A Study of "Inflation Indexed Bonds" in Indian Debt Market

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Abstract

This research attempts to explain India as an upcoming Debt Market with the introduction of the new instruments like "*Inflation Indexed Bonds*" (both for the retail and the institutional buyers) followed by the explanation about both the technical and the conceptual aspect of the "Inflation Indexed Bonds (IIB)" and their applicability in Indian Debt Market.

After discussing about the literature on IIB's, in the last section, we have seen the yield of a hypothetical "Inflation Indexed Bond" higher as compared to "Normal bond" (non-inflation adjusted). We have also commented upon the real value of the returns keeping in mind the Investor's perspective (purchasing power) and his behavior in buying and evaluating such instruments. Lastly, we have compared both the bonds in the rising inflation scenario. We have analyzed that for an Inflation Indexed Bond, bond value increases with increase in the Inflation and vice-versa but for a Normal Bond, it remains unaffected by the rising Inflation levels (keeping interest/reinvestment rate as constant for both the bonds).

Keywords: inflation, normal bond, inflation indexed bond, WPI, CPI, purchasing power

1. Indian Debt Market: An Overview

The equity market is much more popular than the debt market in India whereas the reverse is true for most parts of the world. In the absence of such maturity in debt market the banking system would be larger than it otherwise would be, making it tougher in moving a crisis outside the banking system and letting the government to stand back. The rationale behind the need for developed debt market is for the development of a diversified financial system with banks and nonbanks operating in equity markets and debt markets that will enhance the risk pooling and risk sharing opportunities for investors and borrowers. As quoted by *Alan Greenspan* that *coexistence of domestic bond market and banking system helps each to act as a backstop for the other. "Efficient financial intermediation"* and *"Developing the derivatives market to facilitate hedging mechanisms"* could be few other reasons quoted for the need of the develop debt market in a country.

In March 2011, the government bond market represented 40% of GDP, compared with the corporate bond market, which amounted to just 7% of GDP (Table 1).

India's government bond market has grown steadily largely due to the need to finance the fiscal deficit and is comparable to many government bond markets in emerging East Asia (39.5%). At 40% of GDP, the Indian government debt market compares well with its neighbouring countries. "The corporate bond market is less developed than most in emerging East Asia, with private placements dominating. At 7% of GDP, corporate bonds are comparable to levels in the Philippines and Indonesia, where corporate finance is less well-developed, as well as with the People's Republic of China (PRC) and Vietnam, where state-ownership remains dominant".

Table 1. India and EEA Bond Markets (% of GDP), March2011

	Government	Corporate	Total
China, People's Rep. of	46.1	4.7	50.8
Hong Kong, China	8.7	35.3	44
Indonesia	17.1	2	19.1
Korea, Rep. of	48.8	61.8	110.6
Malaysia	48.1	37.5	85.6
Philippines	33.3	3.5	36.8
Singapore	41.2	30.7	72
Thailand	40.7	15.9	56.6
Vietnam	14.6	2.1	16.7
India	**36.1**	**3.9**	**40**

Sources: Asian Bonds Online, Bank for International Settlements, and Reserve Bank of India.

"The Indian bond market is, however, less well-developed. While having seen rapid development and growth in size, the government bond market remains largely illiquid. Its corporate bond market remains restricted in regards to participants, largely arbitrage-driven (as opposed to driven by strategic needs of issuers) and also highly illiquid. The lack of development is anomalous for two reasons: First, India has developed world-class markets for equities and for Equity Derivatives supported by high-quality infrastructure. And second, the infrastructure for the bond market, particularly the government bond market, is similarly of high quality."

Though significant improvements have been made in the primary market, the secondary market continued to be plagued by certain shortcomings like dominance of a few players, strategy of holding to maturity by leading players (inability to provide depth), the pre-1992 "telephone market" continued to exist (prevents information dissemination and hence price discovery is limited) and low retail participation in Government Securities (G-Secs) market continues to exist even today. It is believed and researched that there is tremendous potential for widening the investor base for Government securities among retail investors. This can be done by, increasing their (investors) awareness about Government securities as an option for investment and improving liquidity in the secondary market that will provide them with an exit route. Also infrastructure is seen as the vital element in the further development and deepening of the market. Hence, in order to accomplish the purpose of introducing the retail investors with an additional investment avenue, in the next chapter we will conduct a "Study of Inflation Indexed Bond" as a new instrument in such an under-developed Debt market both for the benefit of the investors as well as the government or the issuer.

2. Introduction of Inflation Indexed Bonds (IIB, Commonly Known as "Treasury Inflation Protection Securities" (TIPS) in the U.S)

In order to provide a stable investment return (growing of purchasing power) in the increasing prices (Inflation) scenario, "Inflation Indexed Bonds" can be treated as a weapon to accomplish the purpose (Fabozzi, 7th Edition). It is done by adjusting the principal of TIPS (U.S) (called as IIB's in India) with Changing CPI i.e. Consumer Price Index/ WPI (base year 1993-94 i.e. 100) i.e. Wholesale Price Index (which is an indicator of inflation in INDIA). The characteristics of IIB's help the consumer to get the returns (based on the elevated principal) that exactly matches the purchasing power of their original investment as defined by the WPI (for India). It also pays the semi-annual cash flows/interest payments/coupons linked to the WPI-indexed principal amounts (see illustration 1 in Table 2). In short, it provides high real yield (Table 2), low correlation to traditional financial assets, and muted volatility.

Table 2. (Illustration1) Cash Flows of a Basic Inflation Indexed Bonds

	Purchase	First Annual Coupon	Interim Annual Coupon	Last Annual Coupon	Principal	Return(Per annum)
Date	1/1/2000	1/1/2001	1/1/2005	1/1/2010	1/1/2010	1/1/2010
Real Rs. Cash Flow	-1000	40	40	40	1000	4.00%
WPI (Base=100)	100	106	133.8225578	179.0847697	179.0848	6.00%
Indexed Principal	1000	1060	1338.225578	1790.847697	1790.848	n/a
Nominal Rs. Cash Flow	-1000	42.40	53.53	71.63	1790.848	10.24%

This Table compares the Real vs. Nominal value of the cash flow whereby the coupon and principal are linked to the WPI for an imaginary annual coupon bearing bond and hence shows the high real yield of such a bond (for calculations, refer to Appendix). (Fabozzi, 7th edition)

TIPS were launched by U.S Treasury a way back in 1997 and until 2004 issued more than $200 billion of the securities. Even in the United Kingdom (issued for the first time in 1981, {refer to table 3 below}), it accounts for more than 20% of the government bonds outstanding. But in India, it was first issued on 29th December 1997 in the form of "6% Capital Indexed Bonds 2002" whereby only principal was indexed to the inflation keeping the semi-annual coupons payments naked/unhedged. But due to less popularity and complex calculations, it didn't pick up by the investors at that time both in the primary and secondary market. Hence, our study of "Inflation Indexed Bonds" (a refinement of "Capital Indexed Bonds") in Indian context would primarily involve the "*introduction of the market participants to this important new investment instrument*" based on comparison from various perspectives.

Table 3. Introduction of Indexed Bonds and Inflation Rates

Date	Country	Inflation Index	Inflation Rate
1945	Finland	WPI	6.40
1952	Sweden	CPI	2.00
1955	Iceland	CPI	15.70
1966	Chile	CPI	22.20
1972	Argentina	WPI	19.70
1981	United Kingdom	CPI	14.00
1989	Mexico	CPI	114.80
1994	Sweden	CPI	4.40
1997	United States	CPI	3.00
1999	France-Domestic	CPI ex tobacco	1.30
1999	France-Eurozone	Eurozone HICP ex tobacco	1.50
2003	Greece	Eurozone HICP ex tobacco	4.00
2003	Italy-Eurozone	Eurozone HICP ex tobacco	2.80
2004	Japan	CPI ex fresh food	-0.10

WPI: Wholesale Price Index; Inflation: in year prior to introduction except Iceland, for which the prior 5-year average inflation is reported.
Source: John Y. Campbell and Robert J. Shiller, "A scorecard for Indexed Government Debt". NBER Working Paper no. 5587 May 1996. © 1996 John Y. Campbell and Robert J. Shiller and PIMCO.

