

A technical Paper on “Inflation Indexed Bonds (IIBs)”

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Inflation indexed bonds (IIBs) provide insurance to investors from inflation and cost savings for the Government on account of reduction in coupon payments with lowering inflation rate, elimination of uncertainty risk premium, and containing inflationary expectations. IIBs, which were issued in United Kingdom during 1981, became popular over the last two decades with an increasing number of countries issuing these bonds. In India also, one variant of indexed bonds, i.e. Capital Index Bond (CIB), 2002 was issued on December 29, 1997 wherein only principal repayments at the time of redemption were indexed to inflation. The response to the issue was subdued as interest payments were not protected against inflation. Based on the past experience and feedback from market participants, a new version of IIB was designed in 2004 with an inherent protection from inflation to both interest payments and principal repayments and linking them to Wholesale Price Index (WPI) for all commodities (1993-94=100).

I. Rationale

In the backdrop of high inflation, increasing preference of investors for diversified instruments and to further improve the depth and width of G-Sec Market, it has been felt that IIBs could be issued at the current juncture. This technical paper sets out the benefits and downsides of issuing IIBs along with explaining its structure comprising of indexation (principal or interest), inflation index lag, issuance method, methodology to compute settlement price, tenure, etc.

II. Benefits of Issuing IIBs

IIBs are inherently beneficial to both investors and issuers. These benefits could be broadly categorized into business proposition and usefulness for policy making. The benefits of IIBs accruing to various stake holders have been discussed below.

- *Insulation from Inflation:* On the demand front, investors may have appetite for such bonds because of their inherent property to insulate against inflation risk. The yield asked by

investors on nominal fixed rate bonds factors in their average inflationary expectations over the maturity period and uncertainty premium besides real yield ($i = r + p^e + u$). Where i is nominal yield, r real yield, p^e average expected inflation, and u uncertainty premium. Thus, investors are exposed to inflation risk especially, as the projections of average inflation over the long term are difficult to be robust and tend to deviate from actual inflation. IIBs give the investors long-term assets with a fixed long-term real yield insulating them against inflation as their real yields are indexed to actual inflation ($i = r + p$). It may be noted that p stands for actual inflation in IIBs as against average expected inflation in case of nominal fixed rate bonds.

- *Risk Diversification:* From a standard portfolio diversification point of view, IIBs provides an avenue for the investors to diversify their asset portfolios especially when inflation is uncertain. In an empirical study, Kothari and Shanken (2004) conclude that US TIPS may have potential benefits for investors and that substantial weight might be given to these instruments in an efficient portfolio. Further, since IIBs offer assured real yield over the maturity, they enable market participants such as pension funds and insurance companies to offer indexed annuity scheme providing inflation protection to their clients. The IIBs would generate some demand from institutional investors for risk diversification.
- *Cost Saving for Issuer:* From cost saving perspective, issuance of IIBs is a good business proposition for the Government. Assuming actual inflation equals expected inflation, the Government will be paying lower nominal yield on IIBs to the extent of uncertainty premium. The estimates of uncertainty premium vary and range from 0.1 to 1 percentage points (Working Group, Dutch Central Bank, 2005). It may be noted that during 2000-01 to 2009-10, average annual inflation in India was 5.1 per cent and ranged 3.4 - 8.3 per cent. Going by the past trend of inflation (5.1 per cent) and assuming that real coupon rate emerges to be 2.0 per cent in the auction, the cost of borrowing through IIBs would be 7.1 per cent. The weighted average cost of market borrowings through dated securities during 2009-10 and 2010-11 (up to December 6, 2010) was 7.23 per cent and 7.86 per cent, respectively. However, the cost savings on issuance of IIBs need to be judged over the life of the security and not on yearly basis. Based on certain assumptions regarding average

inflation during the life of a bond and other parameters such as real yield, liquidity premium and nominal yield, a scenario analysis has been attempted to find out cost savings on issuance of IIB vis-à-vis nominal fixed rate bond of commensurate maturity. Based on above assumptions and results of the scenario analysis, it can be seen that the Government may be able to save cost on issuance of IIBs.

- *Constant Real yield:* Another benefit to the Government is that the real yield on IIBs would remain constant over the period despite changes in the inflation rate, while real yield on the nominal fixed rate bonds would vary as per the changes in the inflation rate. In the case of nominal fixed rate bonds, whose coupon rate is contracted based on current inflationary expectations, issued during high inflation period would become very costly during low inflation period and *vice versa*.
- *Anchored Revenue:* Interest payouts on IIBs would be indexed to inflation as would be the Government's revenue. Thus, nominal interest payouts would be anchored to the revenues of the Government leaving no mismatch on account of inflation.
- *Gauging Inflation Expectations:* IIBs also help in gauging the markets inflation expectations, which are pivotal for policy purposes. Increasing issuance of IIBs by the Government also reflects its commitment towards inflation and in the process facilitates anchoring of the inflationary expectations.

