

Pension Finance

David Blake



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For M.L.T.

Contents

Preface		xv
1	Investment Assets Held by Pension Funds	1
1.1	Money-market securities	1
1.2	Bonds and loans	5
1.3	Shares	10
1.4	Collective investment vehicles	13
1.4.1	Unit trusts and open-ended investment vehicles	13
1.4.2	Investment trusts	15
1.4.3	Insurance products	16
1.4.4	Exchange-traded funds and guaranteed growth funds	17
1.5	Real assets	18
1.5.1	Property	18
1.5.2	Land	21
1.5.3	Collectibles	21
1.6	Derivatives	22
1.6.1	Forwards and futures	22
1.6.2	Options, warrants and convertibles	26
1.6.3	Swaps	32
1.6.4	Forward-rate agreements	36
1.6.5	Synthetic securities	37
1.7	Alternative investments	37
1.7.1	Public market strategies	38
1.7.2	Private market or private equity strategies	44
1.7.3	Natural resources	47
1.8	Socially responsible investment	48
1.9	Global custody	49

1.10	Different asset characteristics and uses	51
1.10.1	Asset characteristics	51
1.10.2	Asset uses	52
1.11	Conclusions	61
	Questions	61
	Appendix: Standard deviation, value-at-risk and correlation	62
	References	64
2	Personal Finance: The Allocation of Personal Wealth to Different Asset Classes	67
2.1	Introduction	67
2.2	Modelling the allocation of personal wealth to different asset classes	70
2.3	Conclusions	74
	Questions	75
	References	76
3	Corporate Pension Finance	77
3.1	The valuation of pension liabilities: differences between the actuarial and economic approaches	77
3.2	Pensions and the company balance sheet: differences between the accounting and economic approaches	79
3.3	The asset allocation of the pension fund	83
3.3.1	A fully funded pension fund	84
3.3.2	An underfunded pension fund	87
3.3.3	A pension fund with liabilities linked to earnings growth	87
3.3.4	An insured pension fund	88
3.4	The relationship between the pension fund and the sponsoring company's profitability, credit rating and share price	91
3.4.1	Profitability	91
3.4.2	Credit rating	92
3.4.3	Share price	93
3.5	Conclusions	96
	Questions	98
	References	99

4	Defined Contribution Pension Schemes – The Accumulation Phase	101
4.1	The optimal design of DC schemes during the accumulation phase	101
4.1.1	Stochastic pension scheme design	102
4.1.2	Risk factors	104
4.1.3	Control variables	111
4.1.4	Simulation output	114
4.1.5	Choosing the optimal asset-allocation strategy	122
4.1.6	The trade-off between risk and contribution rates	123
4.2	Charges	124
4.2.1	Types of charges	124
4.2.2	Reduction in yield	125
4.2.3	Reduction in contributions	127
4.2.4	Changing charging structures and the impact of hidden charges	130
4.3	Persistency	132
4.3.1	Persistency rates	132
4.3.2	Adjusting reported charges for policy lapses	133
4.4	Conclusions	134
	Questions	135
	Appendix: Charges	137
	A.1 Reduction in yield	138
	A.2 Reduction in contributions	139
	A.3 Adjusting for lapse rates	140
	References	142
5	Defined Contribution Pension Schemes – The Distribution Phase	145
5.1	Annuities	145
5.1.1	Purchase arrangements	146
5.1.2	Coverage	146
5.1.3	Variations	147
5.1.4	Other features	147
5.1.5	Payment terms	148
5.1.6	Decomposition of annuity charges	152
5.1.7	Mortality drag	159

5.2	The optimal design of DC schemes during the distribution phase	161
5.2.1	Alternative distribution programmes	162
5.2.2	Stochastic pension scheme design	166
5.2.3	Simulation output	174
5.2.4	Impact of poor health	183
5.2.5	The annuitisation decision	183
5.3	Conclusions	187
	Questions	188
	References	189
6	Defined Benefit Pension Schemes	191
6.1	Types of defined benefit scheme	191
6.2	Defined benefit liabilities	194
6.3	The option composition of pension schemes	196
6.4	Valuing the options	199
6.5	The pension scheme preferences of members, sponsors and fund managers	206
6.6	Conclusions	208
	Questions	209
	References	209
7	Pension Fund Management	211
7.1	The role of a pension fund	211
7.2	The functions of a pension fund manager	217
7.3	Fund management styles	218
7.4	Different fund management strategies for defined benefit and defined contribution schemes	220
7.5	The fund manager's relationship with the trustees	224
7.5.1	Determining the trustees' objectives and constraints	224
7.5.2	Determining the trustees' benchmark portfolio	225
7.5.3	Investment-risk budgeting	231
7.6	Passive fund management	233
7.7	Active fund management	237
7.7.1	Active share-fund management	238
7.7.2	Active bond-fund management	243
7.7.3	Mixed active-passive fund management	248
7.8	Asset-liability management	250
7.8.1	Managing surplus risk	253

7.8.2	Managing contribution risk	259
7.8.3	Key ALM strategies	260
7.9	The Myners Review of institutional investment	274
7.10	Conclusions	280
	Questions	281
	Appendix 7A: Investment-objectives questionnaire	283
	Appendix 7B: Derivation of the optimal contribution rate and asset allocation in a defined benefit pension fund	287
	References	290
8	Pension Fund Performance Measurement and Attribution	293
8.1	<i>Ex post</i> returns	293
8.2	Benchmarks of comparison for actively managed funds	296
8.3	Risk-adjusted measures of portfolio performance for actively managed funds	299
8.3.1	Performance measures based on risk-adjusted excess returns	300
8.3.2	Performance measures based on alpha	302
8.4	Performance attribution for actively managed funds	305
8.5	Liability-driven performance attribution	310
8.6	Realised investment performance	314
8.6.1	Investment performance of DC funds	314
8.6.2	The investment performance of DB funds	317
8.7	Performance-related fund management fees	324
8.8	How frequently should fund managers be assessed?	326
8.9	Conclusions	328
	Questions	329
	Appendix: Deriving the power function	330
	References	332
9	Risk Management in Pension Funds	335
9.1	The objective of hedging	335
9.2	Hedging with futures	336
9.2.1	Hedging with stock-index futures	338
9.2.2	Hedging with bond futures	340
9.2.3	Hedging with currency futures	343

