NWM Inflation Primer

NatWest Markets

Desk Strategy | European Macro Strategy

A prelude to inflation-linked products

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1. Inflation basics and the concept of breakeven inflation

1.1. A few definitions…

Inflation is a rise in prices for goods and services in an economy. When prices are increasing, cash in the future is worth less than today. In other words, inflation represents a loss of purchasing power for the consumers.

Deflation. When consumers expect prices to decrease, they tend to save and delay their spending waiting for prices to fall further. Periods of deflation included, for example, the Great Depression in the US in the 1930s, or more recently, in Japan.

Real interest rate. The real interest rate is an interest rate adjusted to remove the effects of inflation to reflect the real cost of funds to the borrower and the real yield to the lender, or to an investor. A **nominal interest rate** refers to the interest rate before taking inflation into account.

1.2. Breakeven inflation and the 'Fisher' equation

Traditional yields, also known as 'nominal' yields, can be considered to embed an element intended to compensate for inflation (a dollar in 10 years probably doesn't buy as much as a dollar today), and an additional return, which we call 'real yield'.

These concepts are linked by what we call the 'Fisher Equation'. An approximation of the formula simply states that the nominal interest rate is the sum of the real interest rate and inflation.

The Fisher equation

Source: NWM

The Fisher equation can be expressed this way:

$$(1 + i) = (1 + r) \times (1 + \pi)$$

With i the nominal interest rate, r the real interest rate and π the inflation rate

This is approximately:

$$i \approx r + \pi$$

Market practitioners call the breakeven inflation the difference, or the spread, between the nominal yield of a conventional bond and the real yield of an inflation-linked bond (or 'linker') of the same maturity and issuer.

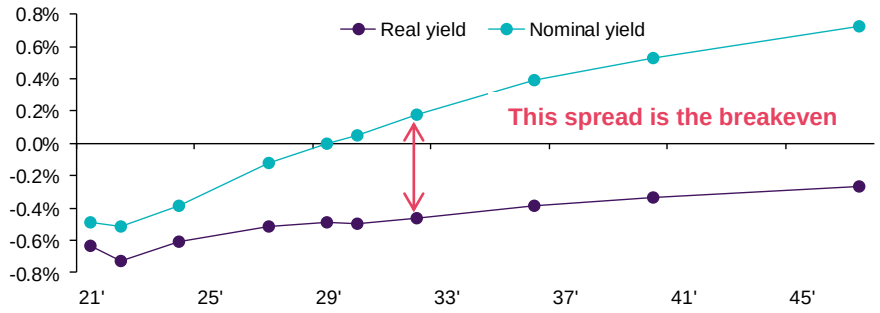
This spread is expressed in percentage or basis points, and can be roughly interpreted as the level of future inflation that would make an investor indifferent between holding an inflation-linked bond and a conventional bond of the same maturity and issuer, also called the comparator bond.

A linker is designed to hedge the inflation risk of a bond whilst nominal bonds aren't protected against the inflation risk, so inflation only erodes the value of the nominal instrument.

In the chart below, the purple line represents the different real yields of French inflation-linked bonds, plotted against the nominal equivalent bonds in blue. The difference in these yields is the breakeven, and we say that breakevens go up, or rally, when inflation-linked bonds outperform conventional bonds.

A breakeven is a spread between the nominal yield of a conventional bond and the real yield of an inflation-linked bond, using OATei

Source: NWM



Example:

- A 10y linker has a real yield of -1.5% and its nominal comparator bond has a nominal yield of -0.5%
- The breakeven rate is 1% (nominal yield – real yield)

The Fisher equation suggests that an investor:

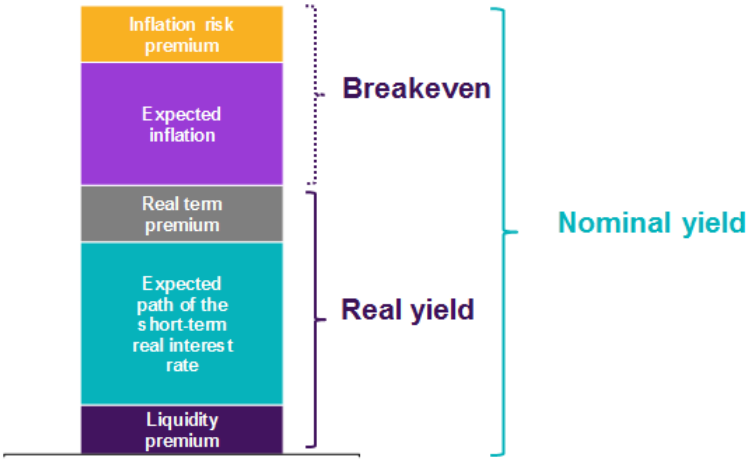
- Would buy the nominal bond if he expects inflation to average less than 1% in the next 10y. A common error here is to interpret 10y breakevens as the expected inflation rate in ten years' time, rather than the average rate during the next 10y.
- Would buy the inflation-linked bond if he expects inflation to average more than 1% in the next 10y
- Would be indifferent between the two assets if he thinks inflation will average exactly 1% over the next 10y

Breakevens can be seen as the price of inflation protection. But it is important to understand that they are not a direct measure of market participants' inflation expectations; it is only the difference in yields between two bonds of the same maturity and issuer – a nominal yield and a real yield.

Important factors, other than the average expected inflation rate, play a role in the difference in price or yield between the two bonds. Supply and demand dynamics, and other market related factors have an influence on the breakeven rate. But here we focus on decomposing the main components of nominal and real yields.

Decomposing the main components of nominal and real yields.

Source: NWM, Bloomberg



2. Inflation-linked bonds: the most commonly traded vanilla product in the inflation-linked space

Definition. An inflation-linked bond, or linker, is a bond whose value is linked to movements in a specific price index in order to maintain its purchasing power. It is designed to protect of the value of the investment from erosion by inflation.

Inflation-linked bonds are thus securities which provide investors with **a protection against rises in prices**.

If you hold a linker, the principal value of your investment grows at the rate of the observed inflation and you are hedged against a move up or down in inflation.

2.1. Basic features of inflation-linked bonds

1. Reference Index

2. The Indexation lag

3. The Index ratio

4. Coupon frequency

5. Inflation floor

Reference index. Linkers pay a coupon and principal that is fixed in real terms. That means that both have to increase in dollar (or euro, pound or other currency terms) in line with the level of the price index to which they are linked.

This inflation index used for European linkers is the Euro Area Inflation Harmonised Index of Consumer prices for all items excluding Tobacco, and for French linkers tracking French domestic inflation, it is the French CPI index ex-Tobacco. In the UK, linkers track the Retail Price Index. In the US, they track the Consumer Price Index for all Urban Consumers. All the indices are non-seasonally adjusted and their unrevised prints are used.

