Bond Asset Management – An Overview

Report of Finance & Investment Board Working Party 1
Asset Management – Bonds

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1 Background

A number of developments have meant that bond management is becoming an increasingly important issue for institutional investors. On the supply side, the growth of the sterling corporate bond market has meant that bond investors now have a much wider range of investment opportunities. On the demand side, a number of factors have increased the interest in bond investing in the UK:

- developments in actuarial thinking have lead to a broader acceptance that bonds are a natural asset to match pension fund liabilities;
- falling equity markets have led to reduced appetite for equity investing;
- pension schemes are maturing, especially due to the large number of schemes that are now closed;
- legislation has increased the level of guaranteed benefits, reducing the scope for discretionary benefits and hence the interest of trustees in trying to achieve equity out-performance;
- disclosure under FRS17 of the pension mismatching volatility has caused finance directors to review their risks and to consider increasing the pension scheme investment in bonds, the actions of Boots having also reduced the perceived risks of being different to other pension funds; and
- insurance companies have also raised their levels of bond investment in response to the solvency worries caused by falling equity markets.

All of this suggests that it would be useful to detail the main features involved in bond investment management, looking first at the background to the various bond markets, including detail on credit ratings and how the bonds are priced, then considering the ways in which performance might be measured, some information on the process of bond management itself, and finally some details on reporting.

2 Types of bonds and their components

2.1 Overview

2.1.1 Lehman Brothers figures indicate that the total outstanding market value of global bonds at 31 December 2002 was $17,233 billion. There are a number of ways in which this global market can be divided, including:

- government and credit;
- fixed interest and index linked;
- Sterling and non-Sterling; and
- actual and synthetic;

2.1.2 Below, we briefly cover these distinctions to give an idea of the range of bonds available.

2.2 Government and credit

2.2.1 Government bonds, in most developed economies, define the risk free rates of return available over various durations. Any bond other than a domestic government bond for a particular country carries some level of risk, whether it is a risk of default or downgrade, a currency risk, or a risk of illiquidity. These risks may be compensated by a higher redemption yield.

2.2.2 Government debt falls into the category of debt classified as "investment grade". This refers to debt where the security of interest payments and principal appear at least adequate. It covers debt that is rated at least Baa by Moody's or BBB by Standard and Poor's. (These ratings are discussed in more detail later.) As well as domestic governments, potential issuers of investment grade debt include overseas governments (i.e. governments issuing bonds in a currency other than their own), government agencies, supranational organisations (such as the World Bank) and companies. Bonds from these other issuers are often referred to together as "corporate bonds", despite the fact that some of these organisations are not corporate entities; corporate, in this sense, is a misnomer for "not issued by the domestic government". Such debt will offer higher redemption yields than domestic government debt to allow for lower liquidity, higher dealing costs and the risk of default or downgrade. Investment grade bonds rarely default and tend to be a stable investment universe.

2.2.3 Sub-investment grade debt, i.e. debt below Moody's rating Baa or Standard & Poor's rating BBB, is referred to as high yield (also known as "junk" or "speculative grade").

Such debt may have been issued as high yield, or may have been downgraded from investment grade. There are two broad circumstances that might cause debt to be downgraded: voluntary and involuntary. A company may voluntarily downgrade if it wishes to significantly increase its debt (e.g. as a result of a leveraged buyout), whereas involuntary downgrades tend to occur when companies are in financial difficulty. Bonds downgraded to below investment grade are often known as "fallen angels". For high yield bonds, defaults are very much a feature of this asset class. However, there is a continuum of increasing credit risk in moving across both the investment grade universe and into the high yield universe

2.2.4 High yield debt, as its name suggests, offers a higher interest yield than investment grade debt. The yield is higher because there is a significant chance that the interest and/or the capital outstanding will be deferred, reduced, or even remain unpaid. Even for the highest grade of high yield debt, the bonds are judged to have speculative elements; their future cannot be considered as well-assured. High yield debt generally refers to corporate issues issued in developed markets.

2.2.5 Emerging market debt, on the other hand, includes predominantly government debt (although emerging market corporate debt does exist). It consists of both investment grade and high yield debt, although high yield debt dominates.

2.3 Fixed interest and index linked

2.3.1 A further distinction between bonds is the basis on which interest is calculated. The majority of bonds are issued on a fixed interest basis. Some governments and a small number of other issuers have issued index-linked bonds. The UK government was the first such issuer, but the US, Canada, Sweden, France and others have also issued such bonds. Whilst these index-linked bonds are freely traded, they are much less liquid.

2.3.2 An even smaller market is the corporate index-linked one. The main reason for this is that very few issuers enjoy incoming cash flows that are known in real terms (household gas companies being notable exceptions in the UK, gas prices being set using an "RPI-X" formula). It is also true that accounting for fixed interest debt is easier than accounting for index-linked debt.

2.3.3 Currently, though, most index-linked corporate bonds trade at lower spreads than conventional bonds, although there are a few examples where illiquidity has widened the spread.

2.3.4 Given that inflation has fallen from historic levels, the question of what happens to index-linked bonds in times of deflation becomes more important. UK index-linked gilts and their Canadian equivalent have no protection against deflation. Thus it is possible for coupon rates to fall or the final redemption payment to be lower than the face value in nominal terms. However US and French index-linked government bonds do protect against deflation, but only since the original issue date. Thus coupon rates can fall, but not below the original coupon rate. This means that old issues which have seen inflation since the original issue date have less deflation protection than recent issues. Some corporate issues also have deflation protection. In particular there have been a number of Limited Price Inflation issues whose coupons increase in line with inflation subject each year to a floor of 0% and a cap of 5%.

2.4 Sterling and non-Sterling

2.4.1 Clearly, this division is of most interest to Sterling investors. Most Sterling bonds are issued by UK companies (and, of course, the UK government). However, a sizeable number are issued by overseas governments, overseas companies and supranationals. Whilst their country of origin is important, it is the fact that they are denominated in Sterling that is of most relevance to investors, and they will be eligible for inclusion in Sterling bond indices.

2.4.2 The Sterling corporate bond market has grown significantly over the last few years and, helped by a decline over recent years in gilt issuance, has overtaken the gilt market in market size.

2.5 Actual and synthetic

2.5.1 Other types of bonds, predominantly of use in the US, are CBOs (collateralized bond obligations) and MBSs (mortgage backed securities). CBOs are essentially portfolios of bonds repackaged as a single fixed interest security. MBSs are instruments issued by US housing loan companies, where the repayment on the bonds is contingent on the repayment of housing loans originated by the loan companies – mortgages are effectively packaged together and issued on the open market as debt.

2.5.2 Related to bonds, and used in conjunction with/as a proxy for bonds are swaps. The most widely used varieties are

- interest rate swaps, where the floating and fixed interest payments are exchanged on a designated notional amount;

- inflation swaps, where the fixed and index linked payments are exchanged on a designated notional amount;
- currency swaps, where principals in two different currencies are exchanged for a period and for that period each party gets the interest on the swapped amount; and
- credit default swaps, where one counter-party receives a premium at pre-set intervals in consideration for guaranteeing to make a specific payment should a negative credit event take place (such as an issuer defaulting).

2.5.3 The swaps market is a large and liquid market and is increasingly being used by a broader range of investors as they discover the broad range of investment solutions that can be employed by using this market. Using some of the above instruments, it is possible to create synthetic bonds – for example buying a corporate bond and then swapping the coupons for inflation linked payments in effect creates a corporate bond with inflation linked cash flows. Alternatively you can create a synthetic sterling bond from a US or a euro-denominated bond by using currency swaps. More and more of the new money entering credit markets is being allocated via credit default swaps (CDSs) rather than bonds. Buying a credit default swap on a name that you do not own is effectively the same as going short the corporate bond. The preference for CDS is due to the greater flexibility, diversification and in some areas depth of the CDS market. As more monies are put in bonds by sterling investors in the coming years, the power of some of these techniques will become clearer to a wider audience.

2.5.4 Also of use, to quickly gain exposure to a particular market or extend duration, are bond index futures. Forwards, the non-standardised versions of futures, might be similarly used.

3 Credit ratings

3.1 Credit rating agencies

3.1.1 Although there are a number of agencies that provide credit ratings for bonds, the two most widely used are Moody's and Standard & Poor's. Bonds that are rated (and not in default) are graded from AAA to CCC by Standard and Poor's, and Aaa to C by Moody's. Anything with a Standard and Poor's rating of BBB or above (Baa for Moody's) is classed as investment grade; anything with a rating lower than this is classed as high yield. Bonds that are given different ratings by different agencies are classed as having a split rating.

3.2 Uses of credit ratings

3.2.1 Credit ratings are intended to give an indication of the security of the income and capital payments for a bond – the higher the credit rating, the more secure the payments. The market's view on the creditworthiness of a particular bond is one factor that determines the difference between the gross redemption yield on the bond and that on a similarly dated government bond. This difference is known as the credit spread. Some market participants refer to the credit spread as being the excess yield over the swap curve (LIBOR). However, the credit spread cannot be directly converted to a probability of default, as discussed in section 4.

3.2.2 Bonds with similar credit spreads tend to have the same credit rating, since the most important determinant of the credit spread is the expected likelihood of default. However, even allowing for secondary factors, the historical default rates for a particular credit rating will appear to be much lower than those implied by the credit spread for that rating. This is because the probability of downgrade (and other factors such as the relative illiquidity of many non-government bonds relative to the equivalent government bond, the price volatility and the uncertainty of recovery rates) needs to be allowed for: a AAA-rated bond has a negligible chance of defaulting according to analysis of historical default rates; however, the probability of downgrade to AA or lower is significantly higher and bonds are likely to be downgraded before they finally default. In addition, quoted default rates look only at the probability of a bond with a particular rating at the start of the year defaulting in that year; in reality, the period over which a bond is downgraded and subsequently defaults might well be longer than this.

Table 1: Cumulative average default rates to 31 December 2002 (%)

		Years after cohort formation									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1 January Rating	**AAA**	0.00	0.00	0.03	0.06	0.10	0.17	0.25	0.38	0.43	0.48
	AA	0.01	0.03	0.08	0.16	0.27	0.39	0.53	0.65	0.75	0.85
	A	0.05	0.15	0.28	0.44	0.62	0.81	1.03	1.25	1.52	1.82
	BBB	0.37	0.94	1.52	2.34	3.20	4.02	4.74	5.40	5.99	6.68
	BB	1.38	4.07	7.16	9.96	12.34	14.65	16.46	18.02	19.60	20.82
	B	6.20	13.27	19.07	23.45	26.59	29.08	31.41	33.27	34.58	35.87
	CCC	27.87	36.02	41.79	46.26	50.46	52.17	53.60	54.36	56.16	57.21
	Investment grade	0.13	0.34	0.57	0.87	1.20	1.52	1.83	2.13	2.41	2.72
	Speculative grade	5.17	10.27	14.81	18.46	21.31	23.67	25.71	27.36	28.83	30.07
	All ratings	1.67	3.36	4.86	6.12	7.14	8.02	8.80	9.47	10.07	10.64

Source: Standard & Poor's Risk Solutions CreditPro® 6.2.

Table 2: Average one-year transition rates from 31 December 1980 to 31 December 2002 (%)

		Rating at end of period								
		AAA	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**	**D**	**N.R.**
Rating at start of period	**AAA**	89.37	6.04	0.44	0.14	0.05	0.00	0.00	0.00	3.97
	AA	0.57	87.76	7.30	0.59	0.06	0.11	0.02	0.01	3.58
	A	0.05	2.01	87.62	5.37	0.45	0.18	0.04	0.05	4.22
	BBB	0.03	0.21	4.15	84.44	4.39	0.89	0.26	0.37	5.26
	BB	0.03	0.08	0.40	5.50	76.44	7.14	1.11	1.38	7.92
	B	0.00	0.07	0.26	0.36	4.74	74.12	4.37	6.20	9.87
	CCC	0.09	0.00	0.28	0.56	1.39	8.80	49.72	27.87	11.30
N.R. – rating withdrawn.										

