CERNO CAPITAL

Inflation-Linked Bonds

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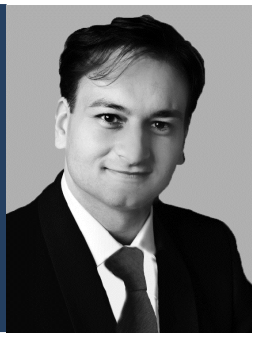
Mustafa Abbas
abbas@cernocapital.com



Although they represent a relatively small asset class compared with nominal government bonds, corporate bonds, equities and cash, the index linked sector has attracted interest from investors other than traditional fixed income managers.

This wider interest makes sense in a monetary environment where Central Banks are actively deploying unorthodox policies to head off the risks of deflation and actively pursue reflation. Their objectives, and tools to achieve these goals, promoted by the Fed and largely copied by sympathetic Central Banks, entail taking a risk on inflation. The presence of index linked bonds in a portfolio should help partially protect against the effects of this risk. We write "should" as index linked gilts have only existed since 1981, and the period since then can be characterised as one of disinflation.

Given the asymmetric bias towards inflation and the experimental nature of Quantitative Easing, there is a very real possibility that the inflation genie will be let out of the bottle in the coming years. Should inflation escalate above the 5-6% range, few financial assets will fare well. Inflation linked bonds will be one asset class that should perform well - that is the core of their attraction. In this paper we characterise the asset class and attempt to explain how linkers will perform under different inflation scenarios.

That said, the immediate prospects for the asset class are probably unexciting; they appear fairly valued at present and perhaps vulnerable to any sell-off in nominal bonds. We think 2013 might be an unexciting year for the asset class and look to a better entry point in the future.

What are index linked bonds?

A bond is simply an instrument of indebtedness of the bond issuer to the holders. In the UK, conventional gilts are liabilities of the Government which guarantees to pay the holder of the gilt a fixed cash payment (coupon) every six months until the maturity date, at which point the holder receives the final coupon payment and the return of the principal.

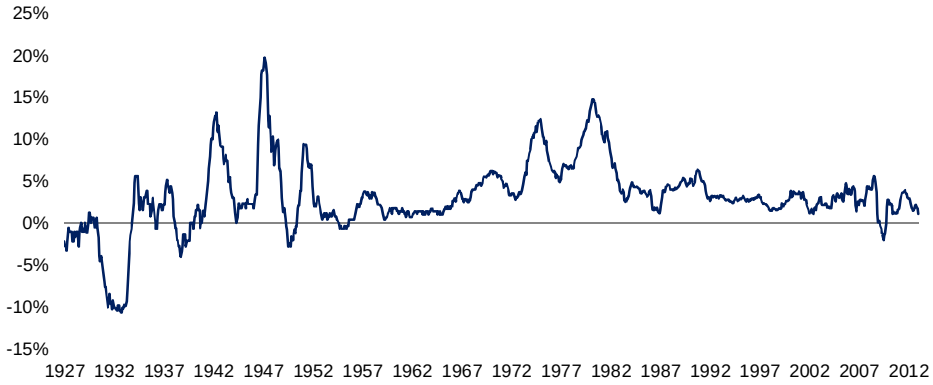
Inflation linked bonds contractually link the bond's principal and coupon payments to an inflation measure. In the UK, index linked gilts differ from conventional gilts in that the semi-annual coupon payments and the principal are adjusted in line with the UK Retail Prices Index (RPI). This means that both the coupons and the principal paid on redemption of these gilts are adjusted to take account of accrued inflation since the gilt was first issued.

The incentive of governments to issue inflation linked bonds is to reduce borrowing costs, provide greater diversity to their investor base and increase their investor base.

In principle, investors should be prepared to accept a lower real rate of interest in return for insurance against inflation. This factor can be expected to reduce the overall cost of servicing government debt making the issuance of inflation linked debt attractive, at times, for governments. A secondary consideration is that inflation linked bonds allow inflation protection to be extended to pension arrangements or other investors wishing to obtain an explicit real return.

The post Volcker period since 1981 has been one of disinflation, which eventually led to stable and low inflation. However, low and stable inflation is not to be assumed as the norm over longer time periods as the chart below illustrates.

Exhibit 1: US Inflation (1927-present)



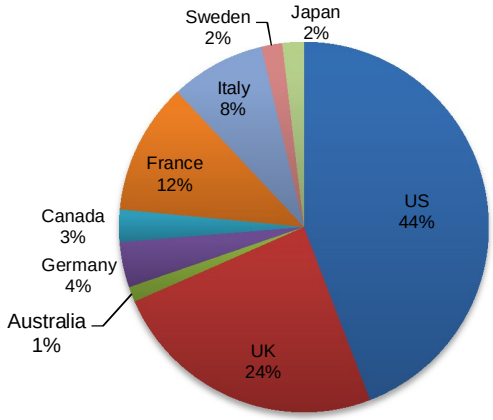
Source: Bureau of Labour Statistics

Where do they exist?

Index linked bonds exist in many countries, including the UK ("Linkers"), US ("TIPS"), France, Canada, Australia, Germany, Italy, Sweden, Hong Kong, Japan and South Africa.

The US and UK comprises nearly 70% of the total market value of the developed world inflation linked bond market. The US market for inflation linked bonds currently has US$918bn in issuance, and the UK market has US$517bn in issuance.

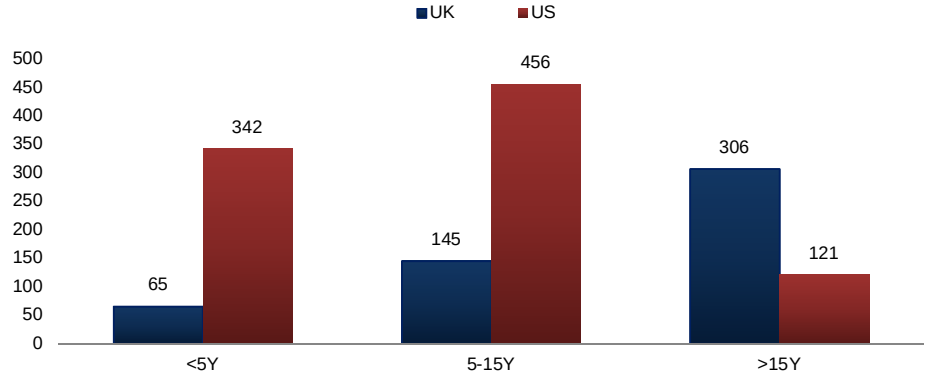
Exhibit 2: Distribution of global inflation-linked bonds in issue (in US dollar terms)



Source: Bloomberg

The bar chart below highlights the dominance of stock in TIPS with the greatest outstanding stock being in the 5-15 year maturity for TIPS and in the longer maturities for Linkers.

