

## Long Term Foreign Exchange Scenario and its impact on external loans for the Road Sector

### ABSTRACT

India's Road Sector is well on its way to becoming world standard, with significant changes occurring over the last three years. One concern is that a large part of the development has been financed by external loans denominated in a foreign currency while any revenues associated with the roads are denominated in local currency.

While the pattern of Rupee movement over the last several years has been long periods of stability interspersed with sudden bouts of depreciation, the last one year has shown fairly slow and steady appreciation.

In an exchange rate environment where market forces are tempered by strong regulatory intervention, forecasting exchange rates, particularly over the long term (10 to 15 years) is a difficult task.

This paper thus uses Monte Carlo simulation, using assumptions derived from economic and market conditions, to work out the possible costs for external loans in Rupee terms over the next 18 years at 99% confidence level. The simulated future currency and interest rates have the same correlation as historical data and use the current forward curve (i.e. current market expectations of the future) as a starting point.

As the borrower has the choice of leaving loans unhedged or applying a variety of hedging instruments to them, each is evaluated in terms of IRR for the loan cash flows. The Results show that hedging the loans partially by using a coupon only swap is expected to give the best results over the next 18 years.

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## Executive Summary

- Loan assistance has been granted from multilateral development agencies – the Asian Development Bank, World Bank and Japanese Bank of International Cooperation – to the road sector in India. Out of the INR 200 billion funding being organized by this route, some part is in the form indirect loans to Road Sector.
- Over the next few years, we see an increasing amount of investment flows into India, resulting in accretion of Reserves accretion and consequently a gradual appreciation of the rupee. There will thus be a continued soft bias on interest rates over the next few years.
- However, as with all views based on fundamental factors, this view is also subject to changes in the economic scenario as time goes by. Thus we need a more objective measure for a longer-term view to review the costs associated with direct/indirect external loans to the Road Sector.
- *Monte Carlo Simulation*: This can be done based upon a simulation of the market factors based on certain assumptions.

- **Results :**

SI No.	Scenario	Expected Cost at 99% confidence Level
1.	Unhedged USD Loan	9.94%
2.	Loan fully hedged with Currency Swap	6.65%
3.	Loan hedged with a Principal Only Swap	9.83%
4.	Loan hedged with a Coupon Only Swap	7.08%

- **Conclusions:**

1. In case of Indirect loans from the Government, the financing cost for the Road Sector can be reduced to a large extent whether or not the Government decides to hedge the market risks.
2. In case of Direct Loans as well, the same conclusions as above apply but for NHAI directly.
3. As the funds used for the Road Sector are Public funds, it is perhaps better to go in for cost certainty and release excess funds earmarked here for more productive use elsewhere.
4. The current interest rate environment and spot INR rates provide an unprecedented opportunity to lock in to long term hedges at very low levels and should be utilized at least for part of the funding portfolio.
5. On NHAI's loan portfolio, using our assumptions, the possible savings are as below: Direct Loans:  $9.94\% - 6.65\% = 3.29\%$  p.a. semi-annual or on a notional of USD 180 million an amount of INR 279.5 million per annum. Indirect Loans:  $12.5\% - 6.65\% = 5.85\%$  p.a. semi-annual or on a notional of INR 190 billion an amount of INR 2.22 billion per annum.(assuming 80% of these loans come as grant to NHAI from Govt.)
6. The current environment also provides a unprecedented opportunity to the Road sector to raise fresh funding on a long-term basis at low costs. With the external sector of the economy secure and in fact doing wonderfully well, long tenor external funding should be available today at cheaper levels than before. Further with the prevailing low interest rate environment the fully hedged cost of an external loan is likely to come in lower than a domestic bond issuance. (As the swap curve is ruling below GOI yields currently).

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## Introduction

The Road Sector in India has witnessed mega-growth over the last three years. The process started with the NHDP program undertaken by NHAI in 1999. This ambitious project envisages road building and construction work comprising more than 14,000 KM to be completed at a total cost of INR 540 bn. This is divided into 2 parts: GQ – Golden Quadrilateral comprising of about 5,850 KM to be completed by end of 2003 at a cost of INR 250 bn and NSEW Corridor connecting the North, South, East and West parts of the country.

### Financing the NHDP project

Total expenditure to be incurred on the NHDP project is INR540 bn. The main sources of funding are a tax on petrol and diesel and external aid from multilateral agencies, each of which account for 37% of the total cost.

#### Sources of Financing the NHDP project (Rupees in Billions)

Source	Amount in INR. Billion
Tax on Petrol & Diesel	200
World Bank/ADB	200
Market Borrowings	100
Private Sector	40
<b>Total Funding</b>	<b>540</b>

Source: NHAI

#### 1. Tax on petrol and diesel

The government introduced a tax on diesel and petrol in 1999 and passed a decree for the funds collected to be put into a Central Road Fund for exclusive utilization for the development of a modern road network.

#### 2. External aid agencies

Loan assistance has been granted from multilateral development agencies – the Asian Development Bank, World Bank and Japanese Bank of International Cooperation. Out of the INR200 billion funding being organized by this route, some part is in the form indirect loans to Road Sector i.e. the external aid agencies have given soft loans to the Government which has then on-lent the funds to the road sector in INR with the objective of taking away the foreign exchange risk on the loans from the road sector.

#### 3. Market borrowing

The NHAI proposed to tap the market by securitizing the tax receipts.

#### 4. Private sector participation

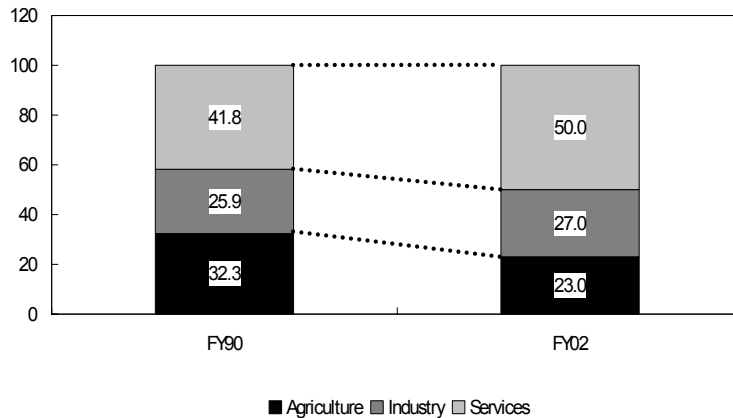
To promote involvement of the private sector in construction and maintenance of the national highways, some projects are offered on a BOT basis to private agencies. After the concession

period, which can range up to 30 years, this road is to be transferred back to the NHAI by the concessionaire.

