
*The Sterling Bond Markets
and
Low Carbon or Green Bonds*
A report to E3G

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About the author

Alex has over 20 years experience in the bond markets, working for brokers, as a quantitative analyst for 10 years, and for Fidelity Investments as a portfolio manager where he managed all types of bond fund. He also chaired the iBoxx oversight committee for several years. He has a deep knowledge of bonds, derivatives, investors and borrowers. Alex left Fidelity in 2007 to complete a Masters in Sustainable Energy at Imperial College, London. After advising and working with several companies in 2009, he has taken up the role of Chief Investment Officer at Partnership Assurance.

1. Executive Summary

- 1.1. The UK Bond market is small compared to global bond markets and biased to longer dated, and therefore riskier, bonds.
- 1.2. The UK Bond market is valued at about £1.2 trillion with £700 billion of this made up of UK government gilts.
- 1.3. The insurance and pension industries hold a combined value of £850 billion of bond assets (not all in the Sterling bond markets) and are clearly dominant buyers.
- 1.4. About half the number of bonds in the Sterling market are issued by UK organizations, making up about 75% of its market value.
- 1.5. Two of the biggest obstructions to pension funds investing in climate related investments are their deficits and obscure case law dating from a 1970s mineworkers dispute.
- 1.6. There is only a short history of green or climate related bonds. These were initially focused on complex products, scandinavian clients or tax-driven instruments.
- 1.7. Tremendous structural efforts are needed to incentivize pension funds and insurance companies to purchase climate related bonds.
- 1.8. Incentives such as guarantees or insurance from the UK government or a new Green Investment Bank are likely to efficiently leverage public money.
- 1.9. Tax incentives, like those offered in the US Municipal bond market (10% of the total US bond market) could be successful. This will lead retail investors into the market, though this will not raise the volumes of capital needed which will come from the institutional market
- 1.10. Green or climate bonds will need to reflect current bond structures to address existing demand. New structures without fundamental demand from major investors will fail.
- 1.11. There is an urgent need for a climate bond “rating agency” to “police” bonds to ensure that funds are used for green investments and that insurance and guarantees can therefore be reliably offered.
- 1.12. Well designed green gilts, and a Green Investment Bank, will show that the Government is serious and committed to tackling climate change as well as helping finance large climate related projects, leveraging public money and leading world and domestic markets.

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2. Introduction to Bonds

Bonds can variously be described as IOUs, loans or debts. They are similar to bank loans, but generally last longer (from 1 year to over 30 years). When institutions, companies, governments and other entities want to raise long term finance but do not want to dilute their share holdings (or, indeed, cannot issue share capital — like the UK Government), they turn to the bond markets. Here they can raise money without having to pay it back for possibly decades. On the other side of the deal are the investors. The biggest investors in the UK are the insurance companies and pension funds. They buy bonds to generate return, offset their liabilities, generate income or diversify their portfolios.

2.1. History

Before electronic ownership of bonds became common in the latter part of the twentieth century, when an institution issued bonds, the lender received a certificate. This was often a very elaborate and large document with pictures of whatever the bond was financing (trains, factories, airplanes etc). Amongst other information it also showed how much the certificate was worth (i.e. how much had been borrowed), the rate of interest, the currency and the borrower.

At the bottom of the certificate were a number of “coupons” attached to the main body by perforations (like stamps). Periodically, the lender would go to the paying agent ¹ with the certificate; the paying agent would tear off the relevant coupon and hand over the interest payment. At maturity, the whole certificate would be presented, the “principal” (or nominal amount) of the loan and final coupon paid and the certificate cancelled. We still use this slightly archaic terminology² today, referring to “coupons” and “principal” even though virtually all bonds are now held electronically.

2.2. Risk Features

When an investor thinks about purchasing a bond, there are four key risk attributes that they will assess to determine whether the bond is a good fit with their portfolio, how likely it is that the expected returns will be achieved and whether the price is fair. These attributes are:

- its issuer
- its currency
- its coupon
- its maturity

Issuer – The issuer of the bond (i.e. borrower of the money) defines the credit risk of the bond. That is, the likelihood that the investor will be repaid their initial loan. For example, governments are generally considered to have a low credit risk (see section 2.4).

Currency – A key difference between equity and debt is that, unlike equity, institutions can issue bonds in many currencies. Indeed bond markets talk about the currency of issuance and not the

¹ The company employed by the borrower to facilitate payments to bonds holders

² In the appendix, A1, there is a glossary of many of these terms.

country of issuance. For instance, Vodafone, with its equity listed in London, issues debt in six currencies including the Australian dollar and Czech Koruna. The currency of the bond defines the second key risk characteristic of the bond.

Coupon – The coupon or interest rate defines the rate of interest paid on the bond. This interest can be paid annually, semi-annually or even every 3 months, depending on the way the bond is structured. The stated rate of interest relates to the original amount of money lent or the “face value” of the bond³ and is more often than not a notional value of 100 or “par”. This is often not the same as the price paid for the bond. The size of the coupon gives an indication of the credit risk of the bond. The higher the coupon, the greater the riskiness of the issuer as an investor will require a higher interest rate to compensate them for the greater likelihood of the issuer defaulting.

Maturity – The maturity date is the date the investor gets their money back. There are a number of subtleties around the maturity date, but most bonds have a single fixed date. The further in the future the maturity date (the “longer” the bond), the more risky the debt as there is more time for the issuer to get into trouble. Indeed, some bonds (including the famous war loan from the UK Government) are “undated”, which means that the issuer never has to repay the debt. Undated, or perpetual, bonds often have features that allow the issuer to pay back the debt under certain circumstances: these are called “call options” and give the issuer the right, but not the obligation, to pay back the lender⁴.

2.3. Legal Status and Growth Participation

There are three broad ways in which a company or institution can raise money: through the equity markets, the banks or the bond markets. Each of these has their own merits as shown in Table 1.

In terms of legal status and growth participation, bank loans and bonds are very similar. The main two differences are the length of the borrowing and what rights the lender has if the company goes into bankruptcy. Banks loans are often much shorter in maturity than bonds and banks usually get their money back before bond holders.

The key differences between bonds and equity is that most equity has voting rights and participates in the growth of the company (i.e. shares in the upside), whereas debt has neither voting rights nor the ability to participate in the company’s growth. However, debtors do have the ability to call in the administrators if the company defaults on a payment or breaks a covenant⁵ (and possibly close down the company). They also have an earlier call on the company’s assets. So if the company does default, the bond holders often get something back whilst the equity holders get nothing. Indeed in this scenario the bond holders usually end up owning the company. In bond market language this means that the debt holders rank “above”, are “higher” or “senior” to the equity holders.

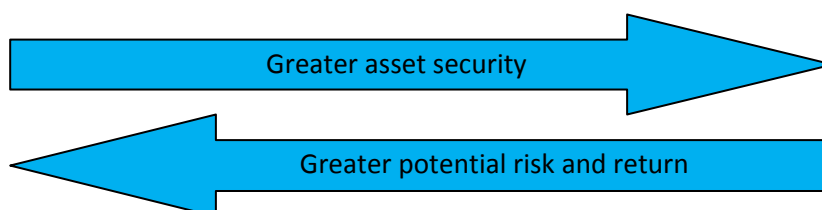
³ A holding of £1,000 in a bond with a 5% coupon, bought at 95 still pays a coupon of £50 (5% * £1000) although the effective or “running yield” will be $5\%/0.95 = 5.26\%$ as 95 rather than 100 was paid for the bond.

⁴ The UK War Loan is undated and has a 3.5% coupon rate that is paid semi-annually (1.75% of the face value every 6 months). However, since 1952 the Treasury has been able to “call” the bond and pay back investors at a price greater than 100 (or Par). Unfortunately, even during the deflationary hiatus of January 2006 the price of the bond only rose to about 94 with a yield of 3.7% so the bond was not called. War loan investors are therefore very unlikely to get their money back (ever)!

⁵ A legally binding promise made by the issuer to the investor in the prospectus.

Table 1: Comparison of equity, bond and bank loan characteristics

BROAD CHARACTERISTICS	Equity	Bond	Bank Loan
Usual Term	Perpetual	Medium to Long term	Short term
Participation in growth	Yes	No	No
Regular payment	Variable	Fixed	Fixed
Creditor ranking	Low	High	Highest
Voting	Yes	No	No
Legal recourse	Company law	Instigate bankruptcy	Instigate bankruptcy



2.4. Credit Ratings

Credit Ratings are fundamental to good bond fund management. Not all bonds have a rating but, those that do not, suffer for not having one, having to pay more for the money they borrow.

There are three major rating agencies, Moody's, Standard and Poor's (S&P) and Fitch. They all have similar rating categories, which reflect the likelihood of a bond defaulting or the rating changing.

From the coarsest perspective, bonds are either investment grade or high yield⁶. The arbitrary band between the two sectors was created by Moody's in the early part of the twentieth century but has remained important – some funds cannot invest in sub-investment grade bonds.

The next level splits each sector into ratings bands⁷ as shown in Table 2. This also shows the average level of defaults for a particular rating over a 1 year and 5 year horizon. The data used is from the whole of the Moody's dataset going back to 1920 (which seems pertinent given what the world is going through at the moment). It is clear that as the ratings fall so does the likelihood of a default and also that the greater the time horizon the greater the probability of default. It is also clear that no bond with a rating of AAA has defaulted over a 1 year horizon. Over 5 years there have been AAA defaults, but these bonds would have been downgraded to other categories over that 5-year period.

⁶ High yield can also be termed "junk", "speculative", "non-investment" or "sub-investment" grade.

⁷ There are even finer spacings than shown in Table 2, and these can be found on the agencies websites

Table 2: Rating agency categories and default rates

	S&P and Fitch	Moody's	One year average default rate*	Five year average default rate*
Investment Grade	AAA	Aaa	0.00%	0.16%
	AA	Aa	0.07%	0.72%
	A	A	0.09%	1.26%
	BBB	Baa	0.29%	3.13%
High Yield	BB	Ba	1.36%	9.90%
	B	B	4.03%	22.42%
	CCC	Caa	} 14.28%	41.18%
	CC	Ca		
	C	C		
Defaulted	D	D	100%	100%

* Source: "Corporate Default and Recovery Rates, 1920 - 2009" Moodys. Data used from 1920 to 2009.