9.3	Hedging with options	344
9.3.1	Hedging with individual stock options	344
9.3.2	Hedging with stock-index options	350
9.3.3	Hedging with bond options	351
9.3.4	Hedging with currency options	351
9.4	Hedging with swaps	352
9.5	Hedging longevity risk	354
9.5.1	Longevity risk	354
9.5.2	A new hedging instrument: longevity (or survivor) bonds	358
9.5.3	The implications of longevity bonds	358
9.5.4	Mortality-linked derivatives	362
9.6	Conclusions	363
	Questions	363
	References	364
10	Pension Fund Insurance	367
10.1	The Pension Protection Fund (PPF)	367
10.2	What the Pension Protection Fund can learn from other financial institutions and compensation schemes	368
10.2.1	The financial regulation of banks	369
10.2.2	The financial regulation of life assurers	374
10.2.3	Financial Services Compensation Scheme	382
10.2.4	The financial regulation of pension funds	383
10.2.5	Pension Benefit Guaranty Corporation (PBGC)	388
10.3	The risks facing the PPF	390
10.3.1	Moral hazard	391
10.3.2	Adverse selection: bad drives out good	392
10.3.3	Systemic risk	392
10.3.4	Political risk	394
10.4	Dealing with these risks	394
10.4.1	An equity claim against the sponsoring company	395
10.4.2	A maximum payout	395
10.4.3	Risk-based premiums linked to the level of underfunding	395
10.4.4	A funding standard for schemes	396

10.4.5	Close supervision and the public exposure of companies that underfund their schemes	397
10.4.6	Comment	398
10.5	Conclusions	398
	Questions	399
	Appendix: The Marcus (1987) and Vanderhei (1990) Models	400
	References	408

Appendix A: Financial Arithmetic **411**

A.1	Future values: single payments	411
A.1.1	Simple interest	411
A.1.2	Compound interest: annual compounding	412
A.1.3	Compound interest: more frequent compounding	412
A.1.4	Flat and effective rates of interest	414
A.2	Present values: single payments	414
A.2.1	Present values: annual discounting	415
A.2.2	Present values: more frequent discounting	415
A.3	Future values: multiple payments	416
A.3.1	Irregular payments	416
A.3.2	Regular payments	417
A.4	Present values: multiple payments	418
A.4.1	Irregular payments	418
A.4.2	Regular payments: annual payments with annual discounting	419
A.4.3	Perpetuities	419
A.5	Rates of return	420
A.5.1	Single-period rate of return	420
A.5.2	Internal rate of return or money-weighted rate of return	421
A.5.3	Time-weighted rate of return or geometric mean rate of return	423

Appendix B: Yields and Yields Curves **425**

B.1	Yields	425
B.1.1	Current yield	425
B.1.2	Yield to maturity	425
B.2	Yield curves	427
B.2.1	The yield to maturity yield curve	427

B.2.2	The coupon yield curve	428
B.2.3	The par (or swap) yield curve	429
B.2.4	The spot (or zero-coupon) yield curve	430
B.2.5	The forward yield curve	433
B.2.6	The annuity yield curve	436
B.2.7	Rolling yield curve	437
Appendix C: Duration and Convexity		439
C.1	Duration	439
C.2	Convexity	446
Index		451

Preface

With many countries in the world facing an existing or looming pension crisis, there could not be a more opportune moment to launch a new series of books on pensions. Countries around the globe are fast waking up to the fact that they have a major challenge on their hands with their state-run pension schemes. The combination of a rapidly changing population and fertility rates well below replacement rates has led to a striking increase in the dependency ratios in many countries. At the same time, many private sector schemes are facing severe funding difficulties as a result of poor stock market returns, falling interest rates and increasing longevity.

Pensions problems are becoming highly complex, and although there are many people with expertise in pensions, their expertise tends to be one dimensional. They might be a pension lawyer with a deep understanding of pension rules and regulations, but their understanding of the role of pensions in lifecycle financial planning might be poor. They might be a pension actuary with an indepth knowledge of how to calculate pension liabilities in a number of different ways, but their understanding of the financial risks in pension funds might be inadequate. They might be a skilled investment manager, but have little comprehension of how pension liabilities respond to macroeconomic or demographic shocks. They might be a pension accountant familiar with all the global pension accounting standards, but have little understanding of how these standards affect corporate dividend and investment policy. All these professions might know very little about the social dimension of pensions in their own country or about the pensions systems operating in other countries.

What is clearly needed is a well-trained group of professionals capable of providing appropriate and sustainable pensions solutions to complex

pension problems. In short, there is a need for a new class of professional, the *pension scientist*. This is someone who can competently deal with the multi-disciplinary nature of pension problems. The development of a common body of knowledge is the first step in this process.

The Pensions Institute was started by economists. But we soon became aware of the limits of our knowledge in the pensions field. We found that actuaries, accountants and lawyers were talking about pensions in a language that was at the same time both strange and familiar. It was strange because of the new terms they used. It was also strange because terms familiar to us had subtly different meanings to them. For us to be able to deepen our understanding of the complexities of pensions, we needed to begin to understand the way that these different professional groups thought about pensions.

In the process of doing this, we realised just how multi-disciplinary a thorough understanding of pensions needs to be. To use a mountaineering analogy, we felt as though we were talking to different groups of skilled mountaineers who had climbed different sides of the same mountain. While each group was an expert at climbing its own side, they knew very little about the other sides of the mountain. We felt that was time to look at the pensions mountain from all sides.

That is why at the Pensions Institute we have started to write a series of books that will look at pensions from each of the different side of the pensions mountain. The first two books in the series are:

- Pension economics
- Pension finance

In due course we hope to have the following additional books:

- Actuarial principles for pensions
- Pension accounting
- Pension law
- Comparative pensions systems and regulation
- Social policy and ageing populations

These books are aimed at those currently working as, or seeking to work as:

- a pension regulator
- a pension policymaker
- a pension scheme manager
- an employee benefit consultant

- a client relationship manager
- a pension lawyer
- a pension scheme auditor
- a pension accountant
- an investment manager
- an investment consultant
- a pension economist

David Blake, Director of the Pensions Institute and Professor of Pension Economics at Cass Business School, London

Investment Assets

Held by Pension Funds

In this chapter we consider the full range of assets in which a pension fund might consider investing. These comprise financial assets (principally money-market securities, bonds and loans, shares and collective investment vehicles), real assets, derivatives and alternative investments. We also examine how these assets are valued or priced.¹ Finally, we review the different characteristics of the different assets and how the assets are used in pension fund portfolios.