## Indian Economy: A Paradigm Shift in Progress?

Over the last 12 years, the shape and structure of Indian Economy has changed in many ways, which has tended to make it more resilient and more integrated with the world economy. The dependence of the economy on the Agriculture sector has reduced and while the Manufacturing sector has tended to more or less stagnate, it is the Services sector, which has quickly gained prominence (see chart).

**Composition of GDP**



Due to this change in the composition of the GDP, the economy's resilience with respect to monsoons has increased. With the gradual opening up of the economy since 1991, Indian Industry has started competing with global industries and in some sectors started beating them. This has resulted in a situation where external investors are now finding increasing confidence in investing in India. Over the last 5-6 years, investment flows in the country have continued even in face of adverse events like Pokhran, Kargil etc.

With the growth in the services sector (especially BPO and software exports which are classified under invisibles), India posted a current account surplus for the first time in FY02. This could be a paradigm shift in progress in the external sector which could mean that the current strength of rupee and soft interest rates are not a temporary phenomenon. It would have a profound impact on the way we have been looking at foreign exchange liabilities traditionally i.e. assume a depreciation rate of 5% p.a. approximately and provide for it.

## Economic Outlook

### Slowdown in industrial production should be short lived

Industrial production saw 6%+ growth rates during July-October but decelerated to only 4% in the last few months, mainly due to the impact of the drought in 2002, which led to a 5.3% y-o-y contraction in consumer durables during April-December 2002. While acknowledging the lagged impact of the drought, we think things would have been a lot worse were it not for the mitigating effect of the increase in retail lending and buoyancy in services sector.

### Buoyant infrastructure activity likely to continue

Despite facing the worst drought in nearly three decades, what really prevented a sharp fall in industrial activity was positive momentum in infrastructure activity. The budget emphasis on roads, railways, airports and seaports should aid growth, along with hopes for passage of the Electricity Bill.

### Trends in Infrastructure Index and Industrial Production (% Y-o-Y, 3mma)



Source: Office of the Economic Advisor, Ministry of Commerce & Industry.

### Maintain 5.7% GDP growth estimate for FY04

We believe that changing growth drivers – large infrastructure projects coupled with the growing influence of retail credit – will limit the impact of FY03’s poor agriculture. In addition, we believe growth will be helped by the positive ongoing trend in macro variables, including a mildly appreciating rupee, benign inflation and stable to soft interest rates.

Key risk factors would be a prolonged conflict in the Middle East (maybe Syria and Iran after Iraq), heightened tension between India and Pakistan, a second consecutive monsoon failure, mid-term polls and sharp domestic rating downgrades.

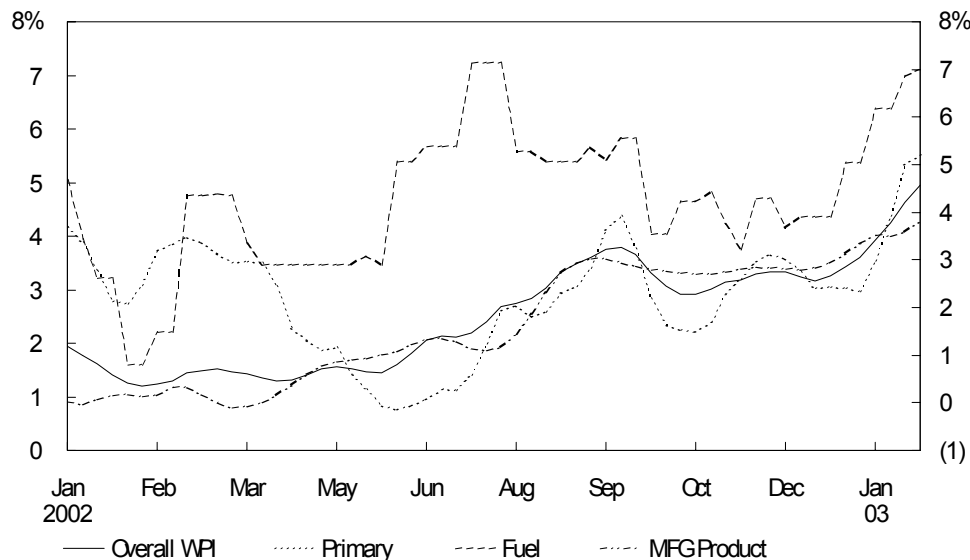
<b>Detailed Breakdown of GDP (% Y-o-Y)</b>							
	Wts*	FY00	FY01	FY02	FY03	FY04E	FY05E
<b>Agriculture</b>	<b>22.2</b>	<b>0.5</b>	<b>-1.4</b>	<b>5.7</b>	<b>-3.1</b>	<b>3.0</b>	<b>3.0</b>
<b>Industry</b>	<b>27.1</b>	<b>5.3</b>	<b>6.5</b>	<b>3.3</b>	<b>6.1</b>	<b>5.8</b>	<b>6.3</b>
Manufacturing	17.1	4.4	7.1	3.4	6.1	5.5	6.2
Mining & Quarrying	2.2	3.5	3.8	1.0	4.8	4.5	4.5
Elect. Gas Water Supply	2.5	6.7	4.1	4.3	5.2	5.0	5.0
Construction	5.3	8.2	6.8	3.7	7.1	7.5	8.0
<b>Services</b>	<b>50.7</b>	<b>9.7</b>	<b>6.2</b>	<b>6.8</b>	<b>7.1</b>	<b>7.0</b>	<b>7.5</b>
Trade, Transport Comm	24.3	8.3	7.8	8.7	7.8	7.0	7.5
Financing & Insurance,	12.7	9.6	3.5	4.5	6.5	8.0	9.0
Community&Social Services	13.7	12.1	6.1	5.6	6.4	5.8	6.0
<b>GDP</b>	<b>100.0</b>	<b>6.0</b>	<b>4.4</b>	<b>5.6</b>	<b>4.4</b>	<b>5.7</b>	<b>6.2</b>

Source: CSO; Citigroup; Wts are for FY03.

### Inflation will creep up, but not for long

Overall WPI has started creeping up in the last few months. A significant portion of this rise is attributed the fuel index. With the dismantling of the APM in April 2002, prices of petroleum products apart from kerosene and LPG are market determined and domestic prices are adjusted on a fortnightly basis. We forecast inflation to decline in 2H03, once oil prices head lower following an expected easing of tensions in the Middle East.