Characteristics and Need of "Inflation Indexed Bonds"

Inflation indexed bonds (IIBs) provide insurance to investors from inflation and on the other hand 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 (RBI, 2010). As the need for instruments that can minimize or diversify the investor's risk increases in a rising prices ("Inflation") scenario, so IIB's can be seen as a solution that can even provide depth to the Government Securities market. Hence, IIB's can be seen favorable from both the issuers as well as the investor's perspective. The reasons that lead to such conclusion are as follows:

2.1 Hedge for Inflation

Investors are exposed to the inflation risk over the tenure of their investment in other fixed income bearing bonds. Hence, this looks as a good idea for the preference of these bonds by the investors as the returns they earned out of these bonds carries their real value in the inflationary economy. Real value of an investment (refers to illustration 1, table 2) return can be defined as the inflation adjusted return and can be expressed by the following formula.

$$1 + I = (1 + r)*(1 + E(I)) \tag{1}$$

Where*:*

- I = Nominal Interest Rate;

- r = Real Interest Rate;

- E (I) = Expected Inflation Rate.

Therefore, "*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*". (RBI, 2010)

2.2 Risk Diversification

IIB's can be considered as a way of diversification of the portfolio by the investors as the principal of these bonds is linked to the change in WPI (indicator of inflation).   So in the event of the rising prices (Table 13) and rising interest rates in the economy, these bonds outperform the normal fixed income bearing bonds. This feature makes it more favorable to include such bonds in the portfolio. 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." IIB's also helps the retired pensioners as it provides an assured real return because of which the money worth doesn't depreciate even at the end of the investment horizon.

2.3 Motivation for the Issuer

2.3.1 Cost Saver to Issuer

As derived from the nature of the IIB's in regard to the lower Coupon payments, it sometimes (when the actual inflation equals the expected inflation) cost less to the government as the issuer of these bonds. For instance, 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 (RBI, 2010). Based on the assumptions for the average inflation during the life of the bond vis-a-vis other parameters like real yield etc and also on the basis of the scenario analysis carried out over the life of the security, it has been found out that government may save money on issuance of such bonds.

On the contrary, if the actual inflation differs the expected then the IIB's would no more act as a cost saver (compared to the normal bond) to the issuer as 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*" RBI (2010).

2.3.2 Real Yield (Price to Yield Relationship)

The real yield on "Inflation Indexed Bonds" remains the same even with the increase in Inflation compared with the Normal Bond whose price would increase with the decrease in inflation and vice versa. So a Normal bond when issued in high inflationary period would become very costly (coupons) when the inflation comes down or vice versa keeping the IIB's unchanged in comparison with its real yield in such a scenario and hence benefiting the issuer (Government).
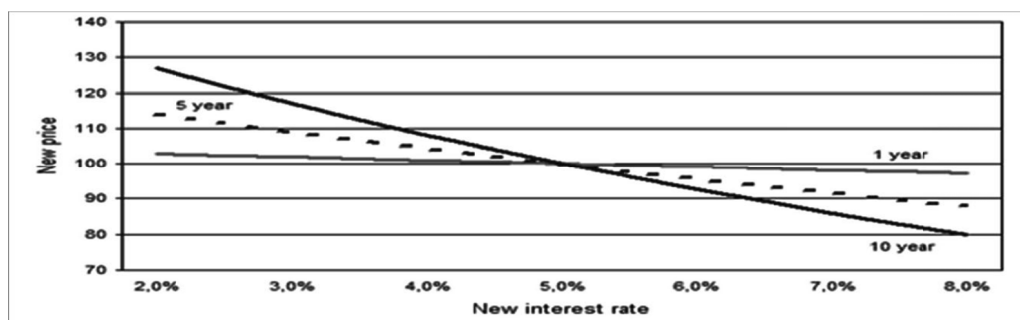
Figure 1. The price/yield curve

Figure 1 Shows the Price/ Yield relationship for a normal bond. Bond prices increases with decrease in the Interest Rate and vice-versa. Hence, Bonds issued in higher inflation would increase in value when the inflation comes down (interest rates also falls in falling inflation). 10 year bond value becomes as low as Rs.80 when the interest rates went up till 8% and increased to Rs. 125 when interest rates were as low as 2%. This is not the case with an "Inflation Indexed Bonds" as the principal is linked to the changing Inflation rates (WPI) and hence keeping its real yield constant over the life of the security.

A Snapshot of the Advantages and Disadvantages of IIB's

Advantages:

• Unlike regular Fixed Deposit or bond, the principal is indexed (or adjusted) to the inflation periodically and the interest/coupon is paid on this inflation-adjusted principal.

- In other words, it hedges your returns against increase in Inflation or rising in prices based on Wholesale Price Index (WPI).

- Works well for the individuals having low risk preference and also it will fetch you more money in rising prices (Inflation) even if you stay invested.

- In the Inflationary times, the real rate of returns on Inflation Indexed Bonds may be greater than any other fixed rate bonds.

- For example, a 10 year-Inflation Indexed Bond with coupon rate of 8% paid semi-annually with Inflation Rate of 5% when compared to the similar but fixed rate bond, IIB's would be worth more both in the principal repayment as well as coupon payments.

Disadvantages:

- Preference is given to CPI as a measure of Inflation when we see the rest of the world. Hence, need for Consumer Price Index (CPI) instead of Wholesale Price Index (WPI) as it does not reflect commodities prices in an efficient way.

- Issued primarily to keep the investors protected from inflation, so normally issued with low coupons/interest rate attached to it compared to Fixed Coupon Bonds.

- Lack of knowledge amongst investors will make these bonds less popular as it involves complex calculations for Indexation according to Reference Rate on changing WPI.

- Infrequent issues by the government because of less popularity amongst investors.

- IIB's is an instrument for the inflationary market and hence might be of disadvantage in falling prices (Deflationary market).

3. Structure of "Inflation Indexed Bonds" in Indian Debt Market: An Insight into Technical and Conceptual Framework

"*The main variants of IIBs prevalent internationally are Capital Indexed Bonds (CIBs), Interest Indexed Bonds, Current Pay Bond, Annuity Indexed Bonds etc*" (RBI.2010). The basic feature of the IIBs is that the coupon rate for the bond is specified in real terms (i.e. Inflation adjusted). Among all the variants, Capital Indexed Bonds are very popular and being issued in Canada, USA, UK and South Africa (refer to Table 3). 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. 1000 and real coupon rate is 4 per cent and paid annually. If the cumulative inflation at the time of coupon payment is 6.0 per cent, the principal for calculating coupon payout will become Rs. 1060 and coupon payment will be Rs. 42.4 (for calculations, refer to Table 2 illustration 1 above). 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 (can be called as a floor cap). For instance, if cumulative inflation is -6.0 per cent (deflation), then indexed principal would be Rs. 940 and real coupon payout would be Rs. 37.6 (4% of the indexed principal of Rs. 940). 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.