Exhibit 3: Debt maturity profile of US and UK inflation-linked bonds ($bn)



Source: Bloomberg

What are the uses and differences between US and UK linkers?

The uses are the same for US and UK inflation linked bonds in as much as they are bond instruments with inflation linked cash flows. The composition of the inflation index is different between the US and UK, and noteworthy is that the UK's weight to fuels is much smaller compared to the US.

The main difference between UK and US bonds is that in the US, the investor receives the greater of inflation-adjusted or original principal, and thus enjoys a principal floor which we might describe as a "deflation put." This is in contrast to the UK where no principal floor exists and the cash flows are simply linked to RPI which in principle may rise or fall.

In theory, this may suggest that investors should pay a premium for US inflation linked bonds over UK inflation linked bonds given that they have a principal floor but in practice no such premium is observed, perhaps owing to the fact that in the period since inception there has been no prolonged period of deflation and hence no value attached to the "deflation put" embedded in the US inflation linked bond.

Exhibit 4: Developed global inflation-linked market basics

	Bloomberg Code	Inflation Index	Bloomberg Code	Inflation Lag (months)	Coupon Inflation Adjustment	Coupon Floor	Coupon Frequency	Principal Inflation Adjustment	Principal Floor
US TIPS	TII	CPI-U nsa	CPURNSA	3	Yes	No	S/annual	Yes	Yes
UK Index-Linked (3m)	UKTI	RPI	UKRPI	3	Yes	No	S/annual	Yes	No
UK Index-Linked (8m)	UKTI	RPI	UKRPI	8	Yes	No	S/annual	Yes	No
Italian BTPei	BTPS	EU HICP ex-tobacco	CPFTFEMU	3	Yes	No	S/annual	Yes	Yes
German OBLei/DBRei	OBLI, DBRI	EU HICP ex-tobacco	CPFTFEMU	3	Yes	No	Annual	Yes	Yes
French BTANei/OATei	FRTR	EU HICP ex-tobacco	CPFTFEMU	3	Yes	No	Annual	Yes	Yes
French BTANi/OATi	FRTR	French CPI ex-tobacco	FRCPXTOB	3	Yes	No	Annual	Yes	Yes
Japan JGBi	JGBI	CPI ex-fresh food	JCPNJGBI	3	Yes	No	S/annual	Yes	No
Swedish SGBi	SGB	CPI	SWCPI	3	Yes	No	Annual	Yes	Yes2
Canadian RRB	CAN	CPI	CACPI	3	Yes	No	S/annual	Yes	No
Australian TIBs	ACGB	CPI	ACIF	Quarterly	Fixed	Yes6	Quarterly	Yes	Yes

Source: UBS

Are index linked bonds an asset class in their own right?

We define an asset class as a broad group of securities or investments that tend to react similarly in different market conditions. Individual asset classes are also generally governed by the same rules and regulations.

For inflation-linked bonds the price rises as real interest rates fall and vice versa. Accepting variations in supply and demand, the family of inflation linked bonds react similarly in different market conditions, and are generally governed by the same rules and regulations. In this respect, inflation linked bonds may be considered an asset class in their own right.

As we will show, inflation linked bonds can be expected to perform differently to conventional bonds and this leads us to consider inflation-linked bonds as a separate asset class to conventional bonds, albeit that they may be governed by similar rules and regulations. It is noted that for pure inflation beta, there exist inflation swaps in the derivatives market.

How are linkers priced and what is the meaning of "inflation break-evens"?

With a conventional bond the market prices in three sources of return: the real yield, a yield to compensate for expected inflation, and an inflation risk premium. In contrast, the return on inflation linked bonds has only two sources of yield: the real yield, and a yield representing actual trailing inflation.

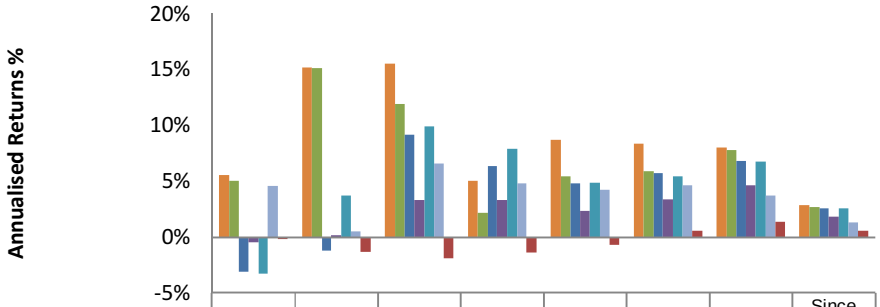
The difference in yield between inflation linked bonds and nominal bonds is called the break-even inflation rate and is a market based approximation of inflation expectations. The breakeven may be seen only as an approximation because prices will be a function of factors other than inflation expectations, such as liquidity and supply and demand.

Break-even inflation rates may alternatively be understood as the required future inflation rate for an inflation linked bond to achieve the same return as a comparable conventional bond, both being held to maturity. If actual inflation is greater than breakeven inflation then inflation-linked bonds may outperform nominal bonds. If actual inflation is less than breakeven inflation then nominal bonds may outperform inflation linked bonds.

What has been the recent performance of index linked bonds?

The recent performance has been positive for inflation linked bonds, although they have underperformed compared to some other asset classes (notably equities) by a significant margin over the last year. Real returns on inflation-linked bonds have been relatively low since 1981 and in fact, inflation-linked bonds offered the second lowest return of the asset classes shown in the table below.