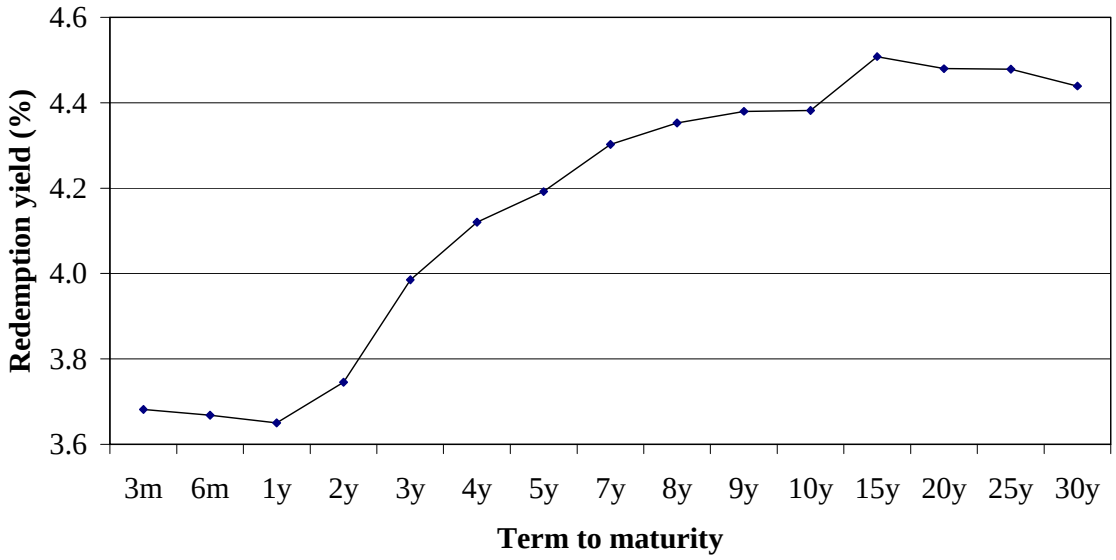
Source: Standard & Poor's Risk Solutions CreditPro® 6.2.

4 Bond pricing

4.1 The gilt yield curve

4.1.1 Most actuaries will be familiar with the principles of gilt pricing and with the gilt yield curve, which shows the yield to maturity against outstanding term. The graph below shows the yield curve at the end of last year:

Figure 1: Gilt yield curve as at 31 December 2002



Source: Bloomberg

4.1.2 The short end of the curve reflects the current base rate as set by the Bank of England Monetary Policy Committee and expectations thereof. Economic theory indicates that the yield curve should normally be upward sloping since investors usually require a premium in the long term to compensate for the greater uncertainty about inflation. But the yield curve is not always upward sloping. At the longer durations, yields are influenced by, among other factors, the stage of the interest rate cycle, inflationary expectations, and are particularly sensitive to demand and supply factors.

4.2 Supply of gilts

4.2.1 Gilts are issued by the Debt Management Office (DMO) to fund the government's borrowing requirements. Nowadays this is done by means of auction, with a prospectus being made available in selected newspapers about a week prior to the auction date. The table below details the auctions held by the DMO during 2002.

Table 3: DMO auctions in 2002

Conventional					Index Linked				
Maturity	**Coupon**	**Nominal (£m)**	**Funds raised (£m)**	**Price**	**Maturity**	**Coupon**	**Nominal (£m)**	**Funds raised (£m)**	**Price**
2008	5%	3,000	2,989	99.6	2013	2.5%	450	890	197.8
2014	5%	2,750	2,779	101.1	2020	2.5%	425	893	210.1
2014	5%	2,750	2,806	102.0	2035	2%	950	929	97.8
2025	5%	2,750	2,838	103.2	2035	2%	826	818	99.0
2025	5%	2,250	2,196	97.6					
		13,500	**13,608**	**100.8**			**2,651**	**3,530**	**133.2**

Source: www.dmo.gov.uk

4.2.2 All of these issues, with the exception of the medium term 2.5% index linked issues, have been priced at close to par, with coupons being close to the prevailing yields at the appropriate maturity on the yield curve at the time of issue.

4.2.3 From time to time the DMO will offer stockholders the opportunity to convert holdings of one gilt into another at a rate based on the market prices of the two gilts. The purpose of this is to retain liquidity in the gilt issues traded in the market by removing illiquid gilts. Acceptance of such conversions is not compulsory, but if the amount of a gilt that is outstanding in the market becomes too small to expect a two-way market to exist it becomes known as a "rump stock". The DMO currently classifies all gilts with nominal outstanding less than £410m as "rump stocks".

4.2.4 A gilt stripping facility was introduced in December 1997. Stripping involves separating a standard interest bearing gilt into its constituent coupon and redemption payments, which can then be separately held and traded in their own right. Such an issue is therefore known as a strip (from "separately traded registered interest and principal"). The value of each constituent would usually be priced by discounting the resultant cash flows using an appropriate rate of interest.

4.3 Pricing of investment grade corporate bonds against the yield curve

4.3.1 Bond pricing for most investment grade issues (BBB or better) is usually quoted by referring to the yield spread against an appropriate benchmark on the yield curve for an "equivalent" gilt, i.e. the spread represents the additional yield that investors require for holding the corporate bond instead of a government bond of similar term.

Credit risk

4.3.1.1 The most obvious form of credit risk is the risk that the borrower defaults on one or more payments. Generally UK government bonds are deemed to be very secure with little or almost no risk of default (the same cannot be said for the governments of less stable countries). However, when investing in corporate bonds, investors will require a premium to compensate for the increased risk of default and other factors (e.g. liquidity). Clearly the higher the risk of default, the higher will be the required additional yield required to hold the bond.

4.3.1.2 Studies are available that examine the probability of issuers defaulting as well as the percentage of the investment that can be expected to be recovered following default – the recovery rate. This allows potential losses from a portfolio to be quantified by an investor, given the credit ratings in the portfolio. The investor can therefore quantify the spread required above gilts to compensate for this risk. But historically the additional yields available on corporate bonds have more than compensated investors for the default probability. This has increased the relative attractiveness of corporate bonds as an asset class to many investors, although there are reasons for the spread on offer being greater than that implied by the default probabilities (chiefly the differences in liquidity).

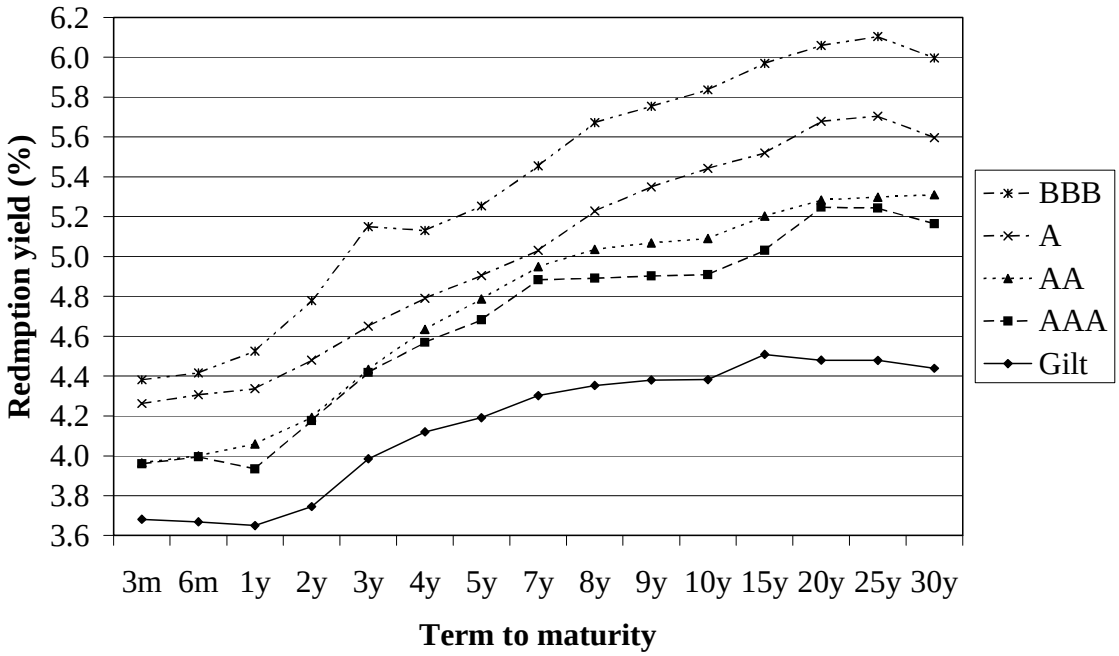
4.3.1.3 A further category of credit risk is the risk that the issuer's credit rating is downgraded by the rating agencies. If this is unanticipated the credit spread associated with the issue will usually increase and result in a decline in the price of the bond concerned.

4.3.1.4 This additional uncertainty means that a higher return can be expected from non-government bonds, and that the size of this additional expected return increases as the credit spread (and, thus, uncertainty) increases.

4.3.1.5 This volatility in the spread and in particular the risk that credit spreads will widen further is essentially a reflection of the fact that corporate bond spreads are linked to the economy and that, for example, spreads will tend to widen during economic recession to reflect the increased risk of corporate borrowers defaulting on their obligations. This negative correlation of credit spread to the economy and therefore to gilt yields creates some stability in the absolute yield on corporate bonds and potentially lower price volatility than for gilts in many cases.

4.3.1.6 Below is a representation of yield curves on Sterling bonds of various credit ratings, illustrating the increasing spread against gilts. AAA bonds are trading at around 50bps to 80bps above gilts with BBB issues trading at 150bps above gilts.

Figure 2: Credit rating yield curves as at 31 December 2002



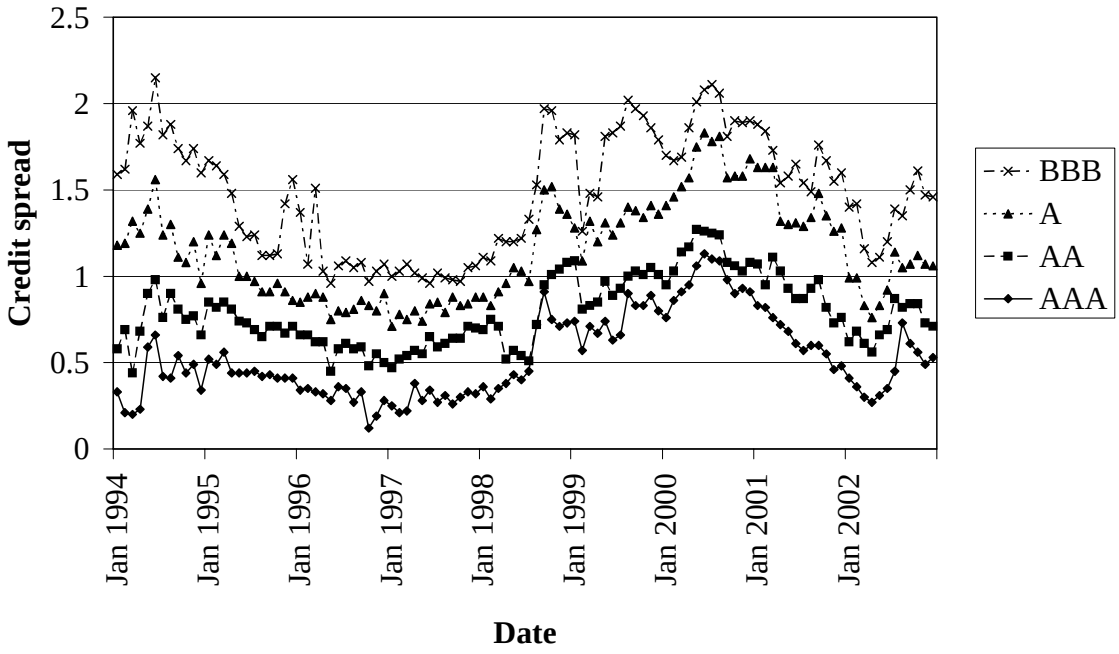
Source: Bloomberg

Relative supply and demand of gilts and corporate bonds

4.3.1.7 Following the Budget in April 2003, the DMO's net financing requirement forecast for 2003-4 was set at £54.8bn. The market therefore expects a relatively larger supply of gilts to be issued in the coming year than had been the case in the last few years. At the same time, with the slowing down of the economy, companies are de-leveraging their balance sheets (reducing the proportion of debt to equity) resulting in a reduced supply of corporate bonds (i.e. reducing the amount of debt in issue relative to the amount of equity). As a result, gilts could be expected to become relatively cheap compared to corporate bonds due to the relatively higher supply. The result is a narrowing of spreads of non-gilts against gilts that is not due to a change in credit risks.