To understand the Inflation Indexed Bond's structure resulted from the refinement of the earlier issues in the form of CIB's in the year 1997 redemption on 2005, one has to take into consideration the following technical aspect. Those are:

- Indexation

- Tenure

- Settlement Price

- Issuance Method

3.1 Indexation

Most Developed countries such as the United States, the United Kingdom, Japan, France, Canada, Singapore and China use the Consumer Price Index (CPI) to calculate inflation. "*CPI is a statistical time-series measure of a weighted average of prices of a specified set of goods and services purchased by consumers. It is a price index that tracks the prices of a specified basket of consumer goods and services, providing a measure of inflation*". The benefit of CPI as an indicator of inflation, as this actually measures the increase in price that a consumer will ultimately have to pay for. India is the only major country that uses a Wholesale Price Index (WPI) to measure

inflation. A research paper of prominent economists *V Shunmugam and D G Prasad* pointed out that *WPI does not properly measure the exact price rise an end-consumer will experience because, as the same suggests, it is at the wholesale level*. However, due to the unavailability of a single figure on CPI for the consumption basket of all section of society in India makes it impractical to be used in indexation of IIB's (RBI, 2010). Reserve Bank of India proposes the use of WPI for indexation which was earlier the same as in the case of "Capital Indexed Bonds of 1997" but with a slighter modification. The frequency of WPI has now been changed from weekly to monthly since November 2009 and also 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 organized and un-organized sectors making it more suitable for indexation purpose (as per the recommendations of *the Working Group for Revision of WPI Index* (Chairman: Prof. Abhijit Sen)).

An Index ratio is hence calculated keeping in mind all the above calculations and recommendations and can be represented by the following formula.

$$Index\ Ratio\ _{Set\ Date} = (Ref\ WPI\ _{Set\ Date})/(Ref\ WPI\ _{Issue\ Date}) \qquad (2)$$

(Where "Set Date" =Interest payment date/settlement date &   "Issue Date" = Original Issue Date of the bond.)

Interpolation using "Ref WPI" for the first day of the calendar month and the first day of the following calendar month should be used in order to calculate the index ratio for any specific date using WPI. It can be done with the help of the following formula.

$$Ref\ WPI\ _{Set\ Date} = Ref\ WPI\ _M + ((t-1)/D) * (Ref\ WPI\ _{M+1} - Ref\ WPI\ _M) \qquad (3)$$

Where 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 January) and   t= settlement date (e.g. January 15).)

Table 4. Wholesale Price Index (WPI, Monthly data from 2005-2011)

Month/Year	2005	2006	2007	2008	2009	2010	2011
January		105.2	112.3	117.3	124.2	134.8	147.4
February		105.4	112.4	118.8	122.9	134.8	146
March		105.5	112.7	121.4	123.2	135.8	148
April	102.8	107.6	114.4	123.5	124.6	138.3	
May	102.5	108.5	114.6	124	125.5	138.8	
June	102.9	109.7	114.8	127.3	126.4	139.4	
July	104	110.6	115.6	128.6	127.8	140.6	
August	104.1	111.3	115.9	128.9	129.3	140.7	
September	104.8	112	116	128.5	129.9	141.5	
October	105.2	112.5	116.3	128.6	130.5	142.4	
November	105.4	112.4	116.7	126.7	132.4	143.1	
December	104.7	112.1	116.6	124.3	132.9	145.4	

*Figures for the latest two months are provisional. Latest two months are to be reckoned with reference to the latest monthly press release issued. Base Year 2004-05 = 100 (For All Commodities). Presently, provisional WPI is released with a lag of two weeks and final WPI with a lag of two and half month (For example: Provisional WPI for 31st March 2008 and Final WPI for 31st January 2008 would be 14th April 2008.)

Source: Office of the Economic Adviser to the Government of India, Ministry of Commerce and Industry

Example for Interpolation (As quoted from the technical paper from RBI,2010):

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

$$Ref\ WPI\ _{30th\ December} = Ref\ WPI\ _{August} + ((30-1)/31) * (Ref\ WPI\ _{September} - Ref\ WPI\ _{August}) \qquad (4)$$

But for settlement date on December 12th, final WPI for the month of September 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". Hence, new calculations in order to interpolate with a lag of four months would look like :

$$Ref\ WPI\ _{30th\ December} = Ref\ WPI\ _{July} + ((30-1)/31) * (Ref\ WPI\ _{August} - Ref\ WPI\ _{July}) \qquad (5)$$

$$Ref\ WPI\ _{12th\ December} = Ref\ WPI\ _{July} + ((12-1)/31) * (Ref\ WPI\ _{August} - Ref\ WPI\ _{July}) \qquad (6)$$

With the help of the above calculations, an Index Ratio can be found out and hence the Principal of the bond can be adjusted by multiplying the Index ratio (Index Ratio $_{Set\ Date}$) with the Principal of the bond which can be called as "Inflation Compensation/ Inflation Reward ".

$$Inflation\ Compensation\ _{Set\ Date} = (Principal \times Index\ Ratio\ _{Set\ Date}) \qquad (7)$$

There are certain propositions made by the Reserve Bank of India in respect of the "Changing base of WPI" because of addition or subtraction of additional goods and services thereby affecting the actual coupons and principal of the bond. These are: "*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"(RBI,2010).

3.2 Tenure

It has been researched that the tenure of this kind of an instrument can vary from 5 years to more than 15 years depending upon the preference by the different Financial Institutions, Banks, Pension Funds, Insurance Companies etc. But keeping in mind the newness of this product, we have tried to form a hypothetical bond issued for the tenure of 5 years (Note 1) keeping the rest of its features as proposed by the Reserve Bank of India.

3.3 Settlement Price

The Settlement price of an "Inflation Indexed Bonds" would be the par value of the bond in a primary auction whereby the IIB would be issued at par and investors would be asked to bid in terms of the '*real yield*' whereas, in the secondary market or re-issuance of the bond, the investors can either bid at 'price *of the bond*' (assuming inflation at zero) or in terms of the '*real yield*' (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 (RBI,2010)).

$$Set\ Price\ _{Date} = (Real\ Cut\ off\ Price + Real\ Accrued\ Interest\ _{Set\ Date}) * Index\ Ratio\ _{Set\ Date} \qquad (8)$$

(Note: Real Cut off Price + Real Accrued Interest $_{Set\ Date}$ = can also be called as a "*Dirty Price*" of a bond opposite to the '*Clean Price*' which is excluding the above two components.)

Hence, the nominal fixed rate bonds, the sum of *cut-off price* and *Accrued Real Interest* would be multiplied with *Index Ratio* (Refer to Table 6 for Index ratio of a hypothetical bond).

Alternatively, "*the settlement price can also be computed directly by multiplying the sum of the cut-off price emerging in the reissuance of the Inflation Indexed Bonds and accrued real interest by index ratio*' (RBI,2010).

But in the case of '*Real Yield*' it is "*real cash flows*" 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 *Index Ratio*.

$$Settlement\ Price = Discounted\ Real\ Cash\ Flows * Index\ Ratio \qquad (9)$$

Hence, "*it is proposed by the Reserve Bank of India 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 Index Ratio*".

3.4 Issuance Method

There are various methods through which Inflation Indexed Bonds (IIB's) get issued in different parts of the world like *Auction, Tap Sale* and *Book Building process*. '*Auction*' process which is the most famous and preferred method for the treasuries around the world involves transferring the responsibility for pricing the bond to investors by asking them to bid for it. '*Tap sale*' which involves fixing the *real coupon rate* as per the market expectations but is ineffective as the issuer finds it difficult to assess the term structure of real rate because of the absence of any credible method. '*Book Building*' is another method to issue IIB's but it proves to be unfavorable as it involves aggressive marketing by the merchant banker that leads to *huge costs* and also this method may be viable when size of the issuance is quite large and investor's base is also wide consisting of international

investors. But due to the unfavorable experience faced by the treasuries of various countries (for instance, UK experimented with tap sales of IIBs in 1988, and thereafter reverted to the auction system due to limitations of this method), it has been suggested that India should adopt the "*Auction*" Process as the size of the IIBs issuance is not going to be very large in an under developed Indian Debt Market.