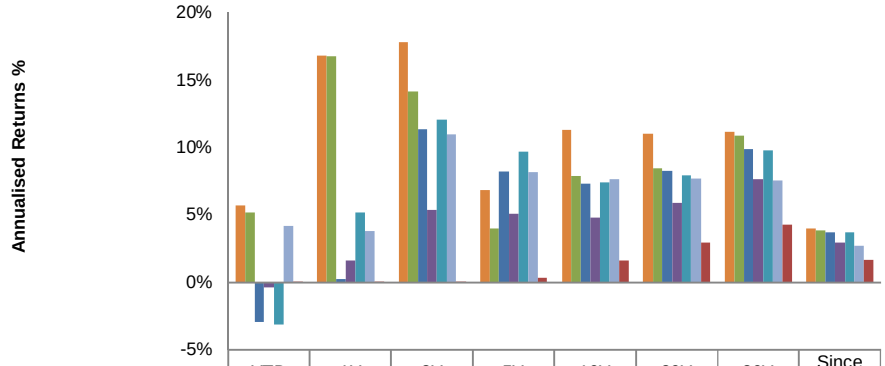
Exhibit 5: Real returns on inflation linked bonds vs. other asset classes for the post-1981 period (local currencies)



	YTD	1Y	3Y	5Y	10Y	20Y	30Y	Since 1981
US Small Cap Stocks	5.5%	15.2%	15.5%	5.0%	8.7%	8.4%	8.0%	2.8%
S&P 500	5.0%	15.1%	11.9%	2.2%	5.4%	5.9%	7.8%	2.7%
US LT Govt Bond	-3.1%	-1.2%	9.1%	6.4%	4.8%	5.7%	6.8%	2.6%
US IT Govt Bond	-0.5%	0.2%	3.3%	3.3%	2.4%	3.4%	4.6%	1.9%
US LT Corp Bond	-3.3%	3.7%	9.9%	7.9%	4.9%	5.4%	6.7%	2.6%
UK Infl Lkd Gilts	4.6%	0.5%	6.6%	4.8%	4.3%	4.6%	3.7%	1.3%
US 30 Day T-bills	-0.1%	-1.4%	-1.9%	-1.4%	-0.7%	0.6%	1.3%	0.6%

Source: Morningstar

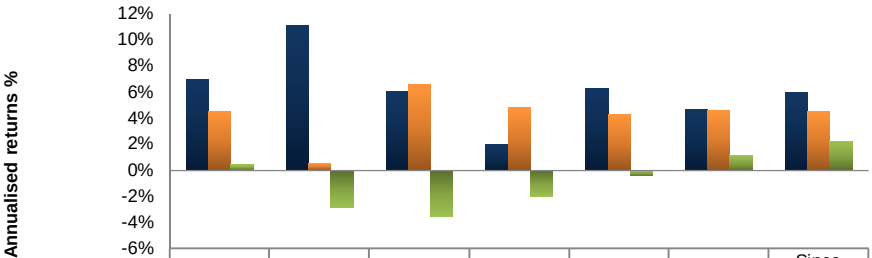
Exhibit 6: Nominal returns on inflation linked bonds vs. other asset classes for the post-1981 period (local currencies)



	YTD	1Y	3Y	5Y	10Y	20Y	30Y	Since 1981
US Small Cap Stocks TR	5.7%	16.8%	17.8%	6.8%	11.3%	11.0%	11.2%	4.0%
S&P 500 TR	5.2%	16.8%	14.1%	4.0%	7.9%	8.4%	10.9%	3.8%
US LT Govt Bonds TR	-3.0%	0.2%	11.3%	8.2%	7.3%	8.3%	9.9%	3.7%
US IT Govt Bonds TR	-0.4%	1.6%	5.4%	5.1%	4.8%	5.9%	7.6%	3.0%
US LT Corp Bonds TR	-3.1%	5.2%	12.1%	9.7%	7.4%	7.9%	9.8%	3.7%
UK Infl Lkd Gilts TR	4.2%	3.8%	10.9%	8.2%	7.7%	7.7%	7.5%	2.7%
US 30 Day Tbill TR	0.0%	0.1%	0.1%	0.3%	1.6%	3.0%	4.3%	1.7%

Source: Morningstar

Exhibit 7: Real Returns of UK inflation linked bonds against UK equity market and cash post-1986

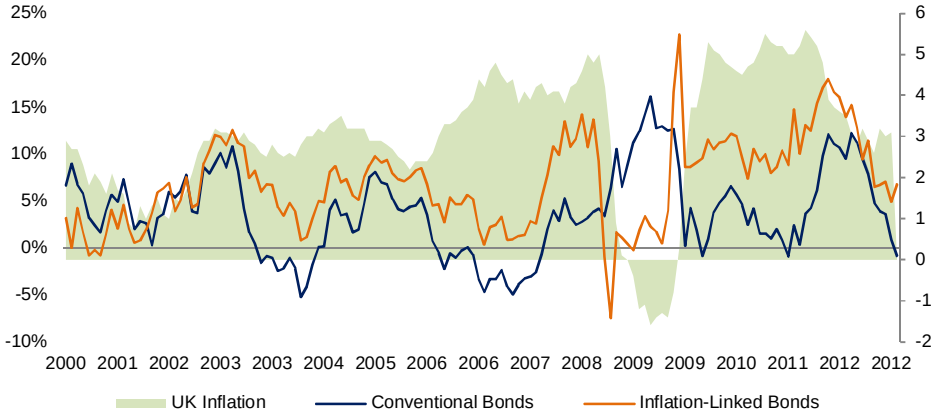


	YTD	1Y	3Y	5Y	10Y	20Y	Since 1986
FTSE 100	7.0%	11.2%	6.1%	2.0%	6.3%	4.7%	6.0%
UK Govt Infl Lkd	4.6%	0.5%	6.6%	4.8%	4.3%	4.6%	4.5%
3M UK T-Bills	0.4%	-2.9%	-3.5%	-2.0%	-0.4%	1.2%	2.3%

Source: Morningstar

The chart below shows the recent performance of nominal and inflation linked bonds with maturity of 5-15 years, along with inflation. As expected, rising inflationary periods correlate with an outperformance of inflation linked bonds over conventional bonds. The deflationary period post March 2009 corresponds to a large outperformance of conventional bonds over inflation linked bonds, again as we would expect.