2.5. Primary and Secondary Markets

The life of a bond has two phases, primary and secondary. The primary phase is the gestation period of a bond before it is priced and launched into the markets. After its initial pricing, it enters its secondary phase.

The primary phase encompasses all the work leading up to the pricing and launching of a bond. This includes:

- Creating the prospectus⁸
- Writing research to support the issue
- Talking with investors to see at what price they would buy the bond
- Building a “book” (gathering a list of investors who have committed to buying the bond)
- Working on selling other bonds to facilitate the purchase of the new bond
- The final pricing

There are often several brokers working together (mainly!) on the primary issuance of a bond. These are called lead and co-lead managers. Having a number rather than one lead manager gives the bond the greatest possible exposure to potential buyers as each broker will have some non-overlapping clients. The key objective for the brokers is to get the best (i.e. highest) price for the bond to raise the most amount of money for the client whilst also ensuring that all the bonds are sold. Indeed, it is good practice to ensure that there is more demand than supply⁹.

⁸ This is a document possibly several hundred pages long written by lawyers to specify in great detail what rights an investor has and what the issuer can do and has to do whilst the bond is still in issuance (not matured)

⁹ If the bond is priced too high and the entire bond is not sold to end investors, the bond becomes tarnished and perform not only badly to start with (i.e. the price will fall) but in the long term the bond may also not perform well (investors have memories!). This impacts the ability of the issuer to sell more bonds in the future.

The primary phase finishes when bonds have been allocated by the brokers to clients, switches¹⁰ out of other bonds completed and the price set. The secondary phase then starts.

When a bond enters its secondary phase it is open to be traded by all. Generally, the brokers, or lead managers, that brought the bond to market commit to making a two way price¹¹ in the bond for its life. In reality, this is not always the case especially in difficult market conditions where there is a lot of volatility¹² or if the bond is of a small size and/or has a complex structure (too many bells and whistles¹³). This is important as it impacts the liquidity of the bond, its price and the willingness of investors to own it¹⁴.

¹⁰ A broker agrees to buy an existing secondary market bond in exchange for sale of the new primary market bond on fixed terms.

¹¹ They commit to both offering to buy or sell the bond or “make a market”

¹² Volatility can be caused by a range of factors including for example emerging economic data, loans crises, political unrest and defaults.

¹³ ‘Bells and whistles’ could include call options, put options, odd coupon payments all of which can be complex to understand and can therefore be a disincentive to ownership. Demand for these types of bonds tends to be lower, because of these time, cost and demand overheads.

¹⁴ Liquidity is essential, as it allows the fund manager to change the structure of their portfolio in the event of difficult market conditions.

3. Sterling Bond Markets

3.1. Global Context

The Merrill Lynch Global Broad Market Index¹⁵ was valued at about USD36 trillion in the middle of March 2010 and includes all international, investment grade bonds. The Sterling portion of this market is relatively small as shown in Figure 1 with only about 5% of the total market. Nevertheless, it is the fourth largest bond market in the world and was the third before the advent of the Euro (bigger than the EuroDEM market).

An interesting characteristic of the market is that it has a very long “duration” (a measure of the average time to maturity of the market). This gives an indication of where most bonds are issued and also the riskiness of the market or how the price moves with interest rates¹⁶. Indeed, if this interest rate riskiness is taken into account, the GBP market contributes to about 7.5% of the total global interest rate risk compared to 5% of the global market value. This is important as it shows that the UK bond market has a strong desire for longer term bonds which is likely to be from where the supply of green bonds comes¹⁷.

Figure 1: Merrill Lynch Global Broad Market Index

Currency	Index Weight (%)	Average Duration (years)
USD	43.7	4.5
EUR	27.8	5.4
JPY	17.9	6.7
GBP	4.9	8.1
CAD	2.9	6.4
AUD	1.0	3.8
KRW	0.7	4.3
PLN	0.3	4.0
DKK	0.3	7.3
OTHR	0.3	5.1
CHF	0.2	6.9
SEK	0.2	6.0

¹⁵ There are many index providers, but the Merrill Lynch series of indices is of high quality and readily available.

¹⁶ The change in the price of a bond moves in the opposite direction to the change in its yield: if the yield moves up, the price moves down. All other things being equal, the longer the time to maturity of the bond or the longer the “duration” of a bond, the greater the movement in the price of the bond for a given change in yield. Hence, if the market has, in aggregate, got a “longer duration”, it is more risky.

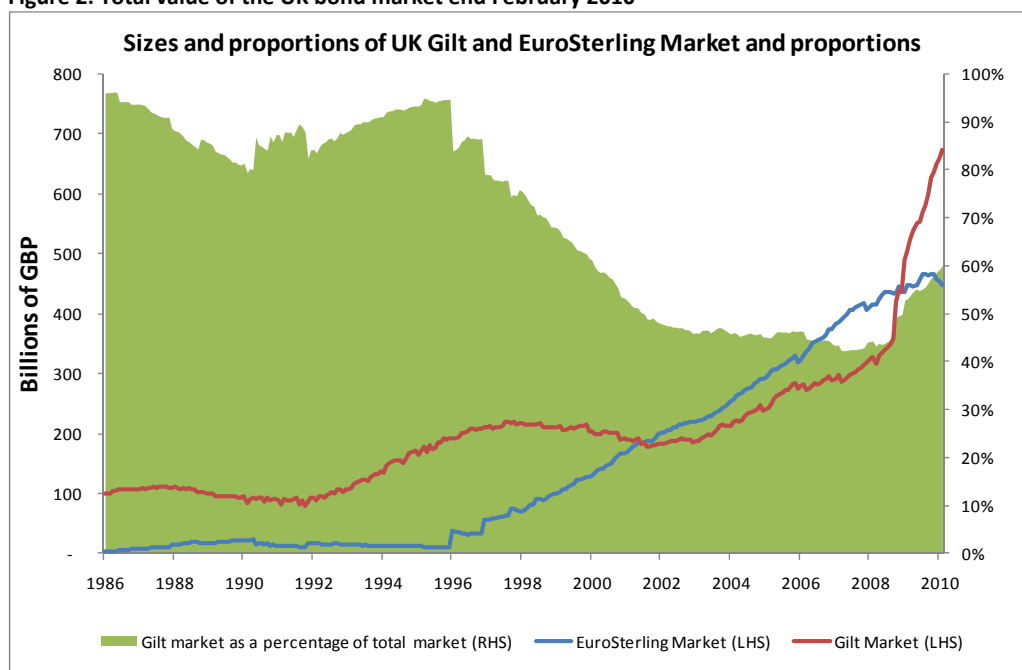
¹⁷ It also indicates that in the past few decades the UK has been regarded as very credit-worthy, due to its prudent fiscal management since the 1970s crises.

3.2. Sterling Bonds

The total market value of the UK bond market at the end of February, according to the Merrill Lynch Broad Market index, was £1.2 trillion. Figure 2 shows how the UK bond market has grown and developed over the last quarter of a century. It does not show the UK high yield sector (bonds that are not rated as “investment grade”¹⁸) as this is a tiny proportion of the UK market worth, only about £22 billion.

Up to the mid 1990s there was no “non-gilt” market to speak of, with more than 90% of the market being composed of issuance from Her Majesty’s Treasury. From the mid 1990s, the size of the non-gilt market grew steadily whilst the gilt market only grew in fits and starts¹⁹. By early 2008, the gilt market was only about 40% of the overall UK Bond market. Since that time however, gilt issuance has accelerated as a result of the government bailout of the UK banks. Now there are over £700 billion of gilts in the market contributing to about 60% of the UK bond market. Over the last few months the size of the non-gilt market has fallen, mainly due to significant maturing bonds, slower growth and deleveraging.

Figure 2: Total value of the UK bond market end February 2010



3.3. Market Sectors

Bonds can be issued either in the domestic, euro or global markets.

3.3.1. Domestic Bonds and Bulldogs

¹⁸ See section 2.4.

¹⁹ The non-gilt market growth was driven by growth in the UK economy and disintermediation of the banks; gilt market growth was driven by borrowing around the economic cycle.

Bonds issues into domestic markets are issued under the relevant domestic law. For instance, Gilts are issued in the UK's domestic market under the jurisdiction of the UK regulators and listed on UK stock exchanges. A foreign company can also issue debt in the UK's market with its bonds being called "bulldogs" (similarly there are "Yankee bonds" in the US and "Samuris" in Japan).

Apart from the, clearly, very important gilt market, the domestic and bulldog market is currently very small and not important in the UK. Indeed there are only about ten domestic bonds listed in UK Bond Indices bonds making up only 0.3% of the overall market. However, this may become a larger sector if local authorities start to issue (climate related) bonds in the domestic market. This would be especially true if there were some form of tax incentive for local authority bonds (see section 3.5.5 on Muni Bonds)

3.3.2. EuroSterling Bonds

This is by far the largest sector in the UK non-gilt bond market covering over 99% of non-gilt bonds. The Euro markets grew up in the 1960s as a result of complex international tax agreements. Broadly, a Eurobond, and specifically a EuroSterling bond, is a bond that is not issued under a particular jurisdiction but, in the case of a euro-sterling bond, denominated in GBP. It is therefore not beholden to a particular tax authority. It is nevertheless often listed on a stock exchange like the Luxembourg exchange where there is no withholding tax²⁰ to fulfill pension fund requirements.

Although many of the reasons for the initial growth of the Euromarkets are no longer valid, because of its flexibility (the markets are above country markets and regulation and therefore lack national barriers to entry and are subject to less political risk), the Euromarkets, and in the UK's case the EuroSterling market, continue to grow and be the market of choice for issuance.