4. Comparison between Inflation Indexed Bond vs. Nominal Fixed Coupon Bond

4.1 Based on Returns- An Edge over Other Fixed Rate Bonds (Numerical Example)

In order to check the applicability of Inflation Indexed Bonds as a hedge against Inflation and also the returns at the time of coupon payments and principal repayment to the investors. We will first compare a hypothetical Inflation Indexed Bond with a Nominal Fixed Coupon Bond to validate the higher nominal and real rate of returns enjoyed by IIB's. Further, by deriving data for the actual Inflation from "Office of the Economic Adviser to the Government of India, Ministry of Commerce and Industry" (Table 4), we will comment upon the capital erosion in Nominal Fixed Coupon Bond vs. Inflation Indexed Bonds. Towards the end of the discussion, we will recommend IIB's not only to a particular class of investors (as investors and market participants understand these bonds only for the pensioners, retired people etc) in India but also to the mass as in the case of retail participation in Equity market. It can also help the government to deepen their under developed debt market and to safeguard the investors from the rising prices due to inflation.

Our computation of hypothetical bond involves some *assumptions*. Those are:

• The Inflation Indexed Bonds in our example are issued with a real rate of return (i.e. 3% per annum with semi-annual compounding) attached to it.

• For the sake of simplicity, IIB is issued directly to the investors (with the pre-set real return and price) instead of investors bidding for it (as in the case of an issuance through the Auction process) and also he/she will retain the bond till its maturity and will not sell it in the secondary market, so there would be no cut-off price, accrued interest, dirty price etc.

• As the previous version of IIB's i.e. Capital Indexed Bond involved complex calculation for calculating the Index ratio etc. Hence in this case, we have taken a situation whereby the bond is issued at the 1st day of December and hence needs no interpolation for the settlement date both for the coupon payments as well as redemption (this is for the simplicity sake of the investor's to understand this new instrument).

• The bond is issued for the tenure of 5 years which is different from the proposition made by the "Reserve Bank of India of 10-12 years". This is because, being a new product IIB's first had to show its commitment to the investors for providing a hedge for inflation.

• Figures for the inflation (I.e. WPI) are taken for "All Commodities" (monthly figures instead of weekly) keeping 2004-05 (base year i.e. 100) as base till 2011.

• Reference WPI and all the calculations are as per the technical discussion of the structure of IIB's given in this paper and indexed by RBI in their study.

• Hence for June, "Ref WPI" will be taken as February and for December it would be August (refer to Table 4 for WPI figures).

• Further, As per the proposal made by Reserve Bank of India, Ref WPI and Index Ratio (IR) for a specific date has been truncated to six decimal places and rounded off to five decimal places

Following is the information regarding the 'Normal Fixed Coupon' bond as well as Inflation Indexed Bonds

Inflation Indexed Bond

Reserve Bank of India issues 3%, 5-year Inflation Indexed Bond on 1st December 2005 redemption on 2010 (1st December 2010) linked to Wholesale Price Index (Table 4) (Base year 2004-2005=100) with a face value of Rs.1000, Semi-Annual compounding with reset dates as per the changing WPI figures from the "Office of the Economic advisor, MCI" (Note 2).

Nominal Fixed Coupon Bond

XYZ ltd Issues, 5 year, 9% bond with face value of Rs. 1000 on 1st December 2005 at par, redemption on 1st December 2010.

Steps in computing the Nominal Rate of Return for *Inflation Indexed Bond:*

Formulas used:

1) Index Ratio $_{Set\ Date}$ = (Ref WPI $_{Set\ Date}$)/(Ref WPI $_{Issue\ Date}$)

2) Indexed Principal/Inflation Compensation $_{Set\ Date}$ = (Principal × Index Ratio $_{Set\ Date}$)

3)   Coupon = (3%/2) * Indexed Principal

Reference Wholesale Price Index (WPI) Figures:

For June, "Ref WPI" will be taken as *February* and for December it would be *August* (refer to Table 4 for WPI figures).

Table 5. Wholesale Price Index (WPI, Monthly data from 2005-2010) with semi-annual coupon payments

Year	Month	WPI (lagged 4 month)
2006	June	105.4
2006	December	111.3
2007	June	112.4
2007	December	115.9
2008	June	118.8
2008	December	128.9
2009	June	122.9
2009	December	129.3
2010	June	134.8
2010	December	140.7

Above dates are the coupon payment dates (reset dates) for an IIB. Base Year 2004-05 = 100 (For All Commodities). Presently, provisional WPI is released with a lag of two weeks and final WPI with a lag of two and half month (For example: Provisional WPI for 31st March 2008 and Final WPI for 31st January 2008 would be 14th April 2008.). But the above table shows the WPI figures with a lag of 4 months in order to avoid the errors while interpolation. (For example: Final WPI for 1st December 2005 would be 1st August 2005 and for 1st June 2005, it would be 1st February 2005 and similar for every coupon date.)
Source: Office of the Economic Adviser to the Government of India, Ministry of Commerce and Industry

WPI on "*Issue Date*" (i.e. 1st December 2005) is 104.1 and on the final "*Settlement Date*" (i.e. 1st December 2010) is 140.7

Calculation of Index Ratio (Table 6):

$$\text{Index Ratio }_{Set\ Date} = (Ref\ WPI_{Set\ Date})/(Ref\ WPI_{Issue\ Date})$$

For example: Index Ratio for 'Set date' as 1st June 2006 (i.e. first coupon payment date) would be :

(Ref WPI $_{1st\ June\ 2006}$/ Ref WPI$_{1st\ December\ 2005}$) = (105.4/104.1) = 1.01249 (truncated and rounded off to 5 places of decimals)

And similarly for the 'Settlement date' i.e. 1st December 2010 it is :

(Ref WPI $_{1st\ December\ 2010}$ / Ref WPI$_{1st\ December\ 2005}$) = (140.7/104.1) = 1.35159 (truncated and rounded off to 5 places of decimals).

Table 6. Wholesale Price Index (WPI, Monthly data from 2005-2010) with semi-annual coupon payments and Index Ratio calculation on reset dates (Interest payment dates)

Year	Month	WPI (lagged 4 month)	Index Ratio
2005	December	104.1	
2006	June	105.4	1.01249
2006	December	111.3	1.06916
2007	June	112.4	1.07973
2007	December	115.9	1.11335
2008	June	118.8	1.14121
2008	December	128.9	1.23823
2009	June	122.9	1.18060
2009	December	129.3	1.24207
2010	June	134.8	1.29491
2010	December	140.7	1.35159

Above dates are the coupon payment dates (reset dates) for an IIB. Base Year 2004-05 = 100 (For All Commodities). Final WPI for 1st December 2005 would be 1st August 2005 and for 1st June 2005, it would be 1st February 2005 and similar for every coupon date. Index Ratio is calculated keeping the Ref WPI Base as "Issue Date" i.e. 1st December 2005 (104.1).

