CHAPTER 3
FX MARKETS AND RISK MANAGEMENT TOOLS

The development of foreign exchange market in India, the factors causing exchange rate fluctuations of USD/INR and product availability for FX risk mitigation and management in India are studied in this chapter. Correlations between variables of FX market, trend analysis of various components covered. Testing of hypothesis is also included in his chapter.

3.1 FX market in India:
Officially, the Indian Rupee has a ‘market determined exchange rate’. But most of the times, RBI intervenes extensively to regulate this market, therefore it is called a ‘dirty float’ or a ‘managed float’. The RBI trades actively on the USD/INR market to deliver a very low volatility; and other exchange rates like the EUR/INR, GBP/INR or JPY/INR have volatilities which are typical of floating exchange rates. The psychological level is normally watched by the market and it keeps changing from time to time. At the time of independence in 1947, the INR was pegged to GBP at 13.33 Rs. (equivalent to 1USD=INR 3.31)31. Over the period, the INR has depreciated/devalued gradually due to impact of wars in 1960s and 70’s, deceleration of economic growth and in line with USD movement against other currencies. It touched 26 level on 3 Jul 1991 when it was devalued and the rest is history after the initiation of financial reforms. Currently it is trading at around USD 1 = INR 49 levels. The pegged exchange rate is accompanied by an elaborate system of capital controls. On the current account, there are no currency conversion restrictions hindering buying or selling foreign exchange (though trade barriers do exist). On the capital account, “foreign institutional investors” have convertibility to bring money in and out of the country and buy securities (subject to an elaborate maze of quantitative restrictions). Local firms are able to take capital out of the country in order to expand globally. Local households are highly restricted in their ability to do global diversification. Owing to an enormous expansion of the current account and the capital account, India is increasingly moving into de facto convertibility.

3.2 FX market developments:
1991 – India began to lift restrictions on its currency. A series of reforms remove restrictions on current account transactions including trade, interest payments & remittances and on some capital assets-based transactions.

1997 – A panel set up to explore capital account convertibility recommended India move towards full convertibility by 2000, but timetable abandoned in the wake of the 1997-98 East Asian financial crisis.

2003 – Government of India asks Finance ministry and RBI to prepare a road map for moving towards capital account convertibility. Chronology FX market developments is given at Appendix 1.

3.3 Factors weighing on the Rupee:
3.3.1 Trade and Current Account Deficit On the surface it would appear that oil would be the cause of the widening trade deficit. But non-oil imports are growing faster than oil imports. The largest growth in imports is... gold!

3.3.2 Fickle Financing is largely being driven by fickle sources such as External Commercial Borrowings (ECBs), Non-Resident Indian deposits (where carry trades are getting wiped out every day, with the Federal Reserve likely to up the U.S. fed funds. The volatile FII inflows are unlikely to continue at the scorching pace they have set so far.

3.3.3 Capital Flows
The Indian rupee (INR) is currently experiencing conflicting undercurrents. On the positive side, the INR is being pushed higher by capital inflows, partly due to India’s strong growth rate, but also due to speculation that there may be an imminent FX regime adjustment in China. Such an adjustment may in turn impact the Indian economy. On the negative side, the Indian trade deficit is at record levels – on a monthly basis – and export prospects look less encouraging given the projected slowdown in global growth. As a result, the INR is looking increasingly overvalued from a medium- to long-term fundamental perspective. However, in our view, positive cyclical fundamentals may push the INR even stronger in the near term. Investors continue to look favourably it would seem on Indian
economic fundamentals and as a result invest in Indian local markets. Indeed, for at least the last 6 months, there has been a marked and distinct change in how global investors have viewed India. As a result, we may be seeing a structural rather than cyclical shift in capital inflows, although it is probably too early to say. Certainly, government economic policy has done much to encourage such a shift though significant fiscal and infrastructure challenges remain.

3.3.4 The REER of rupee on the trade weighted index is used by RBI to assess the INR’s competitiveness. Based on the Standard Chartered INR REER index, which essentially replicates the RBI’s 5-country REER (base year 1993-94), the INR’s real value has rarely been outside a 3.5-4.0% band. However, it is currently roughly 7% overvalued in comparison with its equilibrium value of 100 (1993-94 parity). An overtly overvalued currency over a sustained period of time will impact India’s trade competitiveness. This is because an overvalued currency makes imports cheaper and exports more expensive and thus exacerbates trade imbalances and hurts growth. Thus, the central bank in such a situation can either intervene in the foreign exchange markets and correct the imbalances or alternatively allow market forces to do so.

3.3.5 IMD Deposits Withdrawal Pressures in December of 5 year IMD deposits of US $ 5 bn issued by SBI are due for redemption; may put pressure on the rupee.

3.3.6 Equity Impact The Indian software outsourcing sector loves a depreciating rupee, as its earnings to a large extent are denominated in U.S. dollars stand to benefit from a weak Rupee.

3.3.7 Inflation, Liquidity, Pegging of exchange rate
(a) Ajay Shah\(^\text{32}\) offers a provocative essay – What RBI Wants? after CRR/repo hikes in April 2007 by RBI in an attempt to tame inflation.

