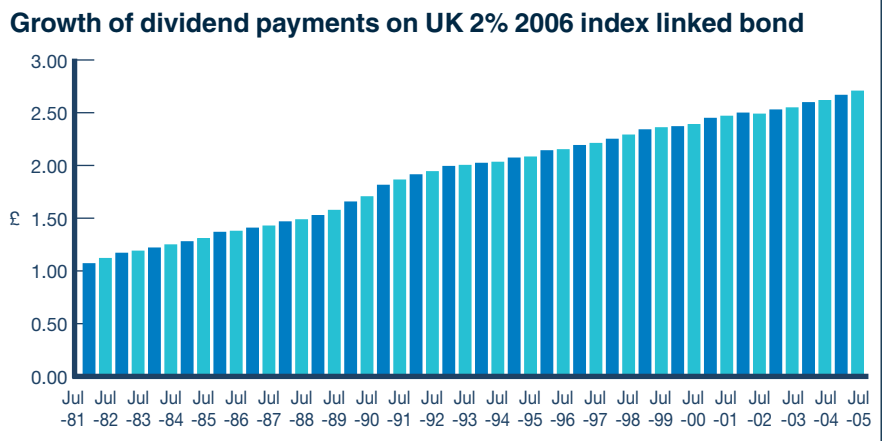


A guide to inflation-linked bonds 2005

Introduction

Inflation-linked bonds (or index-linked, with the index being some inflation measure) are bonds that offer protection from inflation. These are therefore excellent instruments to use to match a liability stream that is impacted by inflation, for example in pension funds where benefit entitlements are often increased in line with inflation. An investor benefits from a real yield that is supplemented by compensation for inflation and so even in times of very high levels of inflation, the value of the assets maintain its spending power (if the inflation impacting the assets and liabilities is the same). The inflation compensation taking the form of coupon payments on the bonds increasing over time (assuming inflation is positive) together with an increasing projected value of the redemption proceeds.



Source: Bloomberg

The chart shows the development of dividend payments on the UK 2006 index-linked bond. The bond issued at a price of 86 in 1981 currently trades on a price above 270 a move largely reflecting the impact of inflation on this type of bond.

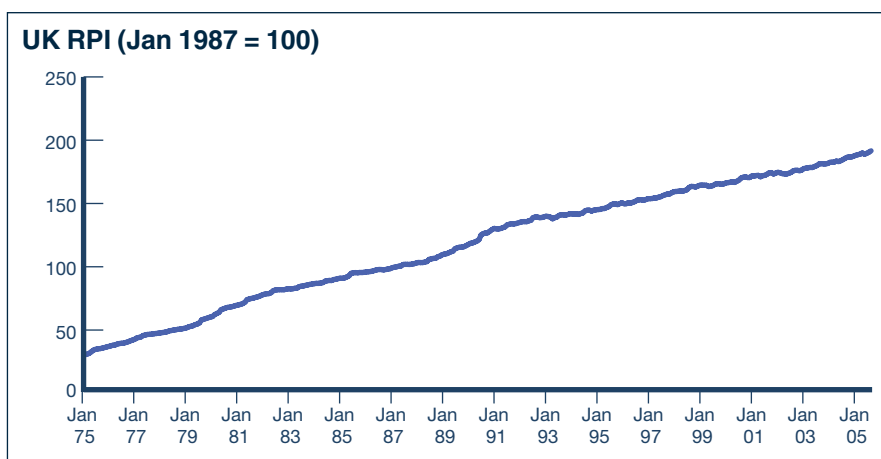
Inflation-linked bond markets have seen a very significant leap forwards in recent years and now represent a sizable, liquid, global market. The US TIPS (Treasury Inflation Protected Securities) market now accounts for about 9% of US Treasury marketable debt (ex T-bills) and France has indicated a desire to have at least 10% of its debt in inflation-linked form within a few years. The market has been extending internationally over recent years with most major economies having established a market. Even Japan with its recent bias towards deflation has issued inflation-linked bonds.

Throughout this note, we concentrate on Government inflation-linked bonds,

but we should point out that a corporate market does exist. This is dominated by the utilities sector where revenues are closely linked with inflationary developments.