Downside Risks

- *May turn out costly for issuer:* One of the benefits i.e. cost saving for the Government borrowings may not accrue under certain circumstances and on the contrary, costs may turn out to be higher. For instance, if the *ex-post* (actual) inflation turned out to be higher than *ex-ante* (expected) inflation, the cost of IIBs would be higher than that of nominal fixed rate bonds. Furthermore, at the time of issuance, the liquidity premium asked by investors on IIBs (as it may be less liquid initially due to lack of a critical mass) may turn out to be higher than the cost savings accruing on account of removing the uncertainty premium.
- On the policy front also, large issuances of IIBs may lead to a higher level of indexation of the economy and in turn, may reduce the effectiveness of the public policy in containing

inflationary expectations. However, studies have not found the link between inflation and indexing inevitable and use of appropriate policies could prevent the indexing leading to higher inflation (Fisher, 1983).

- Like demand-push inflation, the Government's revenue cannot be anchored to inflation emanating from supply side shocks as prices are not driven by income. Therefore, larger issuance of IIBs may destabilise the Government finances during a cost-push inflation period.

Considering the aforementioned benefits and downside risks attached to IIBs, it may be worthwhile to go for issuance of IIBs in small lots. Based on our initial experience, issuance of IIB in large lots may be considered.

III. Product Structure

The main variants of IIBs prevalent internationally are Capital Indexed Bonds (CIBs), Interest Indexed Bonds, Current Pay Bond, Annuity Indexed Bonds etc. The basic feature of the IIBs is that the coupon rate for the bond is specified in **real terms**. Among all the variants, CIBs are very popular and being issued in Canada, USA, UK and South Africa. In CIBs, principal is indexed (inflation adjusted) and real interest/ coupon is calculated on the indexed principal. For example, an IIB is issued at face value of Rs. 100 and real coupon rate is 2.5 per cent and paid annually. If the cumulative inflation at the time of coupon payment is 5.0 per cent, the principal for calculating coupon payout will become Rs. 105 and coupon payment will be Rs. 2.60. In case of a deflationary scenario, real coupon will be calculated on indexed principal that will be lower than its par value but at the time of redemption, principal repaid will be equivalent to its par value. For instance, if cumulative inflation is -5.0 per cent (deflation), then indexed principal would be 95 and real coupon payout would be Rs. 2.38. Thus, investors receive inflation adjusted interest payments periodically and also inflation adjusted principal repayments at the time of redemption or its original par value, whichever is higher.

Therefore, it is proposed that we may issue IIBs wherein the principal is indexed and the coupon is calculated on the indexed principal, as set out in the discussion paper on Capital Indexed Bond issued by the Bank in 2005.

a. Indexation related issues

IIBs by definition mean providing protection to investors against inflation. But it is difficult to ascertain the price index that would provide complete protection against inflation. The consumer price index (CPI) is supposed to represent level of inflation that the public at large face and thus, the CPI is widely used index for adjusting the cash flows for the indexed bonds in many countries. However, unavailability of a single CPI representing the consumption basket of all sections of society in India renders it impractical to be used in indexation of IIBs. Therefore, under given circumstances, wholesale price index (WPI) for all commodities may be used for linking IIBs. In the past also, WPI was used for indexing the capital indexed bonds (CIB) wherein principal was indexed at the time of redemption. The frequency of WPI has also been changed from weekly to monthly since November 2009 making it more suitable for indexation purpose. Moreover, following the recommendations of the Working Group for Revision of WPI Index (Chairman: Prof. Abhijit Sen), the base year of the WPI has been updated from 1993-94 to 2004-05 along with broadening the basket to incorporate more items from both organised and un-organised sectors. The new series would be used for indexation. The formula for calculating index ratio would be as under:

$$Index\ Ratio_{Set\ Date} = \frac{Ref\ WPI_{Set\ Date}}{Ref\ WPI_{Issue\ Date}} \quad (1)$$

Where “Set Date” is the interest payment date/settlement date and “Issue Date” is the original issue date of the bond.