US/UK and EU inflation-linked bonds markets features

Source: NWM, Bloomberg, ISDA, DMOs website

Country	Launch	Linking Index	Bloomberg ticker	Indexation Lag	Linking Methodology	Inflation Floor
United-Kingdom	1981	RPI	UKRPI Index	8 months	UK	No
	2005	RPI		3 months	Canadian	
United-States	1997	CPI-U	CPURNSA Index	3 months	Canadian	Yes
France	1998	French CPI, ex-Tobacco	FRCPXTOB Index	3 months	Canadian	Yes
	2001	Euro Area HICP, ex-Tobacco	CPTFEMU Index			
Italy	2003	Euro Area HICP, ex-Tobacco	CPTFEMU Index	3 months	Canadian	Yes
Germany	2006	Euro Area HICP, ex-Tobacco	CPTFEMU Index	3 months	Canadian	Yes
Spain	2014	Euro Area HICP, ex-Tobacco	CPTFEMU Index	3 months	Canadian	Yes

The indexation lag. Because the inflation indices for a given month are usually published in the middle or at the end of month, linkers in the Euro Area, the US and the UK track inflation indices with a lag. In the Eurozone and the US, it is a three-month lag for all linkers, and in the UK it is an 8month lag for linkers issued before 2005 and a 3 month lag for new linkers issued after 2005.

The index ratio. The index ratio is the level of the price index, where that level is rebased to the first accrual date of an inflation linked bond. More simply, it is the factor by which you have to multiply the 'real' cash-flow to find the nominal cash-flow which is actually paid. You'll find the detail of the precise calculations to obtain the index ratio below.

Index ratio and Daily Reference Index calculations (3 month lag, Canadian style)

Source: NWM, Bloomberg

- **Index Ratio.** It is the accretion rate of inflation to apply to the notional and real coupons when calculating the cash flows of a linker.

Index Ratio = Daily Reference Index / Base Reference Index .

- **Base Reference Index.** It is the daily inflation index the first day of interest and inflation accrual. This is the base reference to compute total accrued inflation on a given date at any point during the life of the bond.
- **Daily Reference Index.** The first day of each month has a Daily Reference Index equal to the CPI Index of three calendar months earlier, i.e. that for December 1, 2019, it is the CPI for September 2019 and that for January 1, 2019 is the CPI for October 2019. **Daily Reference Indices** for intervening days are calculated by straight line interpolation, using the formula below.

Daily Reference Index = HICPxTm-3 + (HICPxTm-2 – HICPxTm-3) * (d -1)/dd

Where:

- *HICPxTm-2* is the price index for month m-2 (i.e. two months earlier)
- *HICPxTm-3* is the price index for month m-3 (i.e. three months earlier)
- *dd* is the number of days in month m
- *m* is the month is which settlement takes place
- *d* is the number of the day in month m, in which settlement takes place

NB: For UK linkers that were first launched before 2005, using an 8-month lag, for the index ration calculations, the base reference index (denominator) is the RPI index from 8 months before the bond was first issued and the reference index (numerator) is the RPI index 8 months before the interest payment date. The method ignores which day of the month the bond is issued on and which day of the month the interest payment is due on. The index ratio thus changes once a month. More details on the difference of calculations between the 8-month and 3-month UK linkers can be found here.

The inflation floor. Some linkers, including Eurozone and US linkers have a floor at maturity embedded in them. A floor guarantees that the principal repayment at maturity will always amount to at least the par value. So it serves to protect bond buyers against deflation. NB: the inflation floor only covers the principal repayment at maturity, not coupons.

UK linkers do not offer that guarantee, so do not benefit from deflation protection.

This inflation floor can be thought of as a put option embedded in the linker. At issuance this put option is at par. The more inflation accrues during the life of the bond, the further out-of-money it becomes.

Inflation floors have been for a long time relatively irrelevant for linker's valuations. But when markets start pricing deflation, as was the case during the 2008 crisis, it becomes an important element of linkers pricing as suddenly the option can be in the money.

2.2. Inflation-linked bonds cash-flows

The cash-flows of a linker – the fixed coupon rate and the principal repayment at maturity – are adjusted for inflation. As a result, at the linker's maturity date, the holder recovers any loss in purchasing power that occurred during the life of the bond.

Coupon payments are calculated as the fixed coupon rate times the index ratio at the payment date, and the final payment at maturity will be the coupon payment and the notional amount adjusted by the index ratio at maturity. If the linker has a par floor, then the minimum principal repayment at maturity is the par value.

As such, when investing in an inflation-linked bond, an investor earns the **real yield plus the 'actual inflation compensation'** (if held until maturity). So to the extent that the price index captures the relevant prices moves in the real economy, the real return to maturity on the linker is certain at the time of purchase. The nominal return, however, isn't known in advance since future inflation levels are unknown when purchasing the bond. Remember that the Index ratio cannot be calculated more than -6 weeks in advance, given the inflation lag.

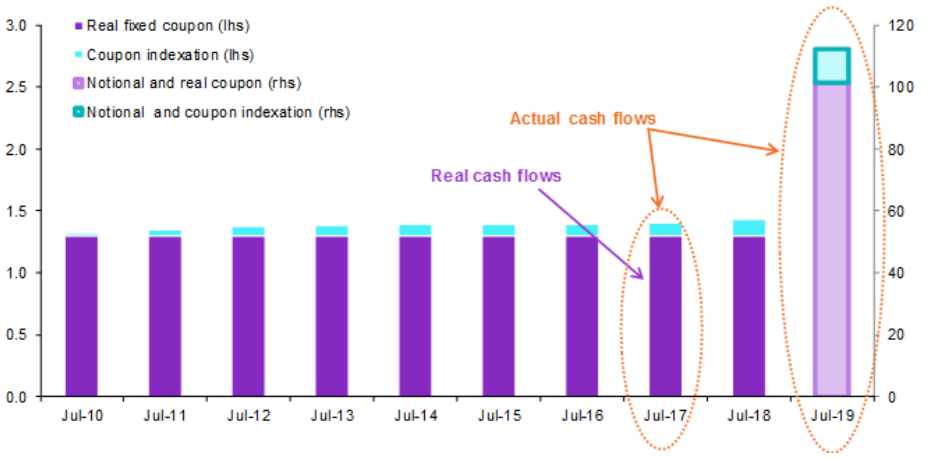
On a nominal bond, an investor would earn the nominal yield, i.e. the real yield plus the breakeven inflation. So the nominal return to maturity is certain but the real return isn't. It will depend on how realised inflation actually erodes the real value of the fixed nominal cash payments.