A brief history

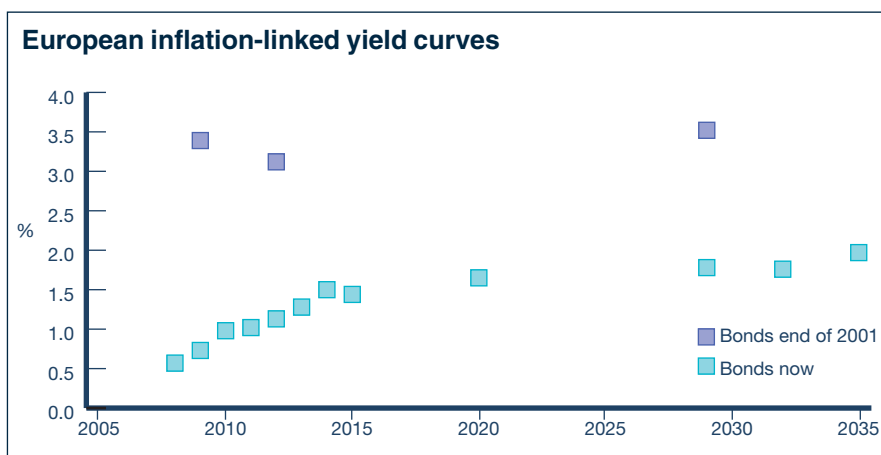
While index-linked bonds have been around for some time, the first major phase of development of the market took place in the UK with the launch of an index linked bond in 1981, issued in response to the very high levels of inflation that had been seen in the UK in the 1970s.



Source: Bloomberg

Initially ownership was restricted to pension funds but the market was soon opened up to a wider universe. With this issue the inflation measure chosen to link to the bonds was the Retail Price Index (RPI) whereas the liabilities of the final-salary pension funds to whom the instruments were targeted of course had their liabilities more closely linked with wage inflation which has often tracked at a higher rate than the RPI, thus still not providing a perfect match. Even with this weakness, the choice of inflation index in the UK has remained the same throughout the market's history.

The addition of Australia (1985), Canada (1991) and Sweden (1994), left a market that globally was still dominated by the UK. The US's entry in 1997 was to change that. It is the US TIPS market ("Treasury Inflation Protected Securities") that is now the largest in the world, with Europe catching up fast with France playing a leading role. In 1998, France issued its first inflation-linked bond. This bond was linked to France's domestic CPI ex-Tobacco index, but some later ones are tied to linked to Eurozone inflation.



Source: Bloomberg

With France having laid the foundations in Europe, Italy and Greece joined the market in 2003 and Germany is likely to join soon. Poland's entry in 2004 added a new dimension to European markets with its domestically based inflation link. The European inflation-linked bond yield curve has evolved from just 3 bonds at the end of 2001 into a recognisable curve of 13 bonds now. Even Japan, long associated with deflation rather than inflation, opened a market in 2004 and so now markets exist in all of the major currencies.

Accompanying this growth in inflation-linked bond markets we have also seen the development of markets in inflation derivatives, most commonly in the form of inflation swaps.

UK Inflation measures

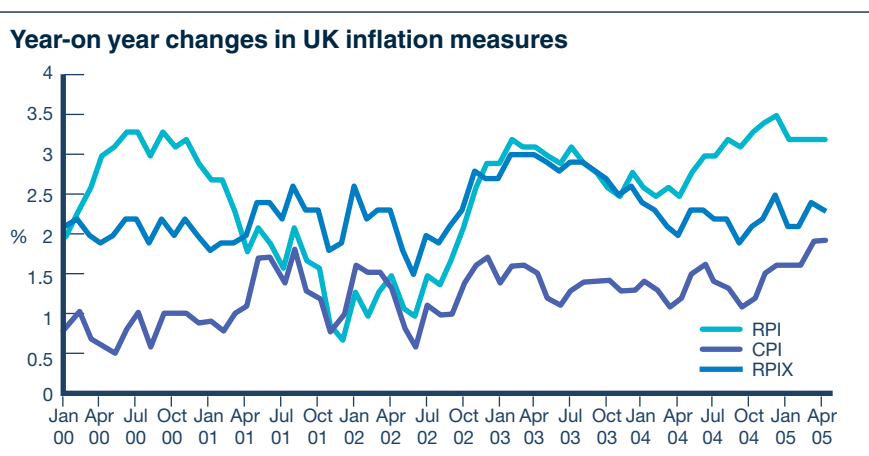
Until recently the RPI has been identified as the measure of inflation in the UK. The Retail Price Index is a weighted average of a selection of about 650 goods and services with prices sampled in around 150 areas of the country chosen to reflect typical household spending. This includes housing costs in the form of mortgage interest payments. The index can be adjusted to allow for changes to spending patterns. The index was rebased to 100 in Jan 1987.

