were higher for the local government funds, partly as a consequence of the volatility of real returns on bonds (Table 6). In this context, Mitchell (1994) analyzed returns and funding ratios on a sample of United States state and local government pension funds and found, consistent with the discussion of risk aversion and of portfolio regulations above, that both returns and funding were lower when retirees and employees were on the board, and when "social investment" was required (i.e., a proportion of the portfolio invested in local companies).

In order to estimate the benefits/contributions trade-off, Table 8 shows the results of illustrative calculations on the relation between costs of providing pensions, average earnings, and real returns (Vittas 1992). The table shows the replacement rate that would be attainable given the real returns attained by funds in each country and the corresponding growth rates of wages shown in Table 6, assuming indexed pensions, a 10 percent "defined" contribution rate, 40 years of contributions, and 20 years of retirement. Abstracting from risk, the table illustrates clearly the benefits of a higher return relative to real earnings; assuming pensions are indexed to prices, United Kingdom funds can obtain a replacement

ratio of 60 percent, Canadians only 25 percent. Conversely, to obtain a pension equal to 40 percent of average earnings, United Kingdom funds need a contribution rate of 6.7 percent, and Swiss funds of 16 percent.

Of course, in practice contribution rates are sometimes higher than 10 percent, implying higher potential benefits; for example the Australian government mandates a minimum of 12 percent beginning in 2000. Danish contributions tend to be around 10 to 15 percent, despite there being no ceiling imposed by taxation. Such ceilings are standard practice elsewhere, for example, in the United Kingdom, total contributions are limited to 17.5 percent of the employee's salary, and the maximum employee contribution is 15 percent of salary. Typically, employees contribute 5.5 percent and employers the remainder. However, in the United Kingdom, employers do not contribute on behalf of those opting out of company plans in favor of personal pensions, which reduces typical contributions to 6 percent. United States employers typically do contribute to employees' 401(k) plans, although these have many of the characteristics of United Kingdom personal pensions. In Sweden, contributions are 13 percent. In countries such as Germany, where private pension plans have limited "supplementary" objectives, contributions are typically much lower, around 3.5 percent of salary. In Japan, contributions to funds remaining in social security (TQPPs) are limited to 3.2 percent of salary regardless of the condition of the fund. Funds replacing social security (EPFs) are more flexible, in that contributions are set to obtain the promised benefit given an assumed nominal return of 5.5 percent. The distribution of contributions between employer and employee varies widely, although it need not have significant economic implications if employers reduce salaries to offset their contributions. The proportion paid by the employer is around 100 percent in Japan and Sweden, 89 percent in Germany, 87 percent in the United States (100 percent for most private defined benefit funds), 70 to 75 percent in the United Kingdom, Canada, and the Netherlands, 66 percent in Denmark, and 58 percent in Switzerland.³⁷

As a further experiment, Table 9 shows the returns on artificial diversified portfolios holding 50 percent equity and 50 percent bonds between 1967 and 1990, implicitly assuming quantitative portfolio restrictions are replaced by "prudent man" rules. As noted, equity holdings are generally below 50 percent (Table 5). Compared with Table 6, the results confirm that returns may be boosted by raising the share of equity, at some cost in terms of risk, although the estimates suggest that risk is mitigated by international diversification.³⁸ Only for the United Kingdom are returns consistently below those actually obtained; for the United States there is little difference, since the portfolio approximates that actually held by United States funds (Table 6). Several of the countries that fall below a

TABLE 9 Artificial Diversified Portfolios: Mean (and Standard Deviation) of Real Total Return, 1967-90 (percent - domestic currency)

Country	Domestic ¹	Domestic - Estimated Portfolio Return ²	Domestic and International ³	Domestic and International - Estimated Portfolio Return ²	Domestic and International - Average Earnings
United States	2.1 (12.9)	-0.1	2.8 (12.5)	+0.6	+2.6
United Kingdom	3.8 (14.8)	-2.0	3.7 (14.1)	-2.1	+1.1
Germany	6.1 (15.2)	+1.0	6.2 (13.4)	+1.1	+2.2
Japan	5.5 (15.5)	+1.5	5.3 (14.3)	+1.3	+1.1
Canada	2.2 (11.2)	+0.6	2.2 (10.8)	+0.6	+0.5
Netherlands	4.5 (17.0)	+0.5	4.2 (15.2)	+0.2	+1.6
Sweden	3.8 (13.5)	+3.6	3.7 (15.2)	+3.5	+2.2
Switzerland	2.0 (15.4)	+0.5	2.0 (12.3)	+0.5	+0.1
Denmark	5.3 (18.9)	+1.7	4.6 (13.4)	+1.0	+1.8
Australia	2.7 (16.1)	-1.1	2.8 (15.1)	+1.2	+2.1
France	5.2 (18.0)	-	4.9 (15.9)	-	+0.9
Italy	1.9 (22.1)	-	2.0 (18.7)	-	-1.1