2.3. Distribution of cash-flows versus nominal and credit considerations

The cash-flow profile of a linker is skewed. Indeed, a linker has smaller nominal CFs in the early stages than later on, if the price levels rise. Usually, at maturity, most of the returns of the inflation-linked bonds are delivered, which means that linkers have i) a higher duration and ii) a higher credit component than their comparator nominal bonds, given this skew in the cash-flow profile.

All cash-flows increase in-line with a price index.

Source: NWM, Bloomberg



2.4. Risk and behaviour: the beta

'Beta' in linker markets refers to the sensitivity of real yields to nominal yields. Nominal yields can rise either because the inflation component rises or because the real yield rises, or at often happens in practise, both. There is a standard economic logic to nominal and real yields moving in the same direction: as inflation expectations rise, central banks should be expected to raise real rates to control that inflation. But there can be plenty of other reasons why nominal and real rates may trade with a varying sensitivity. There is no standard way to evaluate this risk concept. It must be inferred in a way that makes sense for an investment style.

The beta is typically between 0 and 1, which is why when nominal yields rise, linkers tend to outperform. Similarly, in an environment of falling nominal yields, linkers tend to underperform nominal bonds.

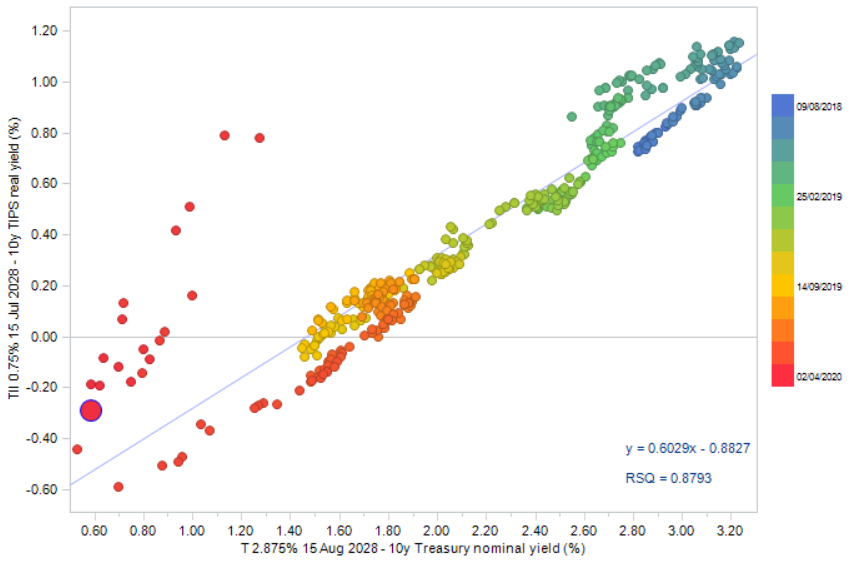
As we said, a change in the yield in nominal bonds is due to either i) a change in inflation expectation change and/or ii) a change in real factors.

- If a change in nominal yields is fully explained by a change in inflation expectations, then the beta should be **equal to 0** i.e. real yields stay at the same levels.

- If the beta is **lower than 1**, a change in the nominal yield will only partially impact the real yield.
- If the beta is **equal to 1**, it means that inflation expectations are stable.
- If the beta is **more than 1**, yield changes in linkers will be larger than in nominal bonds.

The beta. 10y Treasury yields vs 10y TIPS yields

Source: NWM, Bloomberg



2.5. Risk and behaviour: duration in inflation-linked bonds

Linkers have a higher duration than their nominal compactor bonds given the higher concentration of their cash-flows closer to and at maturity. Indeed, the coupons on inflation-linked bonds are usually smaller than those of their nominal comparator bonds, whilst the repayment at maturity is usually larger.

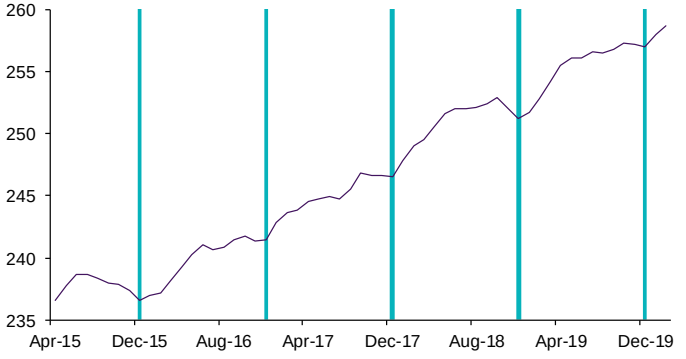
3. Seasonality in inflation-linked bonds

3.1. What is seasonality?

Inflation-linked bonds protect against inflation. But prices display seasonality. From January to June, inflation is typically much higher than from July to December. As a result, the nominal value of inflation linked bonds is also seasonal.

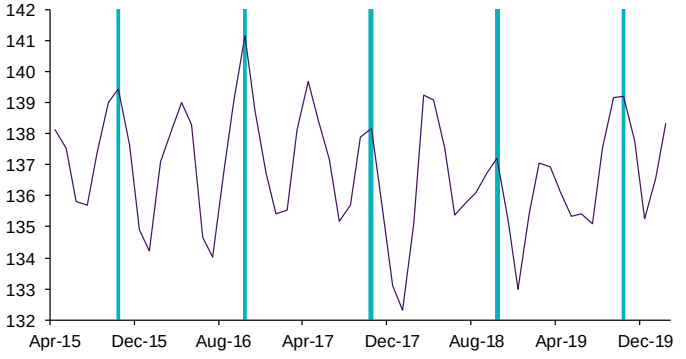
Seasonality in US inflation…US CPI-U index, NSA, December prints outlined in turquoise

Source: NWM, Bloomberg



….and even more seasonality. US footwear CPI, October prints outlined in turquoise

Source: NWM, Bloomberg



3.2 Why do we seasonally adjust linkers?

Quoted bond prices and hence yields fluctuate throughout the year on the basis of any seasonal pattern in the CPI. This is why we only look at seasonally adjusted real yields and breakevens in our publications.

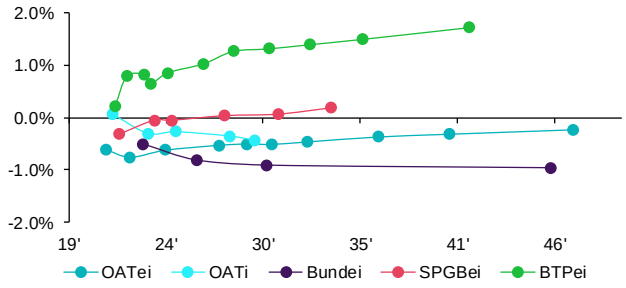
3.3. How to seasonally adjust your linker in practice?

By definition, price fluctuations that are seasonal even out over the year. The 'seasonal' element of a future cash-flow is therefore related to the non-integer part of the day count between settlement and payment. That is, a cash-flow in 4.3 years has a seasonal element related to the normal seasonal change in the price level over the next 0.3 years. The total seasonal value a bond enjoys (or doesn't enjoy) is the sum of the total seasonal value of all its cash-flows.