3.3.3. Global Bonds

Global bonds are simply bonds issued in the Euromarkets and domestic market at the same time. This allows investors who cannot engage in one of these markets to still be able to buy the bonds and so expands the investor universe. The global bond market has been particularly popular with the largest supranational agencies such as the World Bank and the European Investment Bank (EIB), who want to ensure that their bonds can be bought by both Euromarket participants and US domestic bond buyers.

3.4. Types of Bonds

3.4.1. Conventional Bonds

Broadly a conventional bond is one that has a fixed maturity date and a fixed coupon. It has few, if any, bells and whistles (like complex formulae for interest payment linked to equity prices, or maturity dates that can be changed). Simply put, it is a bond that will pay a set interest rate over a predetermined time and return the original or par value of the investment at this maturity date. These very plain bonds are often called "Vanilla" bonds.

3.4.2. Indexed Bonds

²⁰ A deduction of tax at source from the coupon that can potentially be reclaimed later.

Index bonds are those whose coupon and/or principal²¹ are not fixed but can change with reference to some sort of index. The best example of this is index linked gilts (“linkers”). Here, the coupon and principal rise (and fall) in line with inflation offering protection against inflation. Conventional bonds, although they may offer a higher initial interest rate, can see their real value²² whittled away in a high inflation environment. For this reason, pension funds and insurance companies with very long term inflation linked liabilities like linkers. However, it is worth making a note that linkers suffer from significantly wider bid/offer spreads than conventional gilts, due to their lower liquidity.

3.4.3. Asset Backed and Securitized Bonds

Asset backed or securitized bonds are similar to ordinary bonds but have specific assets whose revenues pay the interest and principal. An ordinary bond’s payments are generally guaranteed by the company that issues them. In asset backed or securitized bonds a set of revenue generating assets are put into a special purpose company and these assets pay the bond holder their interest and principal.

For instance, Enterprise Inns set up a special company to hold all its pubs. The revenues from these pubs, after certain costs, were then used to pay the principal and interest of the bonds. This structure works because the revenues are thought to be robust so the rating agency can give the bond a strong rating. Indeed, it is common for there to be a number of bonds attached to the assets with different claims on the assets. The bonds with stronger claims have higher rating, perhaps “AAA” whilst those bonds with lesser claims may only be rated “BBB” as they have to wait for all the other bonds to be serviced before they get their slice of the cake.

In the arena of climate change, the Breeze bonds (see section 4.1.4) are a good case in point. These bonds are issued from a securitized vehicle or company which owns a number of wind farms which in turn generate revenues sufficient to pay the principal in and interest.

3.5. Issuers are the Supply

Without borrowers, or issuers of bonds, there would be no bond market. Fortunately there are many keen and diverse borrowers ranging from institutions like the UK government to pre-profit-making project finance²³ companies. Brokers and index companies provide a useful way of examining the market by providing indices²⁴. There are a number of similar providers that not only cover the UK but also global markets. The author has chosen to use the Merrill Lynch (ML) series of bond indices as they cover all markets (UK and international) and are readily available with good bond data.

3.5.1. Country, Industry and Ratings Breakdown

²¹ Amount paid back at maturity.

²² Their value adjusted for inflation. The price of goods goes up with inflation. However, the value of a bond will not and so it becomes worth less when compared to “real” assets. This is particularly the case in periods of high inflation. An index linked gilt however, will rise in value in line with inflation and the cost of goods and so maintain its “real” value.

²³ A company that is set up specifically to operate a large project such as an infrastructure project.

²⁴ A bond index is similar to an index like the FTSE 100 index. It has rules for inclusion and is market cap weighted.

Figure 3 shows a breakdown of the “ML UK Broad Market index” (covering all investment grade²⁵ bonds) by each bond’s issuer country. As expected, about half the number of bonds in the UK are issued by UK institutions and contribute to over three-quarters of the index. However, as we will see, much of this percentage comes from the UK government. There are also many European companies in the index (like EoN and France Telecom) with over 100 of the bonds coming from US companies (like GE and Citibank).

Figure 3: UK Investment Grade Market by Country of Bond

Country of Issuer	Number of Bonds	Percent of index
UK	523	76.7
US	110	4.2
France	65	2.5
Germany	61	4.2
Supra National	50	4.1
Australia	31	0.9
Netherlands	31	1.0
Italy	30	1.3
Ireland	25	0.9
Spain	20	0.8
Other	116	3.3
Total	1062	100.0

An alternative way to split the bonds is into sectors such as corporates (eg British Telecom, Barclays etc); quasi and foreign governments (Royal Bank of Scotland, the Italian government and the EIB); securitized or collateralized bonds²⁶ (Enterprise Inns, Canary Wharf etc); and sovereigns (only the UK Government). Table 3 shows the split by these classifications and, rather than show the number of bonds, it shows the number of issuers. We know that there are over 1000 bonds in the index but that there are only about 380 issuers. The UK Government has the largest weighting but the largest number of issuers comes from the corporate sector which contributes to 25% of the index and more than half of the non-gilt index.

Table 3: Bond issuers by sector

	Number of Issuers	Weight in index
Corporates	253	25%
Quasi and foreign governments	55	11%
Securitized or collateralized	67	4%
Sovereign (UK Govt gilts)	1	60%

Figure 4 shows the broad structure of the UK market by both industry sector and rating category²⁷. It is worth noting that there is a distinct pattern in the matrix shown by the weights in bold. That is that the “centre of gravity” for financials, industrials and utilities is a rating of “A”²⁸ and industrials “BBB” with sovereigns and other government bonds at “AAA”.

²⁵ See section 2.4.

²⁶ See section 3.4.3.

²⁷ For more detail on Credit Ratings see Section 2.4.

²⁸ There has been a change here as the centre of gravity for financials used to be “AA” but with the credit crisis, many financial institutions have either been downgraded or brought under the UK government AAA rating.

The sovereign sector is clearly the largest sector and only includes only gilts.

The quasi and foreign government sector (10.3%) is dominated by the EIB (3.5%) and KfW Bankengruppe (2.5%). The former is a supra-national agency rated AAA and the latter a German government agency also rated AAA.

The financial sector (predominantly banks and insurance companies) is more broadly spread but still has a handful of dominant issuers like GE (whose debt contributes to about 1% of the total index), Barclays (1%) and HSBC (0.8%). The securitized or asset backed sector²⁹ and industrial sector is even more broadly based with no issuers holding more than 0.4% of the index. The utility sector has slightly more concentration with issuers like EDF (0.5%) and EoN (0.4%) having reasonable exposure.

Figure 4: Merrill Lynch Sterling non-gilt index

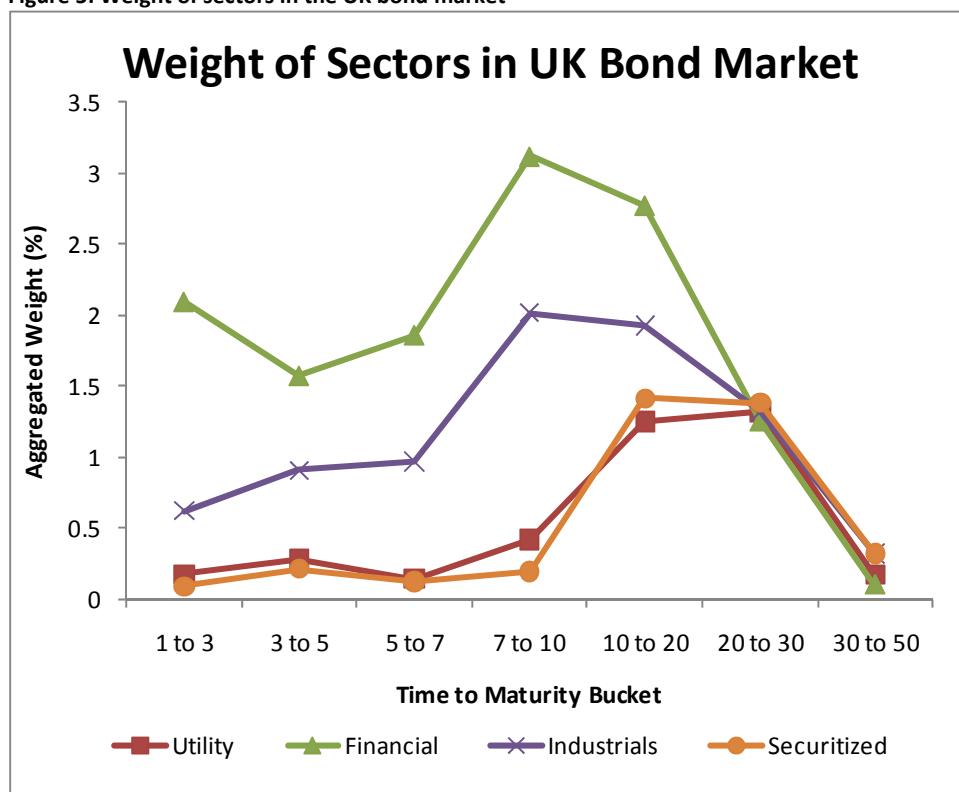
	AAA	AA	A	BBB	Total
Sovereign	60.2	-	-	-	60.2
Quasi & Foreign Government	10.3	0.4	-	0.2	10.9
Financial	0.8	3.1	6.5	2.4	12.8
Securitized	0.8	0.9	1.2	0.7	3.7
Utility	-	0.4	2.8	0.6	3.8
Industrials	0.1	1.3	3.1	3.7	8.1
Grand Total	72.6	6.1	13.6	7.6	100.0

Figure 5 shows the maturity of each of the major sectors in Figure 4. As we know, the Sterling market is a “long dated” market and the figure shows that the securitized and utility sectors are clearly “long sectors”. However, it is the gilt section (not shown), because it is so large, that dominates the duration of the sector.

The duration of the market is important because of the likely type of issuance that green or low carbon bonds are likely to bring. It is expected that this will be long and since the market is set up for this, this supply is likely to be neatly absorbed by existing end investors looking for longer dated bonds in sectors that diversify their bond exposure.

²⁹ Bonds that are secured by a particular set of assets: see section 3.4.3.