### Current Trends in Inflation (% Y-o-Y, 3mma)

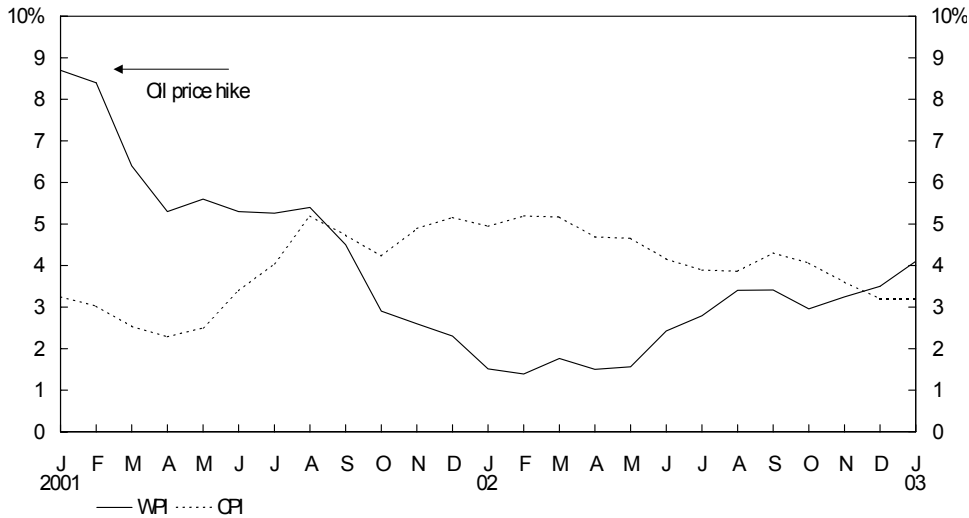


Source: Office of the Economic Advisor; Ministry of Commerce and Industry.

### Stock of food grains limits inflationary pressures

Sharp falls in crop production in the past led to rising inflation, particularly in the Consumer Price Index (CPI) where food items have a weighting of 57%. However, release of surplus stocks of food grains has helped keep inflation low and dampen inflationary expectations arising from the crop failure. This is shown by current trends in the WPI and CPI, where the CPI is now lower than the WPI.

**Recent Trends in the WPI and CPI (% Y-o-Y)**

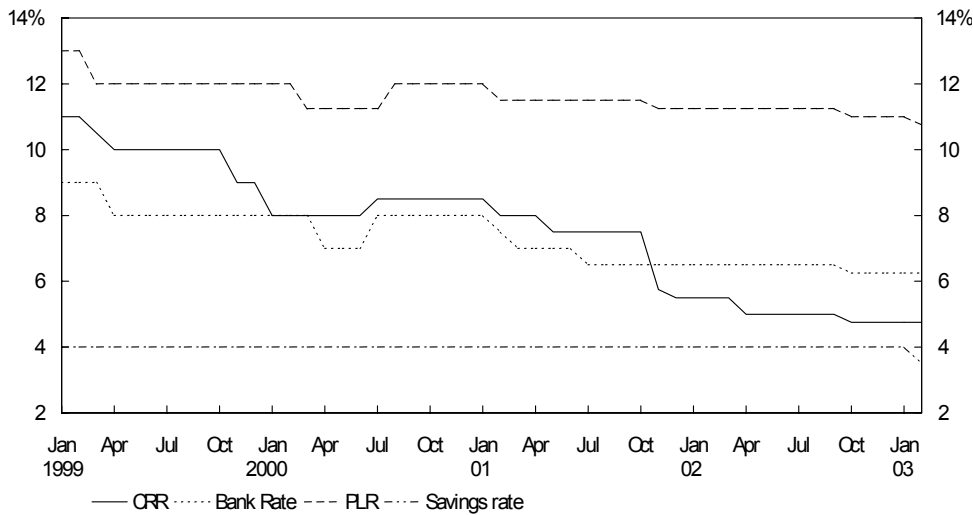


Source: Office of the Economic Advisor; Ministry of Commerce and Industry.

**Higher than expected interest rate cuts will help spur growth**

Despite being a pre-election budget year, the finance minister took the brave decision to reduce the contractual savings rate by 100bps. Shortly after the budget was presented, the RBI cut its savings deposit rate by 50bps. The savings deposit rate had been left unchanged at 4% since April 2000 and thus created a floor for deposit rates. Besides cutting the savings deposit rate, the RBI also cut the repo rate by 50bps from 5.5% to 5%. These rate cuts will allow banks to lower their lending rates and will aid the current boom in retail lending, thus spurring growth.

**Trends in Interest Rates**

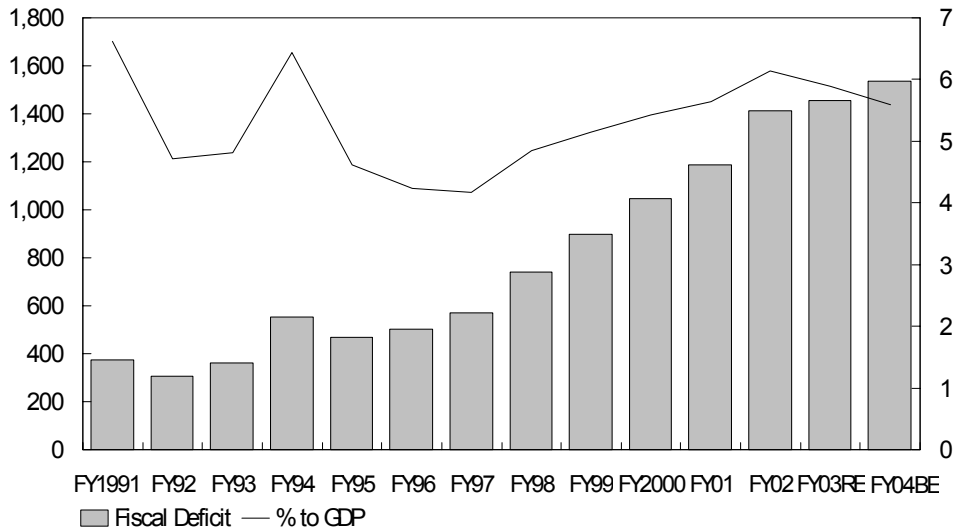


Source: RBI.

## High fiscal deficits remain unresolved issue

While doling out goodies and trying to make everyone happy, the budget has not been able to rein in the fiscal deficit and has thus targeted a deficit of 5.6% for FY04. History indicates that budget deficits differ from revised estimates while revised estimates differ from the final numbers. An example of this was in FY02, where the budget estimate was 4.7%, while the revised estimate was 5.9% and the final estimate released this year was a high 6.1% – the first time the fiscal deficit crossed 6% since 1991.