A rupee appreciation directly assists inflation control. But events have shown that when faced with such a choice between pegging the exchange rate and controlling inflation, the RBI is not interested in controlling inflation. However, under a shroud of

secrecy, the RBI has purchased dollars, thus injecting liquidity into the economy, which has fuelled inflation. The RBI purchased $3.2 billion in November, $1.8 billion in December and $2.8 billion in January. Between April 2006 and January 2007, the RBI bought $12.6 billion, thus adding Rs 56,543 crore to the domestic monetary base.

1.1. The Financial Express reports that interest rates may continue to rise and/or remain high this year, as the RBI seeks to control inflation & credit growth – "We expect 2007 to be the year of multiple policy instruments wherein if liquidity conditions ease, we could see the RBI not hesitating to hike the cash reserve ratio to absorb excess liquidity."

One beneficiary of this should be the Indian rupee - if Indian interest rates remain high, inflation begins to drop, and the US Fed doesn't raise (or lowers) interest rates, the dollar-rupee rate will drop further (i.e. the rupee will strengthen) – boosted by the strong FDI/FII inflows expected this year (2007).

"A move towards greater CAC raises a conflict between two major policy objectives — monetary policy autonomy and exchange rate stability. This conflict, known as the 'Impossible Trinity', implies that it is impossible for a country to achieve simultaneously stable exchange rates, monetary policy freedom and CAC". Or to put it simply, if the RBI wants to contain inflation via interest rates, it will have to let the rupee appreciate further.

1.2. Liquidity crunch – Record moves in call rates & Indian rupee

Isn't it amazing what a liquidity squeeze can do? Money market rates touched 9-year highs as the liquidity squeeze in the banking system worsened – the overnight call money rate touched 60% intra-day on March 21, 2007. That in turn drove banks, which had exhausted their borrowing limits in the call money market, to swap dollars for rupees – which made the rupee jump to a 19-month high of Rs 43.74 per dollar.

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33 Financial Express Article, March 27, 2007
34 Business Standard Article, March 21, 2007
3.3.8 Year end demand and supply
The Indian rupee has been on a tear lately, going from 44 in mid-February to 44.7 in early March 2007, and then a huge move to 43 & below over the past 3 weeks. The key question - is this just a year-end quirk, or a significant bullish move in the dollar/rupee rate? Such questions ponder over which needs to be understood.

3.3.9 Trade deficits
In 2004/05 India recorded its largest ever-annual trade deficit of –USD26.5bln due to high oil and goods imports. Even the trade gap excluding oil imports has been negative since mid-2004. This high deficit was despite a healthy 25% growth in exports. More recently the monthly trade deficit in April 2005 was a record –USD3.85bln, the largest monthly deficit in India’s history. The current account has also deteriorated switching from a record high surplus of USD8.1bln in 2003/04 into deficit. In the first 9 months of 2004/05 the deficit stood at –USD7.4bln. We expect the current account to remain in deficit (-1.0% of GDP) in 2004/05 and (-0.8%) in 2005/06.

3.3.10 Denomination of FX transactions by Indian corporates
The majority of Indian companies have at least 80% of their foreign exchange transactions in US Dollars. This is wholly unacceptable from the point of view of prudent Risk Management. “Don’t put all your eggs in one basket” is the essence of Risk Diversification, one of the cornerstones of prudent Risk Management.

Dollar to Rupee risks. Many factors affect the Rupee rate. Every serious event in one of the leading G-8 countries may lead to fluctuations of the unstable Indian currency. Not to mention jumping and chaotic oil prices.

Disadvantages:
1. The very nature or structure of the Dollar Rupee market can be harmful because it is small, thin and illiquid. Thus, dealer spreads are quite wide and in times of volatility, the price can move in large gaps.
2. Impacted in full by the Trend of the market. For instance, if the Rupee is depreciating, its impact will be felt in full by an Importer.

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Economic article Mar 29, 2007
3. Dollar to Rupee exchanging, in particular, brings the following risks:

1) Lack of Flexibility...Payables once covered cannot be cancelled and rebooked.

2) Unpredictability of the Dollar to Rupee rate. The Rupee is not a freely traded currency and hence extremely difficult to predict. The normal tools of currency forecasting, such as Technical Analysis, are best suited to freely traded markets.

3) Lack of Information... Information on Dollar to Rupee and Rupee to Dollar rates is not freely available to all market participants. Only subscribers to expensive “quote services” can get accurate information.

Advantages of Major currencies

1. By diversifying into a more liquid market, such as Euro-Dollar, the risk arising from the Structure of the Indian Rupee Market can be hedged.

2. Trends in one currency can be hedged by offsetting trends in another currency.

3. These constraints do not apply in the case of the Major currencies:

1) Flexibility...Hedge contracts in Euro-Dollar or Dollar-Yen etc. can be entered into and squared off as many times as required.

2) Predictability...the Majors are much more predictable and liquid than Dollar-Rupee and hence Entry-Exit-Stop Loss can be planned with ease, accuracy and effectiveness.