4.3.1.8 At certain terms, demand may be relatively higher for gilts to meet the need to match portfolios of liabilities. This will drive down yields (widen spreads) at those durations. For example, the desire to match pensioner liabilities under the Minimum Funding Requirement for UK pension funds resulted in an increased demand for long-dated gilts. These two factors that relate to gilts are partly why some market participants measure credit spreads against swap yields, as the swap curve is typically much smoother and less impacted by idiosyncratic supply and demand issues.

Figure 3: Historical 10-year spreads against gilts



Source: Bloomberg

Reinvestment risk

4.3.1.9 This refers to the risk that a holder of a bond may only be able to invest the income stream from holding the bond at a relatively low interest rate. This risk increases as the level of coupon and term increases.

Duration or discounted mean term

4.3.1.10 Duration refers to the degree to which the price of a bond varies for a given change in interest rates. Longer-term bonds will have longer durations than shorter dated issues. Amongst bonds with similar redemption dates, low coupon issues will have longer durations than bonds with higher coupons. Longer durations indicate a higher sensitivity to changes in interest rates and therefore greater volatility for the same change in interest rates. Short-dated rates are typically more volatile than long-dated ones though as they are more sensitive to short term market conditions.

Liquidity

4.3.1.11 More liquid issues will attract less of a spread against the gilt yield curve. Often a wide bid-offer spread quoted on an issue can be an indicator of poor liquidity. The reason for this is that investors will demand a higher return to compensate them for the risk that they may not be able to sell the bond on favourable terms if the need arises.

Trading costs

4.3.1.12 These tend to be higher for non-government bonds than for government bonds, increasing the spread on the former over the latter.

Options

4.3.1.13 Some corporate bonds have options allowing the issuer to redeem the bond before the final maturity date. Such options are of value to the issuer and are put in place so that if interest rates fall, the issuer can redeem bonds, often at par, and borrow at a lower rate. This feature will impact on the spread.

Special features

4.3.1.14 Any special features of an issue will obviously also impact on the spread. An example of a recent development is step-up clauses on credit downgrades. As investors have been concerned about the possibility of a company being downgraded by the credit agencies, they have sought and obtained clauses stating that the coupon of an issue will be increased by, say, 25 basis points each time the credit is downgraded by a certain level.

4.4 Pricing of sub-investment grade corporate bonds against the yield curve

4.4.1 Below investment grade, bonds tend to trade on price in a similar way to equities, as yield spreads become very large. The considerations above still apply to the assessment of the risks involved, however. When the market assesses that a borrower is close to default, the convention is to express the price of the bond as a nominal amount, say 50p, to reflect the expectation that if the bond defaults, investors expect to receive 50 pence in the pound in settlement.

4.5 Accrued interest

4.5.1 Prices quoted in the market are clean prices. For gilts, this is for settlement the following day, for non-gilts this is usually 3 working days later. Clean prices exclude the value of the accrued interest since the previous coupon date. In practice, the buyer pays for the accrued interest from the previous coupon date to the settlement date as well – the "dirty" price. Different bond issues use different day-count conventions to calculate accrued interest. Some examples are given below:

Table 4: Bond coupon conventions

Class of bond	Day-count convention	Coupon
UK gilts	Actual/Actual	Semi-annual
US treasuries	Actual/Actual	Semi-annual
US municipal and corporate bonds	30/360	Semi-annual
Eurobonds	30/360	Annual

4.5.2 An actual/actual day-count convention refers to counting the actual number of days since the last coupon payment in the numerator and the actual number of days between the coupon payments in the denominator. With the 30/360 convention, each month is treated as if it has 30 days and a year as if it has 360 days in the calculation of accrued interest.

4.6 Swaps

4.6.1 Swaps are contracts that oblige two parties to exchange pre-defined cash flows. They are usually based on a predetermined notional amount of principal. The most common type of swap involves the exchange of a fixed coupon for a coupon varying by reference to an underlying reference rate– a floating rate note. The reference rate is usually LIBOR. The pricing of the swap contract involves a dealer setting the floating rate equal to LIBOR and quoting the fixed rate that will apply. The fixed rate will then be some spread above the gilt curve with the same term to maturity as the swap contract. This spread is called the swap spread.

4.6.2 There are also many other types of swap – total return swap, currency swap, credit default swap and inflation swap. Inflation swaps (where fixed or LIBOR payments are exchanged for inflation-linked payments) are of particular relevance to investors with inflation-linked liabilities.

4.6.3 An alternative measure often used in pricing of corporate bonds is to consider the spread against a reference swap rate. This effectively translates into pricing the bond with a spread against LIBOR rather than against gilts.

4.6.4 This comparison is useful because LIBOR is seen as the natural benchmark by some investors / bond issuers / investment banks - LIBOR is considered to be the rate available on cash deposits (or something close) – so an alternative to buying a bond is to put your money on deposit and swap your floating rate for a fixed rate. In addition the swap curve is typically much smoother and less impacted by idiosyncratic supply /demand factors that can impact the gilt curve.

4.7 Arbitrage

4.7.1 The majority of the pricing models used by portfolio managers are complex multi-dimensional surface models that consider the outstanding term, yield, credit rating, default probability, expected recovery values and sector of an issue. Portfolio managers attempt to derive their own estimate of "fair-value" for a bond based on their views on the features of the issue. Their models then attempt to identify any anomalies between their assessed "fair-value" and the price the bond is trading at in the market, as well as any anomalies between the issue and related swaps or forward contracts.

4.8 Opacity in bond pricing

4.8.1 Bond valuation can be relatively opaque for the following reasons:

Number of bonds

4.8.1.1 In comparison with equities, there are a vast number of bonds in issue and one corporate group may have in issue a number of different securities with different credit ratings, seniority and issued by different entities within the group.

Market size and liquidity

4.8.1.2 These vary between issues. For example in the US treasury market the most recently issued securities, referred to as "on-the-run", tend to trade far more actively than older issues or those that are "off-the run".

Market makers risks

4.8.1.3 The amount of risk that a market maker is required to take to make a book in a particular issue will be reflected in the bid offer spreads that they quote, particularly in illiquid issues.

Factors affecting price

4.8.1.4 There are a large number of factors affecting the price of an issue, one of which is often the fact that an issuer has several bonds that can be purchased. These factors lead to matrix pricing and to the multi-dimensional models referred to above.

Counter party trading

4.8.1.5 The lack of pricing transparency caused by counter party trading (as opposed to exchange trading for equities) creates an informational imbalance. At any one time there is no one agreed market price for a corporate bond even though bond pricing is increasingly more widely available thanks to electronic trading.

Additional features

4.8.1.6 Bells and whistles, such as interest rate caps and floors and credit step-ups, can be difficult to evaluate.

Supply and demand

4.8.1.7 Supply and demand vary and are not always predictable. Possible discontinuities are very difficult to assess.

5 Benchmarks and indices

5.1 Overview

5.1.1 Bond indices follow a similar methodology to equity indices, but with some subtle differences. A commonly used bond index in the UK is the FTSE Actuaries UK Gilt All Stocks index. This index comprises all the major gilts across all maturities. There are approximately 30 bonds in the index, and each one is weighted according to the market value of the amount outstanding (which is equal to the par amount of the outstanding bond multiplied by its market price). We can therefore see that if, for example, one particular sector of the bond market were to outperform the rest of the market, then that sector's prices will have outperformed, and therefore its weighting in the index will increase. In this sense, bond indices work in a similar fashion to equity indices, as when the price of an individual security increases relative to the rest of the index, then its weighting in the index will increase.

5.1.2 Equity indices usually have real-time pricing, whereas most of the bond indices to date have just been priced at the close of business on each trading day. This is partly due to the less liquid trading of bonds in the past but more importantly to the fact that bonds are traded on an OTC (over-the-counter) basis as opposed to being exchanged traded which is the case for equities. However, there is one new index that has real-time pricing. In co-operation with seven leading investment banks, Deutsche Börse AG offers a real-time index family for the European bond markets - the iBoxx index family, which is comprised of the iBoxx € and the iBoxx £ indices. It is compiled through a consortium of ABN AMRO, Barclays Capital, BNP Paribas, Deutsche Bank, Dresdner Kleinwort Wasserstein, Morgan Stanley and UBS all of whom deliver real-time bond prices as the basis for calculating the iBoxx index family. These indices thus provide investors with a more transparent benchmark for European bonds than has previously been available. Another real-time index is to be launched in 2003.

5.2 Single currency government bond indices

5.2.1 The FTSE Actuaries UK Gilt series is the most commonly used index for gilts, although there are gilt sub-categories in other indices (such as the Barclays Capital, Merrill Lynch and JP Morgan series).

5.2.2 The FTSE Actuaries UK Gilt series is also divided by term (0-5 years, 5-10 years, 5-15, 10-15 years, 15+ years and undated) so investors are able to choose the most appropriate index for their needs.

5.3 Global government bond indices

5.3.1 When one looks outside of a single-currency government-only index (which the above-mentioned FTSE Actuaries UK Gilt All Stocks index is), then it starts to become more complicated. The next group of bond indices to look at are the global government bond indices. The best known of these are the Salomon Smith Barney World Government Bond Index (WGBI) and the JP Morgan Global Government Bond Index (GBI Global), both of which were introduced in the mid 1980s. The Salomon Smith Barney WGBI index uses a market capitalisation weighting for each of the components, as does the JP Morgan GBI Global index which also gives the user a choice of sub indices based on "Traded", "Benchmark" or "Active", as explained below:

Benchmark

5.3.1.1 These are the most liquid issues, recognised as market indicators

Active

5.3.1.2 Active includes all benchmark issues, plus other issues with significant daily turnover usually including previous benchmark issues.

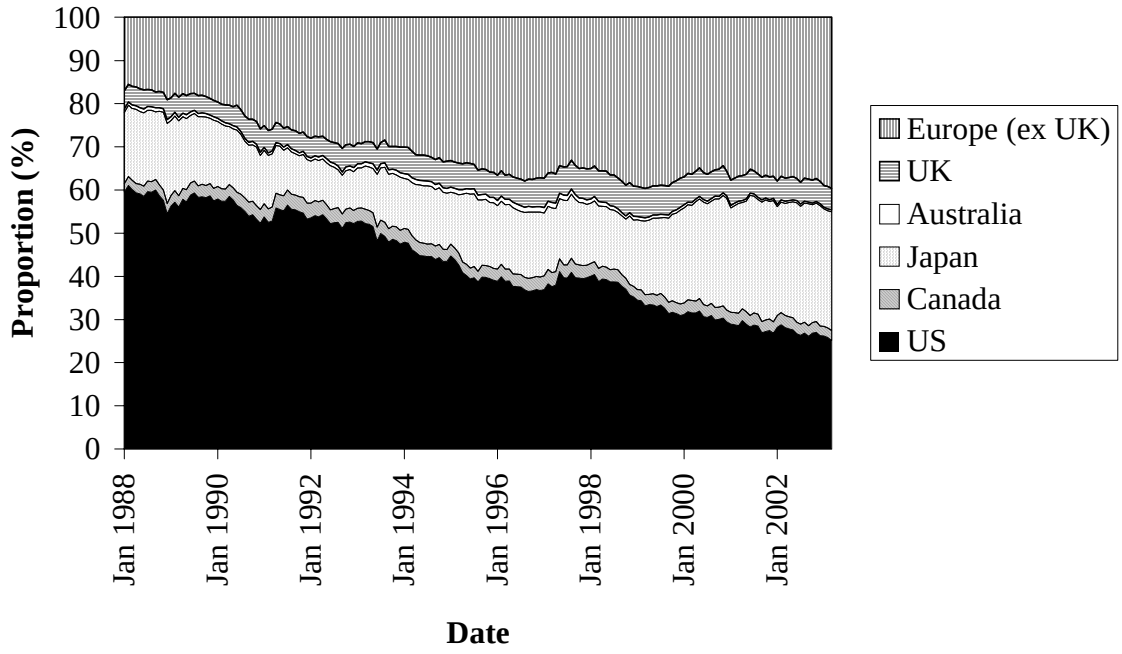
Traded

5.3.1.3 This includes all benchmark and active issues, plus any other issues which meet the liquidity criteria of the index. This is the most widely used index.