Source: Davis (1994a).

Note: ¹50% domestic equity, 50% domestic bonds.

²From Table 7.

³40% domestic equity, 40% domestic bonds, 10% foreign equity, 10% foreign bonds.

satisfactory return on assets relative to average earnings (such as Japan, Australia, Denmark, and Sweden) would have found providing funded pensions less costly (absolutely and relative to pay-as-you-go) if they had followed such a rule. German funds would also have boosted their headroom considerably.

In summary, this section suggests that support be given to a "prudent man" rule, backed by flexible accounting and funding standards (perhaps, as in the United Kingdom, focusing on income rather than market value) to permit holding of a proportion, varying with the maturity of the fund, of high return but volatile assets. (It is not, of course, implied that a 100 percent equity portfolio would be anything but *prudent*). Since foreign investment is shown invariably to reduce risk, albeit often with a slight reduction in return, limits on such holding are suggested to be particularly counterproductive. Meanwhile, decentralized fund management may be superior to centralized, if the poor performance of the Swedish ATP fund can be generalized.

Conclusion

The diversity of experience in the external funding of private pensions has been shown to be influenced particularly strongly by social security and fiscal regulations, as well as by funding regulations per se. A generous

and compulsory social security system across a broad range of incomes can effectively "crowd out" private pensions, while discriminatory tax treatment can discourage external funding. Such structures would seem to be counterproductive in the light of the higher return to funding relative to pay-as-you-go both in a steady state and given the aging of the population and the more adverse side effects of pay-as-you-go on economic efficiency, as well as the greater risk and danger of inefficient investment from "booking." An optimal system would probably include only a minimal pay-as-you-go sector catering for basic needs and for alleviation of poverty, with the bulk of earnings replacement being provided by private externally-funded plans. Only Australia (and Chile) approximate this at present.

Meanwhile the efficiency with which pension funds provide pensions is influenced by regulations such as those of minimum funding and of portfolios, as well as features such as taxation, accounting standards, and the competitiveness of fund management. In effect, these prevent the fund from reaching an optimal trade-off between risk and return. I would suggest that streamlining such regulations so as to allow "prudent man" rules and flexible funding limits may increase coverage of private pensions by increasing their attractiveness to the sponsor or member or, in the case of compulsory provision, reduce the cost of providing a given level of private pensions in terms of competitiveness. Other issues that arise in this context include the appropriate degree of risk for defined contribution funds as opposed to defined benefit funds, and conversely, the potential for excessively conservative investment strategies when employees are influential in fund management. Given the existing size and importance of pension funds in the countries studied, as well as buoyant prospects for development of occupational funded pensions in both European Union and developing countries, these issues are of considerable importance.

I would like to thank Zvi Bodie, Olivia Mitchell, and participants at the 1994 Pension Research Council conference for helpful comments. The views expressed are my own and not those of the Bank of England, the Financial Markets Group, or the EMI.

Notes

¹This chapter draws on Davis (1994a).

²In effect, younger members may accept occasional shortfalls in the coverage of their pension rights while older workers continue to receive their pensions.

³The implicit assumption is that workers receive "actuarially fair" pensions proportionate to their contributions; in practice redistribution is common under pay-as-you-go.

⁴This discussion abstracts from distributional considerations. As noted below, private funding tends to benefit those who have a sufficiently high income to save during their working lives, whereas pay-as-you-go lends itself more readily to redistribution.