3) Free Information...The Internet provides LIVE and FREE prices on currencies.

The biggest beneficiaries from the Rupee appreciation are importers, as the Dollar is now worth less for every rupee or to put it in different terms, less rupee can buy more dollar denominated assets/commodities/goods. Among the importers, companies from energy dependent sectors are likely to benefit in a significant manner (energy, paints and few textile majors). Companies that source raw materials from the global markets and are largely domestic demand driven could potentially witness margin improvement. Besides companies, rupee appreciation is also a positive for the government’s financials and capital goods sector (most of the equipments are imported, as the country is technology deficient).

3.3.11 Volatility of Rupee – concerns by FICCI

With the rupee appreciating by as much as four per cent over a fortnight in March-April, the Federation of Indian Chambers of Commerce and Industry\(^{36}\) has voiced economic time article, April 22, 2004, FICCI voices concerns over Rupee fluctuations.
concern at the volatility in the rupee exchange rates, saying such uncertainties should be avoided. The then FICCI President said that sharp fluctuations in the short term created problems of adjustment for the domestic industry. Against the backdrop of the rupee’s volatility he welcomed the new market stabilisation bond scheme, which he felt could be an effective instrument in smoothening out the fluctuations.

3.3.12 Summary of factors affecting Exchange rates

⇒ Floating Exchange Rates – Technical Analysis
In a floating exchange rate environment, the exchange rate responds to the flow of imports and exports, the flow of capital, relative inflation rates and more. Often, limits are placed on exchange rate fluctuations according to government policies.

⇒ The Merchandise Trade Balance
One factor affecting the exchange rate between currencies is the merchandise trade balance. This is the net difference between the value of merchandise being exported and imported into a particular country. For example, the net difference between the Canadian demand for US dollars to buy American merchandise, and the supply of Canadian dollars affected by the Americans’ purchase of Canadian merchandise, is the merchandise trade balance between the two countries.

⇒ Flow of funds to pay for stocks and bonds
The flow of funds between countries to pay for stocks and bonds also affects the currency exchange rate between countries. However, in the near term, capital flows are greatly influenced by yield differentials.

⇒ Yield differentials and their affect on currency values
A yield differential is the difference between interest rates in various countries and how it affects currency values. As an example, let’s use German and American securities to illustrate how interest rates affect exchange rates. All else being equal it stands to reason that a higher yield on German securities (compared to American securities) would make German securities more attractive. What’s more, an increase in German yields would raise the flow of U.S. dollars into German securities, and decrease the outflow of Deutsche marks to American securities. This increased flow of funds into Germany would lower the value of the U.S. dollar and increase the value of the Deutsche mark. Hence, the Deutsche mark to U.S. dollar ratio, as it is represented in the foreign exchange market, would potentially decrease.
Rate of inflation:
Consumers try to avoid the eroding effect inflation has on their purchasing power. Consequently, goods from countries with a low inflation rate become more attractive than the goods from countries with higher inflation. In turn, the currency from the lower inflation country rises in value, while the currency from the higher inflation country falls in value. Both the inflation factor and the purchasing power of the currencies directly impact currency exchange rates. For example, if USA is experiencing lower inflation than its trading partner Germany, the DM/USD ratio would rise to reflect the growing price level in Germany relative to the United States. This factor is rooted in the concept of purchasing power parity. It holds that, over the long run, a currency exchange rate adjusts to reflect the difference in price levels between countries.

Fundamental and Technical Analysis
Fundamental Analysis tries to understand price moves in the market by analyzing the economic factors that can affect the price of a particular financial instrument, in this case, currencies. Importance is placed on interest rates, trade balance, government policies, market supply and demand, and a myriad of other factors that can affect the intrinsic value of a currency against another currency.

Technical Analysis, on the other hand, states that all the factors whether it be economic, political, or even the effect of weather on the value (or price) of a currency is all factored into the ‘market price’ of a currency. It is therefore only necessary to study the technical charts, which show all the effects, and all the causes that a “fundamentalist” would study. Thus the study of price movement is of primary importance to a “Technician” to determine where the markets are going.

In reality, both factors are important in determining the value of buying and selling currencies. Whichever school of thought you adhere to, the fact remains that when the perceived value of a currency is over-priced it will be sold, if the perceived value is under-priced it will be bought. If there are more ‘sellers’ in the marketplace, the price will go down. If there are more ‘buyers’ than ‘sellers’ the price will go up.
3.4 FX Instruments

Spot rates
An FX transaction is the simultaneous purchase and sale of one currency against another currency at an agreed price. Each party promises to pay the other a certain amount of currency on an agreed date called Value Date. By convention this value date is set for two business days after the transaction date, this will enable the two parties to effect payment on good time.

A transaction conducted on this basis is called Spot quotation, and it may either be a Direct Quotation or an Indirect Quotation.