Calculation of Inflation Compensation/ Indexed Principal (Table 7):

Indexed Principal/Inflation Compensation $_{Set\ Date}$ = (Principal × Index Ratio $_{Set\ Date}$)

For example: Indexed Principal/Inflation Compensation 'Set date' as 1st June 2006 (i.e. first coupon payment date) would be : (Principal × Index Ratio $_{1st\ June\ 2006}$) = (1000 * 1.01249) i.e. 1012.49

And similarly for the 'Settlement date' i.e. 1st December 2010 it is :

(Principal × Index Ratio $_{1st\ December\ 2010}$) = (1000 * 1.35159) i.e. 1351.59

Table 7. Wholesale Price Index (WPI, Monthly data from 2005-2010) with semi-annual coupon payments, Index Ratio and Indexed Principal (Inflation Compensation) calculation on reset dates (Interest payment dates) based on index ratio (Face value of a bond is Rs.1000)

Year	Month	WPI (lagged 4 month)	Index Ratio	Inflation Compensation
2005	December	104.1		
2006	June	105.4	1.01249	1012.49
2006	December	111.3	1.06916	1069.16
2007	June	112.4	1.07973	1079.73
2007	December	115.9	1.11335	1113.35
2008	June	118.8	1.14121	1141.21
2008	December	128.9	1.23823	1238.23
2009	June	122.9	1.18060	1180.60
2009	December	129.3	1.24207	1242.07
2010	June	134.8	1.29491	1294.91
2010	December	140.7	1.35159	1351.59

Above dates are the coupon payment dates (reset dates) for an IIB. Base Year 2004-05 = 100 (For All Commodities). Final WPI for 1st December 2005 would be 1st August 2005 and for 1st June 2005, it would be 1st February 2005 and similar for every coupon date. Index Ratio is calculated keeping the Ref WPI Base as "Issue Date" i.e. 1st December 2005 (104.1). Inflation compensation or Indexed Principal is calculated by multiplying the index ratio by the face value of the bond i.e. Rs.1000 in this case. (Though the Principal is indexed to Inflation on every reset date (Coupon date) but the final payout would only be at the time of redemption i.e. 1st December 2010)

Calculation of Coupon on Indexed Principal (Table 8):

Coupon = (3%/2) * Indexed Principal

For example: Coupon on 'Set date' as 1st June 2006 (i.e. first coupon payment date) would be :

((3%/2) * Indexed Principal) = (0.015 * 1012.49) i.e. 15.1873

And similarly for the 'Settlement date' i.e. 1st December 2010 it is:

((3%/2) * Indexed Principal) = (0.015 * 1351.59) i.e. 20.2737

Hence, we can say that at the time of redemption i.e. on 1st December 2010 (after 5 years) an investor for such bonds will get the the Indexed Principal repayment along with the coupon adjusted for inflation. The Cash Flow in our case would be (Table 8): 1351.59 + 20.2737 = 1371.8587

Kindly note, that in the case of IIB, though the Principal is indexed to Inflation on every reset date (Coupon date) but the final payout would only be at the time of redemption i.e. 1st December 2010.In some cases, we can even see the principal and coupon of these bonds going down with the decreasing Inflation (for example, WPI on 1st June 2009 is 122.9 (Prinicpal = Rs. 1180.60 and Coupon = Rs. 17.70893) which was 128.9 on 1st December 2008 (Prinicpal = 1238.23 and Coupon = 18.5734) hence reducing the principal as well as coupon.

Table 8. Wholesale Price Index (WPI, Monthly data from 2005-2010) with semi-annual coupon payments, Index Ratio, Indexed Principal (Inflation Compensation) and Coupon calculation on reset dates (Interest payment dates) based on 3% per annum (with semi-annual compounding i.e. 1.5%) times Indexed Principal

Year	Month	WPI (lagged 4 month)	Index Ratio	Inflation Compensation	Coupon
2005	December	104.1			
2006	June	105.4	1.01249	1012.49	15.18731
2006	December	111.3	1.06916	1069.16	16.03746
2007	June	112.4	1.07973	1079.73	16.19596
2007	December	115.9	1.11335	1113.35	16.70028
2008	June	118.8	1.14121	1141.21	17.11815
2008	December	128.9	1.23823	1238.23	18.57348
2009	June	122.9	1.18060	1180.60	17.70893
2009	December	129.3	1.24207	1242.07	18.63112
2010	June	134.8	1.29491	1294.91	19.42363
2010	December	140.7	1.35159	1351.59	20.27377

Above dates are the coupon payment dates (reset dates) for an IIB. Base Year 2004-05 = 100 (For All Commodities). Final WPI for 1st December 2005 would be 1st August 2005 and for 1st June 2005, it would be 1st February 2005 and similar for every coupon date. Index Ratio is calculated keeping the Ref WPI Base as "Issue Date" i.e. 1st December 2005 (104.1). Coupon is calculated at the rate of 3% per annum (i.e. 1.5% six monthly) on the Indexed Principal on reset dates.

Calculation of Nominal Rate of Return with the help of Inflation (WPI) and Real Rate of Return   (Coupon Rate) in order to compare it with a Nominal Fixed Coupon Rate Bond (Table 9) :

$$1 + I = (1 + r)*(1 + E(I))$$

Where:

- I = Nominal Interest Rate;
- r = Real Interest Rate;
- E(I) = Expected Inflation Rate.

For Example: Nominal (Six monthly) Rate of Return for 1st June 2006 can be computed as:

Nominal Rate $_{June\ 2006}$ = ((1 + 1.5 %) * (1 + 5.400%)) – 1 = 6.981%

Nominal Rate $_{December\ 2006}$ = ((1 + 1.5 %) * (1 + 5.598%)) – 1 = 7.181%

Nominal (Yearly) Rate of Return for the year 2006 can be computed as:

Nominal Rate of Return 2006 = Nominal Rate $_{June\ 2006}$ + Nominal Rate $_{December\ 2006}$ = 6.981% + 7.181% = 14.1627%.

Table 9. Wholesale Price Index (WPI, Monthly data from 2005-2010 with Base year as 2004-05: 100) with Semi-annual inflation, Coupon rates (as fixed by the government) and Nominal Rate of return (both semi-annually and yearly)

Year	Month	WPI	Inflation (WPI)	Coupon	Nominal Rate (Semi-Annual)	Nominal Rate(Yearly)
2004-05		100				
2006	June	105.4	5.400%	1.50%	6.9810%	
2006	December	111.3	5.598%	1.50%	7.1817%	14.1627%
2007	June	112.4	0.988%	1.50%	2.5030%	
2007	December	115.9	3.114%	1.50%	4.660%	7.163%
2008	June	118.8	2.502%	1.50%	4.0397%	
2008	December	128.9	8.502%	1.50%	10.1292%	14.1689%
2009	June	122.9	-4.655%	1.50%	-3.225%	
2009	December	129.3	5.207%	1.50%	6.785%	3.561 %
2010	June	134.8	4.254%	1.50%	5.8175%	
2010	December	140.7	4.377%	1.50%	5.9425%	11.76%
						10.1633%

*Above dates are reset dates for an IIB. Base Year 2004-05 = 100 (For All Commodities). Final WPI for 1st December 2005 would be 1st August 2005 and for 1st June 2005, it would be 1st February 2005 and similar for every coupon date. Inflation rate (WPI) is calculated by

comparing the previous WPI figures and hence dividing it by current WPI figures (Inflation (June, 2006) = (WPI June, 2006)/ (WPI Base year)). Coupon rate is fixed at the rate of 3% per annum (i.e. 1.5% six monthly) by the issuer of the bond. Hence, Six monthly and yearly Nominal rate can be found out by the below mentioned formula.

Hence, the Average yearly Nominal Rate of Return, of an "Inflation Indexed Bond" with 3% real rate of coupon (Semi-Annual compounding), issued for the period of 5-years i.e. on 1st December 2005 redemption on 2010 (1st December 2010) linked to Wholesale Price Index with a Face Value of Rs.1000 with reset dates as per the changing WPI figures is coming out to be 10.1633%.

Steps in computing the Nominal Rate of Return for a *"Nominal Fixed Coupon Bond"*:

XYZ ltd Issued, 5 year, 9% bond with face value of Rs. 1000 on 1st December 2005 at par, redemption on 1st December 2010.