Exhibit 8: 1 year rolling real returns of UK 5-15 year conventional bonds vs. inflation-linked bonds



Source: Morningstar, FTSE Actuaries indices

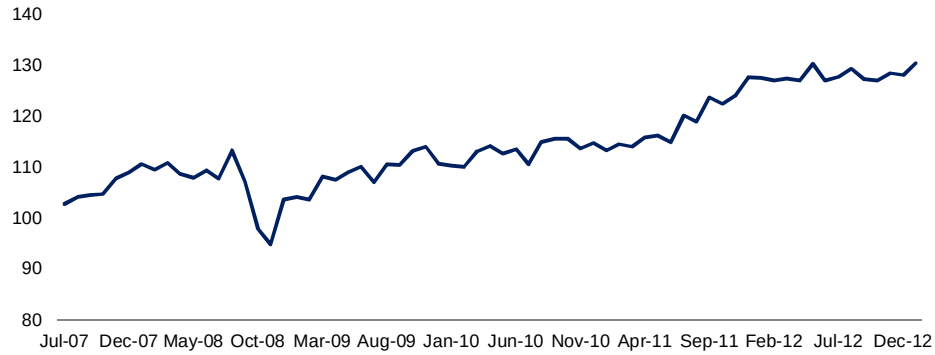
A simpler chart showing the capital price line of a single inflation linked gilt - the current 10Y inflation-linked gilt (UKTI 1 7/8 11/22/2022) - exhibits the typical recent trading pattern of these bonds. Many, especially leveraged investors, were long breakeven

trades into late 2008, serving to heighten the sell-off in inflation linked bonds, which effectively faced a triple hit:

(1) Many were long inflation protection when deflation fears reared up over Lehman Brothers,
(2) There was no demand as many participants looked to exit their positions, and
(3) Those participants long the break-even inflation (BEI) were effectively short Treasuries and the ensuing flight-to-safety precipitated a massive demand for Treasuries.

At the low point 10y break-evens were trading at 0% thus implying 0% inflation in the US over 10 years; the price of inflation linked gilt in Exhibit 9 increased by 37.9% since its low point in November 2008.

Exhibit 9: Price movement of the current 10 year inflation-linked gilt (UKTI 1 7/8 11/22/2022)



Source: Bloomberg

We might ascribe this enhanced period of performance of Linkers to wider investor interest stimulated by their inflation protection attributes, and Chris Lupoli of UBS makes an interesting observation about latent demand for TIPS. An ever increasing size of market begets an ever wider range of inflation hedging participants and the additional US Treasury issuance will soon take us to $1,000bn in stock.

However, the observed positive correlation of nominal and inflation linked bonds would also lead one to the conclusion that the good performance of linkers has been largely based on that of nominal bonds. Extending this correlation argument might then suggest that

inflation linked bonds would fare poorly in an environment where nominal bonds are losing value, and broadly speaking this is true if inflation remains stable. Combining the two variables of nominal rates and inflation leads us to a consideration of changes in real rates as the determinant of prices for inflation linked bonds.

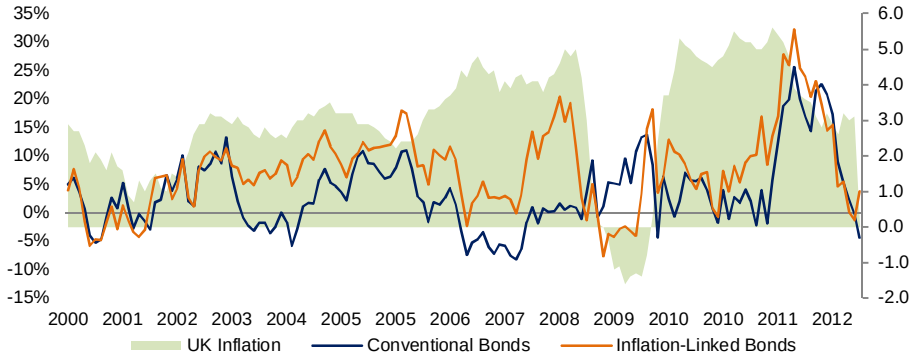
What is the expected performance from index linked bonds under different inflation scenarios?

In principle, the price of inflation linked bonds is a function of real rates: when real rates fall then the price of inflation linked bonds rises and vice versa. If held to maturity, then the total return is a function of the real yield and actual inflation. We will consider the likely performance of inflation linked bonds under a variety of circumstances.

I. Deflation

In a deflationary environment, we would expect that conventional bonds perform very well, but inflation linked bonds would offer a negative return to investors. The chart below shows the negative returns of linkers during the deflationary patch post March 2009. Linkers behaved as expected during this small sample period.

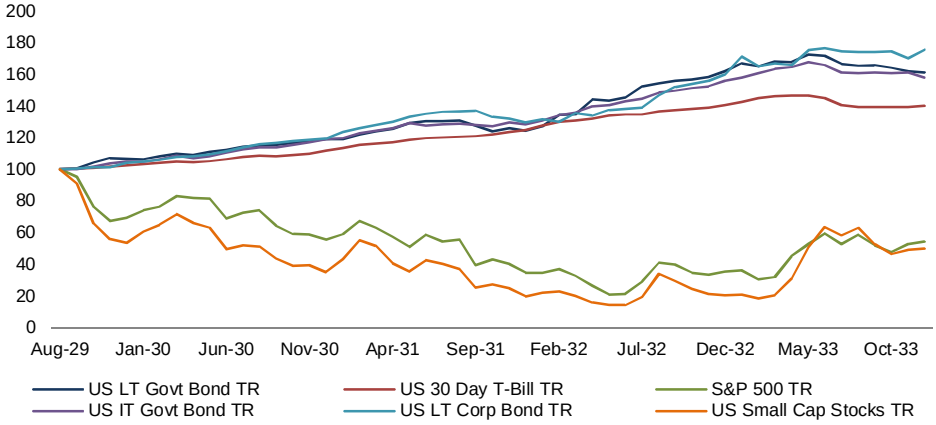
Exhibit 10: 1 year rolling real returns of long-term (15+ years) UK conventional bonds vs. inflation-linked bonds



Source: Morningstar, FTSE Actuaries indices

During an extended deflationary period, for example the Great Depression of 1929-33, we would expect stocks to have negative returns and nominal paper of any duration to outperform equity.