Direct quote\(^\text{37}\) is when the Foreign Currency (FC) is the base currency, and the exchange rate is expressed as the amount of a local currency per one unit of FC, For eg. USD/INR = 44.1250 meaning that USD 1 = INR 44.1250; EUR/USD = 1.3100, where 1EUR = USD 1.3100.

Indirect quote is when the FC is not the base currency and the exchange rate is expressed as the amount of FC per one unit of the local currency, like Rs.(INR) 100 =USD 2.5000.

When asked for a quotation, a dealer will give two rates called the “Bid and Offer rate”, in other words the rate at which he is willing to buy and another at which he is willing to sell.

Forwards, Outrights & Swaps
All deals that have to be delivered beyond two business days from transaction date (i.e. after spot) are considered as Forward or Outright contracts.

The forward rate is composed of the spot rate plus or minus the interest rate differential between two currencies that is expressed in points\(^\text{38}\).

\(^{37}\) C. Jeevanandam, 1993, A brief course on Foreign Exchange Arithmetic, New Delhi, Sultan Chand & Sons, Page 9

\(^{38}\) Ibid, page 12
These forward points are subject to move, upward or downward, according to interest rate differential.

In addition to the flexibility of settling future payments, Forwards are more appropriate than spots if a company has a strong directional view of expected movements in exchange rates. But certainty is rare and hedging entirely with forwards may leave a company locked into unfavourable exchange rates.

DERIVATIVES

Derivative instrument is one that derives its value from some underlying variable or variables. The underlying variables could be the price of a financial asset, an interest rate, the spread between two interest rates, or the amount of snowfall in Aspen, Colorado or Index of S&P 500 or Dow Zones Index. Indeed, the possibilities of variables underlying a derivative contract are limitless.

Generally, all derivative instruments are not traded in organised exchanges. These instruments include Forwards, Swaps, FRAs, Barrier Options, Futures.

FORWARD CONTRACTS

A forward contract is an over-the-counter agreement between two parties for the future delivery of the underlying at a specified price at the end of a designated time period. The party that assumes the long (short) position is obligated to buy (sell) the underlying at the specified price. The terms of the contract are the product of negotiation between the two parties. No money changes hands between the parties at the time the forward contract is established. Both sides are making a promise to engage in a transaction in the future according to terms negotiated upfront.

At expiration, the party with the long position pays the specified price called the forward price in exchange for delivery of the underlying from the party with the short position. The payoff of the forward contract for the long position on the expiration date is simply the difference between the price of the underlying minus the forward price. Conversely, the payoff of the forward contract for the short position on the expiration date is the

difference between the forward price minus the price of the underlying. Clearly, a forward contract is a zero-sum game. A forward contract involves potential credit risk for both the buyer and the seller depending on the relationship between the never changing contract rate and the ever changing market rate.

SWAPS

A Swap contract is defined as the simultaneous purchase and sale of identical amounts of a currency for different value dates. In other words, it is a combination of a spot transaction and a forward with reverse directions.

The fixed rate receiver in the swap is the party that pays the floating rate and received the fixed rate. It is generally the bank.

Benefits of IRSs

1. Corporations using interest rate swaps typically have extensive needs for raising capital. The companies use swap either to reduce interest expense or to manage interest rate exposure.
2. Asset managers use IRS to diversify their investment portfolios and to increase yield on investments. They can purchase fixed rate corporate assets and, by using swaps, covert these assets into a floating rate.

The Contract

3. A floating rate quotation in the swap is usually quoted on a money market basis. This interest rate assumes year base as 360 days and each month has the actual number of days.
4. The floating rate index is normally the US Dollar Libor, 3 and 6 months rates are the most frequent used indices.
5. The “bid” rate is the rate the customer receives, and the “offer” is the rate the customer pays.

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Interest Rate Options

As for the currencies, options could be dealt for interest rates. These instruments are commonly used for hedging purposes or pure trading, they have become one of most important and flexible hedging instruments in the money market.

OPTIONS

Options are contracts that allow, but do not require one or both parties, to obtain certain benefits under conditions. The calculation of an option's contract value must take into account the possibility that this option will be exercised⁴¹.

- currency options, commonly used for hedging purposes as well as for pure trading, have become one of the most important and flexible instruments in the FX market.
- Think of an option as an insurance policy against the risk of price fluctuation and volatility.
- An option is a contract between two parties that gives the buyer the right but not the obligation to buy or sell a currency, commodity or a financial instrument at a specific price on a specific date in the future. To enjoy this right, the buyer will pay a small percentage known as the premium.

- There are two types of options, calls and puts.
- A call gives the buyer of the option the right to buy the underlying currency, commodity or any other instrument, while the buyer of a put has the right to sell the underlying.
- The maximum a buyer can lose is the premium he pays for the option, where as the risk facing the seller is theoretically unlimited. The seller is obliged to deliver the underlying at the contracted price regardless of the prevailing market price whenever the option is exercised.
- The contracted price or exchange rate at which the contract will be fulfilled is called the Strike price.

⁴¹ Ibid, page 199
• In case of a call option, the strike price is said to be **out of the Money** when the strike price is higher than the prevailing market price, and it is said to be **in the Money** if the strike price is lower than the prevailing market price, and it is vice versa for a put option.