We can calculate the Coupon for "Nominal Fixed Coupon Bond" with semi-annual compounding with the help of the following formula:

Coupon = (9%/2) * Principal or Face value of the Bond

I.e. Coupon $_{June\ 2006}$ = (9%/2) * 1000 = Rs. 45

At the time of Redemption (December 2010) = Principal + Coupon $_{December\ 2010}$ = 1000 + 45 = 1045

Table 10. Nominal Fixed Coupon Bond that pays 9% per annum (4.5% semi-annual compounding) issued on 1st December 2005 at par (Rs.1000), redemption on 1st December 2010 for 5 years

Year	Coupon Date	Cash Inflow (Rs.)
2006	June	45
2006	December	45
2007	June	45
2007	December	45
2008	June	45
2008	December	45
2009	June	45
2009	December	45
2010	June	45
2010	December	1045

*Above dates are the coupon payment dates for a Nominal Fixed Coupon that pays Coupons/Interest on every Six months starting from 1st December 2005 till 1st December 2010 along with the repayment of Face value/par value/redemption value of Rs.1000.

We can say that at the time of redemption i.e. on 1st December 2010 (after 5 years) an investor for such bonds will get the the Principal repayment along with the coupon. The Cash Flow in our case would be (Table 10): 1000 (Redeemed at par) + 45 (Coupon) = 1045

Hence, the Nominal Rate of Return, of an "Nominal Fixed Coupon Bond" with 9% Nominal rate of coupon (Semi-Annual compounding), issued for the period of 5-years i.e. on 1st December 2005 redemption on 2010 (1st December 2010) with a Face Value of Rs.1000 is coming out to be 9% (as the bond is issued and redeemed at par).

4.2 Based on Nominal Rate of Return and Future Cash Flow at the Time of Repayment (An Investor's Perspective)

With reference to the above calculations, we can now conclude that Nominal Yield on an Inflation Indexed Bonds linked to Wholesale Price Index (Table 4) (Base year 2004-2005=100) with a face value of Rs.1000, Semi-Annual compounding (3% real return per annum) with reset dates as per the changing WPI figures resulted in superior return of 10.1633% as compared to the Nominal Fixed Coupon Bond with Nominal Yield of 9%. The Cash Inflow for investors of these bonds at the time of repayment of their Principal along with the Coupon (Rs.) is Rs.1045 in the case of '*Nominal Fixed Coupon Bond'* but it is as high as Rs.1371.8587 in the case of an 'Inflation Indexed Bond".

In simple words, a retail investor will analyze the growth of Indexed principal in the case of 'Inflation Indexed Bond" at the rate of ((1351.59 – 1000) / 1000)* 100 = 35.16% (in 5 years i.e. around 6.21% year-on-year growth rate) in addition with 3% per annum as real rate, whereas in the case of 'Nominal Fixed Coupon Bond', the

principal remains the same i.e. Rs.1000 at the time of repayment. A Nominal Bond pays the investors coupon at the rate of 9% per annum (4.5% every six month) but due to a shortcoming of Yield-to-Maturity Curve, the investors would find difficulty in investing the coupons at the same rate (which is one of the assumptions in "Nominal Fixed Coupon Bond's Yield-to-Maturity (YTM) curve) in falling interest rate market. Though the technical concept behind the calculation of growth rate is wrong but this is the way an individual investor analyze an instrument. In the next section, for simplicity sake, we will analyze the "purchasing power" of an investor at 1st December 2005 (start of an investment) compared to the "purchasing power" at "1st December 2010 (redemption date) and will comment on the probability of capital erosion (less chances) in the case of IIB's and also in the case of 'Nominal Fixed Coupon Bond'.

Table 11. Compares the two kinds of bond on the basis of 'Nominal Rate of Return' and 'Cash Inflow at Redemption'

Basis/Bond Type	Nominal Fixed Coupon Bond	Inflation Indexed Bond
Nominal Rate of Return	9%	10.1633%
Cash Inflow at Redemption	1045	1371.8587

Above figures are computed for a hypothetical 'Nominal Fixed Coupon' and 'Inflation Indexed Bond' that pays Coupons/Interest on every Six months starting from 1st December 2005 till 1st December 2010 for the bond with Face value of Rs.1000.

5. Acceptability and Applicability of Inflation Indexed Bonds

5.1 An Insight into Purchasing Power

'Purchasing Power' can be defined as the number of goods/services that can be bought with a unit of currency. It is known that the purchasing power declines with the increasing prices in a country (or in other words, it decreases with an increase in inflation). Hence, purchasing power is inversely proportional to Inflation keeping the income level of an individual as constant. For example, the purchasing power of a rupee in the year 1950 was far more than in the year 2011. But in the case of "Inflation Indexed Bonds" as the bond's principal and coupon are linked with WPI figures (an indicator of Inflation), the purchasing power can be seen as positive with an increasing prices scenario. As compared to the investment in a Nominal Fixed Coupon Bond, whereby it pays a higher nominal rate of return during the tenure of its investment, IIB's can be preferred as it pays comparatively lower coupon rate during the tenure but reset according to the changing WPI figures which leads to a hedged (against inflation) Principal and Coupon payment at the time of redemption. Repayments from IIB's and Nominal Fixed Coupon Bonds can be questioned for the purchasing power at the time of redemption and hence can be checked for the potential loss due to capital erosion (in the case of the Nominal Bonds). Hence, in order to compare the investor's worth at the time of repayment of both the bonds, we will take into consideration a situation whereby we will compare the price of a car in the year 2005 and the price of the same car in the year 2010 i.e. Prices at the start of the investment cycle (i.e. December 2005) compared with the prices at redemption (i.e. December 2010). By doing so, we will show whether the investors by investing in these bonds are capable of buying the same car from the investment repayment after 5 years (i.e. December 2010) which he/she could anyways bought it at the start (i.e. December 2005) without investing in these bonds.

Alternatively, we will also compare the future value based on the '*coupon reinvestment*' for both 'Normal Bond' as well as 'Inflation Indexed Bond' at a fixed interest rate over the investment horizon which is in line with an assumption made by the yield-to-maturity curve.

Nominal Fixed Coupon Bonds vs. Inflation Indexed Bond

5.2 Comparison from the Investor's Perspective (No Reinvestment of Coupons)

Let's understand the investment's worth in this kind of a financial instrument by taking an example as we have already considered the cash flows and the nominal yield involved with this bond (For evidence: Refer to Table 10). As we are examining the purchasing power from the principal repayment of both these bonds from the investor's perspective, hence we have assumed that the investor will consume the interim coupon payments and will not reinvest it at the prevailing interest rate.

This type of an assumption is fundamentally incorrect and hence in the next section we have critically examined both the bonds by reinvesting the coupon payments at the rate of 9% constant over the investment horizon.

Suppose, on 1st December 2005, an individual investor (Mr. Brajesh) who is well versed and equipped with the financial knowledge and loves investing in Indian Debt Market, plans to buy a Maruti Suzuki made Wagon R.

But his interests in bond markets induced him towards an alternative option of a *"9% Nominal Fixed Coupon Bond"* (discussed earlier) which stands to redeem after 5 years (on 1st December 2010). So, in order to reap the benefit of a 9% nearly risk-free return (as bonds are considered to be a safe mode of investment), he bought 300 such bonds and deferred the decision of buying a car for 5 years. There is an additional option to invest in an "Inflation Indexed Bond" but due to its newness and low real rate of return of 3%, he is reluctant to invest in such a bond.

Wagon R on 1st December 2005 priced at around Rs.300000 (ex-showroom price).

Mr. Brajesh enjoyed his coupon payments at the rate of 4.5% on every six months (9% per annum) till the end of 5 years. Alternatively, if he would have invested in Inflation Indexed Bonds, it would have only paid him a real return of approximately 1.5% (before inflation adjusted) on every six months. On knowing this, Mr. Brajesh was very happy and proud of his investment in that 9% Nominal Fixed Coupon Bond.