Exhibit 11: Real asset class returns during deflation (1929-33)



Source: Morningstar

	US LT Corp Bonds	US LT Govt Bonds	US IT Govt Bonds	US 30 Day T-bills	S&P 500	US Small Cap Stocks
1929-33	75.58%	60.98%	57.95%	40.22%	-45.47%	-50.14%

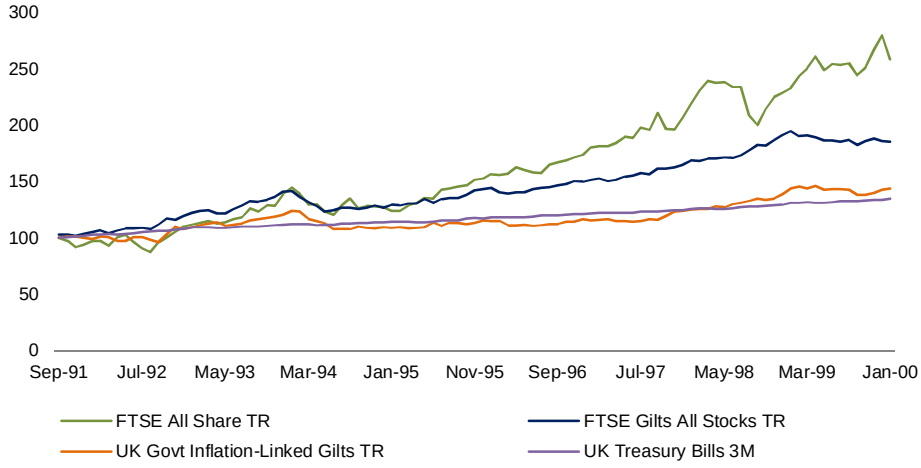
Although there has been a positive correlation of nominal bonds to inflation linked bonds since 1981, during a period of prolonged deflation we would expect positive returns from nominal bonds and negative returns from inflation linked bonds with the observed correlation breaking down.

II. Moderate inflation and disinflationary periods

In a disinflationary environment, as happened during the 1990s, we would expect inflation linked bonds, benefitting from the increasing capital values of conventional bonds, to offer positive attribution to the portfolio but perhaps underperforming nominal bonds, if the environment was also one of rising real rates.

The chart and table below illustrate that over the 1990s there was positive attribution from all UK bonds but nominal bonds outperformed inflation linked bonds.

Exhibit 12: Real asset class returns during moderate inflation (1991-2000)



Source: Morningstar

	FTSE All Share	FTSE Gilts All Stocks	UK Inflation-linked Gilts	UK 3-month T-bills
1991-00	258.1%	185.2%	140.5%	135.1%

III. High and rising inflation

The inflationary period of the 1970s reminds us of the negative returns obtained in traditional asset classes such as equities and conventional bonds.

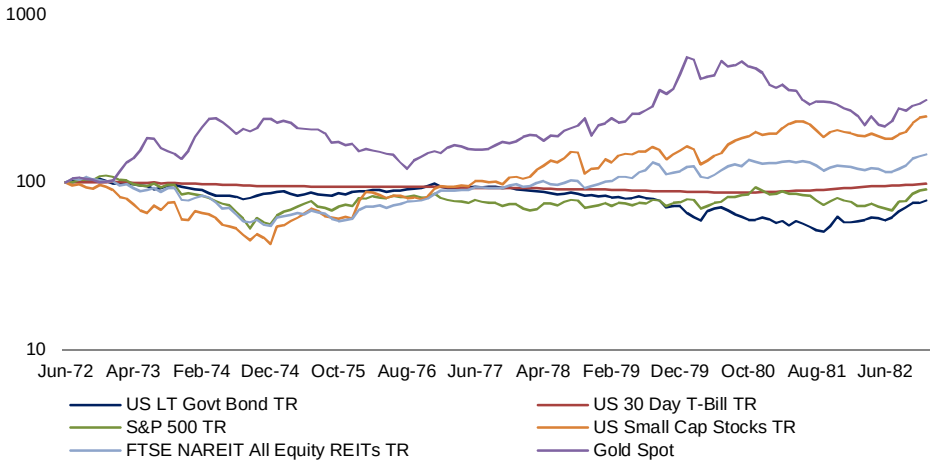
In the long run we might expect that equity would offer positive returns during inflation, or at least maintain real wealth, but the evidence suggests that there is a destruction of real wealth lasting several years under such conditions (Cerno Research, November 2010: “Age of Inflation”).

Inflation linked bonds have an explicit and contractual relationship to inflation and therefore under conditions of high and rising inflation would offer a positive real return, and would possibly be one of the few asset classes offering positive attribution in this scenario.

The only other asset class that would plausibly offer positive returns would be where a tradable asset class was the actual source of inflation. For example, in an oil shock, owning oil would secure outperformance (or value protection) against other tradable assets.

The chart below shows that there is an inverse correlation of the excess return of conventional bonds versus inflation linked bonds when inflation rises. This is very much what we would have anticipated given that, typically, higher inflation corresponds to lower real rates which benefits inflation linked bonds.

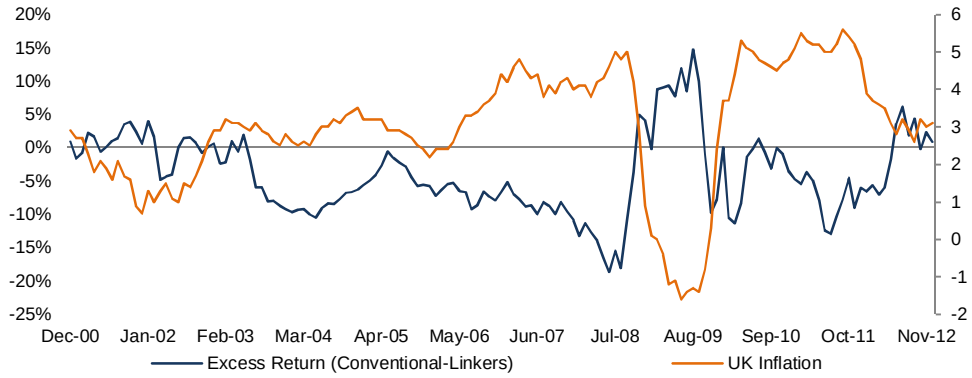
Exhibit 13: Real asset class returns during high and rising inflation (1972-81)



Source: Morningstar

	Gold	US Small Caps	Equity REITs	US 30 Day T-bills	S&P 500	US LT Govt Bonds
1972-81	208.7%	147.2%	47.4%	-1.7%	-8.8%	-22.2%

Exhibit 14: Excess returns of long-term (15+ years) conventional over inflation-linked bonds



Source: Morningstar, FTSE Actuaries indices, ONS

Do past correlations help to explain the future?