• Using an option for hedging gives the holder protection against adverse exchange rate movements with the flexibility to profit from favourable exchange rate movements. Risk is limited to the premium paid.

• Using an option for trading gives the holder the opportunity to position himself for a big market move even when he does not know when this move will occur or in which way.

• Participants in the foreign exchange options market include all the key players in the global financial markets.

**Corporate** clients use them to manage their foreign exchange risk resulting from payments and receivables in foreign currencies.

**Investors** use them to hedge their exposure in foreign securities and for trading purposes.

**Options trading strategies** can be created to meet any expected market condition. The choice of a strike, buying or writing, can be used to vary the degree of risk exposure and consequently, the potential profit or hedging efficiency.

• **Bullish Spread** Called also Call Spread. It is the purchase of a call at one strike price and the sale of another Call at a higher strike price.
  
  o A bullish spread is a strategy used when there is an expectation of a rising currency rate and that will not exceed a certain level.
  
  o The purpose of this strategy is to minimize the value of the total premium to be paid, as it will be the net between the premium to pay on buying the first Call and the premium to receive on selling the second Call.
• **Bearish Spread** Called also Put Spread, it is the purchase of a Put at one strike price and the sale of another Put at a lower strike price.

  - A bearish spread is a strategy used when there is an expectation of a falling currency rate and that the fall will not exceed a certain level.

• **Straddle** It is the strategy established by buying a Call and a Put at the same strike price, this strategy is a typical trading on the volatility of a currency, we buy a straddle when we expect a higher volatility and we sell the straddle when we expect a lower volatility

  - Straddle could be suitable for speculative customers.

  - Risk exposure = Total premium paid (buyer)
    Unlimited (seller)

  - Profit potential = Unlimited (buyer)
    Total premium received (seller)

**Average Rate Option**

- It gives the holder the right but not the obligation to receive on the expiry date the difference between the exercise price and the average value of the currency over the option's life time. The way the average is calculated could be on daily, weekly or monthly exchange rates as agreed between the buyer and the seller.

- This strategy is especially designed for the corporate market, it enables a corporate treasurer, for instance, to establish a year budget based on an average exchange rate. It is also a useful way to hedge a series of foreign currencies payable and receivables with different maturities at a lower premium cost than a series of regular individual options covering each currency exposure.

**Knockout options:**

It is just a simple option with an added feature, the Knockout trigger that makes the option price cheaper. KO option reacts like a simple Call or Put option if the trigger is not touched during the option life, and becomes immediately worthless if the trigger is touched.
• Knockout options were specifically designed to be part of hedging strategies, being an inexpensive way to cover a directional exposure.

**Knock-in Option**

It is also like a simple option that is activated if a specified spot rate reaches a specified trigger level between inception and expiry.

• As a barrier option, it is suitable for hedgers due to the lower cost in covering market exposure.

**Binary Option**

• It is similar to Knockout option with the only difference that, a Binary option has two outcomes, it pays a fixed amount if exercised and nothing if triggered.

• **Binary options** are mainly designed for investors who seek a good return with a small risk, as investors could define in advance the amount they are ready to risk, and therefore, will know the maximum amount they will gain if the barriers are not reached.

**Forward Rate Agreement**

**Main Features**

• It is used to manage short-term interest rate exposure, so it is a contract between the bank and the client to set an interest rate at some point in the future to continue for an additional period.

• In a FRA, principal is not exchanged, only the amount above or below the contracted rate is actually exchanged between the parties.

• The buyer or taker of the FRA is the party seeking protection against a rise in interest rates. The buyer will make a payment only if the actual rate is below the contract rate.
• The seller or placer of the FRA is the party taking the risk of an upward movement in interest rates. The seller will make a payment only if the actual rate is above the contract rate.

Benefits of FRA

• It is used to manage short-term interest rate exposure, so it is a contract between the bank and the client to set an interest rate at some point in the future to continue for an additional period.

• FRA is an interest management tool used by corporations with short term debts to lock-in their borrowing cost for short periods of time, mainly below 2 years. For example, an FRA with a settlement in 6 months from the contract date and a maturity in 9 months from the contract date is quoted as a 6 x 9 FRA (six by nine).

• A company can sell an FRA contract to hedge investments, so the “bid” is used to hedge investments, and the “offer” to hedge borrowings.

Interest Rate Swap

An IRS is a contractual agreement between the bank and the client to exchange interest payments over a period of time. It allows the company to change its floating rate borrowing into a fixed rate or to change its fixed rate borrowing into a floating rate. It is a powerful financial tool used by many companies to generate interest rate savings and to manage actively their interest rate exposures.

Main Features

• No principal is actually exchanged either initially or at the maturity of the contract. Instead, only periodic interest rate differentials are paid between the parties.

• The size of an IRS deal varies from US$ 20 to 200 mn, and the term from 1 to 15 years.

• The fixed rate payer in the swap is the party that pays the fixed rate and receives the floating rate. It is the party that wishes to hedge against interest rate rises.
• The fixed rate receiver in the swap is the party that pays the floating rate and received the fixed rate. It is generally the bank.