After 5 years i.e. on 1st December 2010, at the time of the principal repayment, Mr. Brajesh got back his par value of Rs. 1000 back along with the last coupon payment of Rs. 45 on a single bond (he bought 300 bonds) whereas in the case of an Inflation Indexed Bonds, it repaid the principal of Rs. 1351.59 along with the last coupon payment of Rs. 20.2737 (for evidence: See Table 8 above).

With the principal repayment of Rs. 300000 (300 bonds of Rs. 1000 each) Mr. Brajesh went to his nearest Maruti Suzuki Showroom in order to buy Wagon R, which he initially deferred because of his investment in the Debt market, he realized that:

Wagon R on 1st December 2010 priced at around Rs.360000 (ex-showroom price).

He found out that with the principal repayment from a '*Nominal Fixed Coupon Bond*' paying as high as 9%, he was incapable of buying the same car due to the inflation and other factors as the prices have already risen from Rs.300000 in the year 2005 to Rs.360000 in 2010.

He also realized that investment in an *Inflation Indexed Bonds* could have fetched him enough money to even buy a bigger car (i.e. IIB repaid Rs. 1351.59 on single bond means on an investment of 300 bonds, he could have got Rs.405477 as principal alone).

Hence, by critically examining the above given illustration, it can be concluded that in the case of *Nominal Fixed Coupon Bonds* there is capital erosion along with the declining purchasing power with increasing inflation which is not the case with an *Inflation Indexed Bond*.

5.3 Comparison Based on Technical and Fundamental Approach (Reinvestment of Coupons)

We have already seen the nominal return and the principal repayment keeping in mind the investor's perspective. But in order to validate our findings with the financial literature, we have to calculate the investment's worth by reinvesting the interim coupon payments in both the cases as previously we have assumed that an investor will not reinvest such payments. Thus, in order to compare both the bonds on a common platform, we will assume that the coupons payments will be reinvested at the rate of 9% for both 'Normal Bond' as well as 'Inflation Indexed Bond' over the life of the investment i.e. 5 years. It can be seen from Table 12, that the first coupon payment by both the bonds on 1st June 2006 (i.e. six months after the investment begins) is reinvested at the rate of 4.5% (9% with semi-annual compounding) for 9 periods (1 period = 6 months) followed by others till the end of the fifth year. At the time of repayment, value of the bond can be calculated by adding the principal along with the reinvested coupons.

After 5 years with coupon reinvestment at the rate of 9%, a '9% Nominal Fixed Coupon Bond' is worth for Rs. 1552.97 whereas '3% Inflation Indexed Bond' is worth Rs. 1565.3578 on a face value of Rs. 1000. Hence, it can be seen that the 'Inflation Indexed Bond' is priced above as compared to the 'Nominal Fixed Coupon Bond'. Additionally, the nominal yield of 9% in the case of 'Nominal Fixed Coupon Bond' is computed with an assumption regarding the reinvestment at the same interest rate during the investment horizon which would be difficult in the case of 'falling/decreasing interest rate scenario'. Practically, it would also be difficult to invest such small amount (coupon payments) every six months at such a higher interest rate (one of the motives to study the investment's worth without the coupon reinvestment in the previous section).

Table 12. Nominal Fixed Coupon Bond vs. Inflation Indexed Bond that reinvests the coupon payments @ 9% per annum (4.5% semi-annual compounding) issued on 1st December 2005 at par (Rs.1000), redemption on 1st December 2010 for 5 years

Investment			Normal Bond		Inflation Indexed Bond	
Tenure	Year	Month	Coupons	Reinvest @ 9% p.a.	Coupons	Reinvest @ 9% p.a.
9	2006	June	45.00	66.87	15.18731	22.5698
8	2006	December	45.00	63.99	16.03746	22.8068
7	2007	June	45.00	61.24	16.19596	22.0404
6	2007	December	45.00	58.60	16.70028	21.7481
5	2008	June	45.00	56.08	17.11815	21.3323
4	2008	December	45.00	53.66	18.57348	22.1492
3	2009	June	45.00	51.35	17.70893	20.2088
2	2009	December	45.00	49.14	18.63112	20.3456
1	2010	June	45.00	47.03	19.42363	20.2976
0	2010	December	1045.00	1045.00	1371.85879	1371.8587
				1552.97		1565.3578

Above figures are computed for a 'Nominal Fixed Coupon' and 'Inflation Indexed Bond' that reinvests Coupons/Interest on every Six months starting from 1st December 2005 till 1st December 2010 for the bond with Face value of Rs.1000. Investment tenures shows the time period for which the given coupon payments are reinvested at the rate of 4.5% semi-annually (hence are given in 6 months). Investment tenure of 9 shows that the coupon is reinvested for 4.5 years (9 periods of six months each) starting from the first coupon payment i.e. on 1st June 2006 until the redemption date i.e. 1st December 2010 where the coupon received is not reinvested (as it is the end of the investment horizon).

That's why for the sake of convenience & simplicity and also by looking at the principal repayment i.e. of Rs.1371.8587 in case of Inflation Indexed Bond (without coupon reinvestment) it can now be said to be much relevant and easily computable return and hence maintains the purchasing power of the investors (as explained in the example related to car above).

5.4 Comparison Based on Rising Inflation in the Economy

In order to compare the sensitivity of the bond values (at the time of redemption) towards the change in inflation rates for both the 'Normal Fixed Coupon Bond' as well as 'Inflation Indexed Bond', we have made the following scenarios starting from 5% to 12% inflation levels. Bond values at redemption are calculated by keeping the reinvestment rate constant at the rate of 9% for all the inflation levels. This kind of an assumption is practically unfair to keep as with the higher inflation, the Reserve Bank of India will increase the interest rates and motivates the investors to save more and more in order to control the liquidity in the economy. But in our case, this kind of an unfair assumption will help us to study the sensitivity of the bond values with changing inflation rates on a common platform. The figures for the Wholesale Price Index (WPI) is adjusted towards the repayment period (end of the investment horizon) for the mentioned inflation rate keeping the other values same (this is done in order to keep the bond value unaffected by the reinvestment rate, as the principal and coupon on redemption date (final settlement date) will not be further invested) as given by the '*Office of the Economic Adviser to the Government of India, Ministry of Commerce and Industry*'. As the principal and coupons in the case of an Inflation Indexed Bond are indexed to the changing WPI figures, hence we can see a positive relationship between 'Bond Value' at the time of repayment and 'Inflation Rate' whereas in the case of a 'Normal Fixed Coupon Bond' the Bond Value is unaffected with the changing Inflation rate (keeping the interest rate as constant). Such positive relationship can be depicted from the Figure 2 given below.

Table 13. Bond Value on redemption with different Inflation levels for Nominal Fixed Coupon Bond and Inflation Indexed Bond that reinvests the coupon payments @ 9% per annum (4.5% semi-annual compounding) issued on 1st December 2005 at par (Rs.1000), redemption on 1st December 2010 for 5 years

Inflation	Inflation Indexed Bond	Normal Fixed Coupon Bond
5%	1441.61	1552.97
6%	1503.87	1552.97
7%	1568.87	1552.97
8%	1636.77	1552.97
9%	1707.68	1552.97
10%	1781.71	1552.97
11%	1858.71	1552.97
12%	1939.62	1552.97

Above figures are computed for a 'Nominal Fixed Coupon' and 'Inflation Indexed Bond' that reinvests Coupons/Interest on every Six months starting from 1st December 2005 till 1st December 2010 for the bond with Face value of Rs.1000 starting from the first coupon payment i.e. on 1st June 2006 until the redemption date i.e. 1st December 2010 where the coupon received is not reinvested (as it is the end of the investment horizon). Figures are computed at different inflation levels keeping the other factors like reinvestment rate, interest rate as constant.