At Natwest Markets, we calculate and publish seasonally adjusted real yields and breakevens regularly. Please contact us if you are looking for these.

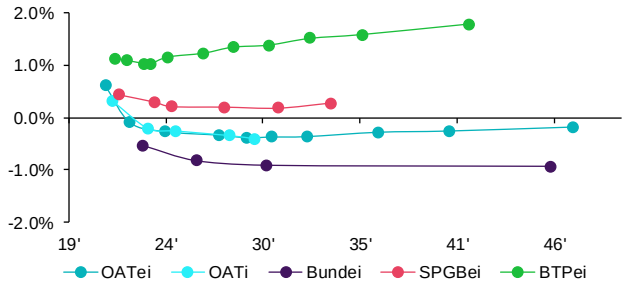
Non-seasonally adjusted real yields or 'quoted' real yields

Source: NWM. Bloomberg



Seasonally adjusted real yields

Source: NWM. Bloomberg



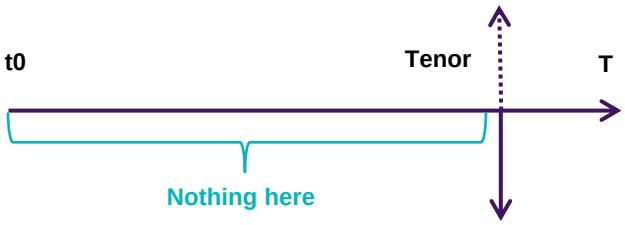
4. Zero coupon inflation swaps: the most common and liquid inflation derivatives

4.1. Structure and cash-flows

Zero coupon inflation swaps. The structure of a zero coupon inflation swap is quite simple, as it involves one single exchange of cash-flows, at maturity.

ZC inflation swaps involve one single exchange of cash-flows, at maturity

Source: NWM



On the one hand, **the receiver of inflation ('or payer of fixed') receives the difference between the notional adjusted for accrued inflation over the life of the swap, and the notional principal, 100, at inception**, if this difference is positive.

So you simply compare the final fixings of your reference CPI index at maturity and at the starting date. The fluctuations of the CPI index during the life of the swaps have no impact on the leg, and you only consider the cumulative rate of inflation during the life of the swap.

$$Notional\ amount\ x\ \left(\frac{Reference\ Inflation\ index\ at\ t0+Tenor}{Reference\ Inflation\ index\ at\ t0} - 1\right)$$

This is your actual inflation rate

On the other hand, **the receiver of inflation (or 'payer of fixed') pays the increase in the swap notional compounded at the fixed rate over the life of the swap**. The rate is determined at the inception of the trade and reflects the inflation expectations at that time.

$$Notional\ amount\ x\ \left((1 + fixed\ rate)^{Tenor} - 1\right)$$

This is your breakeven rate

The fixed rate is therefore the market's 'price' of inflation protection over a given period at the time of the trade, as we said earlier, that price is in some sense the expected inflation adjusted for various factors including liquidity.

At maturity, if the annualised average inflation over the swap's period equals the initial fixed rate, both parties breakeven on the trade.

ZC inflation swaps allow investors to take exposure across maturities, and are hence more flexible in terms of matching maturities than linkers. A good illustration of that can be found in the French inflation linked markets, where at the moment, the longer-dated linker is a 2029 maturity, so if an investor wants to take an exposure on French inflation in the 30y sector, he will still be able to do so via swaps.

It's worth noting that short-dated inflation swaps have a stronger correlation to CPI, whilst breakeven rates in longer-dated inflation swaps tend to be more vulnerable to other market dynamics. For example, some investors buy cash linkers on ASW, that is, they purchase a linker and sell a package of inflation swaps as a hedge against inflation risk. By paying inflation in the ZC coupon inflation swaps, they put downward pressures on the breakeven rate of this derivative instrument.

Monthly 1 to 2y Inflation swaps fixings can be traded to take a view on inflation prints. Fixings are available for those wishing to hedge or take a view on very short-term inflation. If your inflation forecasts differ from what is quoted by breakeven inflation rates implied by markets fixings, you can take a position via inflation swaps fixings, with a maturity up to 2 years.

4.2. Market conventions and terminology

Market conventions for zero coupon inflation swaps

	Euro		UK	US
Linking index	Euro HICPxT	French CPIxT	UK RPI	US CPI-U
BBG ticker	CPTFEMU Index	FRCPXTOB Index	UKRPI Index	CPURNSA Index
Indexation	3m lag not interpolated	3m lag not interpolated	2m lag not interpolated	3m lag interpolated
Clearing	LCH /Eurex Max tenor 30y	LCH/ Eurex Max tenor 30y	LCH/ Eurex Max tenor 50y	LCH Max tenor 30y

Source: NWM, ISDA, LCH

Terminology

Note that different terms are used by market practionners, especially in different jurisdictions. In Europe for example, investors tend to talk in terms of the inflation leg, whilst in the UK they would talk in terms of the fixed leg.

Paying inflation / Receiving fixed

- **Short inflation / Short breakeven**
- You will pay the accrued inflation and receive a fixed rate

Receiving inflation / Paying fixed

- **Long inflation / Long breakeven**
- You will pay a fixed rate and receive the accrued inflation

Steepening in the ZC inflation swap curve

- **Short-end breakeven rates go down** – *inflation expectations decrease*
- **Long-end breakeven rates go up** – *inflation expectations increase*

5. Linker on Asset Swap ('ASW')

Asset swaps are a popular trade in inflation-linked markets. **Why do this trade?**

Potential attractive pick-up. An investor that doesn't want an inflation risk but still wants to benefit from the pick-up a linker on ASW might offer relative to their nominal comparator bond might enter this type of trade.

Credit rather than interest rate exposure. In an ASW, the investor ends up with a bond and a swap package whose net cash-flows look like a floating rate note. As with any asset swap trade, credit risk is not transferred, and the funding strategy for the swap portion, including possible divergence between the swap discounting and the market's implicit bond valuation rate, should be borne in mind.

Neutral on inflation. In all versions of ASW, you pay away all the inflation-linked cash-flows immediately. As a result there is no exposure to inflation.

Capital consumption. Linkers are not in general as liquid as nominal bonds, but they are still high liquidity assets, eligible HQLA and zero capital risk weighted.

In practice, **there are three styles of asset swap**: ad-hoc replication package, par/par and proceeds. We detail them here.

5. 1. An ad-hoc replication package

Investors can buy (or sell) an inflation-linked bond versus a package of cleared swaps. They buy a linker and sell a zero coupon inflation swap and some interest swap(s) that match most of the risk as closely as possible.