5.3.2 The benefit of the JP Morgan breakdown is that some government bonds are very illiquid, so using total market capitalisation does not reflect the market available to investors. However, the actual difference in weightings is not substantial, as usually when market capitalisation increases, so does the volume of traded bonds. One downside of this breakdown is that it can be somewhat subjective as to how actively traded each bond actually is.

5.3.3 The weightings of each country in the global bond indices are therefore proportional to the amount of bonds outstanding. Therefore, the more debt that a country has, the higher the weighting it will have in a bond index. A good example of this is in the JP Morgan GBI Global Index, where the US's weighting has fallen from around 60% in the late 80s to just 26% today. Over the same time, Japan's weight has increased from around 16% in 1990 to 28% now.

Figure 4: Composition of the JP Morgan Global Government Bond Index



Source: MorganMarkets

5.3.4 We can see that as Japan's fiscal situation has worsened and the amount of government debt has increased (concurrent with a decline in its credit rating), the country's weighting in the GBI index has increased. On the other hand, after a buoyant decade of prosperity and a reduction in debt issuance, the US weighting has fallen sharply. This highlights a major drawback with the market capitalisation: an index weighting *increases* because a country's economy has *worsened*, and a country that has had a *strong* economy sees its index weighting *fall*. There are some stabilising forces that help an investor here. If the credit quality of a country declines, its debt is excluded from certain indices. Unfortunately, there are also ways that governments may try to limit the amount of "recognised" public debt, such as by utilising partnerships with the private sector. An example of this at the time of writing is the Private Finance Initiative (PFI) in the UK, where the government has debt obligations in conjunction with the private sector, yet these are not included in most measures of national debt.

5.3.5 Usually an investor would be more interested in buying the debt of a strong economy than of a weak economy, all other factors being equal, yet the index weights bias investors towards the opposite – as can be seen with Japan's weight in the GBI Global index above. There are ways around this. One way that investors have recently avoided Japan has been to simply take the country out of their investible universe, therefore benchmarking against, for example, the GBI Global ex Japan. Another method is to have weightings ranked by a country's GDP or GNP, therefore the larger the economy, the higher the weighting. The

MSCI equity index publishes both market capitalisation and country weightings. The differences can be quite large: Germany, which has quite a small equity market, has just a 3.9% weight by market capitalisation, but a 10.6% weight by GDP (reflecting its position as the world's third largest economy). Similarly, the US, which has a weight of 44.6% by market capitalisation, only has a weight of 33.4% when measured by GDP (all as of July 2002). Alternative index weighting methods are also mentioned above in the various descriptions of index weightings, such as the JP Morgan diversified method of weighting an index.

5.3.6 One important factor to take into account when assessing a global index is the potential impact of currency movements. Currency volatility has traditionally been much greater than the price volatility of government and investment grade bonds, which means that currency movements can dominate bond movements in a global bond index. There are three ways an investor in global indices can assess the index:

- by looking at the returns in each market in local currency terms;
- by looking at the returns of each market fully hedged back into the base currency; or
- by looking at the overall returns in terms of the base currency.

5.3.7 The local currency return gives just the return of each market, but is not overly meaningful because it omits any return as a result of exchange rate movements, and also excludes any costs involved in hedging (or "funding"). The fully hedged return is the best measure for comparison of the returns in each individual market, as it is not distorted by the currency returns, but takes into account the "funding" cost (i.e. short term interest rates). The overall returns in terms of the base currency will give the bond and currency returns, and will be much more volatile than the previous measures, but will also show the actual returns if an investor were to choose not to hedge their currency exposure.

5.3.8 Funding costs are an important consideration when comparing bond returns in different countries. This is because the country with the highest local currency return may not necessarily give the highest total returns to an investor. This can best be demonstrated with a hypothetical example. Assume country A (with a currency of A*) has 12-month rates at 15%, and a 10-year bond at 15%. Country B (with a currency of B*) has 12-month interest rates at 4%, and a 10-year bond at 5%. If interest rates and bond prices remain the same over the next year, a bond investor in country A will get a return of 15%, and a bond investor in country B will get a return of only 5%. However, if an investor had no cash to start with, and therefore borrowed money over the year at the 12 month rate, then in country A the return would be 15% less 15% in interest on the borrowings, giving a net return of 0%. However, in country B an investor will get a return of 5% less the cost of borrowing of 4%, giving a total return over the year of 1%. Therefore, an investor will actually earn a higher "funded" return in Country B. This advantage will usually disappear

if the currency risk in the bond is eliminated completely by using cross-currency swaps rather than retaining the rollover risk of short-term hedging/funding.

5.4 Single currency aggregate/corporate bond indices

5.4.1 Corporate bond markets have grown at an enormous rate across Europe in the past decade, resulting in many new corporate bond indices. Single currency indices are usually the most popular as many investors are looking to broaden their investments within a single market, without the complications of investing in overseas bond markets where economic factors external to an investor's domestic liabilities may cause undue influence on their investments.

5.4.2 The main providers of these indices in the UK are:

- Barclays Capital;
- iBoxx;
- Merrill Lynch; and
- JP Morgan

5.4.3 Single currency corporate bond indices are also usually dominated by issuers based in that country, as they are not surprisingly the biggest users of capital in their base currency. Many issuers also think globally, especially if they are multinational corporations, and therefore foreign companies (and foreign governments) are often present in a single currency index. For example, in the Merrill Lynch UK non-Gilt index, there are issues from, amongst others, Heinz, Toyota and the Government of Finland. Also, there may simply be opportunities for cheaper borrowing in a different country, with the proceeds repatriated back to a company's home currency (via the swap market). For many international companies the definition of home country is increasingly vague.

5.4.4 Corporate bond indices can include all credit ratings, or could be just investment grade or just sub-investment grade. These indices will usually include all the bonds meeting the index's rating criteria, and above a certain size threshold (e.g. Merrill Lynch UK Sterling Broad Index, which is only for investment grade, has a minimum issue size of £100 million for a bond to be included in the index). The indices can also be broken down into various maturity sectors, credit rating sectors and industry sectors, such as an over 15 year maturity index, a AAA only bond index, or a corporate index of just financial and utility issuers.

5.4.5 As mentioned above, these indices also contain government bonds (note that government bonds issued in a foreign currency are credit investments). This is important to bear in

mind as it might mean that an aggregate (i.e. government and non-government) index is used when a corporate index is required.

5.4.6 Corporate bond indices again tend to be weighted by the market capitalisation of each bond issue. Therefore, there is a problem analogous to that mentioned above with Japan, which is that the more debt a company issues, the greater its weighting in a bond index. There is a self-correcting mechanism in this, which is that if too much debt is issued, a company credit spread rises and bond prices fall. There is also a risk of having its debt downgraded to below investment grade and then it is automatically excluded from an investment grade index (although it will most probably then enter a high yield index. Compare this with an equity index weighted by market capitalisation. If a company's equity price were to increase due to the company having high quality earnings, then its weighting in the index would increase. However, if a company increases its debt, it can be deemed that there is a greater risk to bond holders of an adverse event affecting the company, and also future earnings may be riskier and of lower quality, yet its weighting in a bond index will increase. For indices derived from the credit default swap market, market capitalisation is clearly not relevant and has not been used as the weighting mechanism.

5.5 Global aggregate/corporate bond indices

5.5.1 There are also now global corporate bond indices encompassing all the major markets. Most of these are quite new, with Lehman Brothers and Salomon Brothers issuing theirs with data starting in 1999, and Merrill Lynch backdating their data to the beginning of 1997. These indices usually include government and corporate bonds in most of the major markets, and will often have several thousand issues. (Merrill Lynch's Global Broad Market Index has 14,631 issues as at June 2002!) An investor using these indices has many options to include or exclude the various countries, credit ratings or industry sectors, thus tailoring the exposure to exactly their requirements.

5.6 Index-linked Indices

5.6.1 The most common index-linked benchmarks for UK funds are the FTSE Actuaries Index-Linked Government Securities series. As with the indices for conventional gilts, they are split by term. The only currently available corporate index-linked index is the Barclays Capital Sterling non-gilt inflation-linked index, which was introduced in 2002. International index-linked portfolios may be benchmarked against either the Barclays Capital Global Inflation-linked Bond Index or the Merrill Lynch Global Governments Inflation-Linked index.

5.7 Other bond indices

5.7.1 There are also High Yield Indices and Emerging Market Indices. High Yield Indices include bonds with ratings below investment grade, which therefore means a credit rating of BB+ / Ba1 or below. High Yield bonds are much less liquid than investment grade bonds, meaning that index pricing can be less accurate, and also adjustments are often made to the weights, such as mentioned above in the MSCI Core Investible High Yield Index. The main high yield index providers are MSCI and Credit Suisse, although there are high yield sections of the broader index series provided by Lehman Brothers and JP Morgan.

5.7.2 Emerging Markets are usually defined as countries with lower than average *per capita* income. For example, JP Morgan use the World Bank-defined "middle income" per capita upper level (in US$) as one of their criteria. Also, having had their debt restructured may allow a country to be eligible for entry into an Emerging Market Index. Emerging Market Indices can be in local currency markets, although these usually consist of shorter maturities as emerging bond markets are often quite small in their domestic currency and do not usually have a wide range of maturities. There are also indices of Emerging Market borrowers in "hard" currencies, such as JP Morgan's EMBI index which just includes borrowers in US dollars, resulting in the index sharing some characteristics with single currency corporate bond indices as mentioned before.

5.7.3 Again, whilst JP Morgan is the predominant provider here, Lehman Brothers have an emerging market section within their series.

5.8 Index Developments

5.8.1 Corporate bond and government bond indices have not changed fundamentally for 15 years. A recent phenomenon is using indices based on credit default swaps, which are rapidly overtaking corporate bonds as the most liquid way to trade corporate credit. The leading product in this area is TRAC-X from JP Morgan and Morgan Stanley, which is a family of indices across regions. The advantage of these products is that they are actually tradable and hence truly reflect the market. Already many other banks are trading these products and their predecessors

5.9 Differentiating between indices

5.9.1 Ultimately for an investor, the choice of a benchmark index/indices is one of the most important decisions they are faced with, as the returns and risk characteristics can vary widely between different types of bond index (let alone the differences between bond and

equity indices, or even between just high yield and investment grade bonds). Also, within each asset class there are usually several competing indices. Having said this, the index to be used might in some instances be determined by the fund manager for a particular asset class, especially if pooled funds are to be used. The criteria necessary for the construction of a good index include the following:

Transparent

5.9.1.1 There should be clear rules on methodology, index changes and eligibility criteria.

From an experienced provider

5.9.1.2 The provider should have suitable knowledge of the market, with a commitment to calculating and supporting their index.

Replicable

5.9.1.3 Detailed data of the index, including its constituents, construction and performance, must be widely available to market participants.

Representative

5.9.1.4 The index should be a fair representation of the major characteristics of the market sectors included. Diversification is also relevant given the asymmetry in bond returns.

Investible

5.9.1.5 Bonds within the index should meet basic liquidity criteria and be available for investment by a wide range of investors.

Flexible

5.9.1.6 Investors can construct customised strategies using sub-indices.

Reflective of investor needs

5.9.1.7 The index should provide a fair basis for peer group comparison.

Consistent

5.9.1.8 The index rules should remain stable Bonds will be removed or added in line with index rules in accordance with a consistent set of rules that don’t change.

5.9.2 Given that the performance of most indices in a specific market is quite similar, index selection can be driven by practical issues such as the availability of data and ability to carry out accurate performance attribution.

6 Liability-based benchmarks

6.1 Overview

6.1.1 A common feature of all traditional bond benchmarks is that they are not usually related to the liabilities of the investor. A more relevant benchmark for many investors may be the "Least Risk Asset Portfolio". This is actually the strongest argument for not using market capitalisation weighted indices: investors should instead select the best benchmark for their situation.

6.2 Least risk asset portfolio

6.2.1 The least risk portfolio for a pension scheme is that portfolio of assets which most closely matches the liability characteristics of the pension scheme at the lowest possible risk. The liabilities of a pension scheme are made up of commitments to pay a series of future cash flows to the members of the scheme and as such are bond like in nature. Normally, pensions in payment will either be subject to fixed rate increases, or increase by reference to inflation in some way. Under certain economic and demographic assumptions, the cash flow pattern for larger pension schemes can be predicted with a reasonable degree of accuracy.