The RPIX represents a subset of the items covered by the RPI by leaving out mortgage interest payments. The RPIX rose to prominence when it was used to define the Government's target UK inflation rate that the Bank of England's Monetary Policy Committee was tasked to control inflation by adjusting interest rates.

In December 2003, in an attempt to move towards a European standard the MPC's target inflation measure was changed to the HICP (Harmonised Index of Consumer Prices) which has since been renamed the CPI. The main differences are that housing costs and council tax are excluded, and the mathematical structure is such that, for the same price data, the CPI will show lower values than the RPI. This series has a base of 100 in 1996. It has been suggested that housing costs are reintroduced on the back of a European-wide move.

When a the significantly new type of structure for UK index-linked bonds was announced recently, the inflation index was perhaps surprisingly kept the same i.e. the RPI.

A more detailed discussion of UK inflation measures can be found at www.statistics.gov.uk



Source: xxxxxxxx

How inflation linked bonds work – A UK example

UK index linked bonds were issued on a common (except for tiny detail relating to the number of decimal places to use in calculating dividend payments) basis until July 2005 when a new standard form came into existence to replace the old form for all new issues. The new form will be discussed in the next section.

Let us now focus on a single issue, the UK index linked 2.5% 2016.

Like all other UK linkers it pays its coupon semi-annually, in this case the payment dates are the 26th January and 26th July with redemption on 26th July 2016.

The bond was originally issued on 19th January 1983. This piece of information is very important for index-linked bonds because it determines a base inflation rate that is associated with the bond for the rest of its life. The base RPI is the value of the RPI eight months prior to the issue date of the bond, in this case 81.6223 the RPI for May 1982. (Note that inflation indices are usually only quoted to 1 decimal place, but this number reflects a rebasing of the index to 100 on 13th January 1987)

To find the dividend paid in, for example, July 2005 we again use an 8-month lag and pick up the RPI for November 2004 which was 189.0.

The coupon to be paid on 26th July 2005 is then:

$$0.5 \times \text{Nominal coupon} \times \text{RPI for November 2004} / \text{Base RPI}$$

i.e. $0.5 \times 2.5 \times 189.0 / 81.6223 = 2.8944\%$ (rounded to 4 decimal places, for some bonds only 2 decimal places are used). The eight-month time lag was chosen to ensure that the next coupon payment would be known throughout all of the accrual period of that payment. The calculation of accrued interest uses this next coupon and standard straight-line accrual.

The redemption proceeds on this bond, paid on 26th July 2016 will require reference to the RPI for November 2015 and is determined by:

$$100 \times \text{RPI for November 2015} / \text{Base RPI}$$

This figure is likely to be quite substantial. From the inflation already built in, if we assume an average inflation rate of 2.5% per year, the redemption price is going to be above 300.

Note that the final inflation data to impact this bond is that for November 2015 and therefore that for the last 8 months of its life there is no further impact from inflation and so the bond is essentially the same as an short-dated conventional gilt (albeit with a rather high maturity value).

Note that during periods of deflation coupon payments may fall and in the UK there is no deflation protection offered in either coupon or redemption proceeds ie redemption could be at less than 100 in the case of net deflation over the life of the bond. In some markets there is protection and the final payment is made at par.

In the calculation of real yields on this old style index-linked bond, it is necessary to make an assumption on the average level of inflation over the remaining life of the bond. The Financial Times, in its FTSE Gilt Indices section quotes real yields on the indices at both 0% and 5% inflation rates.

For details on the calculation of real yields, please see the Debt Management Office's web-site www.dmo.gov.uk

Changes in the UK market

As from July 2005 all new index linked gilts will be issued in a new format (any issuance of existing linkers will be in their current format). The new structure will be based on the Canadian model and will bring the UK market into line with international markets.

There are two significant changes from the old format. Firstly the 8-month time lag in incorporating inflation data has been reduced to 3 months. Secondly the new bonds will trade on a real price rather than the old-style inflation-adjusted price. An inflation adjustment will be applied to this traded real price to obtain the settlement price. Thus instead of having prices on UK linkers typically over 200 under the new arrangements prices will remain closer to 100.

The inflation adjustment on new style linkers changes at a variable rate rather than the straight-line accrual basis between dividend dates under the old format. Thus for each day, for the purposes of calculating accrued interest or dividend payments we need to calculate an index ratio which multiplies by half the nominal coupon to give the next semi-annual dividend payment or by half the nominal coupon and then day-count weighted (on an actual-actual basis) to give the accrued interest.