Pros: Clearing. Liquidity. Cons: not cash-flow matched, not totally inflation neutral, likely not accounting hedged. Because a package of a few zero coupon inflation swaps can be cleared, and is likely to be more liquid than the 'bond leg' of an asset swap. The ad-hoc style is popular, especially in the UK because the UK market is dominated by asset managers who are sophisticated investors accustomed to the risk calculations, but who may not necessarily care about designated hedge accounting.

5. 2. The par/par convention.

A par asset swap in linkers works just as it does in nominal bonds. An investor buys a linker, earns a floating rate plus a margin on their investment, and the investment is returned at the end of the term. The ASW spread – or margin - is fixed to Euribor/Libor and reflects the market's perception of the issuer's credit risk.

In more detail, the way this works is that a linker is bought at par from a dealer along with a swap which is (a) off market: the value of the swap compensates you or the dealer for the difference between the market price of the bond and the par amount actually paid; (b) the inflation pay leg mirrors exactly the actual bond cash-flows and (c) the inflation receive leg involves a floating rate +/- a spread on a notional amount of par, including a final payment of that notional amount. Note that most linkers trade above par because of the inflation uplift they have earned since first issue. As a result, the swap tends to embed loan from the dealer – the investor buys the bond for par, and repays the difference between par and the market price to the dealer over the life of the swap.

Par asset swaps. Pros: accounting treatment. Cons: pricing, clearing. The main reason for par asset swaps is that a bond may be held at par in a book with a designated hedge that may not have to have mark-to-market separately recognised. The problem with it is that entering a significantly off-market swap involves funding risk for bilateral margin and discounting risks may not align with the economic reality faced by the investor.

5.3. The proceeds convention

A proceeds asset swap effectively achieves the same thing as a par asset swap in the sense that an investor buys a bond, receives a floating rate on their investment and gets their investment back at the maturity of the bond. The big difference is the value of the investment. Instead of paying the par amount of the bond, the investor pays the market price. The face value of bonds held is not the same as their investment, but on the other hand the swap they enter is entered at market (zero-PV).

Proceeds asset swaps. Pros: accounting treatment. Cons: pricing, clearing. Proceeds asset swaps may benefit from many of the advantages of a par asset swap, although the position may need to be held at amortised cost. The advantage compared to the par swap is that the swap is initially at-market and so the funding risks are reduced. This may also result in more attractive pricing.

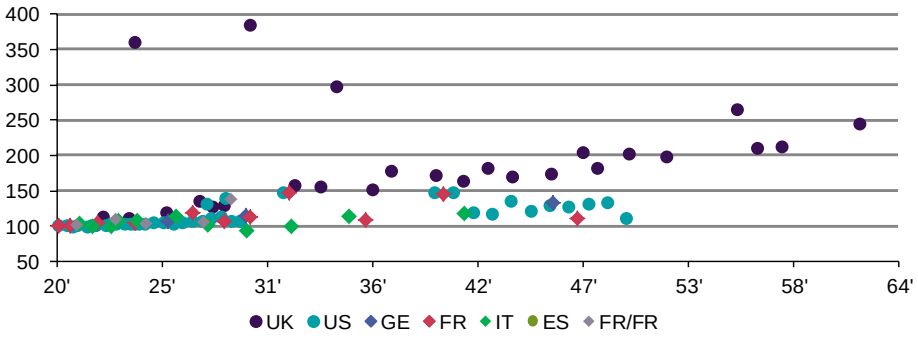
Let's summarise the points we've just made on the Par/Par and Proceeds methodology:

- In both cases, the investor ends up with a bond and a swap package whose net cash-flows look like a floating rate note.
- In the Par/Par case, this floating rate note costs 100, or par, the floating coupons are calculated as a percentage of Par and you get a nominal Par back at the end.
- In the Proceeds case, you pay the Proceeds, you get floating coupons calculated on a notional equal to Proceeds and you get the nominal Proceeds back at the end.

Proceeds have been much more popular than par asset swap in the UK and US and increasingly in Europe too. The main reason is that as linkers age, and because real yields have fallen so far in recent years, proceeds are so dramatically different to par in many cases, that the pricing and swap-funding considerations dominate.

Inflation-linked bonds trade far away from Par in the UK, increasingly in US/EU

Source: NWM, Bloomberg



6. Z-spread iota

6.1 Yield-to-maturity and z-spread

How do you compare a high and a low coupon bond fairly? Yield-to-maturity is the absolute number 1 most popular relative value metric, and a good start, but it values all the bond's cash-flows at the same rate.

Indeed, it tells you what fixed discount rate, when applied to all the cash-flows of a bond, gives you the right price.

$$Price = \sum_{t-1}^{T} \frac{Cash\ Flows_t}{(1+YTM)^t}$$

But that's not quite right, as we know that there is a term structure to interest rates, so we should value cash-flows on a term structure.

Cash-flows in the near term should normally be discounted at a lower rate than more distant ones. For inflation-linked, which are very back loaded, this is a real problem.

Ideally, you would try to fit a term structure to a 'curve' of comparable bonds. But that's hard work. The swaps curve, on the other hand, is easily observable. Many institutions have systems that are set up to value cash-flows on swaps curves quickly and easily. So the swaps curve is a popular starting point to use for discounting.

What is the z-spread? It is the distance you need to 'shift' the swap curve to price a bond at market. That is, it tells you something like 'this bond says the curve is x basis points higher than swaps'.

Another way to say this is that the z-spread is the fixed spread that represents the incremental return that an investor can earn by buying that bond over an entire zero-coupon curve.

What's not good about z-spreads? The assumption that the true curve is parallel to the swaps curve is clearly inaccurate. But it is nearly always better than yield-to-maturity.

6.2 Inflation-linked z-spread

The z-spread is a popular relative value metric to look at when valuing a bond, whether nominal or inflation-linked.

For linkers and floating rate notes, projecting unknown future cash-flows requires a projection curve. For linkers, the natural choice is the inflation swaps curve, to value the inflation-linked component.

So the unknown future inflation-linked cash-flows are projected using the inflation swaps curve and then discounted on the shifted zero coupon nominal swaps curve.

What's not good about inflation z-spreads? You now have two problems. As for nominal z-spread, the true discount ('value') curve might not be parallel to the swaps curve. But now, we also have a projection curve to contend with. How do we know that the market values inflation-linked cash-flows for bonds and swaps consistently? That is, how appropriate is it to use the raw inflation swaps curve to project the linker's cash-flows? Just as nominal bonds and swap curve are generally different, inflation curves in bonds and swaps are also different.

6.3 'Iota' spreads.

In our publications, you will often see us comment on iotas, and more specifically z-spread iota. It is a relative value metric that tells you the difference between the cost of inflation protection in cash breakeven and the cost of the same protection in inflation swap format.