Figure 5: Weight of sectors in the UK bond market



3.5.2. Gilts

We have seen that the UK Government is the largest issuer in the UK bond market but it is also important to understand the key role that it has in defining the return on all other bonds in the market. Yields on gilts are often seen as the reference point for all other bonds. Hence increases in gilt yields will likely lead to increases in other bonds yields (and falls in prices). This is most pronounced for bonds that have the highest rating and progressively falls as the credit rating of a bond falls. Eventually for low rated, high yield bonds, gilts yields have very little effect on the bond's yield or price as the majority of the risk in these bonds is from the viability of the company and not from the level of interest rates.

3.5.3. Other Key Issuers

Another key sector that is keenly watched is the "supra and sovereign" sector. This includes names like the EIB, KfW Bankengruppe and the World Bank. These bonds are important because they, like gilts, offer great liquidity (the ability to buy or sell in large size without changing the price). They do not have quite the same liquidity as gilts but have the advantage of offering a higher yield.

3.5.4. Bond Issuer Size

Minimum typical issuance size for an institutional investment grade bond (i.e. one that will have good liquidity) is about £300m. Bonds that are issued in lesser size will generally suffer from illiquidity. Nevertheless, issuance in the high yield sector is smaller with issuance sizes of £100m or less.

3.5.5. US Municipal Bonds

Muni bonds (or Tax exempt municipal securities) are often cited as the route to green bond financing in the UK. It is often posited that UK local authorities could issue Muni bonds to finance efficiency or other projects.

The US Muni bond market has a market size of about USD 830 billion³⁰. This is about 10% of the total size of the US investment grade bond market of about USD 9,800 billion³¹. Unlike US treasury bonds and conventional corporate bonds (either in the domestic or euro market), which are mainly owned by pension funds and insurance companies, most Muni bonds are owned by the retail sector.

Muni bonds are issued by local and state governments (Municipalities). They are used to finance municipal projects such as roads, sewers and bridges etc and are generally secured on either the full “faith and credit” of the issuer (e.g. the State) or on the revenues from the project that is being financed. This generally gives them a good investment grade rating.

However, Munis are not special because of their rating but because of their tax status. They are normally exempt from income tax. The interest that they pay, via the bond’s coupon, is not subject to taxation at the federal level and is also usually exempt from state tax³². For a tax-paying individual this means that they are a very good investment compared to other types of bond. For a person paying a marginal tax rate of, say, 40%, a Muni bond that pays a coupon of 4% is equivalent, after tax, to an ordinary bond paying a coupon of 6.7%³³.

A relatively new Muni sector has recently been introduced which is made up of PACE bonds³⁴ (Property Assessed Clean Energy bonds). These PACE bonds are, and will be, used to finance energy efficiency and renewable energy improvements in buildings. The particular innovation that makes this financing popular and widely available, is that the security for the repayment of the loans underlying the bonds³⁵ lies with the property and not with the owner of the property. Hence, when the property is sold, the liability to repay the loan is transferred to the new owner of the house. In this way the property that benefits from the improvements stays “on the hook” for the repayments and increases the incentive for the home owner to make improvements.

Muni bonds could therefore be a useful additional source of capital for the UK. However, even with the tax incentive, this US market is only 10% of the overall market so cannot be relied onto deliver the majority of finance needed.

3.6. Brokers are the Glue

Brokers are the glue that brings together “issuers and investors” in the primary financial markets and “buyers and sellers” in the secondary markets. Rather than an investor having to find another investor to buy or sell bonds to, they go to a broker who purchases bonds immediately from them and takes the risk of on-selling them. If they can’t immediately, or don’t want to, sell them, they will warehouse them until they have found another end-investor to sell them to. This also works in reverse in that they will also sell bonds to an investor before they have actually bought the bonds.

³⁰ Merrill Lynch Municipal Master Index on the 11th March 2010.

³¹ Merrill Lynch US Corporate and Government Master Index on the 11th March 2010.

³² The US taxation system is different in a number of ways than that in the UK. In relation to muni bonds though, both the federal and state can deduct tax from an individual’s income. Muni bonds, as well as being exempt from federal tax are often exempt from state tax if the holder resides in the state.

³³ $6.7\% * (1-40\%) = 4\%$

³⁴ http://www.whitehouse.gov/assets/documents/PACE_Principles.pdf

³⁵ See section 3.4.3 on asset backed securities

Brokers have general skills and particular specialties depending on their history, strategic goals and the people that they employ. Relationships with brokers are usually on a one to one basis even though it is the companies that are transacting.

Unlike the equity market, there are no commissions paid in the bond or fixed income markets. Brokers make their money by “buying low and selling high”. There are two principal ways that this is achieved, first by making money from the “bid/ offer spread” and second by managing a book³⁶ of bonds.

The former method clearly indicates that brokers are incentivized to increase flow in the market. Profits are made by making a small amount of money on each transaction by buying and selling bonds between customers. The more transactions they complete, the more money they make hence, they are incentivized to increase their “deal flow” with trade ideas and research.

The second principal way they make money is through the warehoused bonds held by traders. The trader constructs a portfolio that they believe will benefit from the way they expect the market to move. This is sometimes called a “back book” or “prop trading” and can require a large amount of “assets at risk” often including derivative positions. The size of position that a trader holds is clearly dependent on the broker’s capital requirements.

Brokers usually have three core teams: the sales team, the trading team and the research team. The sales team is the team on the phone to clients trying to drum up business by suggesting transactions and passing on the best prices from the trading team.

The trading team’s role is to make or give prices on all bonds that they cover at the most commercially competitive rates taking into account their inventory of bonds and their view on the market. They not only talk to their sales team but to other traders in their company (from the swaps, government, corporate and other derivative desks), interdealer brokers, futures exchanges and even traders in other brokerage companies.

The research team generates research on economics, companies, interest rates, yield curves³⁷ and other subjects to generate sales. There are often questions regarding their impartiality ahead of new bond issuance as there is an incentive for the research to be positive about the new bonds. Indeed, these questions extend to research produced when the bonds have entered the secondary markets as brokers tend to like to maintain good relationships with the issuer.

There are numerous brokers in the market. However, the brokers with the most influence in the Sterling markets are the so called “GEMMs”³⁸ – the Gilt Edged Market Makers. In particular, the most important brokers in the UK market are the likes of Royal Bank of Scotland, Barclays and HSBC. These are the key houses for both issuing and trading not only UK-denominated government debt but also corporate bonds ranging from AAA to high yield.

To become a GEMM, a broker has to commit to the Debt Management Office³⁹ (DMO) to making continuous markets in gilts to both buyers and sellers, although not to other GEMMs. They also have to maintain a reasonable market share – meaning that they have to actually buy and sell bonds (rather than just making markets and not transacting) in both the primary gilt auctions and the secondary markets. As a benefit, they are the only market participants that can buy gilts directly

³⁶ A book is a trader’s portfolio of bonds. This will be made up of both real bonds and derivatives.

³⁷ See section A.4.

³⁸ A list of the current GEMMs is in Appendix A.2.

³⁹ The gilt issuing arm of the UK Treasury.

from the DMO and are able to “strip” and “reconstitute” gilts⁴⁰. They are also invited to a quarterly DMO meeting to discuss future issuance and offer their advice to the DMO.

The DMO has two sets of meetings each quarter: one for investors and one for GEMMs, both of which follow the same form. The DMO first presents their view of the market, their expectations on future issuance over the following quarter in the context of the financial year, and any other pertinent detail. The floor is then given to the investors or GEMMs, who have their chance to air their views on issuance, maturities and asset mix (conventional and index linked). Investors and GEMMs can also make other relevant points. These are key meeting at which the DMO learns about investor demand. There is also an annual meeting with the Treasury to discuss broader themes.

Built around the broker’s gilt business is the Euro-sterling and domestic sterling business.

The bid/offer spread in gilts can sometimes be so small that it is called “choice”, which means that the bid and offer price are the same. The bid/offer spread in the euro-markets will often be 0.5% and sometime 10 points (i.e. 10% of the price!). This is a reflection of the liquidity in the market as there is significantly more activity in the gilt market than the Euro-sterling market.

3.7. End Investors are the Demand

Final demand for bonds comes from four core constituencies: pension funds, insurance companies, alternative asset management companies (like hedge funds) and the retail investor. The largest sectors are insurance companies and pension funds. At the end of 2008, these two sectors held about £850 billion of bonds assets⁴¹. The largest of these was the insurance companies that owned about £680 billion of bonds with the pension industry owning £170 billion.

Figure 6 shows the breakdown of these assets in more detail. It shows that both the pension and insurance industry have a preference for long term assets. Part of this reason is that both of these industries are heavily regulated. Pension industry regulation started in earnest after the Maxwell enquiry⁴² and has continued since to protect the right of the pensioner and their assets in defined benefit pension schemes⁴³. The preference for long term assets is a result of protecting stake holder rights who have long term agreements.

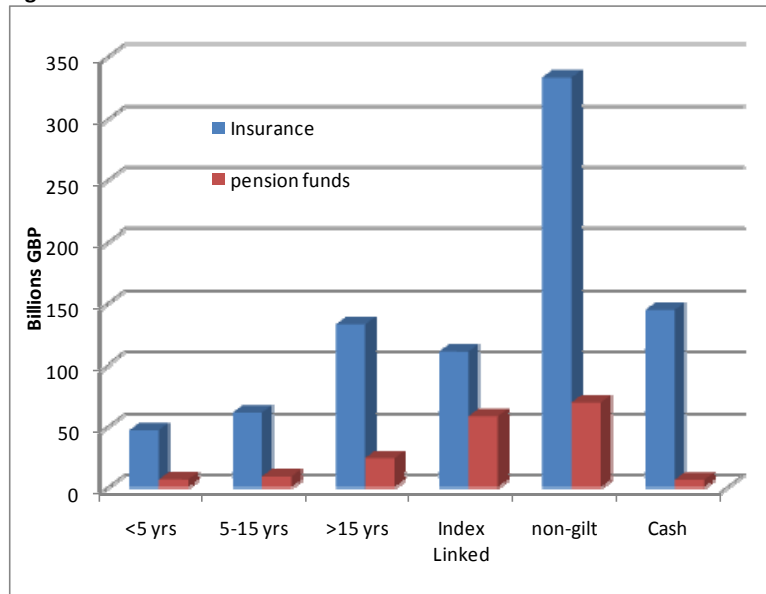
⁴⁰ <http://www.dmo.gov.uk/docs/publications/operationalrules/guidebook211204.pdf>

⁴¹ “MQ5, Investment by Insurance companies, pensions funds and trusts”, Office of National Statistics, 3rd Quarter 2009.