1.1 MONEY-MARKET SECURITIES

Money-market securities are short-term instruments with maturities of less than one year. There are two main classes: those that are quoted on a *yield basis* and those that are quoted on a *discount basis*.

The most important examples of money-market securities that are quoted on a yield basis are money-market deposits and negotiable certificates of deposit. Such instruments are always issued at par. *Money-market deposits* are fixed-interest, fixed-term deposits of up to one year with banks. The deposits can be for the following terms: overnight, 1 week, or 1, 2, 3, 4, 5, 6, 9 or 12 months. They are not negotiable, so cannot be liquidated before maturity. The interest rates on the deposits are fixed for the term and are related to LIBID (the London inter-bank bid rate) of the same term. The interest and capital are paid in one lump sum on the maturity day.

Negotiable certificates of deposit (CDs) are receipts from banks for deposits that have been made with them. The deposits themselves carry a fixed interest rate related to LIBID and have a fixed term to maturity, so cannot be withdrawn before maturity. But the certificates or receipts on those deposits can be traded in a secondary market; that is, they are negotiable. CDs are, therefore, very similar to negotiable money-market

¹ Further details of the pricing of the instruments considered below can be found in Blake (2000).

deposits, although the yields are about 0.25% below the equivalent-term deposit rates because of the added benefit of liquidity. The maturities of CDs are generally between one and three months, although some CDs have maturities in excess of one year (e.g. five years). Interest is paid at maturity, except for CDs lasting longer than a year, in which case interest is paid annually. While most CDs are fixed-rate, some have variable interest rates. For example, a 6-month CD could have a 30-day roll-over; this means that the interest rate on the CD is related to 6-month LIBID and is fixed for 30 days, and it will change every 30 days if LIBID has changed. Pension funds hold CDs in sterling and the major overseas currencies.

Another money-market security quoted on a yield basis is a *repurchase agreement* (or repo). This involves lending cash using a government bond as collateral for a specified term; that is, the bond is sold for cash with an agreement to repurchase it at a later date. The transaction from the counterparty's position is known as a *reverse* (or reverse repo).

Treasury bills, local-authority bills, bills of exchange, bankers' acceptances and commercial paper are the most important examples of money-market securities that are quoted on a discount basis; that is, they are sold on the basis of a discount to par.

Treasury bills (TBs) are short-term UK Government IOUs of 3 months' duration. On maturity the holder is paid the par value of the bill from the National Loans Fund. *Local-authority bills* are similar to TBs but are issued by local authorities. *Bills of exchange* (or *trade bills* or *commercial bills*) are also similar to TBs but are issued by private companies against the sale of goods. They are used to finance trade in the short term.

Bankers' acceptances are written promises issued by borrowers to banks to repay borrowed funds. The lending bank lends funds and in return accepts the bankers' acceptance. The acceptance is negotiable and can be sold in a secondary market. The investor who buys the acceptance can collect the loan on the day that repayment is due. If the borrower should default, the investor has legal recourse to the bank that made the first acceptance.

Commercial paper (CP) comprises unsecured promissory notes issued by large corporations. The notes are not backed by any collateral, rather, they rely on the high credit rating of the issuing corporation. Such corporations also tend to maintain credit lines with their banks sufficient to repay all their outstanding commercial paper. CP is therefore a quickly and easily arranged alternative to a bank loan. The sterling commercial-paper market began in 1986. *Medium-term notes (MTNs)* are unsecured

notes with durations of between 9 months and 40 years whose issuance is underwritten by an investment bank.

All these securities are sold at a discount to their par value. On maturity the investor receives the par value. Explicit interest is not paid on discount instruments. However, interest is reflected implicitly in the difference between the discounted issue price and the par value received at maturity.

Money-market funds are pooled portfolios of money-market instruments offering safety and liquidity combined with yield. The instruments must be at least A1/P1 quality, have a weighted average maturity of no more than 60 days, have no more than 10% invested in the instruments of any one issuer and no more than 20% in repurchase agreements, and have daily dealing and same-day settlement. There must also be a complete separation between fund manager and custodian.

Pension fund trustees are monitoring the returns from cash more intently than in the past: it is no longer acceptable for administrators and fund managers to simply leave surplus cash, arising from contributions and dividends etc., in a bank account with the custodian.

We will illustrate the valuation or pricing of money-market instruments, using TBs as an example. TBs are quoted on the basis of a *discount rate*. The issue price of TBs is determined as the difference between the face value and the *discount*. Given the discount rate, d , the discount is found as follows:

$$\text{Discount} = 100 \times d \times (\text{Nim}/365) \quad (1.1)$$

where *Nim* is the number of days between issue and maturity. From this we can find the issue price as:

$$\begin{aligned} P^{\text{TB}} &= 100 - \text{Discount} \\ &= 100 \times \left[1 - d \left(\frac{\text{Nim}}{365} \right) \right] \end{aligned} \quad (1.2)$$

If we know that the discount rate on a 91-day £100 TB is 10%, then we can calculate the issue price as:

$$\begin{aligned} P^{\text{TB}} &= 100 \times \left[1 - 0.10 \left(\frac{91}{365} \right) \right] \\ &= 97.51 \end{aligned}$$

implying a discount of £2.49.

The *equivalent yield*, r , on the TB is given by:

$$\begin{aligned} r &= \frac{\text{Discount}}{P^{\text{TB}}} \times \frac{365}{\text{Nim}} \\ &= \frac{d}{1 - d(\text{Nim}/365)} \end{aligned} \quad (1.3)$$

For the TB given here:

$$\begin{aligned} r &= \frac{0.10}{1 - 0.10(91/365)} \\ &= 0.1026 \quad (10.26\%) \end{aligned}$$

The alternative way of pricing the TB is to substitute the yield into a standard present value formula²:

$$\begin{aligned} P^{\text{TB}} &= \frac{100}{[1 + r(\text{Nim}/365)]} \\ &= \frac{100}{[1 + 0.1026(91/365)]} \\ &= 97.51. \end{aligned} \quad (1.4)$$

This means that £97.51 is the present value of £100 to be received in 91 days' time when the yield is 10.26%. This is because if we invested £97.51 for 91 days when the annual interest rate is 10.26%, we would end up with exactly £100.