### Rising Fiscal Deficits — Trend Remains Unchanged



Source: Budget documents.

## Fiscal consolidation moves

- 1 **Cash Management:** The budget proposes to initiate cash management on a pilot basis in some major spending industries, releasing budgetary allocations in a timely manner to avoid mismatches between receipts and expenditures.
- 2 **External debt repayment:** A start has been made with the government prepaying US\$2.7bn of its high-cost debt to the ADB and World Bank. We expect an additional US\$5bn in the coming year.
- 3 **Domestic debt of the Central Government:** The government is proposing a *voluntary* buy back of banks' holdings of central government debt that was contracted under high interest rates. This will likely attract a premium, which will be offered on a transparent basis. If banks declare the premium as business income, this could be used to set off provisions on their NPAs. The key issues are "voluntary" and what would be the level of premium.
- 4 **State Government debt:** The debt swap scheme introduced would allow states to prepay high-cost debt and substitute it with low-coupon-bearing instruments. States are expected to save INR810bn in interest and deferred loan repayments over the residual maturity period of the loans. Two issues arise from this – what is the time period to substitute this debt and how would the central government deficit be impacted by this?

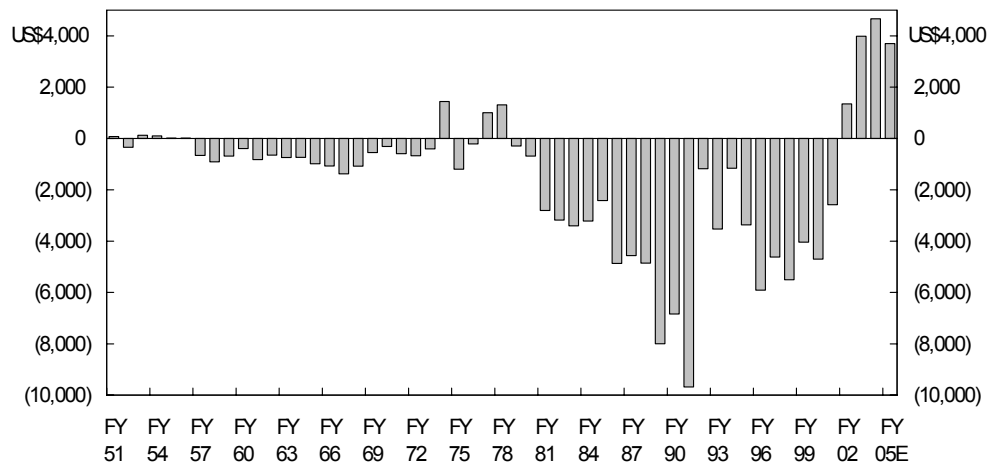
While there are unresolved questions, the overall direction being followed by the Government is positive.

## External Sector

Forex reserves increased US\$22bn in 2002 (US\$16bn during April-December). The key driver for this surge has been the positive structural change in the BoP. From running current account deficits, India recorded a current account surplus in FY02 for the first time in 24 years. While the trade deficit is unlikely to narrow much, the buoyancy in invisibles is likely to continue:

- Software exports, which were US\$6.1bn in FY02, are expected to grow a minimum 20% pa. BPO, which was US\$1.6bn in FY02, is expected to continue to be the engine for the entire sector, growing over 50%
- Apart from IT services, remittances are likely to remain strong. A contributing factor is the fact that the “hawala,” or the unofficial route of getting money into the country, has been totally curbed since the terrorist attacks of Sept 11

### Trends in the Current Account (US Dollars Millions)



### RBI's explanation of build-up in forex reserves

India's forex reserves, excluding gold, increased by US\$21bn during April02-February03. In view of speculation arising from the build-up of reserves in terms of sources and costs, the RBI released a paper explaining the rise. Its explanation included (1) the surplus in the current account has arisen due to strong growth in merchandise and software exports and remittances, which are non-reversible (2) increase in other capital, i.e., export receipts that were kept overseas are now being brought back quicker and (3) valuation changes. Net-net, with the leakages being plugged and Indian industry learning slowly to compete globally and finally starting to hold its own against global competition, the situation on the external front seems pretty secure.

### No evidence of arbitrage in NRI deposits

The RBI study looked at trends in data to November and its finding was that during April-November02 there was a net increase of US\$2.1bn in NRI deposit schemes compared to US\$2.2bn during Apr-Nov01 – thus there is little evidence of arbitrage.

A close look at the various NRI deposit schemes indicates while incrementally the trends in NRI deposits are similar to last year, there has been a surge in NRE deposits (Non-

resident external rupee A/Cs) to US\$4.1bn compared to US\$1.2bn the previous year. This can be partially attributed to money shifting out of the NR(NR) RD to NRE rupee accounts, where the interest rate offered for 1-3 years is 5-6.5% compared to the US, where rates are 1-1.25%, thus making investments in NRE deposits very attractive. Also, this indicates that NRIs are increasingly confident of being able to get their money back and also are more confident of rupee not depreciating much.

**Incremental Inflows into NRI Deposit Schemes (US\$ Million)**

	Apr-Nov 01	Apr-Nov 02
FCNR (B)	528	540
NR (E) RA	1,202	4,128
NR(NR) RD	444	-2,607
<b>Total</b>	<b>2,174</b>	<b>2,061</b>

FCNR (B) - foreign currency non-resident bank a/c; NRE - Non-resident external rupee a/c; NR (NR) RD - Non-resident, non-repatriable rupee accounts - this one has been discontinued since 1 April 2002 with a provision that existing deposits would be allowed until maturity. Source: RBI report on forex reserves.

**Cost of issues not a problem**

Regarding the cost of reserves, the RBI said a substantial portion of the fresh accretion in reserves was due to non-debt creating flows (current account surplus, currency valuation, foreign investment). The debt creating flows account for only 23% of total reserves and thus the cost of accretion is not significant.

**Policy implications of high reserve growth**

- Given the liquidity management issues of holding the exchange rate at current levels and the limited scope to cut domestic interest rates (max 50bps), the RBI is expected to continue to allow a marginal appreciation of the rupee.
- In a bid to manage liquidity, the RBI has pre-paid US\$2.7bn of India's high-cost debt to the World Bank and ADB. We believe we could see a further pre-payment of high-cost debt of US\$5bn.
- Most Asian currencies have appreciated against the US dollar thanks to the bearish sentiment gripping the greenback. The rupee's rise, however, has been modest and thus India still has an edge in exports.