Benefits of IRSs
• Corporations using interest rate swaps typically have extensive needs for raising capital. The companies use swap either to reduce interest expense or to manage interest rate exposure.

• Asset managers use IRS to diversify their investment portfolios and to increase yield on investments. They can purchase fixed rate corporate assets and, by using swaps, covert these assets into a floating rate.

The Contract
A floating rate quotation in the swap is usually quoted on a money market basis. This interest rate assumes that the year base is 360 days and each month has the actual number of days.
The floating rate index is normally the US Dollar Libor, 3 and 6 months rates are the most frequent used indices.

• The “bid” rate is the rate the customer receives, and the “offer” is the rate the customer pays.

Interest Rate Options
• As for the currencies, options could be dealt for interest rates. These instruments are commonly used for hedging purposes or pure trading, they have become one of most important and flexible hedging instruments in the money market.

Cap: It is a call option to protect from an interest rate rise.

Floor: It is a put option to protect from a decline in interest rates.

Collar: It allows the company to fix an interest rate within a band, so it combines the purchase of a cap and the sale of a floor. The cap protects from the upside, the floor
reduces the protection cost by limiting the company to a minimum borrowing rate in case of a fall in interest rates.

**Corridor:** It is the buying of a cap at one strike price and the sell of another cap at higher price to partially offset the premium paid.

**Swaptions:** It is an interest rate option giving the right to enter into an interest rate swap. The cost is cheaper than a cap, and would be switched to an IRS if rates are higher.

**Structured products**
In order to get a protection from markets exposure or to provide higher returns linked to diverse underlying markets and instruments, specific client views can be translated into suitable strategies for both hedging and investment purposes.

Structures would be designed to match the following criteria:
1- Hedge interest rate exposure in short or long term funding.
2- Assure capital guaranteed investments and higher returns for cash rich depositors.

Structured strategies are suitable for hedgers as well as for investors looking to enhance returns.

**Constant Maturity Swap**
In a constant maturity swap, the parties exchange a Libor rate for a fixed swap rate. For example, the terms of the swap might state that six-month Libor is exchanged for the five-year swap rate on a semi-annual basis for the next five years, or for the five-year government bond rate. In the U.S. market, the second type of constant maturity swap is known as a constant maturity Treasury swap.

**Accreting and Amortizing Swaps**
In a plain vanilla swap, the notional principal remains unchanged during the life of the swap. However it is possible to trade a swap where the notional principal varies during its life. An accreting (or step-up) swap is one in which the principal starts off at one level and then increases in amount over time. The opposite, an amortizing swap, is one
in which the notional reduces in size over time. An accreting swap would be useful where for instance, a funding liability that is being hedged increases over time. The amortizing swap might be employed by a borrower hedging a bond issue that featured sinking fund payments, where a part of the notional amount outstanding is paid off at set points during the life of the bond. If the principal fluctuates in amount, for example increasing in one year and then reducing in another, the swap is known as a roller-coaster swap. Another application of an amortizing swap is as a hedge for a loan that is itself an amortizing one. Frequently this is combined with a forward-starting swap, to tie in with the cash flows payable on the loan. The pricing and valuation of an amortizing swap is no different in principle to a vanilla interest-rate swap; a single swap rate is calculated using the relevant discount factors, and at this rate the net present value of the swap cash flows will equal zero at the start of the swap.

Zero-Coupon Swap

A zero-coupon swap replaces the stream of fixed-rate payments with a single payment at the end of the swap’s life, or less common, at the beginning. The floating-rate payments are made in the normal way. Such a swap exposes the floating-rate payer to some credit risk because it makes regular payments but does not receive any payment until the termination date of the swap.

Libor-in-Arrears Swap

In a Libor-in-arrears swap (also known as a back-set swap), the reset date is just before the end of the accrual period for the floating-rate rather than just before the start. Such a swap would be attractive to a counterparty who had a different view on interest rates compared to the market consensus. For instance in a rising yield curve environment, forward rates will be higher than current market rates, and this will be reflected in the pricing of a swap. A Libor-in-arrears swap would be priced higher than a conventional swap. If the floating-rate payer believed that interest rates would in fact rise more slowly than forward rates (and the market) were suggesting, he or she may wish to enter into an arrears swap as opposed to a conventional swap.
Basis Swap
In a conventional swap one leg comprises fixed-rate payments and the other floating-rate payments. In a basis swap both legs are floating-rate, but linked to different money market indices. One leg is normally linked to Libor, while the other might be linked to the CD rate or the commercial paper rate. This type of swap would be used by a bank in the United States that had made loans that paid at the prime rate and funded its loans at Libor. A basis swap would eliminate the basis risk between the bank’s income and interest expense. Other basis swaps are traded in which both legs are linked to Libor, but at different maturities; for instance one leg might be at three-month Libor and the other at six-month Libor. In such a swap, the basis is different as is the payment frequency: one leg pays out semi annually while the other would be paying on a quarterly basis.