The important point to note is that with all discount securities the yield is always greater than the discount rate; i.e. $r > d$. This follows precisely because the securities trade at a discount: the return of £2.49 is achieved with an investment of only £97.51, not £100; the yield is based on £97.51, whereas the discount is based on £100.

Equation (1.4) is an example of a *discounted cash flow pricing model*: the future cash flows on the security (in this case just the principal repayment on the maturity date of the Treasury bill) are discounted (using an appropriate yield or discount rate) to the current date and then summed to derive the present value of the security. The financial markets use discounted cash flow models to value securities that generate future cash flows.

² Present values are explained in Appendix A of the book.

1.2 BONDS AND LOANS

Bonds are capital-market securities and as such have maturities in excess of one year. They are negotiable debt instruments. There are many different types of bonds that can be issued. The most common type is the *straight bond*. This is a bond paying a regular (usually semi-annual), fixed coupon over a fixed period to maturity or redemption, with the return of principal (that is, the par or nominal value of the bond) on the maturity date. All other bonds will be variations on this. The frequency of coupon payments can differ between bonds: for example, some bonds pay coupons quarterly, others pay annual coupons. The coupon-payment terms can differ between bonds: for example, some bonds might not pay coupons at all (such bonds are called *zero-coupon bonds* and they sell at a *deep discount* to their par values, since all the reward from holding the bond comes in the form of capital gain rather than income); some bonds make coupon payments that change over time, for example, because they are linked to current market interest rates (*variable-rate bonds* or *floating-rate notes*), and some bonds make coupon payments only if the income generated by the firm that issued the bond is sufficient (such bonds are known as *income bonds*; unlike other bond-holders, an income-bond holder cannot put the issuing company into liquidation if a coupon payment is not paid). The redemption terms can differ between bonds: some bonds have a range of possible redemption dates (such bonds are known as *double-date bonds*) and sometimes the actual date of redemption is chosen by the issuer (*callable bonds*) and sometimes it is chosen by the holder (*puttable bonds*); some bonds have no redemption date at all, so that interest on them will be paid indefinitely (such bonds are known variously as *irredeemables*, *perpetuals* or *consols*). Some bonds have option features attached to them: callable and puttable bonds are examples of this, as are *convertible bonds* (bonds that can be converted into other types of bonds or into equity) and *bonds with warrants* attached to them.

Bonds can also be differentiated by their issuer. Most bonds in the UK are issued by the British Government in order to finance and manage the national debt; they are commonly known as *gilts*. Then there are bonds that are issued by UK public authorities, especially local authorities. Such bonds are secured on the revenues of the local authorities and are generally not guaranteed by the government. The duration of local-authority bonds is typically between one and five years, although most are for one year and are known as *yearling bonds*.

Private companies also issue bonds, known as *corporate bonds*. There are several classes of corporate bonds. *Debentures* are the most secured form of corporate debt (unlike in the USA, where debentures are unsecured corporate obligations). They are secured by either a *fixed* or a *floating charge* against the assets of the company. *Fixed-charge debentures* specify certain specific assets that are chargeable as security and the company is not permitted to dispose of them; in the event of default, the assets are sold and the proceeds used to repay the debenture-holders. *Floating-charge debentures* are secured by a general charge on all the assets of the company. The company is able to dispose freely of assets until a default crystallises the floating charge, at which time the charge fixes on the assets of the company that are not secured by a fixed charge. Fixed-charge debentures rank above floating-charge debentures in the event of default, but only floating-charge debenture-holders can ask for a company to be declared insolvent under the 1986 Insolvency Act.

Unsecured loan stocks are corporate bonds that are not secured by either a fixed or floating charge. In the event of liquidation, loan-stock holders rank beneath debenture-holders and preferential creditors (such as Her Majesty's Customs and Revenue (HMRC), formerly the Inland Revenue). *Guaranteed loan stocks* are corporate bonds that are not secured by a fixed or a floating charge but are guaranteed by a third party, typically the parent company of the issuer.

Asset-backed bonds are bonds backed by assets which generate predictable cash flows, such as rents and interest on mortgages, loans and credit cards (the process of issuing asset-backed bonds is sometimes known as *securitisation*).

Corporate bonds tend to be less liquid than gilts; partly this is because many bonds are held to maturity and hence not traded. Corporate bond price indices are provided by iBoxx, a consortium of investment banks.

Bonds can also be distinguished by the currency of denomination. Bonds issued in the UK in sterling by domestic issuers or foreign issuers are known as *domestic* and *foreign* (or *bulldog*) *bonds*, respectively. The coupons on domestic bonds are generally paid net of UK basic-rate income tax, whereas the coupons on bulldogs do not generally have tax deducted.

Bonds issued and/or traded in the UK in a currency other than sterling are known as *eurobonds* or *international bonds* (the introduction of the euro as a currency has changed the use of the term eurobond to avoid confusion with euro-denominated bonds). The first eurobond was issued in 1963 by the Italian company Autostrada with a coupon of 5.5% and

an issue size of \$15m. *Eurosterling bonds* were first issued in 1972; they have all the characteristics of eurobonds, rather than those of domestic or bulldog bonds, and the main issuers have been UK building societies seeking long-term funds to finance their home loans. The main currencies of issue of eurobonds are US dollars, euros and Japanese yen. They are generally issued by multinational companies, international agencies (such as the World Bank) and sovereign governments, and are generally unsecured. New issues are underwritten and placed with investors by a syndicate of international banks led by a *lead manager bank* (such as UBS, Merrill Lynch or JP Morgan). The size of a eurobond issue usually lies between \$50m and \$100m, with a maturity of about six or seven years. Eurobonds are principally in bearer form, transferable by delivery with no record of holder. The bond certificates have detachable coupon claim tokens and coupon payments are generally paid annually free of UK income tax and withholding tax. Eurobonds are usually listed on the London or Luxembourg stock markets.

The international bond market has been the most innovative of all bond markets in designing new types of bond, in terms of both coupon payments and redemption proceeds. For example, there are: *dual-currency bonds*, where the coupon payments are in one currency and the redemption proceeds are in another; *currency-change bonds*, where coupons are first paid in one currency and then in another; *deferred-coupon bonds*, where there is a delay in the payment of the first coupon; *multiple-coupon bonds*, where the coupon payments change over the life of the bond (although in a predetermined manner); *fixed-then-floating bonds*, where the coupons change from being fixed-rate to floating-rate; *floating-then-zero bonds*, where the bonds change from being floating-rate coupon bonds to zero-coupon bonds; and *missing-coupon bonds*, where a coupon payment is missed whenever a dividend payment on the issuing corporation's shares is missed.