**Accretion of reserves in the region**

**Increase in Forex Assets (Excluding Gold) in 2002**

Country	US\$ Billions.
China	54.3
Hong Kong	0.7
India	18.4
Indonesia	3.3
Korea	18.6
Malaysia	3.7
Philippines	-0.4
Singapore	4.9
Thailand	5.7
<b>Total</b>	<b>109.1</b>

Source: IMF.

## **Economic Scenario : Conclusion**

Given the above economic scenario on the external value of rupee and the interest rates in the economy, no obvious conclusions can be drawn as to whether the rupee will appreciate or depreciate in the long run (i.e. beyond the immediate next couple of years) and whether or not the domestic interest rates will rise. There can be equally plausible reasons in support of either view.

The biggest problem with trying to forecast long term currency and interest rate movements based upon fundamental analysis is that there are too many economic parameters which have a bearing on these market factors and a small deviation in a few of those parameters from the predicted values can accumulate into larger errors as we go ahead in time and lead to the forecast being completely out of sync with reality. Thus, a market view based on fundamental analysis needs to be constantly refined and rebalanced.

Our view is that over the next couple of years we could see increasing amount of investment flows into the country leading to reserves accretion and consequently a gradual appreciation of rupee along with a continued soft bias on interest rates (as again reiterated by RBI Governor in Monetary Policy announcement). However, it is also becoming clear that the downward cycle in interest rates might well be coming to an end and from here on we could be looking at a scenario of stable rates for a couple of years at best and then a gradual rise in interest rates again. Also, this is likely to impact the longer tenors first.

As with all views based on fundamental factors, this view is also subject to changes in the economic scenario as time goes by. In view of such uncertainties and the long tenor of liabilities, it is a good time to review the costs associated with the external loans to the Road Sector on a fully hedged, partially hedged and un-hedged basis and then decide upon a strategy to managed the existing loans as well as decide the sources for future funding requirements.

## Monte Carlo Simulation

This comparison could be done based upon a well-known and widely used technique of Monte Carlo Simulation. The technique is dependent upon a simulation of future currency and interest rates scenario based on historical data and adjusted to accommodate current market expectations and then seeing what could be the possible interest cost for NHAI under the different scenarios i.e. indirect INR loans, un-hedged direct loan or hedged direct loan at a given confidence level. We can also consider different kinds of hedges in this analysis.

This technique does not give a precise answer to the question of the exact cost the Road Sector could incur under any of the scenarios considered but attempts to lay down the worst case scenario at a certain confidence level based upon a statistical analysis of the market factors which affect the cost.

For our analysis we have taken certain assumptions about the future behavior of the two market factors that impact the costs of external loans, namely USD 6m Libor and USD/INR exchange rate. We then calculate the 99% confidence level cost for the external loans which basically gives an estimate of the worst case scenario. Viewed in another way, the cost is likely to be more than the 99% confidence level cost only if there is an extreme movement in the market factors way beyond the normal limits.

99% Confidence Level Cost: The cost for NHAI if there is a 2.33 standard deviation adverse move in a market factor.

The choice of 2.33 standard deviations equates to a 99% confidence interval in a normal distribution and is a requirement defined in the Bank for International Settlements (BIS) norms for market risk measurement for international banks

*In the absence of full actual details on the debt portfolio of NHAI and the details of the foreign currency loans with the Govt. against which indirect loans have been extended to NHAI, we are making certain assumptions about these as detailed below which will present our analysis on a hypothetical portfolio. Also, we are basing our analysis taking the example of one of the indirect loans extended to NHAI by the Government.*

## Assumptions

The Loan we have considered is a USD 589 million loan taken by the Government from IBRD. The loan was contracted in 2001 and has to be drawn down fully by end of 2006. The Loan has got certain commission (1% upfront) and other commitment charges attached to it which we are ignoring for the purpose of these cost calculations. Also, the interest on the Loan is based on USD 6m Libor + 0.75% + a funding spread of IBRD which is not quantified or benchmarked hence for the purpose of this analysis we are assuming the loan to bear an interest rate of Libor + 1.25% i.e. assuming 0.5% as the funding spread of IBRD. The Loan has a repayment schedule as below and assuming that 40% of the loan has been drawn down so far (Given that 40% of the draw-down period is over) we are assuming further that the repayment schedule applies proportionately to this amount.

### 1. Indirect External Loan Details.

#### On NHAI Books.

Status as on:	End April 2003
Amount:	INR 11.37 billion
Tenor:	20 years, (remaining tenor 18 years approx.)
Amount as Grant:	INR 9.1 billion
Amount as Loan:	INR 2.27 billion
Interest rate:	13.5% p.a. payable semi-annually
Amortization:	As per schedule 1

#### On Govt. Books.

Status as on:	End April 2003
Amount:	USD 235.6 million
Average draw down rate:	48.25
Tenor:	20 years, (remaining tenor 18 years approx.)
Interest rate:	USD 6m Libor + 1.75%
Amortization:	As per schedule 1

#### Schedule 1

Dates	Repayment (USD)	USD Outstanding
30-Apr-03	-	235,600,000.00
15-Sep-03	-	235,600,000.00
15-Mar-04	-	235,600,000.00
15-Sep-04	-	235,600,000.00
15-Mar-05	-	235,600,000.00
15-Sep-05	-	235,600,000.00

15-Mar-06	-	235,600,000.00
15-Sep-06	-	235,600,000.00
15-Mar-07	4,952,000.00	230,648,000.00
15-Sep-07	5,100,000.00	225,548,000.00
15-Mar-08	5,254,000.00	220,294,000.00
15-Sep-08	5,412,000.00	214,882,000.00
15-Mar-09	5,574,000.00	209,308,000.00
15-Sep-09	5,740,000.00	203,568,000.00
15-Mar-10	5,914,000.00	197,654,000.00
15-Sep-10	6,090,000.00	191,564,000.00
15-Mar-11	6,274,000.00	185,290,000.00
15-Sep-11	6,462,000.00	178,828,000.00
15-Mar-12	6,656,000.00	172,172,000.00
15-Sep-12	6,854,000.00	165,318,000.00
15-Mar-13	7,060,000.00	158,258,000.00
15-Sep-13	7,272,000.00	150,986,000.00
15-Mar-14	7,490,000.00	143,496,000.00
15-Sep-14	7,716,000.00	135,780,000.00
15-Mar-15	7,946,000.00	127,834,000.00
15-Sep-15	8,186,000.00	119,648,000.00
15-Mar-16	8,430,000.00	111,218,000.00
15-Sep-16	8,684,000.00	102,534,000.00
15-Mar-17	8,944,000.00	93,590,000.00
15-Sep-17	9,212,000.00	84,378,000.00
15-Mar-18	9,488,000.00	74,890,000.00
15-Sep-18	9,774,000.00	65,116,000.00
15-Mar-19	10,066,000.00	55,050,000.00
15-Sep-19	10,368,000.00	44,682,000.00
15-Mar-20	10,680,000.00	34,002,000.00
15-Sep-20	11,000,000.00	23,002,000.00
15-Mar-21	11,330,000.00	11,672,000.00
15-Sep-21	11,672,000.00	0.00