For calculating the index ratio for a specific date, daily WPI values would be linearly interpolated using ‘Ref WPI’ for the first day of the calendar month and the first day of the following calendar month. The formula for computing the index ratio for a particular day is as under:

$$Ref\ WPI_{Set\ Date} = Ref\ WPI_M + \frac{(t - 1)}{D} \times (Ref\ WPI_{M+1} - Ref\ WPI_M) \quad (2)$$

Ref WPI_M = Ref WPI for the first day of the calendar month in which Date falls, Ref WPI_{M+1} = Ref WPI for the first day of the calendar month following the settlement date, D = Number of days in month (e.g. 31 days in August), and t= settlement date (e.g. August 6).

$$Inflation\ Compensation_{Set\ Date} = (Principal \times Index\ Ratio_{Set\ Date})$$

Presently, provisional WPI is released with a lag of two weeks and final WPI with a lag of two and half month by Office of the Economic Adviser, Ministry of Commerce and Industry, GoI. For instance, provisional WPI for August 2010 and final WPI for June 2010 would be released on September 14, 2010. At times, final WPI deviates widely from the provisional WPI with even directional changes. *Since the objective of the IIBs is to provide protection against actual inflation, final WPI may be used for indexation.*

Next, the lag of final WPI for ref WPI has to be decided. For settlement at specific day, we would require final WPI for two consecutive months for linear interpolation. Since final WPI is published on the 14th of each month with a lag of two and half months, two consecutive final WPI can be available with a lag of four months throughout the month in which the coupon payment or settlement date fall.

For instance, for the settlement date on 30th August, final WPI would be available for the month of April and May. Final WPI for the month of May would only be available on 14th of August and hence, it could be used for interpolation to calculate reference WPI for any day on or after 14th August. Thus, reference WPI as under:

$$Ref\ WPI_{30th\ Aug} = WPI_{April} + \left(\frac{30 - 1}{31}\right)(WPI_{May} - WPI_{April}) \quad (3)$$

But for settlement date on August 6, final WPI for the month of May will not be available to calculate reference WPI for interpolation. *Thus, in order to overcome this anomaly, it is proposed that final WPI with a lag of four months may be used as Ref WPI for the first day of the calendar month in which 'Issue Date' and 'Set Date' falls.*

With a lag of four months, formula to arrive at reference WPI for settlement date on August 6 and August 30, respectively would be as under:

$$Ref\ WPI_{6th\ Aug} = WPI_{March} + \left(\frac{6-1}{31}\right)(WPI_{April} - WPI_{March}) \quad (4)$$

$$Ref\ WPI_{30th\ Aug} = WPI_{March} + \left(\frac{30-1}{31}\right)(WPI_{April} - WPI_{March}) \quad (5)$$

Further, WPI index is periodically revised in terms of both coverage and base year and these will have implications for bondholders as cash flows are linked to index ratio. The revision in WPI index on account of improved coverage with inclusion of goods and services representing the current consumption basket would enhance the representation of the actual inflation; however, it may result in lower/higher cash flows to the bondholders as compared with the old WPI series. Notwithstanding these technical problems, treatment of such changes in WPI index needs to be provided. *Thus, it is proposed that as and when WPI index is being revised on technical grounds (coverage, base year, etc.), the new WPI index will be used for indexation purposes and the past value of new WPI index would be computed through linking factor or splicing the base.*

Further, it is also proposed that Ref WPI and Index Ratio (IR) for a specific date may be truncated to six decimal places and rounded off to five decimal places.

b. Tenure

Tenure of IIBs has to factor in the preference of the market participants. The preference of the market participants may vary as per their portfolios and investment needs. Financial institutions such as Insurance Companies, Pension Funds etc. may prefer the IIBs of longer maturity (15 years and above), while banks and mutual funds may like shorter maturity (5 to 10 years). *Keeping in view the divergent preferences of market participants, it is proposed to issue IIBs of 10/12 years as it is felt that the instrument would have more demand in this time bucket.*

c. Settlement Price

In the primary auction, the IIB would be issued at par and investors would be asked to quote their bids in terms of **real yield**. So, the settlement price would be the par value of the bond in the primary auction. During re-issuance or in secondary market, investors can bid in terms of price or real yield. In case of former, investors would bid in terms of price of IIBs assuming inflation at zero and implicit cut-off real yield would be computed from the cut-off price, as implicit cut-off yield is being calculated in case of nominal fixed rate bonds. For arriving at the nominal settlement price, the sum of cut-off price and accrued real interest would be multiplied with index ratio. The settlement price for the reissuance of IIBs would be as under:

$$\text{Set Price}_{\text{Date}} = (\text{Real Cut off Price} + \text{RAI}_{\text{Set Date}}) \times \text{IR}_{\text{Set Date}} \quad (6)$$

Alternatively,

$$\text{Set Price}_{\text{Date}} = \text{Dirty Price} \times \text{IR}_{\text{Set Date}} \quad (7)$$

IR is Index Ratio and RAI is real accrued interest rate.