Indeed, a breakeven roughly tells you the inflation implied by a bond. But inflation implied by cash breakevens and by inflation swaps might not be the same.

The most basic way to look at the iota would be to compare a linker breakeven with an inflation-linked swap rate of a similar maturity. But this relative value approach has several issues. Breakeven is a yield spread between an inflation-linked bond and its nominal comparator. On first order, it is fine to use, but we are comparing bonds with different maturities and very different profiles, as linkers tend to be back-loaded versus nominals

Z-spreads control for some extent for differences in term structure. Comparing z-spreads is a better way to compare a 5y and 10y bond than simple yield to maturity. It's also a better way to compare a high and a low coupon bond.

So instead of comparing yield- to-maturity of a linker versus a nominal bond, we compare their z-spreads. A definition of the z-spread iota is the linker z-spread minus nominal z-spread. It is a spread of spreads.

In general, inflation protection in breakevens is cheaper than in inflation swaps, especially in the Eurozone and to a lesser extent in the UK or the US. This is largely a function of credit, liquidity and the fact that inflation-linked bonds and their comparator's duration do not perfectly match.

Iotas conventions differ according to markets. In Europe, a high iota means that cash breakevens are cheap versus inflation swaps. A low iota means that cash breakevens are rich versus inflation swaps. If we expect iota to widen, we expect cash breakevens to underperform versus swaps. We say we buy the linker on iota if we expect breakevens to outperform versus swaps, or the iota to tighten. In the chart, you can see that BTPei iotas are wide versus other EMU issuers' iotas across the curve.

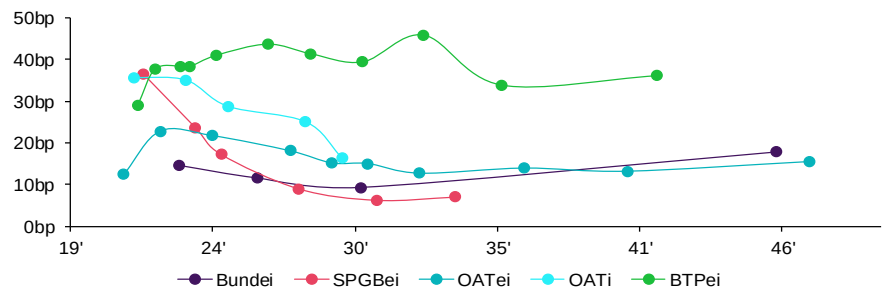
Spanish inflation-linked bonds

Source: NWM

	Linker maturity	Comparator bond
SPGBei21	30-Nov-21	30-Jul-21
SPGBei23	30-Nov-23	30-Jul-23
SPGBei24	30-Nov-24	31-Oct-24
SPGBei27	30-Nov-27	31-Oct-27
SPGBei30	30-Nov-30	30-Jul-30
SPGBei33	30-Nov-33	30-Jul-33

Z-spread iota in bp. EMU issuers. (April 2020)

Source: NWM, Bloomberg



In the UK, a long iota position is a trade that involves being long an RPI swap and short a breakeven rate. In this way, “buying the iota” implies a more bullish view on inflation swaps than breakevens. Iotas are an attractive way to play issuance events and asset swap activity.

In the US, the same concept is called basis. The conventions are the same as in the UK and the discussions evolve around a “wider/tighter” basis, implying an out/under-performance of inflation swaps vs TIPS breakevens.

Conventions on iota differ according to jurisdictions and sometimes companies’ own jargon, which is why we detail what we mean by ‘long iota’ or ‘tight iota’.

Z-spread iota isn’t directly tradable. Z-spread is a relative metric, it is not a directly tradable metric but in a certain sense, relative value trades motivated by this can be seen as a way to extract the value that your relative value assessment tells you exist.

Memo on seasonality: One of the technical features of linkers that put investors off most quickly is seasonality. The nice feature of z-spread based measures is that, although the basic level of inflation implied by bonds and swaps may be a bit different, the seasonality is probably pretty similar. By using a seasonal inflation swaps curve to project the linker cash-flows, you end up with a measure that is 'seasonally adjusted' - that is consistent for comparing bonds with different maturity dates. This is a big advantage compared to quoted real yield and breakeven.

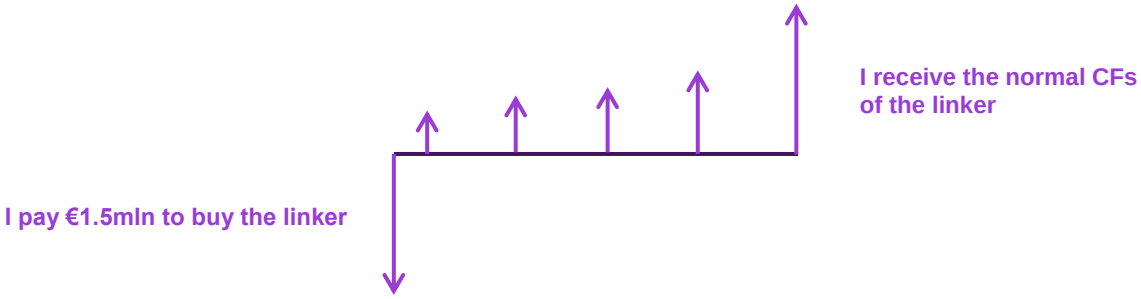
Quoted bond breakevens, in the sense of a bond real yield spread to a nominal yield are seasonal, whilst quoted inflation swaps are not, because they are always quoted as whole numbers of years. This distortion is bigger for short-dated bonds than for long dated ones. So to compare a linker z-spread with a nominal z-spread gives a much better sense of the relative value than comparing quoted breakevens versus inflation swaps.

APPENDIX – ASW

The ASW spread is the incremental return over Euribor/Libor that an investor will earn from buying a fixed-coupon bond and simultaneously entering an interest rate swap.

I. The Par/Par convention. Example

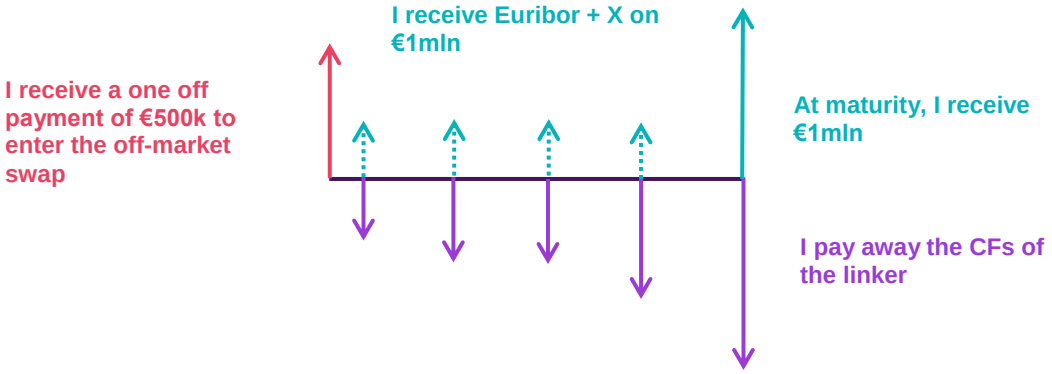
1. I buy €1mln notional of a linker worth 150. So I pay €1.5mln.