## 2. Spot FX simulation related assumptions.

- INR will exhibit similar volatility as in the more recent past rather than that observed over a longer period like the last 5 years. Hence volatility is taken as 3.5% p.a. This is based upon the expectations in the market coupled with historical volatility over the last few years.
- USD/INR spot rate follows a Log Normal Distribution centered on the forward rate for 18 years. (This assumption is based on the classical economic theory).
- Spot INR has a 20% tendency to move towards the forward rate i.e. in any given time interval, the move in spot USD/INR rate from its initial value to the final value can be explained to the extent of 20% by its tendency to move towards forward rate in accordance with the classical economic theory and

80% of the move is based upon short term market factors which are not known currently and hence is random.

4. USD Libor related assumptions.

- 18 year USD Cap volatility (35%) is a fair estimate of USD 6m Libor volatility.
- 18 year USD Forward Libor rate of 5.75% is a fair estimate of the mean of the Log Normal distribution, which Libor tends to follow.
- USD Libor has a 30% probability of moving in the direction of the mean.
- Interest rates, as per classical economic theory, tend to be mean reverting i.e. they tend to move around a long term average and move in tandem with the business cycle in the economy with a certain lag. Given the situation in USA currently where the interest rates over the last two years have already come down to 5 decade lows, we feel that the rates are at the bottom of the cycle and should be reverting to the mean which also is around 6% on a long term basis for USA.

5. Current Hedging Cost Levels

- USD/INR currency swap (see Annexure 1) level = 6.79% p.a. semi-annual, A/365
- 10y USD/INR Principal only swap (see Annexure 2) level = 0.9% p.a. semi-annual, A/365
- 10y USD/INR Coupon only swap (see Annexure 3) level = 5.95% p.a. semi-annual, A/365

6. Hedging choices

- NHAI can do a currency swap on the direct loan.
- In case of indirect loans, the Govt. could enter into a hedge and pass on the benefits to NHAI.
- NHAI/Govt. can run the direct loan un-hedged.
- NHAI/Govt. can hedge the currency risk on the principal by way of a principal swap while leaving the coupon payments open.
- The interest rate risks can be hedged by way of a Coupon only swap while leaving the currency risk open on principal amount.

## Methodology

### Simulation

We have assumed that the USD/INR spot rate and USD 6m Libor rate will follow a lognormal distribution centered on the current eighteen-year forward rate (F). Starting from the current spot rate the spot has a P(fwd) probability of moving towards the

forward rate and  $(1-P(\text{fwd}))$  probability of moving randomly up or down. Accordingly the simulation is done using the below formula for Spot in period I ( $S_i$ ):

$$S_i = S_{i-1} * (1 + \Psi * \sigma) * (1 - P(\text{fwd})) + (P(\text{fwd}) * F)$$

Where:

$\Psi$  = A random variable distributed Normally.

$\sigma$  = Log Normal Volatility of Spot rates.

We have divided the 18-year period into intervals of 6 months each i.e.  $i$  varies from 1 to 36 and We have done 1000 trials for each market factor.

### Cost Calculations

Next, we worked out the cash flows under three different scenarios i.e. un-hedged loan, Loan hedged with a Principal Only Swap leaving the coupon flows un-hedged and hedging the coupon flows with a Coupon Only Swap and leaving the principal un-hedged. For each of the three cases, there were thus 1000 possible cash flow streams. We then worked out the IRR of the cash flow streams. As we have assumed the average drawdown rate of 48.25 for the foreign currency loans, the initial cash flow is then the USD notional \* 48.25. Thus for each of the three cases we now have 1000 IRRs which are themselves distributed normally.

We then calculate the Mean and Standard Deviation for the three cases. As per the properties of Normal distribution, if we want to calculate the expected cost in the three cases with 99% confidence interval we need to calculate  $(2.33 * \text{Standard Deviation} + \text{Mean})$ . Thus for each of the three cases we can calculate the expected cost i.e. IRR with 99% confidence level.

## Results

### INR Simulation

Mean: 55.21                      Standard Deviation: 1.89

99% confidence level value:  $55.21 + 2.33 * 1.89 = 59.61$

Hence the expected value of USD/INR in 18 years time with 99% confidence level is going to be less than 59.61.

**Libor Simulation**

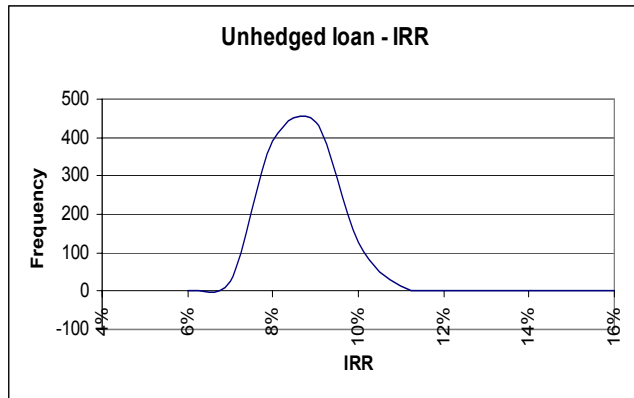
Mean: 5.76%                      Standard Deviation: 1.51%

99% confidence level value:  $5.76 + 2.33 * 1.51 = 9.29\%$

Hence the expected value of USD 6m Libor in 18 years time with 99% confidence level is going to be less than 9.29%.