⁵Conceptually, the discussion in this section applies to benefits obtainable for "defined contributions," but for defined benefit schemes the reasoning is similar. "Defined benefit" contribution rates under pay-as-you-go for a given population, replacement rate (i.e., pension relative to final salary), and a pension indexed to wages depend only on the dependency ratio. Under full funding, the contribution rate to obtain a similar replacement rate depends on the difference between the growth rate of wages (which determines the pension needed for a given replacement rate) and the return on assets, as well as the passivity ratio. For a given population and population distribution, if the dependency ratio equals the passivity ratio, the schemes will be equivalent if the growth rate of wages equals the return on assets.

⁶An interest rate in excess of the economic growth rate is a prediction of most theories of economic growth, given a positive rate of time preference (i.e., that consumers require compensation for postponing consumption).

⁷In practice, average earnings growth may increase and the rate of return to capital fall during the process of population aging, thus constituting a partial offset.

⁸That is, the United States, the United Kingdom, Canada, France, Italy, Germany, and Japan.

⁹This risk is less important for defined benefit funds, as long as profitability of firms is unaffected. Investment risk *plus* a collapse of profitability are needed to threaten occupational defined benefit funds.

¹⁰In line with this suggestion, Blanchard (1993) has observed a decline in the premium on equity relative to debt, and attributes this to institutionalization. There remains a possibility that a switch to funding at a global scale could depress the world rate of return.

¹¹Even in a closed economy, this point should not be exaggerated. At least ownership of the capital stock may be a more secure basis for retirement than the willingness of existing workers to pay pensions as in pay-as-you-go schemes. If, as suggested, funding raises saving relative to pay-as-you-go, then capital formation and growth will be higher with funding and the national income from which pensions must be paid correspondingly boosted.

¹²In the model of Merton (1983), all uncertainty regarding a worker's marginal product derives from the aggregate production function, with no individual-specific effects. Labor income is assumed to be perfectly correlated across individuals. Workers save for retirement via individual saving (or defined contribution pension funds). Since human capital cannot be traded, there is economic inefficiency, as individuals hold too much human capital early in their lives relative to physical capital, while at retirement all wealth is invested in physical capital. These rigidities prevent optimal sharing of factor share risk (i.e., relating to the division of GDP between wages and profits), which might, for example, derive from unforeseeable long-term secular trends related to the degree of union militancy or technological developments. Merton shows that a pay-as-you-go social security scheme is welfare-improving in this framework.

¹³This, in practice, depends on the benefit formula; it is not the case if benefits are based on career-average revalued earnings.

¹⁴However, note that the trust fund invests solely in government bonds, which has ambiguous consequences for benefit security.

¹⁵Adequate provision of unfunded pensions is likely to be particularly difficult for declining industries, as the worker/pensioner ratio falls.

¹⁶Projections of inflation will be needed when benefit indexation is a contractual or legal obligation.

¹⁷This is guaranteed in the United Kingdom and the Netherlands.

¹⁸This is a legal obligation in Germany and Sweden and will soon be in the United Kingdom; it is generally provided in Switzerland and the Netherlands.

¹⁹The facility with which funds of declining industries in the United Kingdom funded on a PBO/IBO basis (such as coal mining and railways) coped with maturity are a case in point.

²⁰Given the cost of this measure, a decline of the company pension fund sector is predicted, but there is little evidence of this to date.

²¹Note that only long-maturity bonds will increase in price so as precisely to offset the increase in liabilities.

²²These limits do not, of course, apply to reserve funding systems such as those common in Germany and Japan.

²³Technically, portfolio restrictions are likely to prevent managers from reaching the frontier of efficient portfolios, which indicates where return is maximized for a given risk.

²⁴For example, by closing down all alternative investment strategies such as international diversification.

²⁵One way to avoid the regulations on equities and foreign investment is reportedly to invest via special security funds, whose investments are not subject to restriction.

²⁶The precise wording is that fund money must be invested "for the sole benefit of the beneficiaries" and investments must be made with "the care, skill, prudence and diligence under the circumstances then prevailing that a prudent man acting in a like capacity and familiar with such matters would use in the conduct of an enterprise of a like character and with like aims."

²⁷There is no explicit prudent man rule, but the duty of prudence to trustees can be interpreted as requiring diversification.

²⁸Their analysis has been criticized for assuming that individuals realize capital gains on equities each year, which seems unlikely to be the case.

²⁹This approach, while being fully consistent with a prudent man rule, highlights the high risk nature of book reserve or pay-as-you-go provision for private firms.