With *index-linked* or *indexed bonds*, the coupon and principal are linked to a particular index, such as the retail price index (RPI), a commodity price index (for example, oil) or a stock-market index. Index-linked government bonds were first introduced in the UK in March 1981. These bonds are linked to the RPI and are therefore designed to give a constant *real* yield. Initially, only pension funds could invest in them, because pension funds had (partially) index-linked pensions to deliver to their pensioners. However, since March 1982, any investor can hold index-linked gilts. Most of the index-linked stocks that have been issued have annual coupon payments of 2% or 2.5%: this is designed to reflect

the fact that the long-run real rate of return on the UK capital stock has been between 2 and 2.5%.

Finally, bonds can be classified according to their default risk. UK Government bonds have a negligible risk of default, whereas the unsecured loan stock of private corporations has a much higher risk of default. The *default risk* (or *credit risk*) on a bond is usually assessed in the form of a *credit rating*. There are two main services providing credit ratings: Moody's and Standard & Poor's. These are shown in Table 1.1.

Table 1.1 Credit ratings on bonds

Moody's			Standard & Poor's
	<i>Investment grade</i>		
Smallest degree of risk – gilt-edged	Aaa	AAA	Highest rating: capacity to pay interest and repay capital extremely strong
High quality	Aa	AA	Strong capacity to service debt
Upper-medium grade: elements suggest possible future weakness	A	A	Strong capacity to service debt but susceptible to adverse changes in circumstances or economic conditions
Adequate security at present but may be unreliable over time; has speculative characteristics	Baa	BBB	Adequate capacity to service debt over time but adverse conditions likely to weaken capacity to service debt
	<i>Non-investment grade</i>		
Speculative: uncertain future	Ba	BB	Lowest degree of speculation
No desirable investment characteristics	B	B	Speculative
Poor standing: in default or in danger of going into default	Caa	CCC	Speculative
Highly speculative	Ca	CC	Highly speculative
Lowest rated: poor prospect of ever attaining investment grade	C	C	No interest is being paid
		D	In default
(Grades B to Aa can be modified by 1, 2 or 3)			(Grades B to AAA can be modified by '+' or '-')

Pension funds hold all these types of bonds as well as overseas bonds; that is, foreign-currency domestic bonds issued by governments, municipal corporations and companies. However, some pension funds are prevented by their trust deeds from holding bearer bonds (which have no official record of ownership) or non-investment grade bonds.

Loans are non-negotiable debt instruments. Pension funds make long-term loans to local authorities, public and private corporations and other financial institutions. One such type of loan is a *mortgage*, which is used to finance property purchase. Loans are almost always secured with collateral provided by some form of lien. The loan can be on either a fixed or variable interest-rate basis. The term of the loan can be fixed; alternatively, there might be provision for early repayment.

We will illustrate the valuation of a bond using a straight government bond. A *straight bond* is a security that promises to pay a fixed interest or coupon payment every half-year, together with the return of principal or par value of the bond at maturity. For example, 8.75% Treasury Loan Stock 1997 was issued on 9 March 1987 and made 20 coupon payments of 4.375 on 1 September and 1 March each year together with a final payment of 104.375 on 1 September 1997.

The *fair price* of such a bond is given by the discounted present value of the cash flow stream, using the market-determined discount rate for a bond of this maturity and risk class (and also using *semi-annual* discounting)³:

$$\begin{aligned}
 P_0^B &= \frac{d/2}{(1 + \frac{r}{2})} + \frac{d/2}{(1 + \frac{r}{2})^2} + \cdots + \frac{d/2}{(1 + \frac{r}{2})^{2T-1}} + \frac{d/2}{(1 + \frac{r}{2})^{2T}} \\
 &\quad + \frac{B}{(1 + \frac{r}{2})^{2T}} \\
 &= \sum_{t=1}^{2T} \frac{d/2}{(1 + \frac{r}{2})^t} + \frac{B}{(1 + \frac{r}{2})^{2T}} \\
 &= \frac{d}{r} \left[1 - \frac{1}{(1 + \frac{r}{2})^{2T}} \right] + \frac{B}{(1 + \frac{r}{2})^{2T}} \tag{1.5}
 \end{aligned}$$

where:

P_0^B = fair price of the bond
 d = annual fixed coupon payment

³ The first term in the last row of Equation (1.5) is the formula for the present value of a T -year annuity making semi-annual payments. For a derivation of the present value of an annuity making annual payments, see Appendix A of the book.

B = par value of the bond

T = number of *complete* years to maturity

r = market-determined discount rate or required rate of return on a bond with this risk class and maturity (as a proportion).

For Treasury Loan Stock 8.75% 1997, we have:

d = 8.75 per 100 nominal

B = 100

T = 9 years (i.e. the date of the calculation is 1 September 1988)

r = 9.54 (assumption).

The fair price of this bond is:

$$\begin{aligned} P_0^B &= \frac{8.75}{0.0954} \left\{ 1 - \frac{1}{\left[1 + \frac{1}{2}(0.0954)\right]^{18}} \right\} + \frac{100}{\left[1 + \frac{1}{2}(0.0954)\right]^{18}} \\ &= 52.07 + 43.23 \\ &= 95.30. \end{aligned}$$

The fair price of £95.30 is composed of the sum of the present value of the stream of coupon payments (£52.07) and the present value of the return of principal (£43.23).

The fair price of a perpetual or irredeemable bond (or consol) is given from (1.5) by setting $T = \infty$:

$$P_0^B = \frac{d}{r}. \quad (1.6)$$

1.3 SHARES

There are several types of shares that can be held in the firm, as specified in the *memorandum* and *articles of association*. The most important type is *ordinary shares* (also called *common stock* or *equity*). Ordinary shareholders are the legal owners of the firm and have voting privileges, the right to receive dividends and subscription privileges in the event of new shares being issued. When a firm is first established, a certain number of shares will be *authorised*. They will have a *par value*, which in the UK is typically 25p. Some or all of the authorised shares will be issued to shareholders (and are called *issued shares* or *called-up shares*), with an issue price which can exceed the par value but cannot be less than

the par value. Any shares that are authorised but not issued are called *unissued shares*. All the issued shares will remain *outstanding* unless they are repurchased by the firm. Large firms will have their ordinary shares listed on the stock market, while the shares of smaller firms may be unlisted.