⁴² Robert Maxwell used pension money to bolster the finances of the Maxwell group of companies including the Mirror group that subsequently went into bankruptcy. The Pensions Act of 1994 was a direct result of this and gave greater security to pension funds.

⁴³ A defined benefit (DB) pension scheme is one where working for a company for a set number of years entitles a person to a certain pension which is dependent on the number of years that they have worked for the company and their remuneration at or near to retirement. To secure this, a company has to put aside money in a DB pension scheme.

Figure 6: End investor assets



3.7.1. Assets and Liabilities

One of the keys to regulation is the measurement and assessment of the so called asset/liability mismatch. This helps reduce the risk that the promises made to the pensioner or insured by the fund or company are not met.

- A pension fund's liabilities are the payments that it is contracted to make to both existing pensioners and prospective pensioners. These payments often stretch out decades and possibly as much as 80 years. The future size and number of these payments is dependent on many factors amongst which are wage growth, inflation and longevity.
- It is difficult to calculate the value of these liabilities since they happen many years in the future. Pension funds use actuaries to build models that endeavor to calculate or estimate the "present value"⁴⁴ of these liabilities.
- On the other hand, the assets that a pension fund owns are generally in the form of equities and bonds whose values are known.
- The difference between the sensitivity or characteristics of the future promises (the liabilities) and the sensitivity or characteristics of the assets is called the asset/liability mismatch.
- The difference between the value of the assets and liabilities defines whether the pension scheme is in deficit or surplus.
- Clearly, there is some link between the sensitivity of the assets and the sensitivity of the liabilities. They are linked most clearly through interest rates and inflation. (Indeed, there is a direct link between inflation linked gilts and future inflation which is why they are so popular with the pension industry.)
- However, there are many factors that are not common to the valuation of both, such as longevity and equity market growth.
- This is why there is a robust regulatory, accounting and legal structure to minimize as best as possible the asset/liability mismatch and its effect on pensioners.

⁴⁴ How much you would have to pay another entity today to buy the liabilities.

As well as pension law, various accounting standards have been introduced to formalise the measurement of the mismatch and also to, superficially, increase the transparency of the pension fund. In the UK this started with FRS17 (a UK accounting standard) and then the international standard IAS 19. The equivalent US standard is SSAP24. The Pension Protection Fund (PPF) was set up in 2005 to insure pension funds against major deficit problems and, if the worst came to the worst, take them over.

Insurance companies have different regulations that, arguably, are more robust.

However, these accounting standards all struggle with the impossibility of comparing apples with oranges. The actual future liabilities are tied to long term effects that are not traded whilst the values of the assets are clearly affected by short term factors.

3.7.2. Pension Fund Deficits

Possibly the biggest obstruction to pension fund investing in climate change assets are their massive deficits. According to Mercers⁴⁵, at the end of 2009, the aggregate deficit of the FTSE 350 pension funds was £170 billion. With aggregate assets valued at about £450 billion, this is a deficit of 27%. In other words this is 27% below the level of assets that actuaries believe are required to meet the funds future pension liabilities of £620 billion. This deficit clearly needs to be addressed as it is massive. To put this in perspective, at the end of 2008, the same companies ran deficits of about 13% and somewhat less in previous years. Similar numbers hold for the entire UK defined benefit pension scheme industry.

On the list of issues that pension fund trustees are worrying about, climate change is rather low on the list⁴⁶. More pressing is how to make up their deficits and the legal and risk implications of allocation change to achieve this. There are also clear implications for their sponsors⁴⁷, as the fund deficits impact on the sponsor's accounting records. Indeed, legislation can be used to enforce payments to the pension fund from the sponsor at the expense of dividend payments to shareholders.

Fortunately, insurance companies have not succumbed to the same sort of deficits. Part of the reason for this is the extra regulation that they exist under. Insurance companies, unlike pension funds, are real companies and have to have a certain amount of capital.⁴⁸ The amount of capital that an insurance company is required to have by regulation is dependent on the riskiness of the assets that it owns. The more risky the assets, the more capital they are required to hold and this is expensive as more capital means more shareholder dividends. This has prevented them from being too "exciting" with their investments being more weighted towards bonds.

3.7.3. Climate change and Pension Decisions

Another barrier preventing pension funds investing in climate related assets is old case law originating from a battle fought by Arthur Scargill and the Mineworkers pension fund in the

⁴⁵ Press release, January 2010.

⁴⁶ One chairman of trustees for a large private DB scheme spoken to by the author said that no one had even brought up climate change in the trustee meetings.

⁴⁷ The underlying company that started the pension scheme.

⁴⁸ The capital for insurance companies is equity. The "capital" for pension funds is the support of their sponsoring company.

1970s. The background can be found in the reference below, but the important point is the ruling that came down such that⁴⁹:

When the purpose of the trust is to provide financial benefits for the beneficiaries, as is usually the case, the best interests of the beneficiaries are normally their best financial interests.

This has been (mis)interpreted such that trustees must seek to maximise profit at the expense of all other considerations and put aside all social, political and moral views – effectively non-financial information – when deciding on their asset allocation. This has clearly led some pension funds to deduce that they cannot take into account climate change when deciding on their asset allocation.

However, in 2008 Lord Mackenzie, in the House of Lords, stated that there was “no reason in law why trustees cannot consider social and moral criteria in addition to their usual criteria of financial returns, security and diversification.”

This is an area that could easily be cleared up legally or via the House of Lords. For instance, a clarification of the case could be made narrowing the scope of the case or pension funds could be explicitly told that they could, or perhaps should, take climate change into account in their asset allocation strategy.

⁴⁹ Claire Woods “Funding Climate Change: how pension fund fiduciary duty masks trustee inertia and short-termism” <http://www.geog.ox.ac.uk/research/transformations/wpapers/wpg09-13.html>

4. Green or Low Carbon Bonds

4.1. History

The major issuers in the green bond arena are the World Bank and the EIB with additional issuance in the US and some specific asset backed issuance. The broad characteristics of these bonds are shown in Table 4. These bonds have generally been targeted at retail investors and some have complex tax structures.

Table 4: Some Existing Green Bonds

	World Bank	EIB	Breeze	CREB (2009)
Rating	AAA	AAA	BB- CCC	AAA-BBB
Currencies	Many	EUR	EUR	USD
Amount Outstanding (£)	700m	750m	800m	1,500m
Return	Fixed	Fixed and equity linked	Fixed	Fixed
Use of funds	Broad adaption and mitigation projects	Renewable energy and efficiency projects	Wind turbine projects	Renewable energy projects

4.1.1. World Bank Bonds

The World Bank dabbled in late 2007 with EUR denominated green bonds targeted at retail investors. The return on the bonds was tied to the performance of an “Eco Index” which was linked to the equity performance of a set of companies defined by ABN Amro. The outstanding amount is about EUR230 million.

They also then launched a small bond (about USD30m) that was linked to certified emission certificates (CERs). These were specifically linked to particular projects and again retail targeted.

The first of the major series of World Bank green bonds⁵⁰ were issued in November 2008 in conjunction with SEB in Swedish Krona to the value of about SEK3 billion (£300m) targeted at both retail and institutional investors. They have continued to issue in the series as shown in Figure 7. The sizes of issuance are typical of World Bank bonds and so far, under this program, they have issued just over USD1 billion. However, since the first issuance of the green bond in November 2007, the World Bank has issued USD51 billion of general bonds and none of these in GBP.

⁵⁰ <http://treasury.worldbank.org/cmd/pdf/WorldBankGreenBondFactSheet.pdf>
http://treasury.worldbank.org/cmd/pdf/Euromoney_2010_Handbook_Environmental_FinanceforGBPPage.pdf

Figure 7: World Bank green bond issuance

Volume	Coupon	Maturity Date
USD 300 million	Floating	2012
USD 180 Million	2.00%	2013
SEK 2.85 Billion	3.50%	2014
NZD 150 Million	5.23%	2015
AUD 150 Million	6.00%	2017
BRL 40 Million	9.50%	2017
HUF 2,500 Million	5.50%	2017
NOK 400 Million	3.75%	2017
NZD 50 Million	5.63%	2017
RUB 750 Million	7.50%	2017
SEK 600 Million	3.25%	2017
TRY 50 Million	10.00%	2017
ZAR 100 Million	8.75%	2017
MXN 200 Million	7.50%	2020
COP 25 Million	8.00%	2020

4.1.2. EIB Bonds

The European Investment Bank (EIB) has also issued bonds in their “Climate Awareness” program⁵¹. To date they have issued two bonds. The first bond, in 2007, was issued in EUR to a value of EUR600m (£550m). Its return was linked to the performance of FTSE4Good Environmental Leaders Europe 40 Index.

The second, two tranche bond was more vanilla with either fixed or floating coupons. These were issued in Swedish Krona to a value of SEK2.2 Billion (£200m).

4.1.3. US Bonds

There have also been issues in USDs (like the Muni bonds already discussed) but also Clean Renewable Energy Bonds (CREB). The Energy Policy Act of 2005 allowed special tax credit bonds that allowed electric utilities to receive interest free loans for qualifying energy projects. There is a limit to the amount that can be issued which, for 2009, was about USD2.2billion⁵².

4.1.4. Breeze Bonds

The Breeze series of bonds are asset backed bonds. They were issued by a company called “CRC Breeze Finance” and are secured on a number of wind farms mainly in Germany. There are seven bonds outstanding totaling about EUR 900million.