³⁰Whether holding equities does help in this sense is a matter of some controversy in the literature. As noted by Tepper (1992), if equity returns are independent from one period to the next, there remains a risk that a series of returns at the tail of the distribution will occur, generating returns far lower than would be possible with bonds. But if returns tend to revert to a mean level, for example due to macroeconomic policy or even self-correcting tendencies in the economy, they will act to prevent longer-term shortfall risk.

Such insights are formalized in so-called asset-liability modeling exercises — an actuarial technique that involves comparing forecasts of liabilities in coming years with asset returns under various scenarios; this shows both risks to the employer and possible changes to portfolio strategy that may be warranted (Blake 1992).

³¹Also according to Wyatt (1993) there are unofficial tolerance limits for equity exposure of 30 percent, imposed by the supervisors.

³²This point indicates the inflexibility of company-based defined contribution plans seeking to cater both for risk-seeking young workers and risk-averse older

ones. Some funds in Australia overcome this by offering four separate funds at different levels of risk.

³⁵Research by Mitchell (1994) suggests that employees' representation reduces returns even for *defined benefit* funds, although in principle the employer is bearing the risk.

³⁶Annual holding period returns on marketable fixed rate instruments are used, as in Table 7, instead of redemption yields. In my view, the holding period returns are the more relevant measure for an ongoing portfolio, since they take full account of losses or gains due to interest rate changes (although other assumptions regarding holding periods could also be made).

³⁷The return in the United States and Canada is considerably higher if the sample begins in 1971 (4.0 percent and 2.7 percent respectively).

³⁸Knox (1993) shows that returns on a fund based on 12 percent contributions with 45 years of payment invested, like current Australian pension funds, will obtain an average replacement rate of 61 percent, but the range of statistical probability of returns based on asset volatility in the past is between 35 percent and 96 percent.

³⁹Employees may not contribute to book reserves or support funds.

⁴⁰The table only shows international diversification up to 20 percent of the portfolio, holding bonds and equities for the "rest of the world" in proportion to global portfolio weights in the 1980s. A full "global portfolio," where domestic holdings are reduced to their weight in the global index, would imply 95 percent international investment for the small countries and over 50 percent even for the United States. Similar calculations for such a strategy (not shown in detail), with again 50 percent bonds and 50 percent equities, again shows lower risk, although the change in return may be in either direction.

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Comments by Marshall E. Blume

E. Philip Davis's chapter has two major themes. First, funded pension plans are generally to be preferred to pay-as-you-go plans. Second, state-supported pension plans, generally pay-as-you-go plans, "crowd out" privately funded pension plans. A related theme is that the investment strategies of private pension funds are often less than optimal to obtain the best possible returns due in part to restrictive government regulations and excessive risk aversion on the part of those making the investment decisions.

The chapter begins with Davis's reasoning for preferring funded pension plans over pay-as-you-go plans. The rest of the chapter contains comparisons across a number of countries of the relative sizes of funded pension plans and social security programs, the taxation and regulation of pension plans, and the asset allocations and returns of the portfolios of funded pension plans. The data presented in these comparisons are extremely interesting, and I recommend that they be carefully examined.

Let us now turn to the first major theme, that funded pension plans are generally preferable to pay-as-you-go plans. The arguments that the author puts forward read almost like an apology, in the classical sense of an explanation or a justification. Davis gives an extensive listing of favorable features of funded pension plans and a shorter listing of favorable features of pay-as-you-go plans. On the basis of these listings, he concludes that "an optimal [pension] system would probably include only a minimal pay-as-you-go sector catering for basic needs and for alleviation of poverty, with the bulk of earnings replacement being provided by private externally funded plans."

Davis may well be right in reaching this conclusion, but at least to this commentator, the arguments put forward in reaching the conclusion are not always persuasive and not as precise as they could be.