6.2.2 The least risk asset portfolio is the portfolio that produces the income required to meet the liability outgo. Usually for a pension scheme this portfolio will be made up of a portfolio of conventional and index-linked gilts, although it may not be possible to match some liabilities exactly using just these assets. The least risk position provides the appropriate benchmark against which to judge all other available investment strategies, for example strategies including corporate bonds where the Trustees will be taking an element of credit risk in order to target additional expected return.

6.2.3 To date, this type of benchmark has rarely been used, but a growing number of UK pension schemes are managing their assets against benchmarks based on least risk asset portfolios.

6.3 Calculating the benchmark

6.3.1 To monitor the performance of a portfolio against the least risk asset portfolio, a return benchmark based on the projected cash flows needs to be calculated. This can be based on a notional portfolio of conventional and index-linked gilts (including stripped variants) that matches the projected cash flows.

6.3.2 Alternatively, swap pricing can be used to derive appropriate discount factors to value the cash flows and changes in the swap yield will then drive the performance of the liabilities.

6.3.3 For many pension schemes, a substantial (and growing) proportion of the liabilities increases in line with Limited Price Indexation (LPI) in payment, but there is limited availability of LPI assets. One way to deal with this is to estimate a "hedge ratio" of fixed and index-linked bonds that approximates LPI increases – in current inflation conditions this may be approximately 50% fixed, 50% index-linked.

6.3.4 If LPI bonds become more widely available, it might be appropriate to introduce an explicit weighting towards LPI bonds in the benchmark.

6.4 Is it worth deriving a liability-based benchmark?

6.4.1 If 95% of the pension plan assets are invested in equities, with 5% in bonds, the choice of bond benchmark will have little influence on the overall risk level, as the equity risk will dominate. Of course, if a plan is invested 100% in bonds, a major source of risk is the cash-flow mismatch between the liabilities and the assets.

6.4.2 The point at which it becomes worthwhile implementing a liability specific benchmark depends on a number of factors, including the size of the plan, the likely cost of implementation and the risk appetite of the plan sponsor.

6.4.3 However, a few simple calculations can help determine the potential benefits in terms of risk reduction of this approach for different equity percentages. The table below indicates the difference in tracking error for various equity/bond allocations depending on whether a traditional or a liability-based bond benchmark is used. The decision as to whether these risk reduction benefits are worth the associated costs is a matter for the plan sponsors, but we would certainly not expect many to decide to opt for a tailored benchmark if they invest more than 50% in equities.

6.4.4 The assumptions used in the table below are:

- an estimated tracking error between the tailored benchmark and the liabilities of 0.2%;
- an estimated tracking error between the traditional benchmark and the liabilities of 2.0%;
- an estimated tracking error between equities and the liabilities of 13.0%; and
- no correlation between the various investment choices.

Table 5: Tracking error and the use of a liability based benchmark

	Tracking error risk	
Equity percentage	**Traditional bond benchmark**	**Liability-based bond benchmark**
100%	13.00%	13.00%
90%	11.70%	11.70%
80%	10.41%	10.40%
70%	9.12%	9.10%
60%	7.84%	7.80%
50%	6.58%	6.50%
40%	5.34%	5.20%
30%	4.14%	3.90%
20%	3.05%	2.60%
10%	2.22%	1.31%
0%	2.00%	0.20%

7 Index-tracking

7.1 Why select an index fund?

7.1.1 The objective of indexed fixed income funds is to produce returns that mirror those of a specified benchmark index. This has the following advantages:

Achieves market performance.

7.1.1.1 Portfolio will achieve virtually the same return as the broad market.

Outperforms the majority of actively managed funds.

7.1.1.2 Many (although by no means all – see later) studies on historical fund performance data show that in investment grade fixed income markets, indices consistently outperform the majority of active fund managers, in both bull and bear markets. Experience also suggests that it may not be possible to reliably identify which active managers will outperform the market.

Low fees/costs.

7.1.1.3 Low turnover in indexed funds together with lower management fees leave more of the money to be invested.

Broad diversification.

7.1.1.4 Index funds tend to hold a great breadth of securities, minimising non-systematic, or issuer specific risk to a portfolio. Whilst this is usually not an issue for government bond funds, it is for corporate bonds vehicles.

Less time-consuming

7.1.1.5 Trustees will generally spend less time monitoring a passive manager and there is a lower likelihood of having to periodically replace the manager; such replacement would again have increased costs.

Rule based investment decision-making process.

7.1.1.6 Indexed portfolios are managed according to an objective process based on quantitative models and strict rules to track an index's performance. This removes the influence of an individual fund manager's subjective views. Because an investor can select a fund knowing the rules upon which investment decisions are made, such investor has greater control over how their money is invested.

7.1.2 Arguments against passive management include:

Anomalies in index construction

7.1.2.1 Anomalies could occur where a weaker economy's weighting in an index increases because it issues more debt – such is the situation with Japan. Under market capitalisation-based benchmarks, passive management would result in holding more money in Japanese bonds whereas investors concerned about concentration may wish to hold less.

Inefficiencies in corporate bond markets.

7.1.2.2 There is more of an argument for the active management of corporate bonds as certain bond markets, including the UK, are deemed to be less efficient. A skilled manager may be able to exploit these inefficiencies.

7.1.2.3 The UK corporate bond market is extremely inefficient compared to equity markets. While a company will have a primary equity listing, it may have tens of different bond issues, fragmenting pricing focus and causing pricing anomalies. It's hard enough understanding what is happening in, say, Abbey National's share price, so imagine the difficulties in following what is happening in 14 different Abbey National bonds of varying maturities, with different levels of protection offered to the investor.

7.1.2.4 The corporate bond market is still far from being efficient. The largest investment banks in the pan-European equity markets have more than one hundred analysts publishing detailed analysis. However the same banks typically employ far fewer corporate bond analysts. In addition, sterling corporate bond fund management teams are typically a fraction of the size of their UK equity counterparts.

7.1.2.5 The lack of pricing transparency caused by counter-party trading (as opposed to exchange trading for equities) creates an informational imbalance. At any one time there is no one agreed market price for a corporate bond.

7.1.2.6 The bottom line is that in the corporate bond market, there is more information to digest with fewer resources, and with less certainty as to what the true price is in the market. Some of the intellectual arguments for passive management are less relevant for bonds than equities.

Replication challenges

7.1.2.7 Equities can be traded down to individual shares, but corporate bonds can only be sold in minimum nominal lots of £1,000, and sometimes £10,000. If we look at broad corporate bond indices, they contain 600 bonds, and sometimes more, requiring well over £1/2 million to be invested to maintain index tracking. Frequently in the Eurobond market,

counter-parties are unwilling to offer certain bonds for sale as they are tightly held by institutions that are unwilling to sell them – again adding to the difficulties of replication.

Sampling challenges

7.1.2.8 The problems identified above have led passive managers down the sampling route, attempting to replicate the index with a "mini-index" containing far fewer stocks. Sampling does provide the flexibility to overcome many of the liquidity issues identified above, but sampling still suffers from the same fundamental problems associated with equity passive management – that managers have to stubbornly hold stock regardless of the environment.

7.1.2.9 Active corporate bond management is more about the identification of losers rather than picking winners – the bonds of an issuer that defaults could fall in value from approx £100 to £30 or less, while the bonds of an issuer that is upgraded from BBB to AA might go from £90 to £100. Hence even the attempt to index involves active selection. In the bond market replication is therefore impossible. Some reasonably diversified CDS indices now constitute an exception as they can be replicated in a single index swap transaction.

7.1.3 The keys to success in bond indexation are:

Understanding

7.1.3.1 A thorough understanding of the market environment, including issuance patterns, maturity structure and taxation issues, is needed.

Knowledge

7.1.3.2 The manager should have detailed knowledge of the benchmark indices, including index rules, and the ability to anticipate, understand and reflect within a portfolio all index changes.

Good construction methodology

7.1.3.3 It is essential to have a portfolio construction methodology that is rigorous, objective, scientific and robust.

Efficient trading

7.1.3.4 Efficient trading practices that limit transaction costs help to keep costs down and aid tracking.

Good monitoring process

7.1.3.5 There should be daily monitoring, performance attribution and analysis in place. This should feed through to a joint focus on minimising tracking error while minimising costs.

7.2 Indexation methodology

7.2.1 Full Replication and Stratified Sampling are the two key methods for tracking bond indices. The choice of methodology depends on the benchmark index being tracked and the size of the portfolio.

Full replication

7.2.1.1 Replication is the preferred index portfolio construction method for indices comprised of a small number of bonds and where portfolio turnover is low. The cost of buying all the stocks in such an index is minimal, and the tracking error only creeps in when there are index changes – this is where experienced portfolio management and trading teams are important.

7.2.1.2 UK Gilt and Index-Linked Gilt indices are ideal candidates for replication. They are small, and have very low turnover. (The FTSE Actuaries Government Securities All Stocks index currently contains only 30 bonds, and the FTSE Actuaries Government Securities Index-Linked Gilt index contains only 11 bonds.)

Stratified sampling

7.2.1.3 The index is broken down into sub-groups or cells sharing similar characteristics. Cells are then constructed according to the following characteristics:

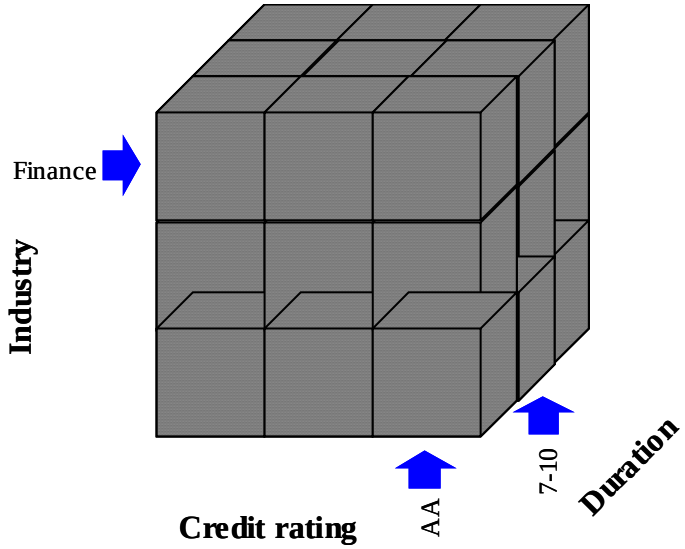
- duration;
- sector/industry;
- credit rating; and
- liquidity.

7.2.1.4 The following average statistics are calculated for each cell:

- weight in the index;
- average duration;
- average yield;
- average option adjusted spread; and
- average convexity.

7.2.1.5 A subset of each cell is selected to represent each cell of the index in the fund portfolio. For example, a cell may contain 20 bonds. 4 to 5 of these bonds will be selected to represent the cell in the fund.

Figure 5: Cell definition for stratified sampling



7.2.1.6 The sample is stress tested to see if it will react in the same way as the cell from which it is taken. Each sample is stress tested against changes in the yield curve such as:

- parallel shift (a change in yield of the same amount at all durations);
- butterfly shift (a change in yield in one direction at a medium duration and in the opposite direction for long and short durations); and
- twist (a change in the difference between yields at long and short durations).

7.2.1.7 This process is repeated for each cell in the index.

7.2.1.8 When sampling bonds from each cell, care needs to be taken to diversify across issuers, and to keep issuer weights in the sampled portfolio in line with index weights. Issuer diversification in a portfolio minimizes tracking error caused by event risk. However, the asymmetry from blow-ups can easily ruin a tracking error record.

8 Active management

8.1 Sources of added value

8.1.1 Value can be added to a bond portfolio by the following:

Market allocation

8.1.1.1 If a portfolio has a benchmark comprising more than one market (e.g. a multi-currency fund), then an allocation away from the split of the benchmark can be used to add value. Examples of this are an allocation from one currency to another, from conventional bonds to index-linked or government bonds to non-government bonds.

8.1.1.2 Such decisions are generally based on top-down analysis of the various markets, considering issues such as relative value of the markets and momentum in the various markets.