**Un-hedged Loan**

Expected Cost: 8.22%  
 Standard Deviation: 0.74%  
 99% confidence level value:  
 $8.22\% + 2.33 * 0.74\% = 9.94\%$



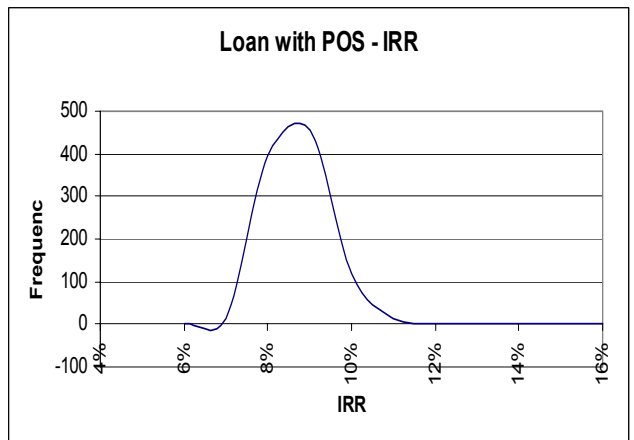
Hence the expected cost of the USD loan at 6m Libor + 125 bps p.a. for 18 years (with the amortization schedule as above) on an un-hedged basis is likely to be less than 9.94% with 99% confidence level. The distribution of IRRs is shown alongside:

**Loan hedged with a Currency Swap**

Cost per annum in INR: 6.79%  
 Current Spot rate: 47.20  
 Average Draw down rate: 48.25  
 Effective IRR = 6.65% p.a., semi-annual

**Loan Hedged with a Principal Only Swap**

Expected Cost: 8.23%  
 Standard Deviation: 0.69%  
 99% confidence level value:  
 $6.23\% + 2.33 * 0.69\% = 9.83\%$



Hence the expected cost of the USD loan at 6m Libor + 125bps p.a. for 18 years (with the amortization schedule as above) with only a Principal Only Swap as hedge is likely to be less than

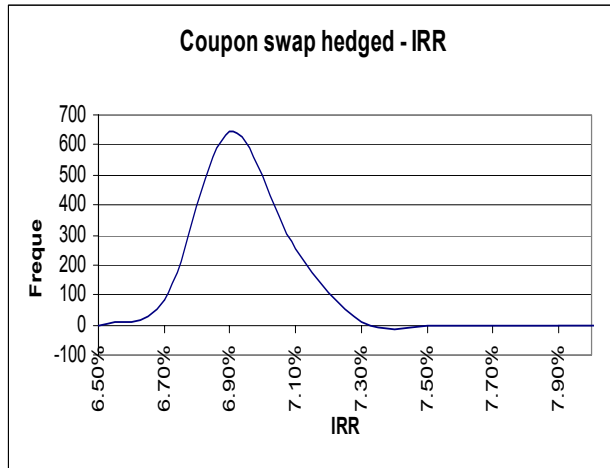
9.83% with 99% confidence level. The distribution of IRRs is shown alongside:

**Loan Hedged with a Coupon Only Swap**

Expected Cost: 6.84%  
Standard Deviation: 0.11%

99% confidence level value:  
 $6.84\% + 2.33 * 0.11\% = 7.08\%$

Hence the expected cost of the USD loan at 6m Libor + 125bps p.a. for 18 years (with the amortization schedule as above) with only a Coupon Only Swap as hedge is likely to be less than 7.08% with 99% confidence level. The distribution of IRRs is shown alongside:



**Sensitivity Analysis**

The Simulation technique used tries to use a combination of Random Walk theory and Market expectations based on fundamental factors to simulate the path of the market factors and is heavily dependent upon the probability of move in the direction of forward rate. Hence, even though the analysis has been done taking probabilities to be 20% in case of USD/INR spot rate and 30% in case of USD Libor, we also considered the 99% confidence level costs under the three scenarios being discussed taking different combinations of these probabilities for both market factors. While there are differences in costs at different probability levels, the overall trend clearly remains the same and the range of costs at 99% confidence level is just about 1% wide. Overall, under all cases, a coupon swap hedge comes out as the best option.

Unhedged Loan scenarios									
Libor Prob	INR Prob.								
	10%	20%	30%	40%	50%	60%	70%	80%	90%
10%	10.001%	9.887%	9.795%	9.732%	9.688%	9.656%	9.632%	9.614%	9.600%
20%	10.169%	10.080%	10.001%	9.943%	9.901%	9.870%	9.846%	9.828%	9.813%
30%	10.015%	9.935%	9.866%	9.814%	9.776%	9.748%	9.726%	9.708%	9.694%
40%	9.854%	9.775%	9.710%	9.663%	9.629%	9.603%	9.583%	9.567%	9.554%
50%	9.722%	9.642%	9.579%	9.535%	9.504%	9.480%	9.461%	9.447%	9.435%
60%	9.618%	9.536%	9.474%	9.432%	9.402%	9.380%	9.363%	9.349%	9.338%
70%	9.536%	9.452%	9.390%	9.348%	9.319%	9.299%	9.283%	9.270%	9.260%
80%	9.471%	9.384%	9.322%	9.281%	9.252%	9.232%	9.217%	9.206%	9.197%
90%	9.418%	9.330%	9.267%	9.226%	9.198%	9.178%	9.163%	9.152%	9.144%

POS Scenario									
Libor Prob.	INR Prob.								
	10%	20%	30%	40%	50%	60%	70%	80%	90%
10%	9.788%	9.782%	9.749%	9.720%	9.697%	9.679%	9.665%	9.654%	9.645%
20%	9.959%	9.981%	9.962%	9.939%	9.919%	9.902%	9.889%	9.877%	9.868%
30%	9.797%	9.829%	9.821%	9.805%	9.790%	9.776%	9.764%	9.753%	9.745%
40%	9.629%	9.663%	9.660%	9.649%	9.637%	9.626%	9.616%	9.607%	9.599%
50%	9.492%	9.524%	9.523%	9.516%	9.506%	9.497%	9.489%	9.482%	9.475%
60%	9.384%	9.413%	9.413%	9.408%	9.400%	9.393%	9.386%	9.380%	9.375%
70%	9.299%	9.325%	9.325%	9.320%	9.314%	9.308%	9.303%	9.298%	9.293%
80%	9.230%	9.253%	9.253%	9.249%	9.244%	9.239%	9.235%	9.231%	9.227%
90%	9.175%	9.195%	9.194%	9.190%	9.185%	9.181%	9.178%	9.174%	9.172%

Coupon swap scenario									
Libor Prob.	INR Prob.								
	10%	20%	30%	40%	50%	60%	70%	80%	90%
10%	7.214%	7.083%	7.005%	6.957%	6.926%	6.904%	6.887%	6.875%	6.866%
20%	7.214%	7.083%	7.005%	6.957%	6.926%	6.904%	6.887%	6.875%	6.866%
30%	7.214%	7.083%	7.005%	6.957%	6.926%	6.904%	6.887%	6.875%	6.866%
40%	7.214%	7.083%	7.005%	6.957%	6.926%	6.904%	6.887%	6.875%	6.866%
50%	7.214%	7.083%	7.005%	6.957%	6.926%	6.904%	6.887%	6.875%	6.866%
60%	7.214%	7.083%	7.005%	6.957%	6.926%	6.904%	6.887%	6.875%	6.866%
70%	7.214%	7.083%	7.005%	6.957%	6.926%	6.904%	6.887%	6.875%	6.866%
80%	7.214%	7.083%	7.005%	6.957%	6.926%	6.904%	6.887%	6.875%	6.866%
90%	7.214%	7.083%	7.005%	6.957%	6.926%	6.904%	6.887%	6.875%	6.866%

## Limitations

1. Actual movement of Market Factors may not follow a lognormal distribution centered on the forward rates.
2. The volatility estimates may not match the realized volatility in market factors.