Correlation coefficients of inflation adjusted conventional bonds and inflation linked bonds reveal a correlation for all maturities of 0.64 and with increasing correlation as the maturity of the bonds increases. This data tends to confirm conventional wisdom that the longer the duration of a conventional bond, the greater the price is a function of anticipated inflation as well as other factors.

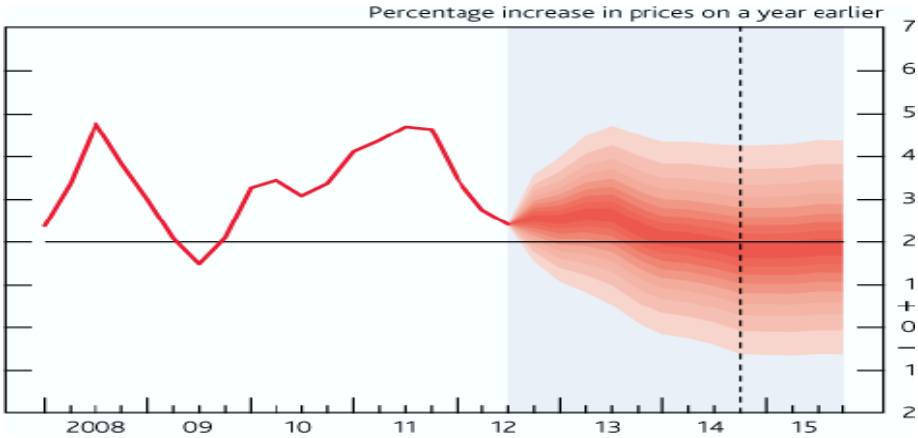
All Maturities	< 5 Yr	5-15 Yr	> 15 Yr
0.64	0.15	0.50	0.71

The period of observable behaviour since Linkers were introduced in 1981 is also one of disinflation followed by low and stable inflation and thus we do not have a large enough sample period to make good inferences for the different scenarios especially high and rising inflation or deflation. In principle the observed positive correlation would most probably breakdown in environments of prolonged deflation or inflation because of the contractual nature of returns to the change in general price levels. Past observable correlations are a very poor guide to the future for this asset class.

Should an investor reasonably expect a positive expected return on inflation linked bonds if they invested now?

The Bank of England makes attempts to show the likely distribution of inflation over the coming years by creating a BoE Inflation Fan showing their distribution of inflation outcomes. As you might expect from a forecasting body that is risk adverse, the fan covers most expected outcomes.

Exhibit 15: Bank of England probability of inflation outcome fan chart

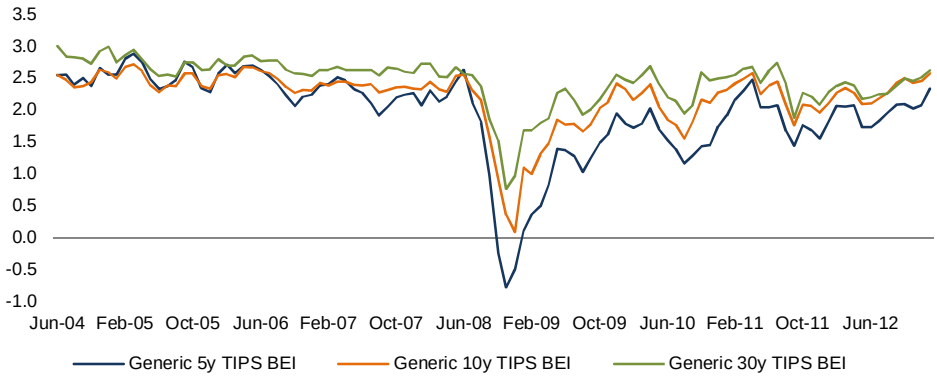


Source: BoE

Breakeven inflation (BE) is the market's view on rising prices and is simply the difference between the nominal yield on a fixed-rate investment and the real yield (fixed spread) on an inflation linked investment of similar maturity and credit quality. The return from purchasing inflation linked bonds is calculated by adding the real return to the actual inflation rate. In this respect, deciding on whether to purchase inflation linked bonds might be put simply as a matter of deciding on the likelihood of inflation being higher than the market currently expects.

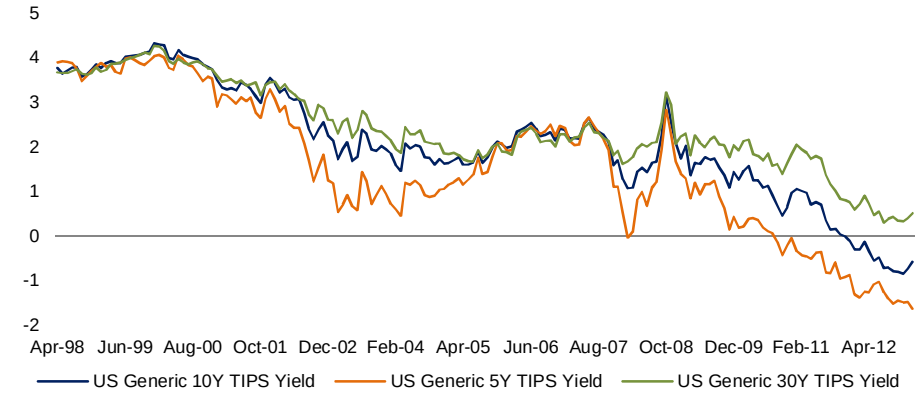
The charts below show that the break-evens for both the UK and the US are currently towards the upper end of their recent ranges, and it is partly this point which leads us to conclude that from a timing perspective inflation linked bonds do not offer a "margin of safety" at today's prices, whilst acknowledging that we may be on the verge of an inflation breakout.