Yield curve/duration positioning

8.1.1.3 An allocation from one part of the yield curve to another can add value. This can include an allocation to cash, which can be considered the extreme short end of the yield curve. Allocations can result in a long or short overall duration if the manager is bullish or bearish of the market. Otherwise a 'butterfly' trade can be performed which results in an overweight or underweight position in one area of the yield curve offset by compensating underweight or overweight positions at longer and shorter areas of the curve (e.g. overweight 10 year bonds against underweight 5 years and 20 years). It should be possible to pick the sizes of the positions so that the overall impact has a neutral effect on the duration of the overall portfolio.

8.1.1.4 Such decisions are again generally based on top-down economic analysis – in these decisions, a good government bond manager is essentially a good macro-economist.

Sector allocation

8.1.1.5 Within a credit portfolio, an allocation can be made from one economic sector to another (e.g. overweight utilities and underweight industrials) or one rating category to another (e.g. overweight AAA-rated and underweight BBB-rated). Allocations between government and non-government bonds are usually treated as an allocation between markets, but may also be treated as a sector allocation.

8.1.1.6 Sector allocations can be based either on top-down macro-economic assessments of the relative strength of the various sectors, or on a bottom-up basis, aggregating the views derived from analysis of individual corporate bonds.

Stock selection

8.1.1.7 As with equities, selection of individual stocks is important. In the case of government bonds individual stocks can perform quite differently from similarly-dated stocks due to, for example:

- the influence of futures contracts and which stock is cheapest to deliver;
- issue size and, consequently, liquidity; and
- coupon size and, consequently, relative attractiveness to investors with varying tax treatment.

8.1.1.8 Stock selection can be all-important in credit management. In recent periods where there have been a number of corporate casualties, the key to performance has been avoiding these stocks. In fact, it is generally much easier to add value by avoiding stocks that are downgraded than by holding stocks that are upgraded, and this approach forms the basis of many managers' strategies. This is a necessary but not a sufficient strategy and success will depend on the index weighting of the issuer that blows-up.

8.1.1.9 The research process for corporate bonds can be enhanced by communication between credit and equity analysts if an investment management firm has both corporate bond and equity management capabilities. However, the degree to which this communication occurs is open to question, regardless of claims in marketing literature.

8.1.1.10 It is also important to note that credit and equity analysts use different criteria to grade managers: corporate bond managers are not interested in whether a company will excel, only whether it will do well enough to meet the payments due on the corporate bonds in issue. A good representation of this is given in the description of the contingent claims model in the section on risk controls, below.

Off-benchmark

8.1.1.11 Any of the above allocations can be considered an off-benchmark strategy if an allocation is made to bonds not part of the benchmark, but permitted by the Investment Guidelines. Particular examples for a portfolio with a pure gilt benchmark would include an allocation from conventional to index-linked bonds based on a low break-even inflation rate or a switch from long-dated gilts into German Bunds to take advantage of a large yield pick-up. In the latter case, the issue of whether to currency hedge the exposure is a factor. The scope for adding value in this manner will be determined by the Investment Guidelines.

8.2 Relative importance of these sources

8.2.1 It is difficult to generalise about the relative importance of the above sources as it depends on the freedom allowed by the investment mandate. Investment performance targets are generally split into two groups, core and core-plus. Core mandates require the investment manager to outperform the benchmark by investing only in elements of the benchmark. For example, a fund benchmarked against gilts would be constrained to invest only in gilts. Core-plus mandates allow the investment manager to tactically invest a substantial proportion of the assets (usually up to 20%) in assets outside the benchmark (for example, in corporate bonds or overseas bonds). In return for the greater freedom of such off-benchmark strategies comes a higher performance target.

8.2.2 Core-plus mandates present more challenges in measuring the capability of the fund manager. In our example above one would expect a portfolio of 20% corporate bonds and 80% gilts to outperform gilts in the long run, so there must be the information available for the client to check whether fund performance has been generated from being strategically committed to a higher returning asset class or whether indeed the fund manager has tactically managed off benchmark exposures and generated value.

8.2.3 If applicable, then market allocations and off-benchmark strategies can often be the most significant contributors to performance. Looking at a portfolio that invests only in its benchmark, duration is typically the most important driver of relative performance. After this, yield curve positioning can be the next important. Stock selection would normally be of lesser importance. However, as mentioned above, holding a credit that has defaulted or one that the market fears will default can have a major adverse impact on performance. For high yield portfolios, what matters most are getting the credit decisions correct.

8.3 Concentration of bond portfolios

8.3.1 In the case of a simple government bond portfolio, there is no need to diversify holdings unduly and a portfolio of 5 or 6 holdings may be used on a single currency portfolio. In the case of credit portfolios, a more diverse portfolio would be recommended to mitigate credit risk.

8.3.2 Managers who are confident that they can analyse holdings in depth in order to avoid credit risks may feel that they can afford to hold a smaller number of holdings. However, this is a potentially risky strategy – the negative impact of a single downgrade would probably wipe out any out-performance arising from otherwise good stock selection decisions. This risk is even greater given that downgrades can occur regardless of sound

stock selection decisions: not only can unforeseeable events damage an issuer's prospects, but companies have been known to deliberately withhold important information from analysts.

8.3.3 There is, then, a strong argument for holding a large number of holdings in order to minimise individual counter-party exposure. This can give rise to the objection that it is difficult to monitor so many companies. In general, diversification is a key driver provided that risk can be allocated appropriately across a large number of credits. Larger risks can then be taken where the credit view is stronger.

8.4 Dispersion of returns, risks and information ratios

8.4.1 There is a large amount of information on managers' bond returns from Russell/Mellon CAPS. However, it is important to use such information carefully. If data covering several periods is used, it is be preferable to use data from managers who are no longer in the index. However, this is not straightforward and requires reference to historical publications. If only data from currently active managers are used, then the study is subject to survivorship bias – less successful managers will no longer be operating.

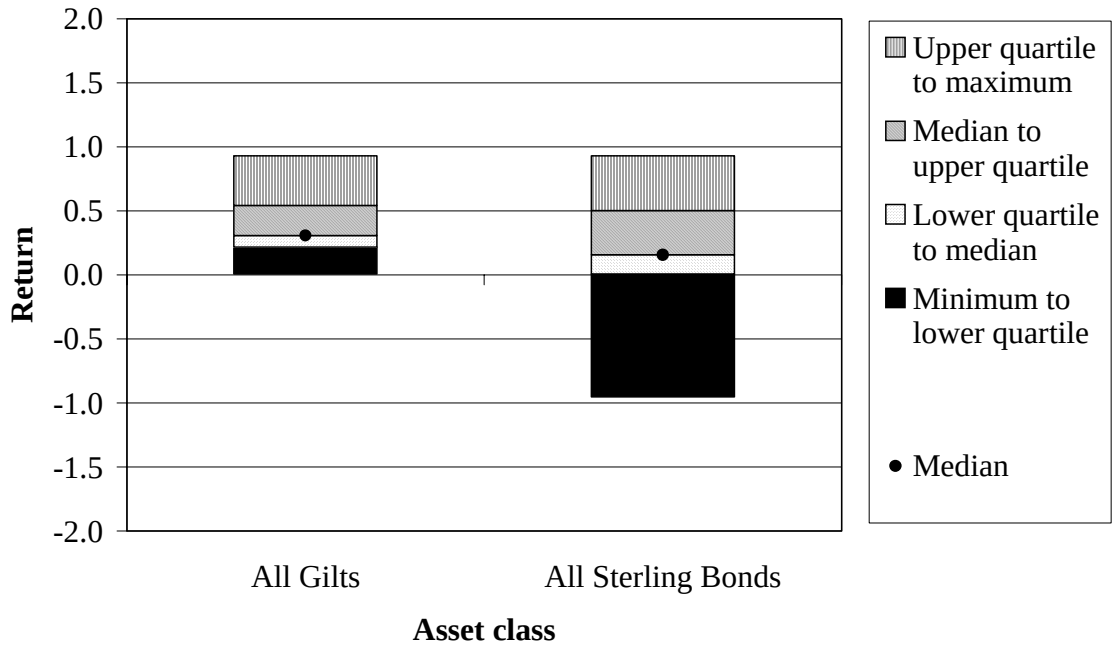
8.4.2 There is, though, a case for using data only from managers who have only been operating over the period from managers who have been active over the period of the analysis (i.e. excluding managers who have only entered the market recently) to ensure some consistency over time.

8.4.3 All of this suggests that the period used should not be overly long, but long enough to give sufficient detail. We have, therefore, used the period from 31 December 1999 to 31 December 2002.

8.4.4 We have looked at two categories. First, we have considered only those funds benchmarked against the FTSE Actuaries All Gilts Index. We have also looked at a broader category of all funds with Sterling bond benchmarks including government and corporate indices of all durations. The statistics given relate to the return (figure 10) and the information ratio (figure 11) and are calculated using the return relative to the appropriate benchmark.

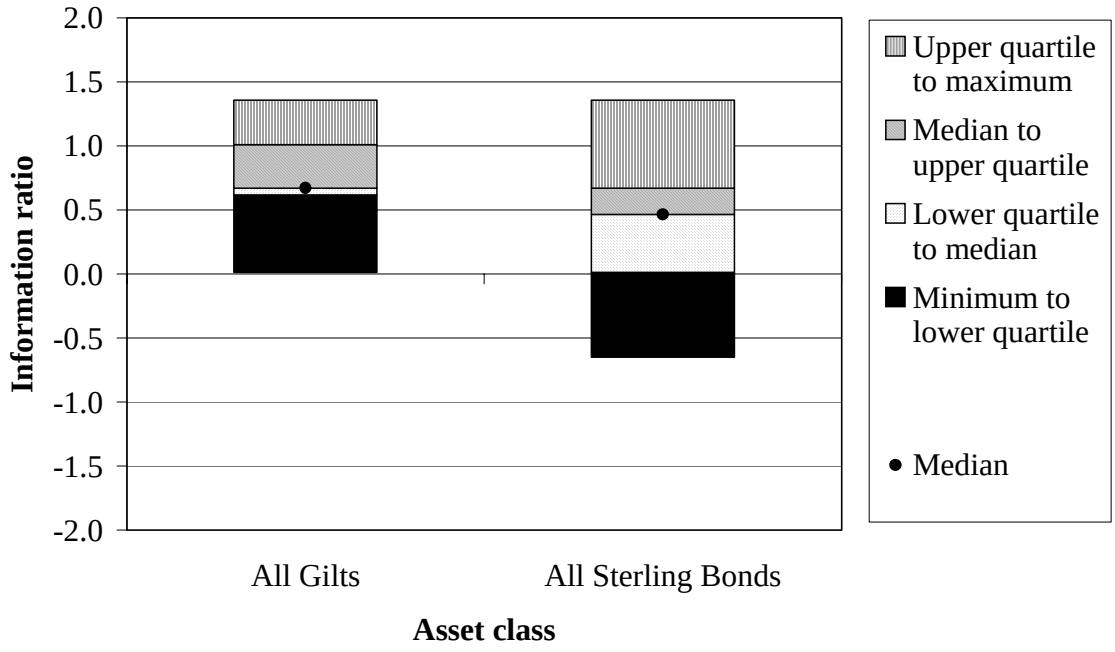
8.4.5 These show, unsurprisingly, that the range of results is wider for the broader range of portfolios, although the median levels of out-performance (0.31% and 0.16%) and median information ratios (0.67 and 0.47) are similar for the two groups, the figures being for all gilt and all fixed interest portfolios respectively.

Figure 6: Average annual returns relative to benchmark between 31 December 1999 and 31 December 2002



Source: Russell/Mellon CAPS

Figure 7: Annual information ratios for the period 31 December 1999 to 31 December 2002



Source: Russell/Mellon CAPS

8.4.6 These figures seem to suggest that it is relatively straightforward to add value through active management. However, the effect of survivorship bias might still be present and a degree of the out-performance in gilt and aggregate (i.e. gilt and corporate) benchmarked portfolios might be due to managers' strategic overweight positions in corporate bonds.

9 Risk Controls

9.1 Risk components

9.1.1 The risks involved in active bond management are closely related to the sources of added value mentioned above. However, the analysis of the risks is easier if they are grouped in a slightly different way.

Interest rate risk

9.1.1.1 Interest rate risk is a measure of how sensitive your portfolio is to changes in interest rates compared to the benchmark. It arises primarily from duration-based investment decisions, but might also occur with relative changed in the real and nominal interest rate if there is an allocation decision made on index linked relative to conventional bonds.