We can now see that the Inflation Indexed Bond is valued higher as compared to the Normal Bond when the inflation exceeds 6%. Starting from 5% inflation with IIB valued at Rs.1441.61, the Normal Bond value (of Rs.1552.97) would be the same for all the inflation levels until 12% where IIB was quoting at as higher as Rs.1939.63.

Hence, by looking at various comparisons first on the basis of a numerical example along with the purchasing power testing with and without coupon reinvestment and now by comparing the bond value in various inflation levels, we can strongly recommend the superiority of an 'Inflation Indexed Bond' as compared to a 'Normal Fixed Coupon Bond' even with a nominal rate of 9%.
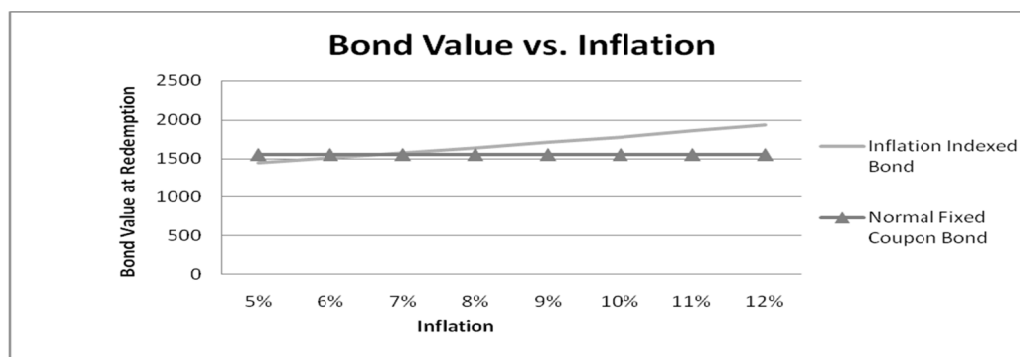
Figure 2. Relationship between 'Bond Value' with 'Inflation' in the case of 'Inflation Indexed Bond' as well as a 'Normal Fixed Coupon Bond'

Figure 2 Shows the Bond Value/Inflation relationship for a normal bond as well as the Inflation Indexed Bond. For an Inflation Indexed Bond, bond value increases with increase in the Inflation and vice-versa but for a normal bond, it remains unaffected by the rising Inflation levels (keeping interest/reinvestment rate as constant for both the bonds).

For an Inflation Indexed Bond, bond value increases with increase in the Inflation and vice-versa but for a Normal Bond, it remains unaffected by the rising Inflation levels (keeping interest / reinvestment rate as constant for both the bonds). 5-year bond value becomes as high as Rs.1939.62 when the inflation rates went up till 12% and decreased to Rs. 1441.61 when inflation rates were as low as 5%. This is not the case with a "Normal Bond" as the principal is not linked to the changing Inflation rates (WPI) and hence keeping its value constant over the life of the security.

6. Conclusions and Recommendations

In the end, we can conclude by quoting few observations and findings based on our analysis of Inflation Indexed Bonds as a new instrument/product for the Indian under-developed Debt market. In our research we have studied the need, advantages, disadvantages, structure and also the technical and conceptual framework of the product. We have compared the Normal Bond with an Inflation Indexed Bond on various parameters starting from the formation of a hypothetical bond that relates to the features as guided by the Reserve Bank of India in their technical discussion about the instrument. In our comparison based on *Nominal Rate of Return* and *Future Cash Flow* at the time of repayment keeping in mind the investor's perspective, we have found out that the Nominal Yield on an Inflation Indexed Bonds linked to Wholesale Price Index (Table 4) (Base year 2004-2005=100) with a face value of Rs.1000, Semi-Annual compounding (3% real return per annum) with reset dates as per the changing WPI figures resulted in superior return of 10.1633% as compared to the Nominal Fixed Coupon Bond with Nominal Yield of 9%. The Cash Inflow for investors of these bonds at the time of repayment of their principal along with the coupon (Rs.) will be Rs.1045 in the case of 'Nominal Fixed Coupon Bond' but it would be as high as Rs.1371.8587 in the case of an 'Inflation Indexed Bond". Further in the study, we have also commented upon *the Acceptability and Applicability of Inflation Indexed* Bonds based on *purchasing power* of the investors. We can now say that IIB's can be preferred as it pays comparatively lower coupon rate during the tenure but reset according to the changing WPI figures which leads to a hedged (against inflation) Principal and Coupon payment at the time of redemption (as we have already seen that the investors by investing in these bonds are capable of buying the same car from the investment repayment after 5 years i.e. December 2010, which he/she could anyways bought it at the start (i.e. December 2005) without investing in these bonds). We have further segregated the comparison based on *"No Reinvestment of Coupons"* whereby the investors will not reinvest the coupon at the prevailing interest rate (9% in our case) and "*Reinvestment of Coupons"* whereby the investors will reinvest the coupon paid to him at the prevailing interest rate i.e. 9% for both IIB's and Normal Bond. In the case of *"No Reinvestment of Coupons"* there was capital erosion in the case of Normal Bond along with the declining purchasing power with increasing inflation which was not the case with an *Inflation Indexed Bond*. After 5 years with "Coupon reinvestment" at the rate of 9%, a '9% Nominal Fixed Coupon Bond' was worth for Rs. 1552.97 whereas '3% Inflation Indexed Bond' was worth Rs. 1565.3578 on a face value of Rs. 1000. Hence, it can be seen that the 'Inflation Indexed Bond' was priced above as compared to the 'Nominal Fixed Coupon Bond'. Lastly, we have compared both the bonds in the rising inflation scenario. We have analyzed that for an Inflation Indexed Bond, bond value increases with increase in the Inflation and vice-versa but for a Normal Bond, it remains unaffected by the rising Inflation levels (keeping interest/reinvestment rate as constant for both the bonds). Five year bond value becomes as high as Rs.1939.62 when the inflation rates went up till 12% and decreased to Rs. 1441.61 when inflation rates were as low as 5%.

After seeing the superiority of IIB's as compared to the Normal Bond, we can now make few recommendations based on our findings. Believing in our analysis, we will recommend IIB's not only to a particular class of investors (as investors and market participants understand these bonds only for the pensioners, retired people etc) in India but also to the mass as like the case of retail participation in Equity market. It can also help the government to deepen their under developed debt market and to safeguard the investors from the rising prices due to inflation. As we know the fact that unlike other developed debt markets of the world, financial literacy is not so common amongst the retail investors in India, hence the initial issue of IIB has to be simple on the issue dates, tenures and also for the matters regarding the auction process etc. It would be better if the central bank prior to issuing this kind of an instrument, holds a literacy program whereby the target audience can be tapped regarding the benefits and structure of this kind of a product.

Appendix: In Table 2, we took the following data and assumptions regarding the calculation

Issue Date: 1/1/2000

Issuance Price: Rs.1000

Maturity Period: 10 years

4% real coupon paid annually

6% year-on-year (annualized) WPI (Inflation)

We have take the base for the WPI as 100 on the issuance date and the WPI for a coupon date after one year is 106 (year-on-year of 6% until 179.08 (100*(1.06)^10)) in the year 10). The adjusted principal would be 1.06 times the face value/redemption value i.e. 1060 in the first year as compared to 1000 at the issue date. Hence, the

coupons are calculated on the indexed principals as one of the feature of the inflation indexed bonds i.e. 4% of 6% increased principal leads to the nominal cash-flow- annualized return of 10.24%.

This was a hypothetical and easily computable Inflation Indexed Bonds as in reality, IIB's cash flow patterns are bit complicated. It involves semi-annual coupons and the inflation-indexed principal is accrued daily, based on an interpolation of the two most recent WPI figures reported prior to the settlement month. "*Thus 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*".

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Notes

Note 1. See Appendix for calculation

Note 2. Data is collected in the month of April 2011