Exhibit 16: US TIPS historical breakeven rates (%)



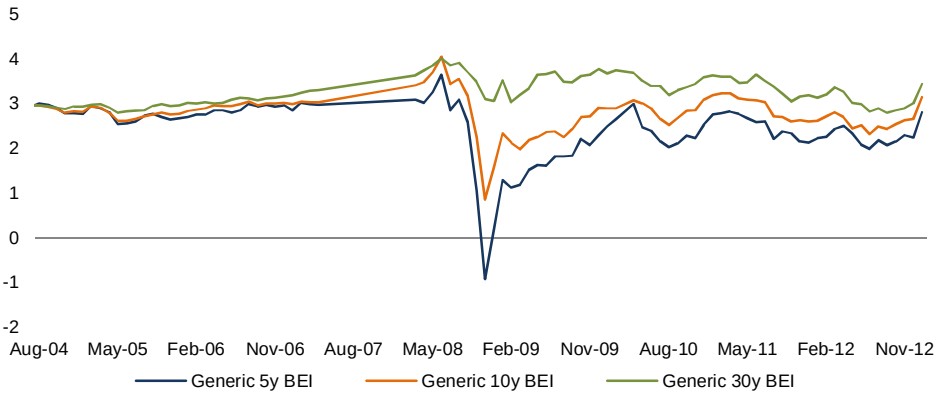
Source: Bloomberg

Exhibit 17: US TIPS historical real yields (%)



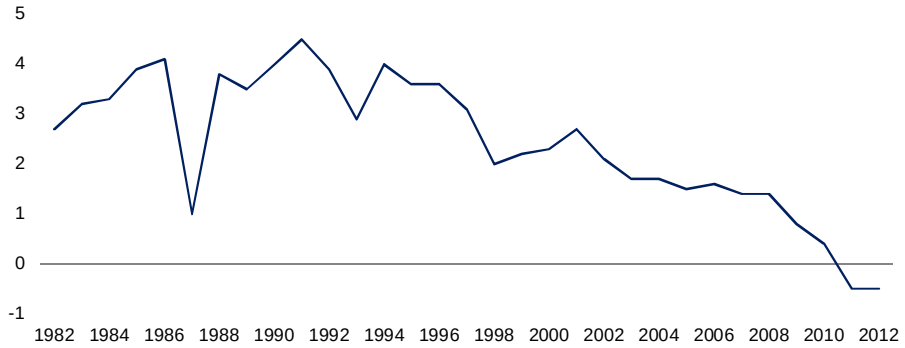
Source: Bloomberg

Exhibit 18: UK inflation-linked gilts historical breakeven rates (%)



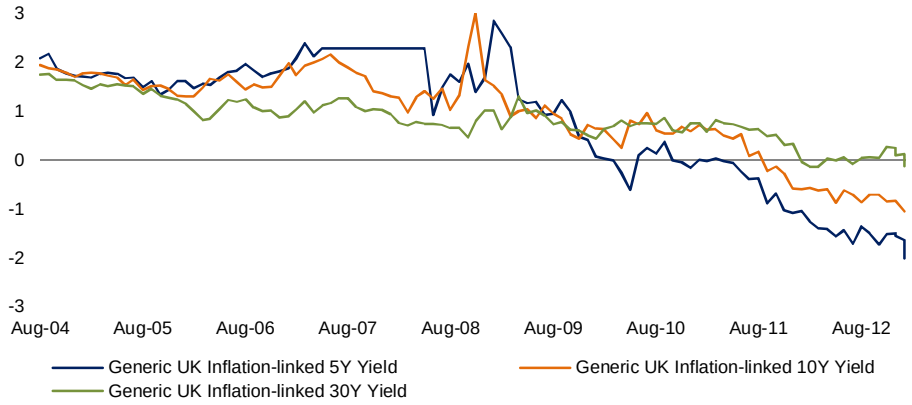
Source: Bloomberg

Exhibit 19: Barclays UK Inflation-linked Gilts Index historical real yields (%)



Source: Barclays Equity Gilt Study 2013

Exhibit 20: UK inflation-linked gilts historical real yields (%)



Source: Bloomberg

Current Breakeven Rates for UK inflation linked bonds:

Period	5Y	10Y
BE Rate (%)	2.877	3.252

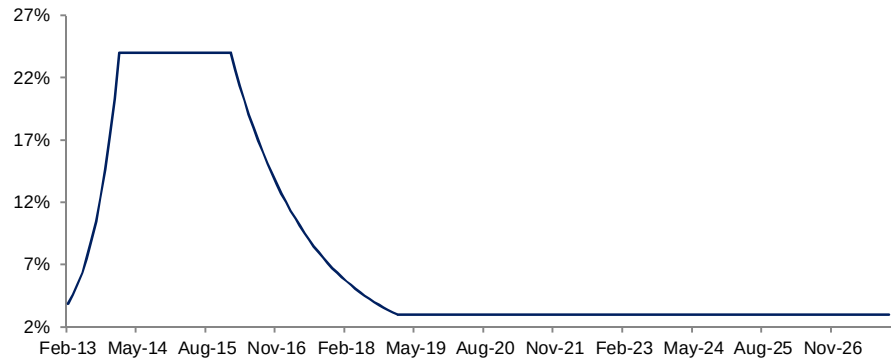
Considering the market's expectation of inflation and the BoE's inflation fan we can assign probabilities to inflation being higher than anticipated.