The bonds are structured so that the revenues from the wind farms pay interest and capital back on the bonds. This is clearly an important structure as it is using the bonds markets directly, rather than through the banks, to finance renewable energy projects.

The characteristics of the revenue stream fit neatly with the needs of bond investors. The wind that powers the turbines is reasonably consistent year to year. The wind turns the generators which

⁵¹ 2007 EPOS II Climate awareness prospectus at

http://www.eib.org/attachments/fi/prospectus_doc/XS0301665310.pdf

⁵² http://www.irs.gov/pub/irs-tege/ncrebs_2009_allocations_v1.1.pdf

produce electricity and receive a set payment through the German Feed in Tariff⁵³. These revenues are reasonably consistent, so they fit neatly with the demands of the fixed income bond investor⁵⁴.

4.1.5. Overview

From the above issuance details it is reasonably clear that initially green bonds were issued and structured for the retail market (many small bonds and currencies with returns linked to stock market indices or designed with tax incentives (in the US)). They have also clearly targeted specific sectors such as the Scandinavian and retail sector.

It is only recently with the World Bank and EIB issues that the institutional market has been targeted with larger issuance size. Nevertheless, it is important to note here that complex bond structures will not appeal to the mainstream investor.

4.2. Source of Funding

Finding investors to buy green bonds is key and the key to finding these investors is to seek out large repositories of money. The largest single concentrations of money are in the hands of institutions such as insurance companies, pension funds, sovereign wealth funds and central banks but the retail sector should also not be ignored even if it is not a point source of money.

Central banks usually have a short time horizon with their emphasis on security and liquidity. Indeed this is also true of the retail sector that generally views bonds as a higher yielding asset than bank deposits with some price volatility. In addition, the retail sector is very much driven by tax incentives (eg ISAs).

Pension funds and Life Insurance companies have long term time frames with liabilities averaging over 20 years and more. Their investing is naturally driven into equities and long term bonds which fits well with climate related projects. It is therefore likely that insurance companies and pension funds will be the largest investors in climate related companies and projects.

The aggregate amount of long term assets held in UK Pension funds and insurance companies was just shy of £3 trillion⁵⁵ at the end of 2008, with bonds and cash held being one third of that number at £1 trillion.

In his seminal work, "The Economics of Climate Change", Nick Stern stated that "central estimates of the annual costs ...[of climate change]... are around 1% of global GDP". In other words, it would cost about 1% of global GDP to address climate change. In the UK, with 2009 GDP at about GDP1.4 trillion, this would amount to £14 billion per year or £70 billion over 5 years.

This estimate now seems low as recent analysis by E3G⁵⁶ has since shown that due to additional infrastructure renewal needs, £265 billion will be needed over the next 5 years, which is equivalent to about 3.8% of current UK GDP spread over 5 years.

⁵³ This is a guaranteed payment to the asset owner of a set price per MWh of electricity generated. I.e., if the wind blows, a set amount of money also flows.

⁵⁴ It is worth noting that this sort of structure would be difficult to create for the UK market because the policy support mechanism – the Renewables Obligation – delivers volatile cashflows, which do not suit the need for a steady income stream to service the coupons.

⁵⁵ MQ5 Investment by Insurance companies, pensions funds and trusts, ONS, 3rd Quarter 2009.

In terms of pension and insurance assets this is equivalent to about 1.7% of total assets or 5.3% of debt assets. If all the money for these investments in efficiency, power generation, power networks, heating, waste, transport and R&D were to come simply from these assets and none from industry or banking (an extreme view) this would mean a re-allocation of 1.7% of total assets or 5.3% of bond assets into this sector per year for five years (see Table 5). In 2015, this would lead to average pension fund and insurance companies owning £265 billion of assets in this sector or almost 10% of their total assets.

Table 5: Allocation to Green Bonds in Pension Funds and Insurance Companies

	Annual allocation as a percentage of assets(per year)	Annual allocation (per year)	Allocation by 2015	Allocation as a percentage of assets by 2015
Total assets	1.7%	£53 billion	£265 billion	8.8%
Bond assets	5.3%	£53 billion	£265 billion	26.5%

This is clearly a steep target and is only looking at the first 5 years. This target is even steeper if only bond assets are taken into account. In order to incentivize insurance companies and pension funds to move this size of assets into the sector will need tremendous long term incentives. These incentives can only come from the Government in the form of guarantees, tax incentives and with the help of a Green Investment Bank.

For comparison, between 2003 and 2009, UK pension funds increased their bond holdings by 9% and reduced their equity holdings by 14%⁵⁷. An asset allocation move from equities to bonds is a more significant change to risk profile than an allocation within a financial sector (like bonds). Hence an allocation of 25% to a different sort of bond (green bonds) is not as risky as it seems, especially if some of these come with an AAA rating (sourced from a guarantee).

4.3. Characteristics and Structure of a Green Bond Market

For a green bond market to flourish, all participants (issuers, brokers and investors) need to be able to make a return. Simply characterizing a bond as “green” appeals to only a small sector of the bond markets and, in particular, to socially responsible investment (SRI) and ethical funds. The promise of only satisfying the investor with being able to tick the SRI or environmental social and governance (ESG) box will ensure that green bonds remain a small sector in the market.

It is clear that if a flourishing green bond market is to be created, policies based on long term, broad based and ambitious cross party political commitment is needed. This means that a long term plan that targets all sectors of the bond market from government to high yield and one whose targets are based on the “need to finance” in conjunction with “need to invest” is crucial.

The conventional markets have grown up the way they are for good reason. They are generally liquid and well priced. A green bond market should therefore broadly reflect the existing bond market with similar characteristics such that an investor can feel immediately comfortable investing

⁵⁶, Ingrid Holmes and Nick Mabey (2010) Accelerating the Transition to a low Carbon Economy: The case for a Green Investment Bank.

⁵⁷ Mercer (2009) Asset Allocation Survey <http://www.mercer.com/assetallocation>

in these important assets. Clearly there will be differences but it is important to stress the similarities.

Instruments that have too many “bells and whistles” will generally not be liquid or well priced. Indeed all bonds need to have a natural market to be successfully sold.

4.3.1. Carbon Ratings

How green are green bonds? How much do they benefit the environment? These are questions that will need to be answered for green or climate bonds to be fully integrated into the mainstream asset management business and the relevant incentives granted.

There are two stages to rating: the initial assessment of what a green bond is and then the ongoing classification of green bonds once they are issued. Although these roles have overlap, they have distinct attributes that require particular skills. For example, in the primary markets negotiating skills are needed, whereas in the secondary market detective work is more necessary. The same issues will apply for green bonds.

For a green bond, potential investors have most power over the legal terms of a bond at the new issuance or primary stage when terms can be negotiated. For instance it may be that issuers can negotiate specific compensation if the “greenness” of the bond falls. Once the bond has been issued though, investors have less leverage over the issuer unless the issuer is looking to raise further debt.

When the green bond enters the secondary market the rating agency needs to ensure that the proceeds continue to be used for the climate issues that were originally specified in the prospectus. If this is not the case then a rating downgrade would follow.

Ratings for these bonds could be in categories such as GGG (for the most climate friendly bonds) and G for the least friendly bonds with GG for something in between. As yet there is no agency fulfilling this function but it is an urgent one that requires attention. Without some form of consistent metric, bonds cannot be compared together or policed in the secondary markets. Companies like Trucost, Asset4, Mapleleaf, EIRIS and the major accountants do some of the needed, roles but none produce ratings as yet. The new “Climate Bonds Rating Authority” is moving in this direction.

4.3.2. Incentives

Before discussing the type of bonds that are likely to be issued and the types that are unlikely to find an investor base, it is worth spending some time on incentives. These incentives can come in the form of tax, guarantees and comfort letters. The purpose of all these is to give the issuer and the investor a better risk/return tradeoff than they would otherwise normally have expected from an unsupported instrument.

The form of the incentive is governed by the comparative advantage of the giver of the incentive or its ability to pool several such incentives⁵⁸. There are three main types: tax incentives, guarantees (or insurance policies) and letters of comfort.

⁵⁸ For example, a traditional insurer pools insurance risks such that they are not exposed to the catastrophic risk of one large loss but are more likely to have regular small losses which are easier to manage.

Tax incentives are a method that is used to good effect in the Muni bond markets in the US. The UK has such vehicles as ISAs. In these, the tax incentive is incorporated into the ‘wrapper’. In other words, as long as the appropriate assets are bought, the capital and income from the assets is received tax free. It is not the assets that are tax free but the way they are held. A pension scheme is another tax efficient vehicle.

The UK nevertheless has tax incentives associated with particular assets like Premium Bonds and Nation Savings Certificates. This is the model that would best be used for green bonds, as it is easier to target the right investment. Giving appropriate bonds tax free status could lead to a massive amount of investment into these instruments. Clearly, the mechanism can be tuned to manage the flow over time but this is likely to be the fastest conduit to leverage private retail investment.

Another effective incentive is the use of guarantees or insurance policies. Insurance policies have been used in the bond markets for many years. The “Monoline” or bond insurers (AMBAC, MBIA etc) specifically insure the principal and coupons of bond issuers. The insurers take a fee and allows the insured bond to be rated at levels of up to AAA, whereas the stand alone bond may be rated at A or below. This is a route down which the UK government or Green Investment Bank could move. It is a less direct way to subsidize the green economy but perhaps a more efficient way as it leverages the AAA rating of the UK government. Clearly, there would need to be monitoring of the uses of the funds to ensure they go to the low carbon projects specified in the bond’s prospectus.

The last and least effective incentive method is the use of comfort letters. These can be given to bond holders and written into the prospectus and often give some assurance that a second, higher rated entity will support the bonds payments. However, unless there is some firm legal tie between the two entities, the letter offers little support to the issue.

4.3.3. Government Bonds

The UK bond market is underpinned by the gilt market. A UK green bond market underpinned by a thriving green gilt market would give a very healthy signal to other market participants and countries that the UK is serious and committed to climate change and to tackling the issues.

A green gilt market would underpin a nascent market for the following reasons.