Currency risk

9.1.1.2 Currency risk is a measure of the sensitivity of your portfolio to changes in currency rates compared to the benchmark. It might be incurred through investing in overseas bonds, or using (or choosing not to use) currency derivatives.

Credit risk

9.1.1.3 We define credit risk as the measure of the sensitivity of the portfolio to changes in credit quality compared to the benchmark. Whilst at the extreme this means corporate bonds defaulting in the main it reflects an overall improvement or deterioration in the credit environment as reflected in corporate bond prices. This is a broad area covering the general level of credit spread, relative spread movements of sectors and the changes in individual bonds' credit spreads.

9.2 Setting bond mandates

9.2.1 There are no hard and fast rules for setting bond mandates. Funds typically set a bond benchmark to be reasonably consistent with a set of liabilities – for a fund with Sterling liabilities for example this could result in a benchmark comprising of index-linked gilts, nominal gilts and Sterling investment grade corporate bonds. It is quite possible that different consultants would come up with different proposals dependent upon the risk appetite of the client.

9.3 Client restrictions

9.3.1 The fund manager and client will agree restrictions to the investment mandate to ensure that no excessive risk can be taken to achieve the performance target for the fund. As we shall discover doing this by using quantitative models is difficult and far from guaranteed to produce the requisite results.

9.3.2 However, it is important that restrictions are not too arbitrary and that they do not encourage excessive risk to be taken in one area at the expense of another (for example, duration relative to credit). Common mandate restrictions are discussed below.

Relative duration

9.3.2.1 There is usually a limit on the relative duration that a fund can have relative to the benchmark. This is a very broad proxy for interest rate risk. Further restrictions in addition can be limits place on amounts to be invested in maturity groups.

Country positioning

9.3.2.2 Another common constraint is a limit on the relative country position that a fund can have relative to the benchmark, this being a straightforward way to constrain currency exposure. However, there should be reference to the degree to which non-Sterling bonds should be hedged back to Sterling to ensure that currency exposure is properly managed.

Credit allocation

9.3.2.3 There are several ways in which credit allocation can be controlled, including:

- a limit on the overall allocation to credit relative to the benchmark;
- limits on investments in corporate bonds depending upon their credit rating relative to the benchmark;
- limits on the maximum size of any corporate bond holding which may well depend upon the rating of the corporate issuer (note that it is issuer rather than issue that is important when looking at risk);
- limits on the relative sector positions for a corporate bond portfolio; and
- a minimum number of corporate bonds that have to be held (to ensure sufficient diversification and to reduce the risk of significant losses arising from a single default or downgrade).

9.4 Modelling credit risk

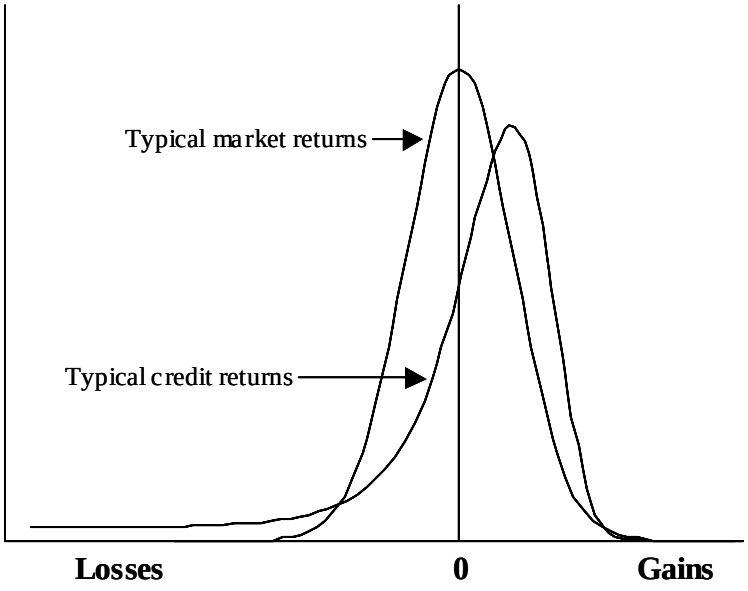
9.4.1 The credit restrictions above are only an approximate way of controlling credit risk. There have, though, been a variety of methodologies used to try to assess credit risk more accurately in recent years. Each method has its advantages and drawbacks. We will look at three of the major approaches used. They are:

- ratings migration methodology;
- contingent claims model; and
- market based approach

9.4.2 Modern portfolio theory has taken enormous strides in its application to equity and other market price risks. Fundamental differences between credit risks and equity price risks, however, make equity portfolio theory problematic when applied to credit portfolios.

9.4.3 The most immediate problem is that equity returns are relatively symmetrical and are well approximated by normal distributions, while credit returns are highly skewed and fat-tailed (as illustrated in figure [x]). Put another way, the downside risk is a lot more than the upside. Because of this asymmetry in credit returns, modelling the full distribution of portfolio values requires a great deal of information beyond simple summary statistics such as the mean and standard deviation.

Figure 8: distribution of corporate bond returns



9.4.4 The second major problem is with the data. Bond spread data is scarce making the calculation of credit quality correlations extremely difficult. Typically credit quality correlations are derived indirectly (such as the equity market) or tabulated at a high level of aggregation – i.e. treating all BBB issues identically. The latter assumption is not consistent with actual market behaviour.

9.4.5 Different models tackle these problems from different starting points.

Ratings migration methodology

9.4.5.1 This approach has intellectual appeal to the actuarial mindset. For any one credit, probabilities are attached to the likelihood of possible credit event, including upgrades and downgrades, not just defaults. The probability that a bond will migrate over a given time horizon to any other rating is derived from a "transition matrix". Each migration results in an estimated change in value (derived from credit spread data and, in default, recovery rates). Each value outcome is weighted by its likelihood, to create a distribution of value across each credit state, from which each asset's expected value and volatility (standard deviation) of value are computed.

9.4.5.2 Finally, individual value distributions for each exposure are combined to yield a portfolio result. Each asset cannot be treated in isolation, however, as rating outcomes are not independent of each other as they are affected by the same economic factors. To calculate the volatility of portfolio value from the volatility of individual asset values requires estimates of correlation in credit quality changes. Since credit quality correlations cannot easily be directly observed from historical data, many different approaches to estimating correlations, including a simple constant correlation, are used.

9.4.5.3 These type of models do have their drawbacks:

- There is a relatively high level of aggregation (e.g. treating all A-rated issuers identically) thus removing key detail;
- ratings migration data is typically based on US experience which limits, somewhat the application to other markets (including Sterling, Euro and Yen);
- identically rated bonds trade at different spreads; and
- ratings migrations may significantly lag spread changes in credit spread movements.

9.4.5.4 The last of these points is of particular interest. Credit spreads can move sharply even when credit ratings on companies have not changed, and in practice spread movements tend to happen ahead of credit downgrades or upgrades. An example is British Telecom.

9.4.5.5 It was not too long ago that BT bonds were AAA-rated stock and the company had ambitions to be a European force in mobile phones. This proved to be an extremely expensive strategy. BT was under massive pressure to boost shareholders returns, so it was financing its strategy by borrowing large amounts through the bond markets.

9.4.5.6 The increased interest payments, in addition to the intense competition in the sector, eventually led to Standard & Poor's and Moody's downgrading BT initially to AA+ and subsequently to A. This indicated a significant deterioration in credit quality by any standard. However, the risk premium (or the extra spread) demanded by investors was increasing ahead of the official announcements by the Rating Agencies.

9.4.5.7 A further deterioration in credit quality led BT to be put on negative credit watch in February of 2001, highlighting that another downgrade was likely. Again, the credit spread had widened leading up to this announcement. Since then, the risk premium demanded by investors has reduced as BT has indicated that it is significantly downscaling its global ambitions and is addressing the challenge of reducing its debt mountain. In May 2002, S&P downgraded the stock further to A-, but this news was well expected and since then the bond has continued to perform. This situation is interesting because it shows a true-life scenario where the credit rating has consistently deteriorated, but where credit spreads both widened (equivalent to under-performing gilts) and tightened (out-performing gilts).

9.4.5.8 Clearly, therefore, credit ratings are not in themselves a good indicator of credit spread movements and, as such, the limitations of rating migrations models need to be appreciated.

Contingent claims model

9.4.5.9 Simple balance sheet theory suggests a relationship between companies' debt and equity. Some people then argue that the equity market is a leading predictor for what happens to the company's credit.

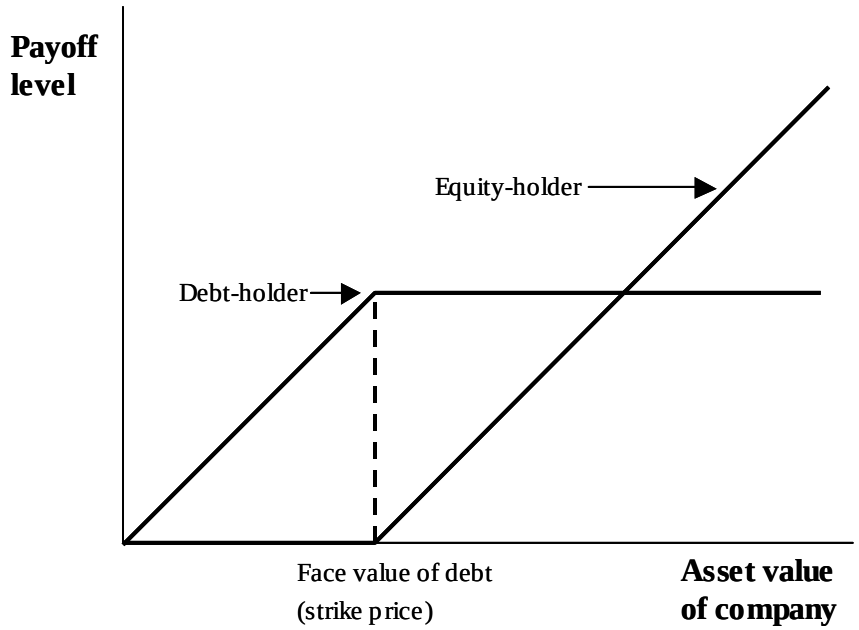
9.4.5.10 A company's assets are funded by a combination of debt and equity. However, the potential returns for the company's debt- and equity-holders are decidedly different. Even if the assets of a company exceed the value of the debt several times over, the maximum a debt-holder can receive remains the same. If the assets fall in value below the level of the debt, the debt-holders will be able to claim all that remains, albeit losing money in the process. On the other hand, the equity-holder does not even begin to benefit until the debt-holders are paid off; thereafter, though, any further increase in the value of the assets accrues only to them.

9.4.5.11 The resultant pay-off patterns are identical to those of a short put option (in the case of the debt-holder) and a long call option (in the case of the equity-holder).

9.4.5.12 The options pricing equations at the heart of this contingent claims theory imply that the price of that debt should depend upon two factors. First, the higher the leverage (ratio of debt to debt plus equity), the higher the risk of default, and thus the lower the price of the debt; second, the greater the asset volatility, the more likely the asset value will fall below the book value of the debt, and hence the lower the price of the debt.

9.4.5.13 The relative importance of these two factors depends upon the degree of leverage of the company and, consequently, to its credit quality. In the case of most investment-grade companies, the equity option can be considered to be deeply "in-the-money": the value of the assets greatly exceeds the book value of the debt (the strike price). Even when the asset value decreases a little, there is relatively little impact on the market price of the debt. However, fluctuations in the volatility of the asset value are rather more important, particularly for longer maturity debt.

Figure 9: comparison of debt- and equity-holder payoffs



9.4.5.14 For companies with lower credit quality, the option is much closer to being at-the-money. Under these circumstances, changes in asset value have a much more significant impact on the credit spread. Thus by its very nature contingent claims is much better suited to appraising dramatic deteriorations in individual credit quality than to analysing the more

gradual fluctuations in value typical of credit sectors. Additionally, there are companies that issue bonds that do not have public equity and workarounds are required to allow for these issuers.

9.4.5.15 The effectiveness of this model is still open to debate. Whilst there is clear evidence to show that this approach can lead rating agency moves, it is not clear that the approach is any faster than that already implied by the credit spread. The case of BT is again worth considering – the contingent claims approach would have signalled a deterioration in credit quality due to the high level of leverage and asset volatility, but we have already seen that the credit spread widened significantly anyway.