Margin Swap
It is common to encounter swaps where there is a margin above or below Libor on the floating leg, as opposed to a floating leg of Libor flat. Such swaps are called margin swaps. If a bank’s borrowing is financed at Libor+25bps, it may wish to receive Libor+25bps in the swap so that its cash flows match exactly. The fixed-rate quote for a swap must be adjusted correspondingly to allow for the margin on the floating side. So in our example if the fixed-rate quote is say, 6.00%, it would be adjusted to around 6.25%; differences in the margin quoted on the fixed leg might arise if the day-count convention or payment frequency were to differ between fixed and floating legs. Another reason why there may be a margin is if the credit quality of the counterparty demanded it, so that highly rated counterparties may pay slightly below Libor, for instance.

Off-Market Swap
When a swap is transacted, its fixed rate is quoted at the current market rate for that maturity. When the fixed rate is different from the market rate, this type of swap is an off-market swap, and a compensating payment is made by one party to the other. An off-market rate may be used for particular hedging requirements for example, or when a bond issuer wishes to use the swap to hedge the bond as well as to cover the bond’s issue costs.
Differential Swap
A differential swap is a basis swap but with one of the legs calculated in a different currency. Typically one leg is floating-rate, while the other is floating-rate but with the reference rate stated in another currency but denominated in the domestic currency. For example, a differential swap may have one party paying six-month sterling Libor, in sterling, on a notional principal of £10 million, and receiving euro-Libor minus a margin, payable in sterling and on the same notional principal. Differential swaps are not very common and are the most difficult for a bank to hedge. The hedging is usually carried out using what is known as a quanto option.

Forward-Start Swap
A forward-start swap is one where the effective date is not the usual one or two days after the trade date but a considerable time afterwards, for instance say six months after trade date. Such a swap might be entered into where one counterparty wanted to fix a hedge or cost of borrowing now, but for a point some time in the future. Typically this would be because the party considered that interest rates would rise or the cost of hedging would rise. The swap rate for a forward-starting swap is calculated in the same way as that for a vanilla swap.

CROSS-CURRENCY SWAPS
A cross-currency swap is similar to an interest rate swap, except that the currencies of the two legs are different. Like interest-rate swaps, the legs are usually fixed- and floating-rate, although again it is common to come across both fixed-rate or both floating-rate legs in a currency swap. On maturity of the swap, there is an exchange of principals, and usually (but not always) there is an exchange of principals at the start of the swap. Where currencies are exchanged at the start of the swap, at the prevailing spot exchange rate for the two currencies, the exact amounts are exchanged back on maturity. During the time of the swap, the parties make interest payments in the currency that they have received when principals are exchanged. It may seem that exchanging the same amount at maturity gives rise to some sort of currency risk, in fact it is this feature that removes any element of currency risk from the swap transaction. Currency swaps are widely used in association with bond issues by...
borrowers who seek to tap opportunities in different markets but have no requirement for that market's currency. By means of a currency swap, a corporation can raise funds in virtually any market and swap the proceeds into the currency that it requires. Often the underwriting bank that is responsible for the bond issue will also arrange for the currency swap transaction.

In a currency swap, therefore, the exchange of principal means that the value of the principal amounts must be accounted for, and is dependent on the prevailing spot exchange rate between the two currencies. The same principles we established earlier in the chapter for the pricing and valuation of interest rate swaps may also be applied to currency swaps. A generic currency swap with fixed-rate payment legs would be valued at the fair value swap rate for each currency, which would give a net present value of zero. A floating-floating currency swap may be valued in the same way, and for valuation purposes the floating-leg payments are replaced with an exchange of principals, as we observed for the floating leg of an interest rate swap. A fixed-floating currency swap is therefore valued at the fixed-rate swap rate for that currency for the fixed leg, and at Libor or the relevant reference rate for the floating leg.

SWAPTIONS

A bank or corporation may enter into an option on a swap, which is called a swaption. The buyer of a swaption has the right but not the obligation to enter into an interest rate swap at any time during the option's life. The terms of the swaption will specify whether the buyer is the fixed or floating-rate payer; the seller of the option (the writer) becomes the counterparty to the swap if the option is exercised. In the market, the convention is that if the buyer has the right to exercise the option as the fixed-rate payer, the buyer has purchased a call swaption, while if by exercising the buyer of the swaption becomes the floating-rate payer he has bought a put swaption. The writer of the swaption is the party that has an obligation to establish the other leg.