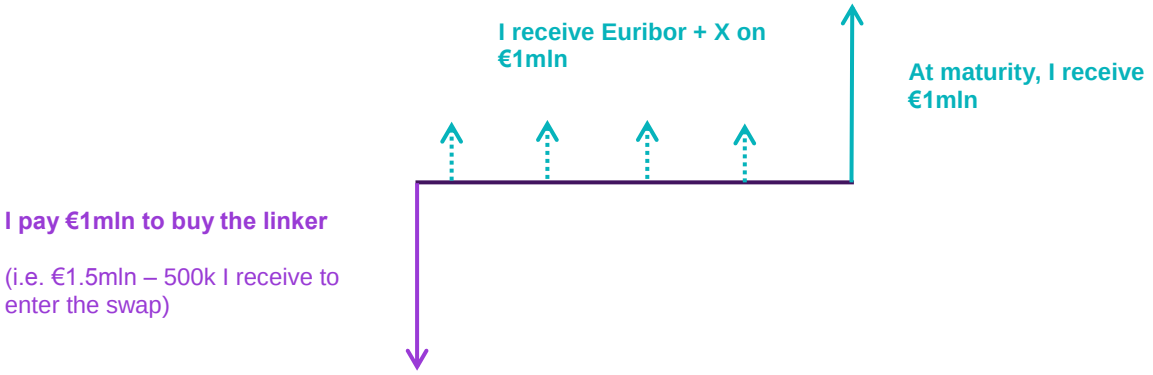
2. I then enter an off-market swap where I pay away all the CFs of the linker and receive Euribor + X on €1mln notional

X is chosen so that the value of the swap is €500k. X is called the ASW (par/par) spread.

My counterparty in the swap pays me €500k upfront to enter the swap. The swap will not normally have a PV of zero on day 1.

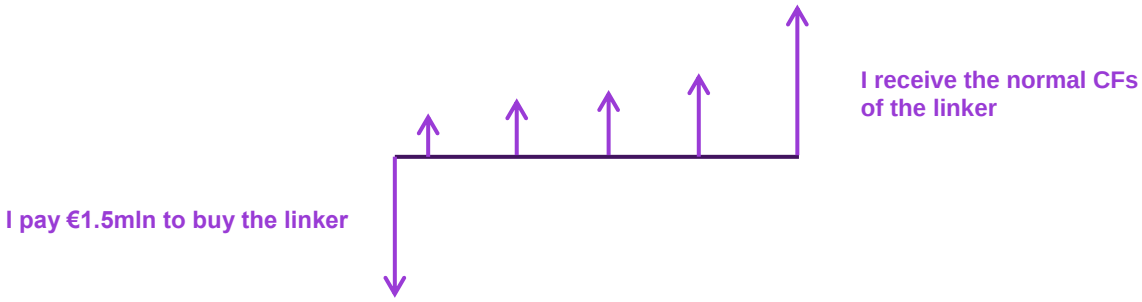


3. Overall, I spent €1mln upfront and I will receive Euribor + ASW par/par spread on €1mln notional. At maturity, I receive the par, i.e. €1mln. Net: this will be what my cash-flow profile look like



II. The proceeds convention. Example

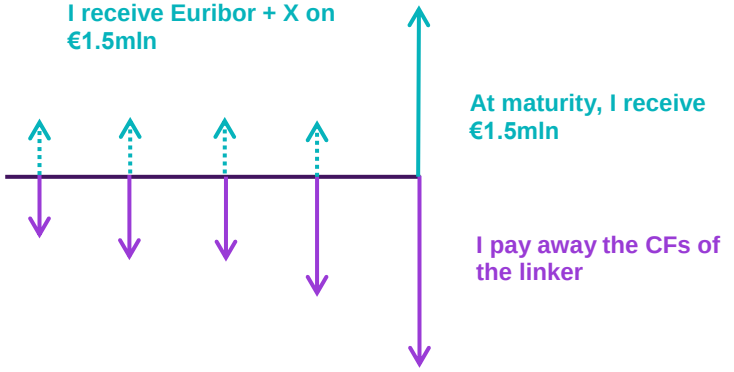
1. I buy €1mln notional of a linker worth 150. So I pay €1.5mln.



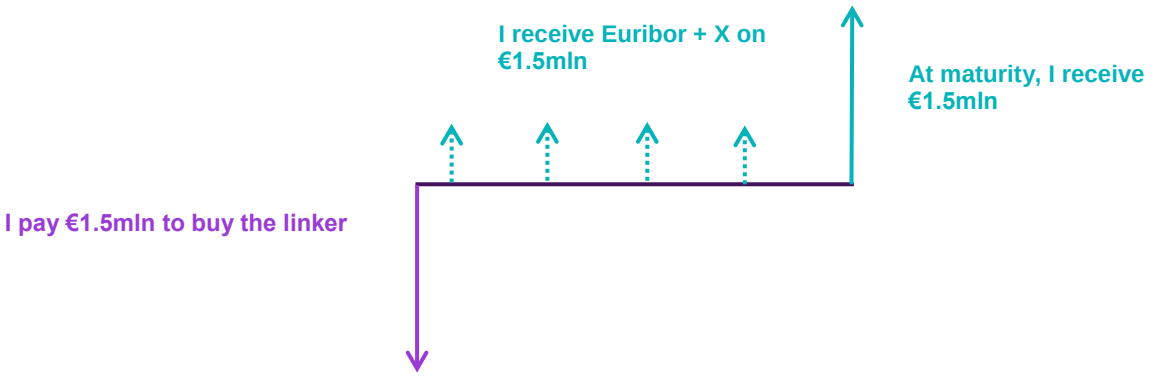
2. I then enter an off-market swap where I pay away all the CFs of the linker and receive Euribor + X on €1.5mln notional

X is chosen so that the value of the swap is 0. X is called the ASW (proceeds) spread.

My counterparty in the swap pays me €500k upfront to enter the swap. The swap will not normally have a PV of zero on day 1.



3. Overall, I spent €1.5mln upfront and I will receive Euribor + ASW par/par spread on €1.5mln notional. At maturity, I receive €1.5mln. Net: this will be what my cash-flow profile look like:



III. Z-spread and iota

We explained that z-spread is a fixed spread over a swap-based discount rate that equates the price of a bond to the present value of its cash-flows. This definition applies to nominal z-spread as well as inflation-linked z-spread and can be expressed by this formula.