Davis's first reason for funding is that funding can generally provide the same level of benefits to retirees with lesser outlays than pay-as-you-go plans. Let us examine this reason in a very simple agrarian world contain-

TABLE 1 Comparing Pay-as-You-Go and Funded Plans: The Effect on the First and Succeeding Generations

Status	Period		
	1	2	3
Work Status			
Original Farmer	Works	Retires	
Son		Works	Retires
Grandson			Works
Income			
Original Farmer	1,000		
Son		1,000	
Grandson			1,000
Pay-as-you-go Plan Pension Contributions			
Original Farmer	0		
Son		300	
Grandson			300
Consumption			
Original Farmer	1,000	300	
Son		700	300
Grandson			700
Funded Plan Pension Contributions			
Original Farmer	200		
Son		200	
Grandson			200
Funded Plan Consumption			
Original Farmer	800	300	
Son		800	300
Grandson			800

ing only a farmer and his son, who will take over the land when the father retires. The father will die when his son retires, and his grandson will then take over the farm. After the first generation, there will as a consequence always be one person working the farm and one retired person. As to finances, the farmer makes US\$ 1,000 a year from farming the land, and this income will remain unchanged into the future. There is a foreign bank that will accept deposits and that pays a positive interest rate.

The original farmer decides to set up a pension plan to provide 30 percent of his yearly income as a retirement benefit, or US\$ 300, and is considering a pay-as-you-go plan or a funded plan. If he chose a pay-as-you-go plan, he will be able to consume US\$ 1,000 a year during his working life and at retirement will receive US\$ 300 from his son, leaving his son and all future generations with US\$ 700 for consumption (Table 1).

If he chose a funded plan instead, he will have to save a portion of his income each year. Because he can invest these savings with a bank, he may have to save only US\$ 200 to be able to have a retirement benefit

of US\$ 300 a year, which leaves during his working life US\$ 800 a year for consumption. Under this plan, succeeding generations will have US\$ 800 for consumption during their working career and US\$ 300 for retirement.

It is true that in this example, the funded plan, not taking into account the time value of money, has a lower total outlay than does the pay-as-you-go plan. But does this mean that the funded plan is better? It depends upon the original farmer's trade-off between his utility of consumption and his concern for the utility of future generations. Thus the comparison of total benefits to total outlays under the two plans is not adequate to determine which plan is preferable.

Davis then turns to a political argument to justify funded plans over pay-as-you-go plans. He points out correctly that, if the G-7 countries maintain the same benefits for their pay-as-you-go plans in the future as today, these plans will require a very much greater proportion of GDP than they do today. This greater demand on GDP could lead to "political risks." But the author has not established that substituting funded plans for pay-as-you-go plans is the correct policy response to this political issue; perhaps, the benefits should be reduced.

Davis then raises but does not fully develop the notion that current savings rates are too low. He suggests that, under certain "plausible" conditions, the substitution of funded plans for pay-as-you-go plans will increase savings rates and, if savings are invested properly, future economic growth. Again, underlying this argument is a trade-off between the utility of the current generation and future generations. But even if policymakers thought that the current savings rates were too low, there are other ways of increasing savings, such as reducing the corporate tax rate.

The second major premise of the chapter is that pay-as-you-go pension plans "crowd out" funded plans. There are some good theoretical reasons for this contention, and the author presents them. The empirical evidence supporting this argument is weak. Table 3 presents the replacement rates of social security by country, and Table 2 contains measures of pension assets to GDP by country. These series should be inversely related following the author's theory, but there does not appear to be such a relation at least from a visual examination of the data.

A secondary thesis of the chapter is that pension funds should put more money into equities. This is a very commonly held view, popularized by McGeorge Bundy of the Ford Foundation in the mid-1960s, and is based upon the empirical observation that in the last 50 or so years the return on equities has exceeded the return of other commonly held financial assets. Fifty years is a long time, and expectations should be borne out. This is almost like a stochastic dominance argument—something that was addressed in detail in the seventies by researchers such as Robert

Merton and Paul Samuelson. What happens is that the probability of doing worse with equities decreases with time, but for any finite horizon is not zero. Thus, risk aversion comes into play.

Over even long horizons, the returns realized on the more risky assets can be less than on less risky assets; that is what makes them risky. Indeed, Jeremy Siegel (1992) found that in 16.9 percent of the decades over the 1926 to 1990 period, the returns on long-term governments bonds exceeded the returns on stocks, and there were even 20-year periods when returns on long-term governments exceeded the returns on stocks. Thus, Davis has not demonstrated that every pension fund should necessarily accept more risk and the corresponding greater expected returns. In recent history, accepting this greater risk would have been a good strategy, but there is no guarantee that the strategy will work over the next 10 or even 20 years.

Despite these objections, however, overall I found the chapter provocative. The comparison of pension plans across countries contains a wealth of interesting data.