Most UK pension funds will hold most of their equity portfolios in UK *listed* shares (i.e. shares listed on the London Stock Exchange or the Alternative Investment Market (AIM)), but in recent years funds have begun investing in *unlisted* or *unquoted* shares. In some cases the risks are great, but so are the potential long-term rewards.

Pension funds have also invested heavily abroad since the ending of exchange controls in 1979. Initially, this was in overseas domestic equity markets, but in the second half of the 1980s, an international equity market began to develop and this has been used by pension funds. More than 600 shares worldwide have a significant international market. In the UK, equities are bought and sold on trading platforms called SETS (used for large-cap securities), SEAQ (for mid-cap securities) and SEATS plus (for small-cap and AIM securities).

The other important class of shares is *preferred shares*. Preferred shares have many of the characteristics of bonds. In particular, preferred shares offer a fixed dividend, like bonds and unlike ordinary shares. But preferred shares do not guarantee to deliver the dividend payment, and a preferred dividend need not be paid if the firm's earnings are not sufficient to fund it. But if this situation arises, preferred shareholders do not have the right to have the firm declared insolvent, unlike bondholders. It is this fact that makes preference shareholders legal owners of the firm (along with ordinary shareholders). There are several types of preferred shares. With *cumulative preferred shares*, all unpaid dividend payments cumulate and are paid when earnings are sufficient, unlike standard preferred shares where a dividend is lost if it is not paid in any given year. *Participating preferred shareholders* have the right to have their dividends increased above the fixed rate if the firm makes large profits. There are also *redeemable preferred* and *convertible preferred shares* (which are convertible into equity).

The most commonly used method for valuing shares is the *dividend discount model* (another example of a discounted cash flow model). Suppose that a firm pays dividends once a year. In reality they usually make two dividend payments per year: an interim and a final dividend. Suppose also that an investor intends to buy the share, hold it for one year and then sell it at the end of the year. He expects to receive a dividend

at the end of the year as well as the price for the share at that time. In order to make this return, he will be prepared to pay the following fair price for the share today:

$$P_0^S = \frac{E(d_1)}{1+r} + \frac{E(P_1^S)}{1+r} \quad (1.7)$$

where:

P_0^S = fair price of the share

$E(d_1)$ = expected (or forecast) annual dividend per share at the end of year 1

$E(P_1^S)$ = expected (or forecast) price of the share at the end of year 1

$E(\)$ = expectations operator based on all current information (the average across all market participants)

r = market-determined discount rate or cost of capital or required rate of return on a firm with this risk class.

In (1.7), the return on the shareholding comprises an income element (d_1) and a capital gain element ($P_1^S - P_0^S$). Clearly, if the return is constant, then the higher the income element, the lower the capital gain and vice versa.

It must also be the case that:

$$E(P_1^S) = \frac{E(d_2)}{1+r} + \frac{E(P_2^S)}{1+r} \quad (1.8)$$

By substituting (1.8) into (1.7) we get:

$$P_0^S = \frac{E(d_1)}{(1+r)} + \frac{E(d_2)}{(1+r)^2} + \frac{E(P_2^S)}{(1+r)^2} \quad (1.9)$$

By repeatedly substituting equations like (1.8) for $E(P_2^S)$, $E(P_3^S)$, etc., into (1.9), we get:

$$P_0^S = \sum_{t=1}^T \frac{E(d_t)}{(1+r)^t} + \frac{E(P_T^S)}{(1+r)^T} \quad (1.10)$$

where d_t is the dividend per share in year t . As $T \rightarrow \infty$, (1.10) becomes:

$$P_0^S = \sum_{t=1}^{\infty} \frac{E(d_t)}{(1+r)^t} \quad (1.11)$$

since we assume that the second term on the right-hand side of (1.10) vanishes as $T \rightarrow \infty$, which will occur if $E(P_\infty^S)$ is finite (i.e. we rule out *speculative bubbles* of the kind that led to the dot.com boom in the late 1990s).

For preferred shares where the preferred dividend is known, (1.11) becomes:

$$P_0^S = \frac{d}{r} \quad (1.12)$$

which is identical to the formula for valuing perpetual bonds given in (1.6).

1.4 COLLECTIVE INVESTMENT VEHICLES

The following are the principal types of collective investment vehicle.

1.4.1 Unit trusts and open-ended investment vehicles

A *unit trust*, is a financial institution which invests in the securities of other companies. Its operations are subject to trust law rather than company law. A unit trust is formed by a trust deed made between the managers and the trustee. The managers operate and manage the unit trust's investments and charge a fee for doing so. The trustee, typically a bank or an insurance company, takes custody of the assets and keeps a register of unit-trust holders. A unit trust is not permitted to borrow funds to invest in securities; that is, it cannot engage in gearing.

The unit trust issues units, which represent claims on the assets of the unit trust. The units must be priced to equal the net asset value per unit in the unit trust. Unit trusts are *open-ended funds*, which means that they can create or cancel units as demand conditions permit. Unit trusts can specialise in different sectors of the market (e.g. shares or bonds, UK or Far East) or pursue different investment objectives (e.g. income, value or growth). Alternatively, a *balanced* unit trust will be widely invested across sectors and will aim to achieve high income with some capital appreciation.

In the past, authorised unit trusts could only invest in bonds and shares that were quoted on an approved market. The approved markets are the listed and unlisted securities markets of Europe, North America and the Far East. The investment powers of unit trusts were extended by the 1986 Financial Services Act. Authorised unit trusts can now

invest in property, options, futures and commodities. Previously, only unauthorised offshore unit trusts could make such investments. Unit trusts must still abide by any restrictions contained in their trust deeds. For example, typically no more than 5% of the fund can be invested in any one investment, and the fund can typically hold no more than 10% of the issued share capital of any company.

Pension funds will tend to invest in *exempt unit trusts*; that is, trusts that are exempt from both corporation tax and capital gains tax. Exempt unit trusts are a suitable investment vehicle for small pension funds, since this enables them to get the maximum benefits from diversification at the lowest cost. A particularly suitable vehicle that enables a small, or even medium-sized, fund to invest in property is the *exempt property unit trust*. Property is a 'lumpy' investment, and a unit trust is effectively the only way for a small fund to get a weighting in this sector.