9.4.5.16 Where the model has a clear lead is in dealing with illiquid debt where an equity-derived credit spread will be a better indicator of default risk.

Market based approaches

9.4.5.17 These systems used actual bond spread histories based on the belief that the most accurate credit risk pricing mechanism is the market itself. Traditionally, though, bond spread data has been notoriously scarce, particularly for low credit quality issues, making the estimation of bond spread correlations impossible in practice.

9.4.5.18 However, if the data issues can be overcome, and UBS with their CreditDelta product claim they can, then this approach obviously has intuitive appeal. Credit spread data contains all the information an investor wants and correlations are calculated directly rather than on the basis of some questionable assumptions.

9.4.5.19 CreditDelta constructs issuer yield curves for hundreds of different issuers, and tracks the correlation and volatility of these curves over time. More liquid bonds have greater weightings in the curve building process.

9.4.5.20 The credit curve will move over time and this can be looked at on an absolute basis or with reference to a government or LIBOR benchmark.

9.4.5.21 The measurement of risk is entirely consistent for both government and credit products, and you are able to examine portfolio risk both on an absolute basis and versus their benchmark.

9.4.5.22 The weaknesses of this approach are twofold. The curve building process is as only good as the data points. The bond price information is based on the trading books of just one investment bank and therefore represents just a portion of the information in the marketplace. The quality of the pricing information is key. In practice, therefore, whereas

CreditDelta is very useful for investment grade portfolios, which are reasonably liquid, it will be of less use for less liquid asset classes such as high yield debt. In addition, no system is very good in estimating risk of extreme moves in yields (i.e. blow-ups).

9.4.5.23 Additionally, by focusing on spread volatility alone, it is likely that the impact of downgrades and upgrades will be overlooked.

10 Implementation

10.1 Execution of a bond purchase

10.1.1 Bond trading is fundamentally different from equity trading for two main reasons. First of all, pricing information is usually expressed in terms of redemption yield and not prices for gilts, and by reference to the yield spread over gilts for non-gilt issues. Secondly, bonds are not exchange-traded like equities but are instead traded over-the-counter (OTC), so prices are not as transparent as for equity markets. However, in selecting an issuer the portfolio manager will have had access to approximate yields via data sources like Datastream, Reuters and Bloomberg, and probably input from sell side analysts at broker/dealers. The manager will have used this input to determine the relative value of an issuer compared to other issuers' bonds and impact on the risk of the manager's overall portfolio relative to the manager's performance benchmark. The manager will also look across the various issues of the particular issuer to find the best relative value taking account of the manager's duration targets.

10.1.2 Most investment firms separate the role of fund manager and dealer. Once the manager has determined precisely which issue is to be purchased, he will instruct his dealer (usually in-house) that he wishes to buy a certain nominal amount of the stock. In doing so he will set a limit on the purchase price in terms of yield or yield spread over gilts. In other words, he will indicate that the dealer should not buy the bond without referring back to the portfolio manager if the yield or yield spread is lower than a certain level.

10.1.3 The in-house dealer will then request prices from sales representatives at the broker/dealers by asking for just a purchase price (not bid and offer or a two-way price) for a notional amount of the particular issue. This is normally done by phone, although an electronic execution market is developing and this is described later. These are normally quoted as clean prices (i.e. excluding the value of the next coupon payment that has already been accrued). For non-gilts, the broker/dealers quote a yield spread over a comparable gilt.

10.1.4 The dealer will normally limit his requests to two or three broker/dealers in order to prevent an adverse market impact on the yield at which the bond is purchased. This can occur if the market becomes aware that there is an order in the market and it is significant relative to normal market volumes. However, the manager's dealer will need to check prices from at least two broker/dealers in order to demonstrate best execution under UK legislation.

10.1.5 If the portfolio manager has used the research of a particular broker/dealer then he will generally request that the in-house dealer check with that particular house for a price in order to reward the broker/dealer for their research.

10.1.6 The in-house dealer will then compare the best yields offered by the broker/dealers and select the best quote. If the quotes are all the same, the in-house dealer may request that the yield quotes are converted into prices by the broker/dealers as this may result in a slight difference even though the quoted yields are the same.

10.1.7 Once the best quote has been selected, a dirty price will be calculated which adds the value of the accrued income onto the clean price so that the accrued part of the next coupon payment can be paid to the purchaser rather than the previous owner of the bond.

10.1.8 Both the manager and the broker/dealer will send confirmations to each other, the relevant custodian and the settlement house. This is usually Euroclear or Cedel for Sterling corporate bonds and the Central Gilts Office (CGO) for gilts. Settlement will then occur on a delivery versus payment (DVP) basis 3 days later for corporate bonds (T+3) and 1 day later for gilts (T+1).

10.1.9 Electronic trading platforms are beginning to become established, especially for government bonds. These can be single dealer or multi-dealer platforms. For example, JP Morgan eXpress (JpeX) offers live two-way prices which can be executed but with a size limitation. A major multi-dealer platform is Tradeweb, which facilitates competitive pricing in the major sovereign markets (but not yet gilts). MarketAxess is a similar platform but which offers prices from multiple dealers in corporate bonds (not currently sterling bonds). Managers can nominate the broker/dealer from which they want to request prices and these broker/dealers are given a certain amount of time to respond.

10.1.10 Liquidity is a key factor in bond trading. The bid-offer spread compensates the trader for risk and is much wider in bonds that have blown-up. Where trading volumes are typically lower and it is difficult to trade in large sizes, bond dealers might not quote for the full notional that is requested and the potential for a market impact is greater. Trading in high yield, emerging market debt, asset-backed securities and structured credit instruments such as collateralised debt obligations (CDOs) tend to have lower liquidity than investment grade bonds

10.1.11 Trading in credit default swaps (CDSs) is often as liquid as the bond issues but the extent of liquidity tends to be driven by the amount of total debt that the issuer has. Bid-offer spreads tend to be slightly wider in CDS than in bonds but the market is deeper in that a large transaction can be executed without moving the market. For names with few or no bonds outstanding, the CDS is likely to be more liquid than the cash market.

10.1.12 Shorting bonds is difficult as the repo market is very expensive and rarely used. Broker/dealers may from time to time quote prices for bonds that they do not hold and then find that they cannot purchase them in time to deliver them. If this happens then the

manager will appoint a buying agent to buy the bonds in the market and the broker/dealer is obliged to make good any shortfall in the agent's purchase price relative to the broker/dealer original quote. CDSs provide a more effective solution to shorting issuer's credit risk.

10.1.13 Trading in corporate bond indices is fairly limited due to the lack of transparency in many indices and therefore the inability for broker/dealers to hedge their exposures accurately. However, government bond indices can be traded usually via total return swaps, and iBoxx and JP Morgan's credit default swap indices can easily be traded in a wide range of sizes in swap or note format. This can facilitate a quick change in portfolio positioning.

10.1.14 Bonds can also be purchased through the primary markets (at issuance) or by reverse enquiry (an investor requesting an issuer to issue a bond for them).

10.2 Process of issuing Sterling bonds

10.2.1 The process of issuing Sterling bonds starts with the issuing entity mandating a bank or group of banks to act as bookrunners. Prior to any information reaching the public domain, the issuer and its advising bank(s) will decide the format, currency, tenor (term), seniority and potentially the pricing. If the issuer has not previously been rated, they will probably seek a rating from one or more of the credit rating agencies. Once the issuer is ready to execute the transaction, an announcement to the market will typically be made (for example, via Reuters) of the entity's intention to issue a bond. The announcement will provide a brief outline of the planned transaction, including the tenor and (potentially) the size of the issue together with which bank(s) will be acting as bookrunners. An announcement is not however required and is sometimes omitted. The process then takes the following steps:

Marketing

10.2.1.1 The bookrunners will solicit interest from their investor clients. Part of this process will involve positioning the credit profile of the issuer with investors. To do this, bookrunners will typically organise a road show, where the issuer's management will present the credit to investors. Road shows can take the form of formal presentations or one-on-one meetings. Bookrunners typically also provide credit research during this process; the bookrunners will also be soliciting feedback on the format and structure of the proposed issue, as details become public.

Feedback

10.2.1.2 The bookrunners will then collect indications of interest from the investors. This will include an indication of the quantity and price/yield at which the investors will buy the

bonds together with any other requirements such as covenants. The investors may indicate a range of prices at which they buy differing amounts (for example, more at cheaper prices).

Pricing

10.2.1.3 Based on the indications of interests and the issuers' requirements, the bookrunners will then issue some price guidance giving a firmer indication of the level at which the issue is likely to be priced.

Launch

10.2.1.4 The bond will then be launched at a particular spread to a reference (gilts or swaps) and investors will be asked to firm up their indications of interest. Once all the indications are in (and all the hedges have been dealt with), the issue will be priced. This involves setting the reference (gilt yield or swap rate) against which the bond is being priced. Then by adding the credit spread, the bookrunners can ascertain the yield of the issue, and hence calculate the coupon and price. The coupon will be the annualised yield rounded down to the nearest 0.125% - and consequently will price at a slight discount to par. Finally, the successful bidders are allocated stock.

10.2.2 In order to lock into a market credit spread, some bond issuers pre-hedge their bond issuance via the credit default swap market. This enables the issuers to have more certainty about what credit spread it will effectively be paying before the bond has been priced and issued.

10.2.3 In addition to the public bond markets, Issuers can also raise debt by accessing the private placements market or tapping (reopening) existing issues. The process of issuing private placements is similar to that of the public markets, although can be much simpler given the limited number of investors. Reopenings of existing bonds are typically underwritten by banks, guaranteeing a cost of funding to the issuer.

11 Reporting

11.1 Frequency

11.1.1 For institutional investment, full reporting is generally provided on a monthly or quarterly basis. Increased automation has enabled a wide variety of information to be provided within a few days of the end of the reporting period.

11.1.2 To enable clients to obtain a more frequent idea of how their portfolio stands, transaction details and valuations may be provided daily or weekly. Alternatively the movement in an appropriate index may be used to provide an approximate interim valuation.

11.2 Content

11.2.1 The following is a list of information that could be provided for a bond investment mandate. Not all data is appropriate for or required by all clients and care must be taken to ensure that clients understand the data that is being provided. For example, if a figure is provided for tracking error, it must be clear whether this is an ex post (historical) figure or an ex ante (forward-looking) estimate provided from an external (e.g. Barra Cosmos) or internal system.

11.2.2 There will also clearly be a difference between reporting on active and index-tracking management. Most of the detail below relates to the former; reports for the latter will concentrate on tracking error.

Commentary

11.2.2.1 This should cover a number of areas including:

- a market report covering the main factors that have affected the chosen markets over the period;
- an activity report explaining the reasons for portfolio positions during the period;
- a performance report detailing the performance against benchmark and explanation of the out- or under-performance;
- a forward looking commentary anticipating the factors that will affect future performance; and
- a statement regarding compliance with investment guidelines and applicable regulations.

Data

11.2.2.2 There are a number of data items that should be included to enable clients and their consultants to both adequately review past results and assess the risks being taken going forward:

- performance data against benchmark should be given, together with attribution analysis looking at contributions from market selection, yield curve and duration decisions, sector selection and stock selection;
- a comparison of the current portfolio position against benchmark, including currency split, economic sector split, ratings split, should be given, together with statistics detailing the overall duration and convexity;
- ex-post tracking errors;
- some risk analysis should be carried out to give an idea of ex ante tracking error using either external systems (such as Barra Cosmos or UBS Credit Delta) or internally calculated data, although this is likely to be less effective in credit portfolios due to difficulty of estimating blow-up;
- market values (clean plus accrued interest), gains versus book values (possibly based on amortised book values depending on accounting basis required), nominal holdings, and modified duration, convexity, outstanding life, sector should be given for each stock and in aggregate; and
- a list of purchases and sales during the period, covering amounts transacted and also gains versus book values on sales should be included.

Other

11.2.2.3 Liability matching funds would require comparison of cash flows from assets and liabilities.

12 Useful websites

www.actuaries.org.uk
www.bankofengland.co.uk
www.barcap.com
www.dmo.gov.uk
www.ftse.com
www.iboxx.com
www.lehman.com
www.moodys.com
www.morganmarkets.com
www.sandp.com
www.sias.org.uk
www.ubswarburg.com