Probability (inflation > 5 year BE by Q3 2013) = 43%
Probability (inflation > 10 year BE by Q3 2013) = 30%

In order to establish an expected return from holding inflation linked bonds, we would need to make further assumptions about the

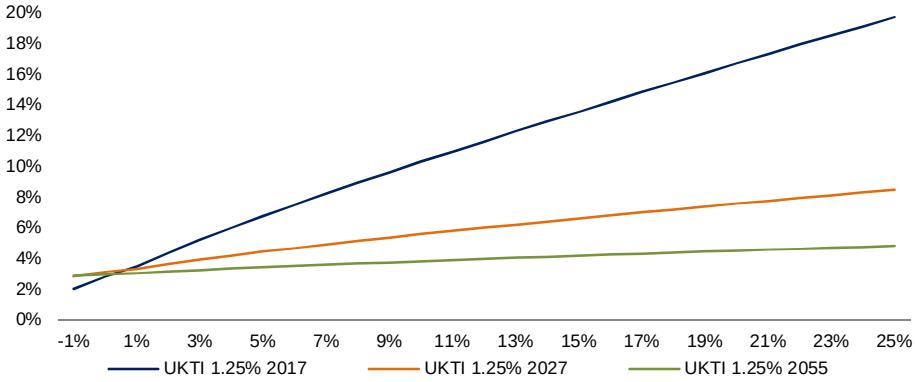
payoff under various scenarios. While mathematical precision here is perhaps foolish, we would like to note that under the current policies of money creation, if we were to assume that the chances of lower inflation ahead were small, the expected return of linkers held to maturity is positive and dependent on the magnitude of inflation. Despite the BoE displaying a symmetrical fan for the distribution of inflation outcomes, we might attach very different probabilities to lower inflation going forwards; it would be very unusual for a central bank to be pursuing balance sheet expansion while simultaneously attaching a strong probability to high inflation. The chart below shows one inflation pattern for illustrative purposes but we acknowledge that there are many variations with very different expected payoffs.

Exhibit 21: Assumption of inflation pattern through the existence of the bond



Source: Cerno Capital

Exhibit 22: Probability and annualised returns of different maturity UK inflation-linked gilts at varying levels of inflation



Source: Cerno Capital

Inflation Bands	Assigned Probability	Return Bands (5Y Bond)	Return Bands (15Y Bond)	Return Bands (40Y Bond)
-1% - 0%	3.0%	2.0% - 2.8%	2.8% - 3.1%	2.9% - 3.0%
0% - 2%	15.0%	2.8% - 4.4%	3.1% - 3.7%	3.0% - 3.2%
2% - 4%	50.0%	4.4% - 6.0%	3.7% - 4.2%	3.2% - 3.3%
4% - 6%	20.0%	6.0% - 7.5%	4.2% - 4.7%	3.3% - 3.5%
6% - 8%	8.5%	7.5% - 8.9%	4.7% - 5.1%	3.5% - 3.7%
8% - 25%	3.0%	8.9% - 19.7%	5.1% - 8.5%	3.7% - 4.8%
>25%	0.5%	0%	0%	0%

Source: Cerno Capital

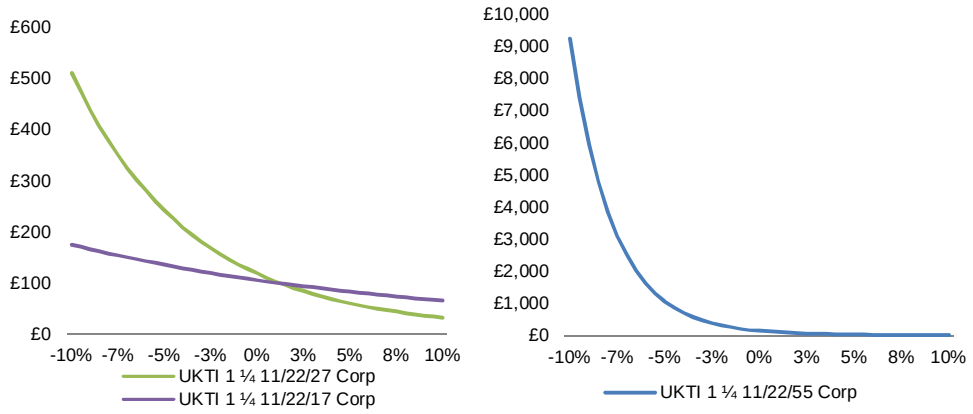
Overall expected return, under the assumptions that the bonds in the calculation are held to maturity and using the probabilities assigned to each possible outcome, is given by the following equation:

$$Expected\ Return = \sum_{i} \text{Return(i)} * \text{Probability(i)}, \quad i = \{1,..,25\}$$

	Short-term (5Y)	Long-term (15Y)	Ultra-long (40Y)
Expected Return	6.0%	4.2%	3.3%

However, suppose the bonds are not held to maturity, the following chart displays how their prices would vary at different levels of real yield.

Exhibit 21: Price-Yield analysis of UK inflation-linked gilts



Source: Cerno Capital

The case for inclusion of linkers in a multi-asset portfolio is as follows:

1) To generate explicit real returns in a portfolio
2) Secure price appreciation in a falling real rate environment thus offering insurance qualities in a portfolio
3) Provide low correlation to many other asset classes (equities, real estate, commodities) thus offering diversification
4) Benefit from supply/demand characteristics which favour price appreciation. There remains strong demand from pensions, with inflation indexed payments, and endowments, seeking to preserve purchasing power.

The case against inclusion of linkers in a multi-asset portfolio:

1) Given a prolonged period of institutional demand supplemented by private wealth demand, most inflation linked bonds offer marginally negative real returns at current prices and inflation expectations and the current break-evens indicate that we are towards the upper end of inflation expectations presently
2) Liquidity of inflation linked bonds versus conventional bonds is poor
3) If not held to maturity, rising real yields would exert downward pressure on the prices of inflation linked bonds
4) The post QE environment is difficult to analyse. Should real yields rise dramatically when policy is reversed then linkers would probably suffer heavily. Conversely, should policy makers be “behind the curve,” then we might experience a period of falling real rates which is beneficial for the prices of inflation linked bonds.

Conclusions

1) Inflation linked bonds offer a contractual manner for investors to hedge against rising inflation and this characteristic is unlike any other financial instrument

2) High and rising inflationary periods have resulted in negative returns for most traditional asset classes apart from inflation linked bonds
3) The restricted supply of sovereign inflation linked bonds, and continuing demand from the institutions requiring an explicit real return such as pension funds, suggests that there will remain a supply/demand imbalance favouring the asset class
4) Performance attribution in the near run may be negligible or even negative for inflation linked bonds
5) Investors should attribute a positive value to the diversification and insurance benefits of ownership of inflation linked bonds in a portfolio.