For example, a CIB was issued on April 15, 2010 at face value of Rs. 100 and an annual real coupon rate is 2.5 per cent and paid semi-annually. The next semi-annual coupon payment date would be October 15, 2010. The settlement price of the bond as on August 6, 2010 would be as under:

1	Index Ratio (Inflation is 5 per cent)	1.05
2	Cut-off Price	97.57
3	Adjusted Cut-off Price (1×2)	102.45
4	Par Value of the Bond	100.00
5	Adjusted Par Value	105.00
6	Inflation Adjustment (5-4)	5.00
7	Premium (Discount) (3-5)	-2.55
8	Indexed Accrued Interest	0.81
9	Settlement Cost (4+6+7+8)	103.26

In the above exercise, the settlement price has been computed taking face value as the base and adjusted for other components such as inflation compensation, premium (discount) and accrued interest indexed from it.

The settlement price can also be computed directly by multiplying the sum of the cut-off price emerging in the reissuance of the CIB and accrued real interest by index ratio, as given in equation 6. Following the above example, the settlement price would be as under:

$$\text{Set Price}_{\text{August 6}} = (\text{cut off price } -97.57 + \text{RAI } -0.77) \times \text{IR} - 1.05 = 103.26 \quad (8)$$

In the secondary market also, the investor would quote an unadjusted clean price (i.e. excluding inflation and accrued interest); this price would therefore be different from the final billed price. As in the case of re-issuance, final billed/settlement price would be arrived at by multiplying total of bid price and accrued interest by index ratio.

In case of bidding in terms of real yield, the real cash flows would be discounted with cut-off real yield emerging in the auction(or real yield at which trade in secondary market trade would take place) and sum of these discounted real cash flows would be multiplied with IR. Thus settlement price would be as under:

$$\text{Settlement Price} = \text{Discounted Real Cash Flows} \times \text{Index ratio} \quad (9)$$

However, bidding in terms of price would be simple and aligned to market convention as for nominal fixed rate bonds. *Hence, it is proposed that investors may be asked to bid in terms of price during re-issuance/ secondary market trade and settlement price may be computed directly by multiplying the sum of the cut-off price emerging in the reissuance/trading of the IIB and accrued real interest by IR.*

d. Issuance Method

Proposed CIB variant of IIBs could be issued through various methods viz., auction, tap sale, and book building. When a new financial product is issued in the market, the main difficulty

faced by both issuer as well as investors is to price it without the availability of a comparable instrument trading in the secondary market for reference. This is likely to be a problem for indexed bonds, both because of their comparative rarity and their relative structural complexity (Deacon, Mark, et al. (2004)). The best way to overcome this pricing problem is to sell indexed bonds by auction transferring the responsibility for pricing the bond to investors. As per international experience also, the auction method is the most popular for issuance of IIBs. Issuers also have some control over pricing of IIBs during auction with right not to fully allot the bond.

Some treasuries such as the UK experimented with tap sales of IIBs in 1988, and thereafter reverted to the auction system due to limitations of this method. The major limitation of tap sale for issuance of IIBs is to fix the real coupon rate, which is as per the market expectations. It may be underscored that issuer finds it difficult to have an objective estimate of real coupon rate in the absence of any credible method to assess the term structure of real rate. International experience also suggests that some of the Treasuries such as France and Canada also occasionally use book building method for issuance of IIBs especially during uncertainty in the market or at the time of the first issuance. Through the book building method, issuance receives an aggressive marketing by the merchant banker but it involves a higher cost. Further, book building method may be viable when size of the issuance is quite large and investor's base is also wide consisting of international investors. In our case, the size of the IIBs issuance is not going to be very large.

In view of above, it is proposed that IIB may be issued through the auction method as is the practice for nominal fixed rate bond.

IV. Salient Features of the Proposed Scheme:

1. Issue IIBs wherein the principal is indexed and the coupon is calculated on the indexed principal, as has been set out in the discussion paper on Capital Indexed Bond issued by the Bank in 2005.

2. As the objective of the IIBs is to provide protection against actual inflation, final WPI may be used for indexation.
3. Final WPI with a lag of four months may be used as Ref WPI for the first day of the calendar month in which 'Issue Date' and 'Set Date' falls.
4. As and when WPI index is being revised on technical grounds (coverage, base year, etc.), the new WPI index will be used for indexation purpose and past value of new WPI index would be computed through a linking factor.
5. Ref WPI and Index Ratio (IR) for a specific date may be truncated to six decimal places and rounded off to five decimal places.
6. Keeping in view the divergent preferences of market participants, IIBs having a tenure of 10/12 years may be issued.
7. Investors may be asked to bid in terms of price during re-issuance/ secondary market trade and settlement price may be computed straight multiplying the sum of the cut-off price emerging in the reissuance/trading of the IIB and accrued real interest by IR.
8. IIBs may be issued through auction method like nominal fixed rate bond.