Pension fund pooling vehicles (PFPVs) are unauthorised unit trusts approved by HMRC for managing the assets of both UK and overseas pension schemes. They are generally established by trust deed and require both a trustee and a custodian. They have not been authorised by the Financial Services Authority for sale to the general public, so they can be marketed to the trustees of exempt approved pension schemes, but not to individuals through personal pension schemes (Financial Services (Promotion of Unregulated Schemes) Regulations 1991)). Their purpose is to create a tax-efficient common investment fund: investors can transfer assets (other than land or buildings) into or out of a PFPV without incurring a liability to stamp duty or stamp duty reserve tax. This is not the case with standard unit or investment trusts. As gross funds, PFPVs are priced gross on a daily basis and they also have the advantage of accruing tax credits on a daily basis, which makes it easy to calculate the tax credits due to members both active and deferred. However, providers of PFPVs are not able to give investment advice. Group personal pension schemes (GPPSs) cannot be offered via PFPVs. PFPVs were designed specifically for multinational employers running defined benefit schemes.

Open-ended investment companies (OEICs) are like unit trusts but are based on company law rather than trust law. They are eligible, under the European Union UCITS Directive on collective investments in transferable securities, for sale on the continent, where trust law is unknown. The manager of an OEIC is known as an authorised corporate director (ACD).

1.4.2 Investment trusts

An *investment trust* is, like a unit trust, a financial institution which invests in the securities of other companies. But, unlike a unit trust, it is not a trust at all; rather, it is a company, subject, as with all other companies, to the provisions of the Companies Acts. In particular, the 1980 Companies Act created a new type of public company, namely the *investment company*, and an investment trust is an example of one of these, since it issues shares to the public.

Investment trusts use their capital and reserves to invest directly in the securities of other companies. A shareholder in an investment trust, therefore, has an indirect interest in the underlying portfolio of securities. As with unit trusts, different investment trusts specialise in different sectors of the market or pursue different investment objectives.

In 1965, the *split-level investment trust* was introduced with two types of equity capital, *income shares* and *capital shares* (usually in the form of *zero-dividend preference shares*), and a fixed life (often of twenty years). During the life of the investment trust, the income shares receive all the income from the underlying portfolio and the capital shares are entitled to all the assets. When the company is liquidated, the income shares are paid out at their par value and the remaining value is paid out to the capital shareholders.

The main differences between investment trusts and unit trusts are as follows. Investment trusts are *closed-end funds*; that is, they have a fixed number of shares which can only be increased through a rights issue. Investment trusts can engage in *gearing* (i.e., borrowing to buy more securities), whereas unit trusts are not allowed to borrow. The prices of shares in investment trusts are determined by market forces, as with the shares of all companies. The prices of unit-trust units, in contrast, are set equal to the net asset value of the underlying portfolio. The prices of investment-trust shares can differ quite substantially from their net asset value. Typically they trade at a substantial discount to net asset value. Unit trusts generally distribute all their income, whereas investment trusts declare dividends, which may be low enough to leave some retained earnings in the company.

Investment trusts provide an alternative to unit trusts as a vehicle for pension funds, especially small pension funds, to engage in low-cost diversification. In addition, the discount to net asset value of most investment-trust share prices makes them a cheap way of buying securities.

1.4.3 Insurance products

Insured funds (or *life funds*) are the collective investment vehicles of life offices. Insured funds are used to invest the premiums of life office defined contribution pension schemes and other life products such as endowment policies. A number of financial services companies have established life offices in order to run their DC pension schemes, including GPPSs. The main advantage of doing this was to accrue for future tax credits on a daily basis within the unit price of the insured fund. However, a life office can only make tax reclaims on a quarterly basis, less frequently than a PFPV, which can also accrue tax credits on a daily basis. On the other hand, life offices enjoy full value-added tax (VAT) exemption on fund management fees and administrative charges, which is not the case with PFPVs. The life office route allows a provider to offer a wider range of services such as guaranteed funds, life cover and annuities. Nevertheless, life offices face certain investment restrictions, for example, they are unable to invest in unquoted securities, and they can only accept pensions business from UK exempt approved schemes.

Endowment policies are a combination of an accumulation fund and a term life assurance policy. The accumulation fund has returns allocated in the form of annual bonuses, which, once awarded, cannot be removed, and a terminal bonus, which generally represents a large proportion of the total return. Insured funds and endowment policies have the protection of the Financial Services Compensation Scheme, which will pay up to 90% of the policy value in the event of an insurance company becoming insolvent.

Traded endowment policies (TEPs) have recently begun to appear in the portfolios of small pension funds. Only around one-third of endowment policies reach maturity, the rest are usually cashed in early with the result that the remaining annual bonuses, as well as the terminal value of the policy, are lost. Traded endowments are a way of capturing the terminal value by assigning the benefits to a new investor for a fee, with the new investor continuing to make the premiums until maturity. The transfer of ownership takes place at auctions or via dealers. The policies are also tradable in a tertiary market with a bid-offer spread of around 6%. The proceeds at maturity are tax free to exempt approved schemes.

An *insurance bond* operates in a very similar way, depending on its structure, to either a unit trust or a with-profit policy. In the first case,

premiums are paid into the bond and these are used to buy a number of units in a fund that invests in a particular stock market or sector. The price of the bond is related to the total value of assets in the fund and will therefore rise and fall in line with movements in the market or sector. In the second case, the premiums earn cumulative smoothed returns through the allocation of annual bonuses (i.e., the ‘profits’ in ‘with profits’), which cannot normally be withdrawn once they have been declared. However, in exceptional circumstances such as a stock market crash, a *market-value adjustment* (MVA) might be applied, which would lower the surrender value if the bond were encashed just after the crash.

The bonds are issued by insurance companies and come in two main types: *single-premium bonds* for lump sum investments and *regular-premium bonds*. A variation on the single-premium bond is the *distribution bond*, which pays an income, usually half yearly. Regular-premium bonds typically have two components: *initial* (or *capital*) units and *accumulation* (or *ordinary*) units. The initial units are used as a means of imposing a front-end charge of between 4 and 5%. This is achieved by cancelling the initial units. With accumulation units, all the income from the assets is reinvested; there is also an annual management charge. It is possible to switch between bonds offered by the same insurance company on a bid-price-to-bid-price basis. If a bond is surrendered before the end of the original term, its value will be calculated on the basis of the ruling bid price less a surrender penalty. The income and capital gains on insurance bonds are taxed at the basic rate. Higher rate taxpayers can take tax-free withdrawals of up to 5% a year on a cumulative basis for up to 20 years, but if the bond is cashed, any profit is taxed at a rate equal to the difference between the higher and basic rates of tax. Insurance bonds can be used by pension schemes, but pension contributions will be placed in *exempt units*, which will be free of income and capital gains taxes. Lump-sum pension contributions can also be placed in single-premium bonds, but not those that make distributions.