Example

The index ratio for a bond 19 May 2005 is given by

$\text{Reference RPI for 19 May 2005} / \text{Reference RPI for the issue date of the bond}$

And the calculation of the reference RPI at a given date is shown for example on 19 May 2005 by

$\text{Reference RPI on 1 May 2005} + (19-1)/31 \times \text{Reference RPI on 1 June 2005}$

i.e. a linear interpolation over the month. The reference RPI for the first of the month is then the reported RPI for three months earlier (since we are now operating with a 3-month lag). In this case we have

$\text{RPI(Feb 2005)} + (18/31) \times \text{RPI(Mar 2005)}$

And of course all of this data is known since the March 2005 RPI was reported in April 2005.

The settlement price on one of these bonds will be the real price traded multiplied by the index ratio for the settlement date plus the accrued interest as described above. The 7-day ex-dividend period will be maintained in the new scheme.

Clearly there will be times when the next dividend payment will not be known in contrast to the old system. However there are advantages too since the real yield can be calculated without having to make assumptions about the future course of inflation.

Benefits to issuers and investors

We have already remarked on the obvious attraction of this asset class to investors wishing to match (at least to a significant extent) liabilities that are linked to inflation. The appeal is however more widespread since inflation-linked bonds give investors a means of diversifying their portfolios. Risks can be reduced through their relatively low volatility and low correlation with other asset classes.

Governments that issue inflation-linked bonds benefit from reduced borrowing costs. This comes from the premium that investors are prepared to pay relative to conventional bonds to receive inflation protection. However there is also a contribution to reducing overall borrowing costs through support of the idea that the issuance of inflation-linked bonds reinforces the commitment of the government to controlling inflation in the economy.

International inflation-linked markets

The main markets are those of the US, Europe and the UK which together account for about 90% of the global market in inflation linked bonds.

Whilst the general principal has been the same, the instruments developed in the various domestic markets do have some differences. The key differences are highlighted in the table at the end of this paper. There are many other tiny differences relating to the rounding of data etc.

What moves inflation-linked markets?

Example								
	First Issuance	Reference Inflation	Bloomberg Inflation Ticker	Time Lag	Coupon Frequency	Market Quote	Liquidity	Deflation Protection
UK: old style	May-81	RPI	UKRPI	8 months	Semi-annual	Inflation adjusted price	****	No
new	2005	RPI	UKRPI	3 months	Semi-annual	Real price	****	No
US	Jan-97	CPI Urban consumers NSA	CRURNSA	3 months	Semi-annual	Real price	*****	Yes, principal
Canada	Nov-91	CPI	CACPI	3 months	Semi-annual	Yield	**	No
Australia	Aug-85	CPI	AUCPI	3-6 months	Quarterly	Yield	*	Yes, coupons and principal
France:OATi	Sep-98	French CPI ex-Tobacco	FRCPXTOB	3 months	Annual	Real price	*****	Yes, principal
OATei	2001	Eurozone HICP ex-Tobacco	CPTFEMU	3 months	Annual	Real price	*****	Yes, principal
Sweden	1994	CPI	SWCPI	3 months	Annual	Yield	***	Yes, principal
Japan	Mar-04	CPI ex-fresh food	JCPNGENF	3 months	Semi-annual	Real price	*****	No
Poland	Aug-04	CPI	POCPILB	3 months	Annual	Real price	**	Yes, principal
Greece	2003	European HICP ex-Tobacco	CPTFEMU	3 months	Annual	Real price	***	Yes, principal
Italy	Sep-03	European HICP ex-Tobacco	CPTFEMU	3 months	Semi-annual	Real price	*****	Yes, principal

Source: Bloomberg

The main factors are inflation expectations together with real yields reflecting the state of the economy and demand/supply balances.

Real yields do vary over time but are much less variable than nominal yields. This accounts for the lower range in coupons on inflation-linked bonds than is seen in the conventional markets.

