



Inflation-linked bonds: the mechanics



Stephen Hart gives a working example of inflation-linked bonds.

Last month I wrote about how well inflation-linked bonds (ILBs) have performed against equities over the last 20 years. This month I'm continuing with the subject of ILBs showing some working examples of how the consumer price index (CPI) uplift works in a capital indexed bond (CIB) and what a real yield means for the holder.

The basics

Discussions with financial advisers often bring up the following questions:

- How does the CPI uplift work?; and
- What does the real yield on a corporate ILB mean?

CPI uplift

The Australian Office of Financial Management defines the way the uplift of most CIBs works, as shown in formula 1. In this formula,

- CPI_t is the CPI for the second quarter of the relevant two-quarter period; and
- CPI_{t-2} is the CPI for the quarter immediately prior to the relevant two-quarter period.

An example would be the CBA 2020, uplifts, which can be worked out as follows.

Formula 1

$$p = \frac{100}{2} \left[\frac{CPI_t}{CPI_{t-2}} - 1 \right]$$

First, one needs to define the relevant CPI dates and values. These dates and values are available from many places, such as the Reserve Bank of Australia website, as shown in the first column of figure 1. In this case:

- CPI_t is December 2010, which corresponds to the CPI index value of 174; and
- CPI_{t-2} is June 2010, which corresponds to the CPI index value of 172.1.

One then needs to insert these values into the formula (see formula 2).

p is then used to increase, or 'uplift' the capital price of the bond to the new adjusted capital price, as shown in figure 1. Using formula 2, you can then determine a series of capital uplifts, as shown in formula 2.

In the case of this ILB, this outcome means that the adjusted capital price of the bond goes up by 0.55 per cent, as shown in the third column of figure 1. Hence the old adjusted capital price is multiplied by 1.0055 (rounded to 4 decimals) from 112.87 to 113.49, as shown in the fourth column of figure 1. This means that the ILB issuer now has an

Formula 2

$$p = \frac{100}{2} \left[\frac{CPI_t}{CPI_{t-2}} - 1 \right]$$

$$p = \frac{100}{2} \left[\frac{174}{172.1} - 1 \right] = 0.55$$

Figure 1: Capital uplifts

| CPI Release Date | CPI Index | Capital uplift | Current index factor |
|------------------|-----------|----------------|----------------------|
| September 2009 | 168.6 | | |
| December 2009 | 169.5 | | 110.48 |
| March 2010 | 171.0 | 0.71 | 111.26 |
| June 2010 | 172.1 | 0.77 | 112.12 |
| September 2010 | 173.3 | 0.67 | 112.87 |
| December 2010 | 174.0 | 0.55 | 113.49 |

Source: FIG Securities Ltd, Reserve Bank of Australia

Figure 2: Effective yields

| Yield | Purchase price | Effective yield |
|-------|----------------|-----------------|
| 5% | 100 | 5.00% |
| | 75 | 6.67% |
| | 50 | 10.00% |
| | 25 | 20.00% |

Source: FIG Securities Ltd

Figure 3: Pricing comparison of a nominal bond and a theoretical ILB

| | Nominal bond | Inflation-linked bond |
|--------------------------------|---------------|-----------------------|
| Settlement date | 28 March 2011 | 28 March 2011 |
| Maturity date | 23 March 2031 | 23 March 2031 |
| Coupon | 3.12% | 3.12% |
| Current adjusted capital value | | 113.49 |

| Purchase price | Yield to maturity | Purchase price | Yield to maturity |
|----------------|-------------------|----------------|-------------------|
| 135.7256 | 1.2% | 153.3290 | 1.12% |
| 100.0000 | 3.12% | 153.3290 | 1.12% |
| 75.1582 | 5.12% | 85.5500 | 5.12% |
| 71.3573 | 5.50% | 81.2600 | 5.50% |

Note: Adjusted capital value is reflected in the higher ILB price when compared to the normal bond.
Source: FIG Securities Ltd



obligation to pay 113.49, not 100, or the prior 112.87, to the investor, upon the maturity of the bond.

Understanding how the CPI feeds into the adjusted capital price is important if you are looking for value among ILB issues.

Effective yields

If an investor can purchase an interest bearing security, not necessarily an ILB, with a yield of 5 per cent, at a price of 100, then the yield on that security is 5 per cent. However, if an investor purchases that same security at a price of 50, or 50 per cent of the original issue price, then the yield on the security is 10 per cent, as indicated in figure 2 – along with other possible purchase prices. In other words, if an investor pays half the purchase price for a security that returned 5 per cent at a price of 100, then that security effectively yields 10 per cent.

Buying an ILB at a discount is just an extension of this idea. Here, buying the ILB at a

discount is similar to buying a nominal (fixed rate) bond at a discount, except for the adjusted capital price has changed as shown above. If the coupon on the ILB is fixed at 3.12 per cent, and a seller needs to sell the bond at a yield higher than 3.12 per cent, then the 3.12 per cent is effectively applied to a value smaller than the adjusted capital price, as shown in figure 3.

All that means is that this settlement amount is the value that solves the discounting of the coupon of 3.12 per cent at a much higher rate of 5.50 per cent over a long period. Figure 3 shows different yield levels for different bond settlement prices, for both a nominal (fixed rate) bond, and for the theoretical ILB. Discounted bonds (those trading at less than \$100) pay higher yields to maturity, whereas bonds trading at a premium (above \$100) will have lower yields to maturity.

Purchase at par, at 3.12 per cent

When investors purchase a

nominal (fixed rate) bond at par or at a yield that equates to the coupon, then the settlement price of the bond approaches 100, as noted above. Yet, in the case of the ILB, the settlement value approaches the adjusted capital price, of say, 113.49, as shown in figure 1.

Purchase at 2 per cent below the coupon level, or at 1.12 per cent

When investors purchase a nominal (fixed rate) bond at a yield lower than the coupon level, then the price will be above 100, in the case of the nominal (fixed rate) bond, and above the adjusted capital price of 113.49 at say, 153.3290, as shown in figure 3.

Purchase at 2 per cent above the coupon level, or at 5.12 per cent

When investors purchase a

nominal (fixed rate) bond at a yield higher than the coupon level, then the price will be below 100, in the case of the nominal (fixed rate) bond, and below the adjusted capital price of 113.49, in the case of the ILB, at 85.5500, as shown in figure 3.

Purchase at 5 per cent real

Here, as with the above example, when investors purchase a nominal (fixed rate) bond at a yield higher than the coupon level, then the price will be below 100, and below the adjusted capital price of 113.49, in the case of the ILB, at say 81.2600, shown in figure 3.

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