## Conclusions

1. In case of indirect loans from the Government, the financing cost for the Road Sector can be reduced to a large extent whether or not the Government decides to hedge the market risks.

If the Government hedges the market risks at today's rates using any of the three alternatives viz. Currency Swap, Coupon Only Swap or Principal Only Swap, then the cost overall is likely to be lower than the cost being charged currently to the Road sector in 2 cases while it is certainly going to be much lower in the case of Currency Swap at 6.63% effective IRR.

If the Government does not hedge the market risks, even then the cost is likely to be less than 9.94% with 99% confidence and the cost of the indirect loans to Road Sector can be reduced to that extent.

However, since the funds being used for the Road Sector are Public funds ultimately and neither the Government nor NHAI are in the business of managing financial risks which may involve putting the public funds at risk or worse a sub-optimal use of those funds, it is advisable to go in for a full hedge using a currency swap and reduce the cost to the Road Sector which will allow the funds so released to be used elsewhere in a timely fashion.

Also for the amount of money given as grant to Road Sector, Government would still have to be provisioning in its budget for the loan repayment that would likely be happening at the same rate as the cost being charged from Road Sector. By implementing the hedge, even that provisioning would come down and effectively release funds being blocked currently.

2. In case of Direct Loans as well, the same conclusions as above apply but for NHAI directly.
3. In spite of the best analyses that may be done, there is always a chance for the remaining 1% of the events to happen hence the decision to proceed or not proceed on the hedging path should be well researched and documented and should not be second guessed in hind-sight.
4. The current interest rate environment and spot INR rates are unprecedented and provide an opportunity to lock in to long term rates at very low levels and should be utilized at least for part of the funding portfolio.
5. The current environment also provides an unprecedented opportunity to the Road sector to raise fresh funding on a long-term basis at low costs. With the external sector of the economy secure and in fact doing wonderfully well, long tenor external funding should be available today at cheaper levels than before. Further

with the prevailing low interest rate environment the fully hedged cost as well comes to a pretty low number.

6. On NHAI's loan portfolio, using our assumptions above the possible savings are as below:

Direct Loans:  $9.94\% - 6.65\% = 3.29\%$  p.a. semi-annual or on a notional of USD 180 million an amount of INR 279.5 million per annum.

Indirect Loans:  $13.5\% - 7.65\% = 5.85\%$  p.a. semi-annual or on a notional of INR 190 billion an amount of INR 2.22 billion per annum.(assuming 80% of these loans come as grant to NHAI from Govt. and 1% commission payable on the loan is added straight to the swapped IRR)

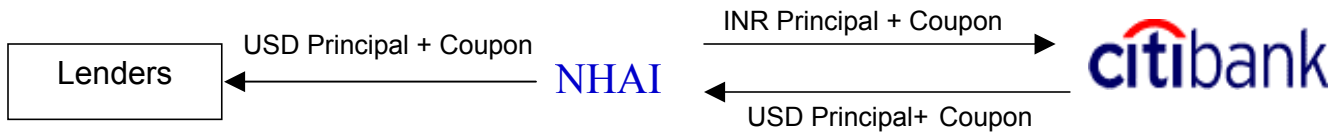
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## ANNEXURE 1

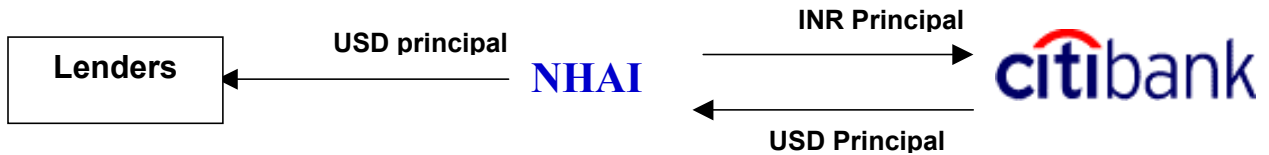
### Currency Swap



- Contract between two parties to exchange periodic coupon payments in two different currencies over a period of time
- Also, the notional principals are exchanged on the maturity of the swap. The initial exchange of principal is optional.
- Effectively, this implies re-denominating a liability into the alternate currency
- Coupon payments are calculated based on notional principal amounts in two different currencies.
- Notional principals are determined at inception using the spot exchange rate.
- Coupon payments can be fixed vs fixed, fixed vs floating, or floating vs floating.

## ANNEXURE 2

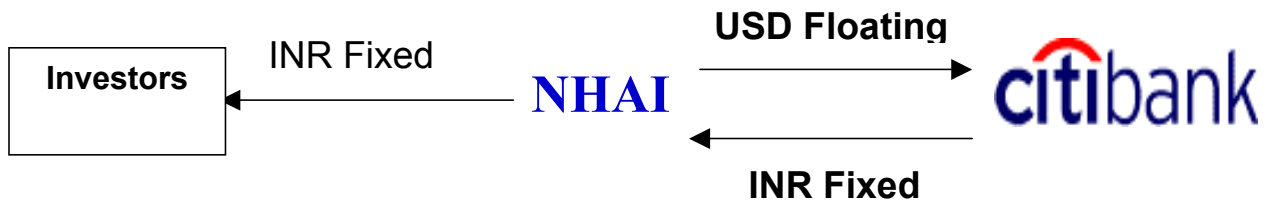
### *Principal Only Swap*



- A cross-currency swap with only principal exchange
- On the maturity date, one party receives the principal in Currency 1 and pays the principal in Currency 2, the exchange rate being equal to the spot rate on the date of the transaction
- The POS is equivalent to a long dated forward contract to buy USD, with the forward premium being amortized over the life of the swap

## Annexure 3

### *Coupon Only Swap*



- The principles are the same as for an IRS: On the trade date, both sides of the transaction have equivalent NPVs.
- This structure re-designates the INR fixed coupon into a floating USD coupon
- The coupon swap gives an “inception carry” which is equal to the difference in steepness between the two yield curves
- FX risk is very low in a coupon swap since the principal is not at risk