An important measure in the assessment of relative value between inflation-



Source: Bloomberg

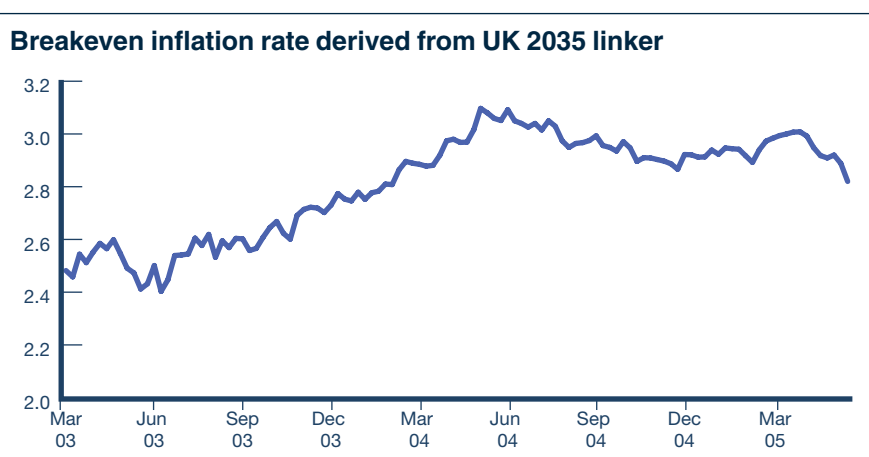
linked bonds and their conventional counterparts is the breakeven inflation rate. This is usually viewed simply as

$$\text{BEIR} = \text{conventional yield} - \text{inflation-linked yield}$$

This, therefore, represents the level of inflation required for conventional bonds and inflation-linked bonds to generate the same returns. (Assuming that the two bonds have the same maturity.) Breakeven inflation rates vary along the yield curve.

For example, at 24th May 2005 looking at UK bonds with a 2013 maturity we see a BEIR of 2.6% and a 2030 pairing generates a BEIR of 2.8%. Therefore, if inflation to 2013 is expected to exceed 2.6% on average, we should expect the 2013 index-linked bond to outperform a 2013 conventional gilt over the remaining life of the bonds. For the 2030 linker to outperform its conventional gilt, inflation would have to average over 2.8% to their maturity date. Thus inflation expectations are the main driver of the relationship between the two asset classes and hence the driver of asset allocation decisions.

To allocate an inflation-linked portfolio internationally we can consider the



Source: Bloomberg

breakeven inflation rates in relation to expectations for inflation in the various economies. An interesting factor that may need to be considered in some conditions is the deflation protection offered in some inflation-linked bonds. For example in the United States the TIPS market does guarantee the principal is repaid at par even if there has been net deflation over the life of the bond which would have otherwise suggested a sub-par redemption. This feature does appear in some other markets but not currently in the UK.

Demand/supply balances are very important, as in conventional bonds, especially when regulatory moves create pressure. This was especially so when the UK introduced the Minimum Funding Requirement (MFR) so creating a rush to buy long UK bonds in both conventional and index-linked form. Similar moves have been seen in Sweden in 2005.

In France there is also the possibility of taking a view on the outlook of French domestic inflation relative to that over the Eurozone because of the two types of inflation-linked bonds issued by the French Government. This is topical in mid-2005 with suggestions of potential VAT increases in Germany. Clearly these would feed through into Eurozone inflation data but not to French domestic data to the benefit of Eurozone-referenced linkers.

Summary

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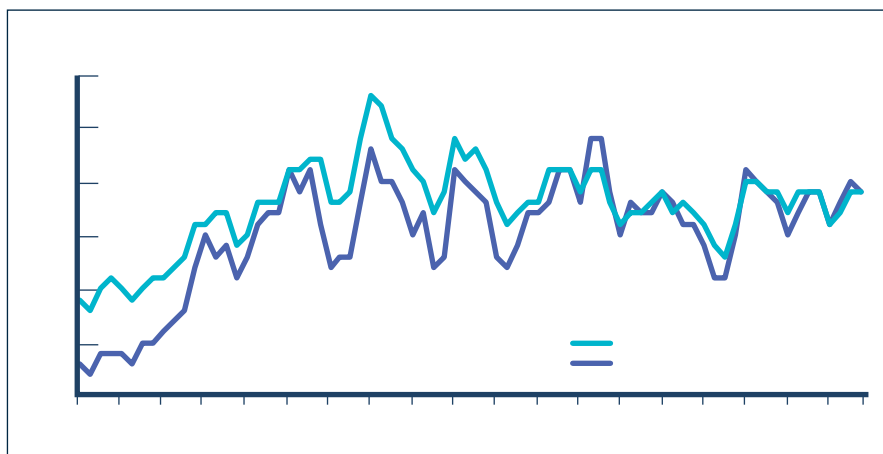
Source: Bloomberg

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The Inflation-linked markets have grown up a lot in recent years and now have to be considered as an important asset class in their own right and not just a quiet corner of bond markets generally. The new diversity of bonds in this category and the improvement in liquidity and larger investor base improves the ability to manage the sector actively.

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