- It would show that the Government was committing specific funds to climate related projects. These bonds could be used to finance the public part of any private/public climate related project.
 - For instance this could be the government portion of investment into a trans-European High Voltage Direct Current (HVDC) network or incentives for large scale built environment efficiency measures.
- It would set a structure for the type of bonds issued.
 - Green index linked bonds would be particularly well received.
- Green gilts would probably be issued at smaller sizes than in the conventional market and so would probably need to be issued at a fractionally higher yield to compensate for lost liquidity. This may seem unnecessary but it is likely to be critical in the first instance to get the market up and running – and in the end would be a small price to pay⁵⁹.

⁵⁹ The World Bank green bonds offer no premium and have therefore not been as well received as they might be by the general investment community as the illiquidity is not rewarded compared to “normal” World Bank bonds.

- There is a precedent for this structure with the 1990 German Unity Fund which issued Treuhand bonds after reunification in 1990.
- Treuhand bonds were issued to finance strong East German companies after reunification. Yields on these bonds were generally 4–5 basis points (1/100ths of a percent) over equivalent German government bonds, as they were issued not by the central Government but by the Unity Fund. In 1995, this fund was brought onto the central Government’s balance sheet and investors saw an immediate rally in their bonds because the credit risk changed.
- This would set a principal that in the short term there was some extra return for buying green gilts.
- Perhaps green gilts could be issued via a Green Investment Bank in conjunction with the DMO – the three main UK political parties have publicly committed to the establishment of such an institution⁶⁰.
- The UK Treasury has a need to finance a structural deficit of £167 billion this year. Taking some of this issuance and earmarking it for climate related projects may reduce some of the headline numbers and send a strong signal of a serious Government intent to address climate change.

4.3.4. Other AAA Rated Bonds

The World Bank and the EIB are likely to be core issuers in the new green bonds market although there will be other issuers. Alternatively the Government could issue guarantee structures whereby they guarantee the principal and interest for a fee. This would increase ratings and decrease borrowing costs.

A Green Investment Bank could be heavily involved in this insurance requiring certain minimum criteria for each investment, including good equity structure, an approved developer or manager and validation that it meets specific low carbon objectives. Government could offer this insurance through the GIB for a fee. The Government’s advantage over the private sector “Monoline” insurers is that it has the policy and regulatory levers to control revenue outcomes and so can create a virtuous policy circle.

4.3.5. Investment Grade Bonds

It is reasonably clear, and likely, that many green bonds will be linked to specific projects and therefore be in the form of asset backed securities. These bonds can come from mainstream companies with a mandate to invest in low carbon projects driven by government policy e.g. the utility companies. Such companies could ring-fence the proceeds from the bonds to allow for the bonds and projects to gain a green rating. This green rating will help the company gain a beneficial green guarantee or insurance policy for the coupon and principal from the government or GIB and allow the borrower to receive funds at lower rate than they would normally whilst also giving the investor a higher return and the government or GIB a fee for insuring the bonds.

Clearly more arithmetic is needed but this is a great way of leveraging the UK Government’s long term policy perspective and good credit rating.

⁶⁰The UK Government announced the establishment of a Green Investment Bank with capitalisation of £2bn in the first instance in the 2010 Budget. The Conservative Party in its 2010 election manifesto also announced it would create a Green Investment Bank. Similarly, the Liberal Democrats in their 2010 election manifesto announced a UK Infrastructure Bank to ‘help the transition to a green economy’.

4.3.6. High Yield Bonds

Many renewable energy projects will fundamentally come out as high yield because of the high capital costs of assets and the relatively long time to breakeven. The UK Government (and its GIB) has the ability to control the revenues on many power projects through project-related incentives such as feed-in tariffs.

From the perspective of Government, guarantees and insurance, in conjunction with the extra policy levers, make projects lower risk than they would be from the perspective of the private sector. Hence, guarantees from government can be provided more cheaply than those from the private sector as political risk is minimized through an alignment of public and private sector financial interests in making the projects a success.

4.3.7. What Will Not Work

As has previously been alluded to, bonds with complex structures will not sell well. Equity linked bonds and carbon related bonds are an example of this. In essence, any structure that is not designed to fulfill a genuine investor need will not sell well. This limits green or climate related bonds to conventional and inflation linked structures.

It has been mooted that bonds tied to the price of carbon are a sensible investment vehicle and the index linked gilt market has been used as an example of the success of indexed bonds. However, the “linker” market addresses a particular investor need for inflation protection. There is no investor need, as yet, for carbon related bonds and certainly not one that is of any size. Carbon related bonds would therefore currently likely be unpopular if marketed.

4.4. Benefits

Clearly the several hundred billion pounds of infrastructure investment necessary to tackle the UK's share of climate change cannot be done with public funds alone. Public funds need to leverage private money in the most efficient way by maximizing the use of each sector's comparative advantage.

Many climate related projects, especially in the power and efficiency sector, are characterized by high initial capital costs and then steady revenues. This is the exact reverse of a bond's cash flows which, when issued, generate a high initial payment followed by steady interest payments. Incentivizing the growth of a climate or green bond market has the potential to significantly leverage public finances.

This leverage can come through:

- Issuing green gilts to show commitment to the market
 - With a suitable discount, pension funds and insurance companies will happily buy these new instruments.
- Guaranteeing bonds to reduce the risk and raise the rating on bonds
 - An upfront fee will be generated which is proportional to the likelihood of the guarantee being called on. The leverage on this will depend on the default probability of the underlying asset but the leverage will certainly be greater than 10 times.

- Setting up a Green Investment Bank, as has been announced, to facilitate issuance of highly rated green bonds.
- Changing regulation such that pension funds are able to take climate change into account in asset allocation strategies
- Allowing some bonds to have a tax free status.

These measures all contain risk for the public sector. However, the public sector also has the levers to control the effect of the incentives. Hence market tax changes can be instigated so that guarantees are unlikely to be called on.

4.6 Moving forward

Financing the low carbon transition of the global economy is going to require massive rerouting of current investment flows to ensure that capital that would be invested in high carbon infrastructure is now directed to low carbon infrastructure. Proportionally more upfront capital is needed to finance this transition since the low carbon economy in effect replaces fuel with capital, but this is only sustainable if the debt markets are willing to become involved at scale.

Capital held in the bond market is estimated to be worth USD36trillion globally, with the UK market worth £1.2 trillion. It is clear that if this capital is to be accessed through a flourishing green bond market, policies based on long term, broad based and ambitious cross party political commitment is needed. The recent political commitment to a Green Investment Bank is an excellent example of this – but the next step is make sure the political vision is executed effectively.

Bonds will need to be backed by visible, stable and transparent revenue streams to pay coupons: it will be critical that the characteristics of the revenue stream fit neatly with the needs of bond investors. Policy will need to be constructed to support this structural requirement. So for example the Renewables Obligation with its volatile revenue streams may preclude the creation of green bonds to free up balance sheets for further investment. A Feed-in-tariff is likely to be more suited to investor needs.

Finding investors to buy green bonds is crucial – and the key to finding these investors is to seek out large repositories of money and understand their portfolio needs. The largest single concentrations of money are in the hands of institutions such as insurance companies and pension funds. Such institutions will be looking for long-dated bonds – and premium is likely to be needed to encourage early uptake when the market is less liquid. Beyond this, for Government to incentivize insurance companies and pension funds to move these billions of pounds, green bonds will need tremendous long term incentives. These incentives can only come from Government in the form of a Green Investment Bank, guarantees and tax incentives.

The task is manageable: between 2003 and 2009, UK pension funds increased their bond holdings by 9% and reduced their equity holdings by 14%⁶¹. An asset allocation move from equities to bonds is a significantly riskier change than an allocation within a financial sector. Hence an allocation of 25% to a different sort of bond (green bonds) is not as risky as it seems, especially if some of these come with an AAA rating.

⁶¹ Asset Allocation Survey: Mercer: 2009

Appendix

A.1 Glossary

Accrued interest	The proportional amount of interest accrued since the last coupon payment date
Bid	The price at which broker will offer to buy a bond
Bid/offer spread	The difference between the bid and offer price
Bond Index	A market cap weighted index of bonds
Broker	An intermediary putting buyers in touch with sellers
Call option	The right but not obligation to redeem a bond
Callable	A bond that has a call option
Choice	The bid/offer spread is zero
Clean Price	The price without any accrued interest, the one most often quoted.
Covenant	A legally binding agreement in a bonds prospectus
Coupon	The interest payment on a bond
CREB	Clean Renewable Energy Bonds
Credit risk	The risk that a bond will default on its payments
Dirty price	The clean price plus accrued interest
DMO	The Debt Management Office
Duration	The present value weighted average time to a bond's cash flows
EIB	The European Investment Bank
Face value	The original size of a bond at issuance.cf Principal
First call date	The first date at which a bond can be called
First call price	The price at which the bond can be called
FITs	Feed in Tariff
FRS	Financial Reporting Standard
GEMM	Gilt Edged Market Maker
Gilt	A bond issued by the UK government
IBRD	The International Bank for Reconstruction and Development
Inter-dealer brokers (IDBs)	Brokers who only deal with other brokers
Investment Grade	Defined by the credit rating agencies
Junior (to)	Ranks behind in a wind up situation
Lead manager/co-lead manager	The broker of cobroker who brings new bonds to market
Make a market	To give a two way price in a bonds
Market makers	Brokers who make markets
Maturity date	The date at which a bond is repaid
ML	Merrill Lynch
Monoline	A bond insurer
Offer	The price that a broker will sell a bond
Par	100
Perpetual	No final maturity date
PPF	Pension Protection Fund

Primary market	The market in a bond before it is issued
Principal	The amount of money borrowed originally cf Face Value
Project finance	Finance for a specific large, often, infrastructure, project
Put option	The option to sell a bond back to the borrower
Rank (above)	Have an earlier claim on assets in wind up
Secondary market	The market a bond trades in after it is issued
Securitized	A bond that is sold with a claim on specific ring fenced assets
Senior (to)	Have an earlier claim on assets in wind up
Settlement date	The date at which money is due after the purchase of a bond
Simple yield	See appendix
Spread	The difference between two yields
Strip/reconstitute	To break a bond down into its coupons and principal so that they can be sold separately. Reconstitution is the reverse
Supra-national	An agency sponsored by many governments but not resident in any country
Time to maturity	The time till a bond makes its final payment
Tranche	One of a series of bonds issued at the same time with slightly different characteristics
UKT	The UK Treasury
Undated	Has no maturity date
Vanilla	A bond with a very simple structure
Volatility	The amount that a bond's price moves
Withholding tax	Tax withheld at the time of a coupon payment
Yield to maturity	See appendix

A.2 Gilt Edged Market Makers (GEMMs)

- Barclays Capital
- BNP Paribas (London Branch)
- Citigroup Global Markets Limited
- Credit Suisse Securities
- Deutsche Bank AG (London Branch)
- Goldman Sachs International Limited
- HSBC Bank PLC
- Jefferies International Limited
- JP Morgan Securities Limited
- Merrill Lynch International
- Morgan Stanley & Co. International plc
- Nomura International plc
- Royal Bank of Canada Europe Limited
- Royal Bank of Scotland
- UBS Limited
- Winterflood Securities Limited

A.3 Bond Calculations

A.3.1 Running or Current Yield

This is the simplest and perhaps the most intuitive way to calculate the yield on a fixed income investment but is not used apart from under very specific circumstances. Simply put it is the annual coupon on the bond divided by its price.

