

## Capital Indexed Bonds: Pricing and Valuation

### Some Issues

1. The RBI has published on its website in December 2010 a technical paper on "Inflation Indexed Bonds" (IIBs). As I understand the structure, the coupon will reflect the real interest rate desired by the investor and the principal will be adjusted based on the difference between the current inflation index and the base inflation index (subject however to its being a minimum 100). Given the lags in publication of the index of around 2 1/2 months, the indices to be used will be for a month **three clear months before the date of valuation**. Thus, if one is doing valuation in August of a bond issued in say May,
  - a. The indices to be used will be for the months of April and January. Again, the actual index for a specific date will be calculated by interpolation of the current and previous months' indices.
  - b. The coupon will be calculated on the indexed principal of the bond, as also the redemption amount.
2. I discuss below the relationship between the prices of (credit risk free) nominal and capital indexed bonds of the same maturity. The realised returns from the two would be identical only if the nominal return bond gives the same real yield, as the indexed bond coupon. It is of course true that, in theory, nominal bond yields should factor in **the expected inflation over the life of the bond, and a desired real return** (which, in theory, should be the coupon of the inflation indexed bond). It is equally true that few market participants consciously quantify these factors.
3. Analysis of returns from nominal and capital indexed bonds in U.S. and U.K. markets (a partial list of recent research papers is at the end of the article), where there is enough data available for back-testing, suggests some interesting empirical conclusions:
  - a. The desired real return (i.e. coupon/yield in indexed bonds) varies significantly from time to time and is volatile; and

- b. Nominal yields embody an inflation risk premium given the uncertainties about expected inflation;

#### Breakeven Inflation Rate

4. While looking at nominal and indexed bonds, it is useful to look at the concept of "breakeven inflation rate", i.e. the average rate of inflation which would equate the nominal compound realized returns on the two, as calculated from ruling prices.
5. In the case of a nominal fixed interest bond, there are three parameters (full price, coupon and maturity) which determine the compound yield at any point of time (provided of course that the bond is held to maturity and inflows are reinvested at the YTM rate. To avoid the latter issue, one can always consider zero coupon yields). In the case of the capital indexed bond there are other variables which would affect the actual (nominal) return.
  - a. Average inflation for the balance life of the bond;
  - b. The current value of the bond principal and coupon depending on past inflation; and
  - c. The real return factored in the current price.
6. The methodology would as follows:
  - a. Calculate the principal amount on each coupon payment and redemption dates, at an assumed rate of inflation;
  - b. Then calculate the actual coupon payments on the indexed principal;
  - c. Discount the coupon and the redemption cash flows at the zero coupon nominal bond yields, to calculate the present value.
  - d. Manipulate the assumed inflation to equate the present value with the full price of the indexed bond.This gives the breakeven rate of inflation.
7. By a similar analysis, one could calculate the implied real coupon in a plain vanilla bond price, given an assumed/expected rate of inflation.

8. Capital indexed bonds have not become a part of the bond market in India and we therefore have no hard data on the desired real yield embedded in the nominal yields – let alone its volatility. Nor have I come across any study comparing the realized annual yields with the actual WPI over, say, the past 10 years. This would also help understand whether the real yields were reasonably stable. (Data older than say 10 years may not really be useful as earlier yields were not really “market determined”.) Such analysis would obviously be the starting point for initial coupons to be bid on capital indexed bonds. For banks, the historical relationship between cost of funds and the rate of inflation, would also be a useful input.
9. What about pricing of IIBs in the secondary market or in reissues? The steps involved would be
  - i. Calculate the indexed principal and accrued coupon on the bond on the date of valuation/reissue;
  - ii. Given the coupon on the IIB, calculate the break-even inflation implied by the yield on a nominal bond of parallel maturity; alternately, based on your inflation expectations, calculate the implied real return on a vanilla bond and its acceptability;
  - iii. A view would need to be taken on whether the implied inflation is an overestimate/underestimate/reasonable. If the number is reasonable then the total of the indexed capital and coupon is the fair full price in the secondary/reissue market, provided the coupon is acceptable as a reasonable real return. If not, the price would need to be adjusted (up or down) to get the desired (lower or higher) real return.
  - iv. If the implied inflation is an underestimate, basic logic suggests that you should sell the vanilla bond and invest in an IIB; if it is an overestimate, the reverse trade is called for.
10. The well-known Taylor Rule may not be of much relevance to fast growing economies like India: it argues that, over the long term, the real rate for overnight funds (the so-called Fed Funds Rate) should average around the growth rate. It follows that, in a

normal yield curve, the coupons would be much higher. This does not obviously help in economies growing at 8/9% p.a., as India's currently is, and the inflation is near double digits.

11. Tax issues can further complicate the price calculations, even if the gross yield is identical. The reason is that, in the initial years, the actual coupon on an indexed bond and hence the tax on it would be lower than on a plain vanilla bond. Again, would the change in the redemption value be treated as a capital gain and taxed accordingly?
12. An analysis of these factors may help arrive at a reasonable coupon to be bid.

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#### References

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