1.4.4 Exchange-traded funds and guaranteed growth funds

Exchange-traded funds (ETFs) are tracker funds with shares traded on the stock exchange. They began in the USA in 1993. There is no stamp duty payable and management fees are in the range 0.35–0.50% per annum, which is higher than a typical institutional investor would have to pay for index tracking (about 0.2% per annum). Barclays Global Investors calls its ETFs iShares: iFTSE 100 and iFTSE ex UK.

Guaranteed growth funds (or *guaranteed funds*) guarantee to return a minimum fund value (e.g. 98% of the original investment) whatever happens to the value of the underlying investments. They come in two types. The first type is a cash- or bond-based investment that uses part of the initial investment, together with the income generated by the cash or bond portfolio, to buy call options on an equity index, such as the FTSE 100 index; in this form the product is sometimes called an *equitised cash portfolio*. The combination of the bonds plus the call options gives complete downside protection against falls in the value of the stock market, but leaves open some upside potential if the stock market rises. The second type of guaranteed fund is equity-based and uses part of the initial investment, together with the income generated by the equity portfolio, to buy put options on an equity index, such as the FTSE 100 index. The combination of the underlying equities plus the put options on the stock market index gives complete downside protection against falls in the value of the stock market, but leaves open some upside potential if the stock market rises. The value of the guaranteed equity product in this second case equals the sum of the values of the equities and the put options held in the portfolio.

1.5 REAL ASSETS

So far we have examined the main *financial assets* that a pension fund might hold in its portfolio. But it can also invest in *real assets*: principally property, land and collectibles.

1.5.1 Property

The main classes of *property* that pension funds invest in are industrial, commercial and office property. They do not tend to invest in residential property. Large funds prefer direct property investment, whereas small funds prefer indirect investment through exempt *property unit trusts* (e.g. the Pension Fund Property Unit Trust).

The main objectives of direct property investment are the attainment of a stable rental income and an appreciation of capital value. Large funds tend to select their investments to meet the latter objective, whereas small funds appear to be more concerned with the former. All funds prefer to let their property to substantial tenants, mainly public companies and public authorities, and this preference influences the type of property

invested in. In other words, the tenant is as important as the property from the investment viewpoint.

Originally, pension funds invested in the equity of property companies, but since the 1960s they have begun to invest directly in property, preferably freehold property, but leasehold property with good capital-appreciation prospects is also acceptable. Direct investment offers more influence over both the type of property purchased and the subsequent management of the property than does investment in property-company shares. Also initially, property holdings were confined to the UK, but with the ending of exchange controls in 1979, pension funds started investing in property overseas, especially in the USA.

In contrast with financial assets, real assets are differentiated by a large number of characteristics. The differences between the shares in two different companies are usually quite small, but the differences between two buildings can be enormous. It is, therefore, important to specify the set of characteristics underlying property investment. Location, design and type and conditions of tenure are three of the most important characteristics of any property. Of these, location is by far the most significant factor in letting property. If the location of a building is good, it can be let even if the design is inadequate. Similarly, a building can become difficult to let because the centre of gravity of activity has shifted in relation to its location. A typical example is the building of a new shopping centre, which reduces the popularity of a traditional shopping zone. The design of a building (both internal and external) also has an important influence on rental values. This is because a poorly designed building or, just as important, a building with an out-of-date design, might have to be internally or externally restructured if it is to be let. Rental values also depend on the types and conditions of tenure: freehold or leasehold, length and nature of leasehold, rental review periods, and so on.

Depending on its location, design and tenure conditions, property is categorised as either prime or secondary. *Prime property* is in the best location, is well-designed and in excellent condition, is freehold and let to a first-class tenant on a lease with frequent review periods. At any one time only about 1–2% of property on the market is prime property; the remainder is *secondary property*, and so is, to some extent, less desirable in terms of these three characteristics. This will be reflected in lower rental values.

Offices, shops and industrial property have different factors that should be considered when designing the investment property portfolio. With offices, the most important factor is ease of access for staff. More

than one-quarter of UK workers work in offices, and half of these are in the Southeast. Proximity to transport routes has a large effect on rental values. Good design is also essential, the most important factors being: modern and sound construction, good lateral and vertical communication, efficient heating and ventilation, flexibility in terms of use of space and adequate servicing, including computing and telecommunications facilities. With shops, the most important factors are: ease of access for customers and delivery vehicles and good storage capabilities. The location restrictions for shops are less severe than for offices, since profitable shopping sites are not confined to central urban locations. With shopping types ranging from hypermarkets down to individual units, the most important type, from the investment viewpoint, is the multiple-shop complex occupied by national chain-store tenants. Specific features of such complexes that contribute to the property's value are good customer access (e.g. car-parking facilities), good pedestrian flow (otherwise customers are not attracted to shopping units on upper levels), good tenant mix (e.g. cafeteria services attract customers to the complex even though they do not maximise rental income on a unit basis), good shape, layout and upper-level access (rectangular units with wide frontage attract the most walk-in customers, while escalators and lifts are needed to attract customers to upper levels; atriums give a sense of openness, even though they are otherwise a 'waste of space') and good access by delivery, refuse and other services.

Industrial property covers light-industrial premises, heavy-industrial buildings and warehouses. Only the first and last categories make suitable investments for pension funds. Heavy-industrial buildings are generally purpose-built by the companies that intend to use them for production purposes. The main criterion for industrial property is the ease with which raw materials can be moved in and finished goods moved out. This suggests that light-industrial property and warehouses with good rail and road connections close to conurbations will make the most desirable investments for pension funds.

Given the heterogeneous nature of property, it is probably not surprising that the property portfolios of pension funds also tend to be very diverse. While many have a general mix of property, some concentrate on office and retail property, with yet others specialising in industrial property.

Property has advantages and disadvantages compared with other investments. The main disadvantages are liquidity and management time and costs. Direct purchasing of property costs 5.5% (including stamp