It does not take into account the time to maturity of the bond and therefore the “pull to par” of a price that does not equal 100. In other words, if 10 year bond is priced at 90 and, as most bonds do will be redeemed at 100, all things being equal, there should be an appreciation of the price up to its redemption. Running or current yield does not take this into account.

$$\text{Running Yield} = \frac{\text{Coupon}}{\text{Price}}$$

A.3.2 Simple Yield

Although its name suggests otherwise, this is not a simple as running or current yield. It does however make a simple adjustment for the “time to maturity” of a bond. This again is not a measure used by the bond markets apart from in Japan where it used as a convention but not as a valuation method.

Simple yield takes the current or running yields and adds or subtracts from it the discount or premium that the bond is trading at (relative to 100) divided by the number of years from settlement date to maturity date.

$$\text{Simple Yield} = \frac{\text{Coupon}}{\text{Price}} + \frac{100 - \text{Price}}{\text{Years to maturity} * 100}$$

A.3.3 Yield to Maturity

Yield to maturity is the measure that is most commonly used in the bond markets. It is not perfect and suffers from a number of inadequacies. Nevertheless is a relatively standard measure. There are a number of ways used to calculate it which arise from conventions in different bond markets (UK, Eurobond, US etc).

It is easiest to explain by taking a bond and a yield and calculating a price. For those with a mathematical bent there is a, simple, formula to calculate the price from a yield. Each of the bond's coupons and the principal redemption is discounted (or divided by the yield). In order to take into account the time to the cash flows, the discount factor (1+yield) is raised to the power of the cash flow's time to maturity. It is not straightforward to calculate the yield from the price of a bond with more than 2 cash flows. This is done using an iterative method.

There are many texts that discuss this as it is fairly standard process but it is nevertheless useful to understand the complications of moving from running to simple to yield to maturity

$$\text{Price} + \text{Accrued} = \sum_{t=1}^n \frac{\text{Cash Flow}_t}{(1 + \text{yield})^t}$$

A.3.4 Other Yield Calculation Methods

There are other means used to value bonds which involve such quantities as interest rate swaps, zero coupon curves, option models and the like. These improve on the basic yield to maturity calculation.

A.3.5 Duration

Duration is the present value weighted average time to the bond's cash flows. It is also a measure of how a bond's price will change when interest rates change.

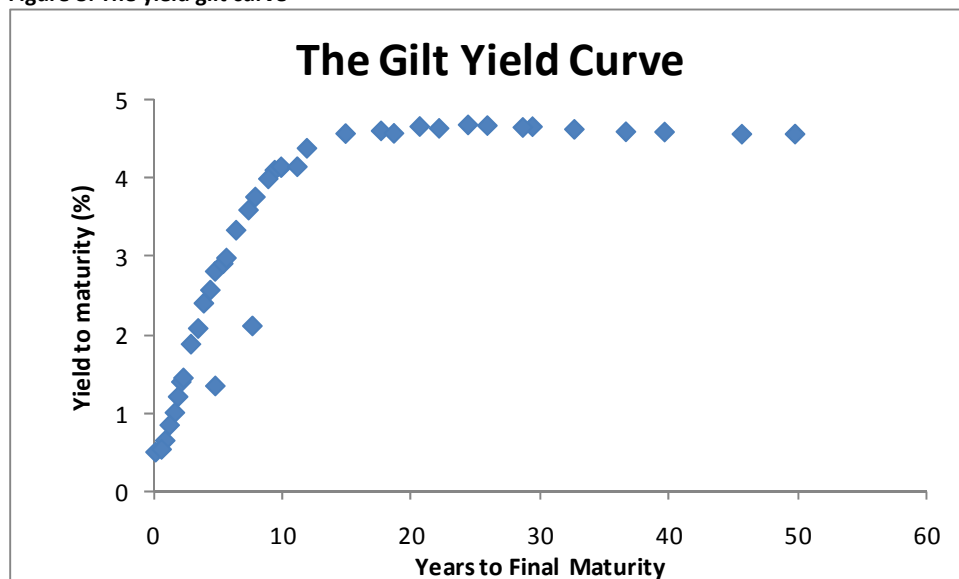
There are many texts that discuss this and the various measures of duration.

A.4 The Yield Curve and its Theories

A yield curve is a construction. Figure 8 shows the gilt yield curve in early March 2010. Each gilt is plotted on a graph with the horizontal axis representing the number of years to the final maturity of the bond and the vertical axis the yield to maturity of the gilt. It is clear that there is some sort of efficiency here as the points seem to fit a curve; hence it is called a "yield curve".

This particular curve shows that gilts have maturities ranging from a few months to about 50 years with yields ranging from about 0.5% to about 4.5%. There are a couple of outlying bonds. These are callable bonds whose likely maturity is less than their final maturity.

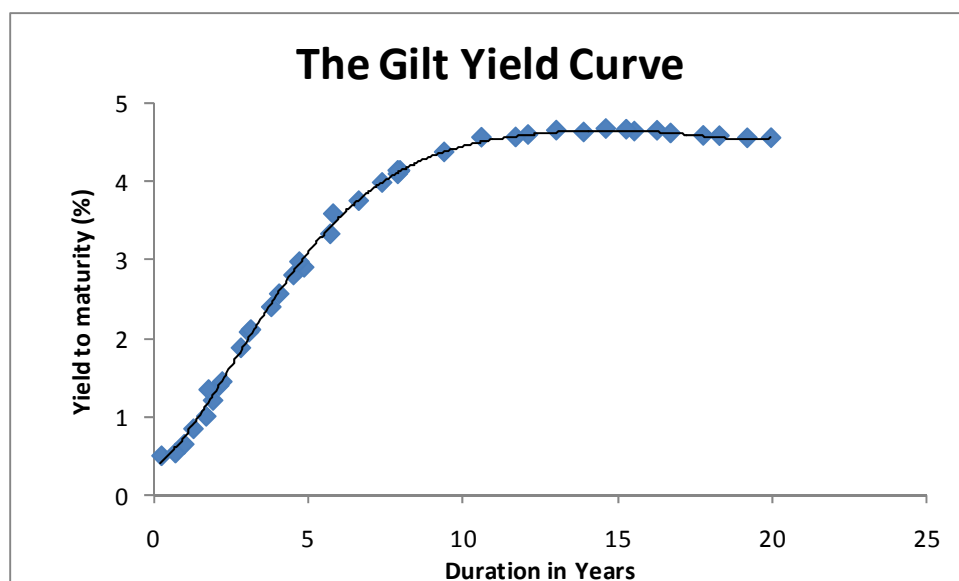
Figure 8: The yield gilt curve



This is not the only way to look at the yield curve and the graph below shows the same gilts. This time, though, the horizontal axis is shown in terms of duration, measured in years. This generates a flatter, less "r" shaped curve. Several points are worth noting.

- The points are more evenly spread out
- The curve is less kinked
- There are no outliers

From a theoretical perspective, this is a better view of the market



A.4.1 Expectations

The first of the theories of the yield curve is the so called “expectations” theory. Part of the shape of the curve is a reflection of where the market expects short term rates (think about base rates) to be in the future. The very short end of the curve is anchored to base rates so, if the market expects that rates will rise, the yield curve is likely to be sloping upwards. If base rates are high and the market expects rates to fall the curve is likely to be downward sloping (long term rates would be below short term rates).

Unfortunately, evidence is only weak that the yield curve is a good predictor of near term rate changes and this is one of the reasons that the Monetary Policy Committee in their economic models use both market rates and constant rates.

A.4.2 Liquidity or risk aversion

Cash is more liquid than 50 year bonds. Owning cash is also less risky than owning 50 year bonds. Rational investors therefore demand a greater return for holding 50 year bonds than cash. Clearly this is an extreme example but the principle is good. The result is that the yield curve has a predisposition to be “upward” sloping.

There is evidence for this but only as far as two year bonds are concerned. Generally, investors who put money into 2 year bonds will gain extra return over those that put money into cash. Moving further along the yield curve though does not seem to generate any consistent long term extra return.

A.4.3 Segmentation

The last theory of the yield curve is called the segmentation theory or the market preference theory. This suggests that different investors and issuers have preferences for different maturity sectors. Figure 9 shows that there is a preference for financial and industrial companies to issue debt under 10 years. However, Utilities and securitized bonds have virtually no debt under 7 years, preferring to issue long dated debt.

On the purchasing side, life insurance and pension funds much prefer to own longer dated debt whilst retail and bank investors have a preference to invest in bonds under 10 years.

Figure 9: Weight of sectors in UK bond markets