Price of a bond $= \sum_{t=1}^{T} \mathrm{CF\ t}/(1 + rt + x)\text{^}t$

Where rt is the zero coupon swap rate to time t. rt is NOT the same for all CFs, so Z-spread takes into account the shape of the yield curve. You need to solve x, which is the Z-spread. If the bond price falls but swap rates do not rise, the z-spread increases.

In bond RV, for bonds with the same credit (for example from the same issuer) a bond with a high z-spread is often considered cheap compared to those with a low z-spread. That works for comparing linkers and nominal bonds too. But what is the interpretation of this value? Linkers often look cheaper than nominals. This could be partly because credit is not constant even for a given issuer – loss given default depends on bond price and recovery assumptions, for example. But it can also be interpreted as due to the difference between the 'cost of inflation protection' provided by a linker issue, and the cost of inflation protection in swap format, which is comparable across all linkers. The figure below shows why this works.

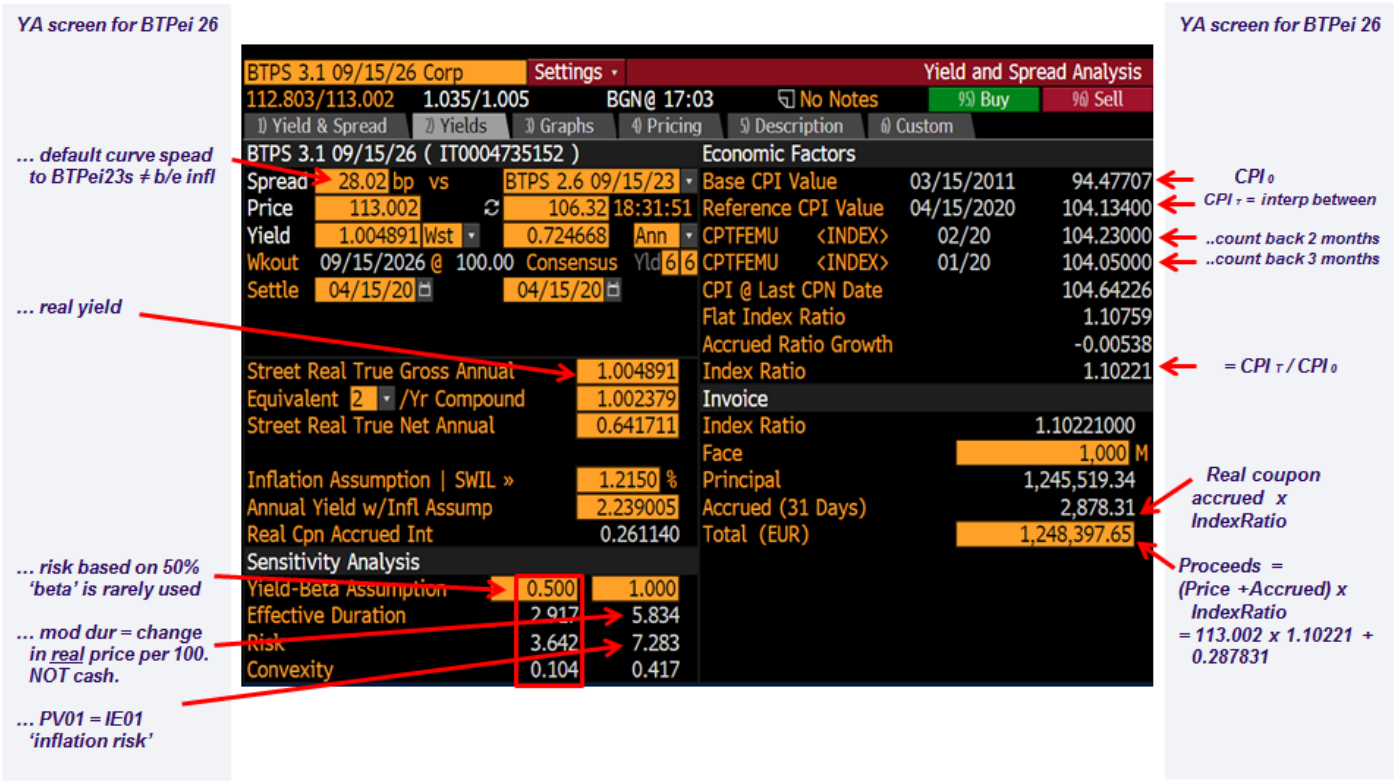
Breaking down the 'iota'

Source: NWM

In Nominal …	*"Swap Spread" ……..…*	*= nominal swap yield – nominal bond yield (A – B)*
In Linkers …	*"Linker swap spread" ……*	*= real swap yield – real linker yield (C – D)*
	"Iota"……	*= swap breakeven – bond breakeven [(A-C) – (B-D)]*
"'z-spread iota" ……..…		= Inflation ASW – Nominal ASW
		= (linker real yield – swap real yield) – (nominal bond yield – nominal swap yield)
		= (linker real yield – nominal yield) + (nominal swap – real swap)
		= Swap Breakeven – Linker Breakeven
		= "Iota"

Reading a Bloomberg screen

Source: NWM, Bloomberg



IV. Inflation swaps: clearing and margin requirements.

There is no regulatory requirement to clear inflation swaps but margin requirements under EMI make it punitive for some counterparties, such as banks, not too. As a result, in practice, market does trade cleared interbank.

The margin requirements under EMIR require counterparties in scope to exchange margin on their OTC derivatives contracts that are not cleared. Exemptions do not include inflation swaps. Firms in scope are required to exchange two types of margin: i) variation margin that covers current exposure and is calculated using a mark-to-market position, ii) initial margin that covers potential future exposure.

Who is 'in scope' to be covered by the margin requirements?

- EU Financial counterparties('FC') when facing other EU FC, EU Non-financial counterparties above the EMIR clearing thresholds ('NFCs+') or third country entities ('TCEs') that would be an FC or an NFC+, if established in the EU. FC include, among others, UCITS, AIFs with an authorised AIFM, EU AIFs, irrespective of whether they have an authorised AIFM, and most EU pension schemes.

- EU NFCs+ when facing other EU FC, EU NFCs+ or TCE that would be an FC or an NFC+, if established in the EU.

Margin requirements are subject to phase-ins based on firms' categorisation and derivatives volumes. Since March 2017, all entities in scope are subject to variation margin. Initial margin only applies for entities in scope with a group notional amount above €0.75tr (since Sep 2019). From September 2020, it was expected that it would apply to entities with a group notional amount above €50bn, and from September 2021 to those with a group notional amount above €8bn. However, these dates are now in the process of being extended to September 2021 and September 2022, respectively.