Swaptions are up to a point similar to forward start swaps, but the buyer has the option of whether or not to commence payments on the effective date. A bank may purchase a call swaption if it expects interest rates to rise, and will exercise the option if indeed rates do rise as the bank has expected.
A corporation will use swaptions as part of an interest-rate hedge for an anticipated future exposure. For example, assume that a corporation will be entering into a five-year bank loan in three months' time. Interest on the loan is charged on a floating-rate basis, but the corporation intends to swap this to a fixed-rate liability after it has entered into the loan. As an added hedge, the corporation may choose to purchase a swaption that gives it the right to receive Libor and pay a fixed rate, say 6%, for a five-year period beginning in three months' time. When the time comes for the corporation to engage in a swap contract and exchange its interest-rate liability in three months' time (having entered into the loan), if the five-year swap rate is below 6%, the corporation will transact the swap in the normal way and the swaption will expire worthless. However, if the five-year swap rate is above 6%, the corporation will instead exercise the swaption, giving it the right to enter into a five-year swap and paying a fixed rate of 6%. Essentially the corporation has taken out "insurance" that it does not have to pay a fixed rate of more than 6%. Hence swaptions can be used to guarantee a maximum swap rate liability. They are similar to forward-starting swaps, but differ because they represent an option (as opposed to an obligation) to enter into a swap on fixed terms. The swaption enables a corporation to hedge against unfavourable movements in interest rates but also to gain from favourable movements, although there is of course a cost associated with this, which is the premium paid for the swaption.

**FUTURES CONTRACTS**

A futures contract is a legal agreement between a buyer (seller) and an established exchange or its clearinghouse in which the buyer (seller) agrees to take (make) delivery of something at a specified price at the end of designated period. The price at which the parties agree to transact in the future is called the futures price. The designated date at which the parties must transact is called the settlement or delivery date. When a market participant takes a position by buying a futures contract, the individual is said to be in a long futures position or to be long futures. If, instead, the market participant’s opening position is the sale of a futures contract, the investor is said to be in a short position or short futures. As can be seen from the description, a futures contract is quite similar to a forward contract. They differ on four dimensions. First, futures contracts are
standardized agreements as to the delivery date (or month) and quality of the deliverable. Moreover, because these contracts are standardized, they are traded on organized exchanges. In contrast, forward contracts are usually negotiated individually between buyer and seller and the secondary markets are often nonexistent or extremely thin. Second, an intermediary called a clearinghouse (whose function is discussed shortly) stands between the two counterparties to a futures contract and guarantees their performance. Both parties to a forward contract are subject to counterparty risk. Counterparty risk is the risk that the other party to the contract will fail to perform. Third, a futures contract is marked-to-market (discussed shortly) while a forward contract may or may not be marked-to-market. Last, although both a futures and forward contract set forth terms of delivery, futures contracts are not intended to be settled by delivery. In fact, generally less than 2% of outstanding contracts are settled by delivery. Forward contracts, on the other hand, are intended for delivery.

Role of the Clearinghouse
Associated with every futures exchange is a clearinghouse, which performs several functions. One of these functions is guaranteeing that the two parties to the transaction will perform. When a market participant takes a position in the futures market, the clearinghouse takes the opposite position and agrees to satisfy the terms set forth in the contract. Because of the clearinghouse, the user need not worry about the financial strength and integrity of the counterparty to the contract. After the initial execution of an order, the relationship between the two parties ends. The clearinghouse interposes itself as the buyer for every sale and the seller for every purchase. Thus, users are free to liquidate their positions without involving the other party in the original contract and without concern that the other party may default. This is the reason why we define a futures contract as an agreement between a party and a clearinghouse associated with an exchange. In addition to its guarantee function, the clearinghouse makes it simple for parties to a futures contract to unwind their positions prior to the settlement date.

Margin Requirements
When a position is established in a futures contract, each party must deposit a minimum dollar amount per contract as specified by the exchange in the terms of the contract. This amount, which is called the initial margin, is required as deposit by the
exchange. The initial margin may be in the form of an interest-bearing security such as a Treasury bill. In some futures exchanges around the world, other forms of margin are accepted such as common stock, corporate bonds or even letters of credit. As the price of the futures contract fluctuates, the value of the user’s equity in the position changes. At the end of each trading day, the exchange determines the settlement price of the futures contract which is an average of the prices of last few trades of the day. This price is used to mark-to-market the user’s position, so that any gain or loss from the position is reflected in investor’s margin account.

Maintenance margin is the minimum level (specified by the exchange) to which a user’s margin account may fall as a result of an unfavourable price change before the user is required to deposit additional margin linked to daily Mark-to-Market (MTM). The additional margin deposited is called variation margin and it is an amount necessary to bring the margin in the account balance back to its initial margin level. Unlike initial margin, variation margin must be in cash, not interest-bearing instruments.

3.5 Hedging Foreign exchange exposures in a multinational computer peripheral manufacturing business – a case study is given at Appendix 14.

3.6 Using Technical Analysis for FX Management

TA in essence is the study of price action to identify trends — spotting repetitive chart patterns that can be traded for profits and or used for taking hedging decision.

FOREX chart patterns repeat themselves — as they reflect human psychology, which is constant. Many traders think that simply studying Forex charts can’t work, because it doesn’t take into account the supply and demand situation, but it does actually work. A simple equation explains the TA as below:

\[
P = MP + F
\]

Where MP is Market perception (trader psychology);

F is Fundamentals (Supply & demand) &

P is the Price

42 Managing Risk in the FX, Money and Derivative Markets, page 218
Price action reflects all the fundamentals – and more importantly, how the participants perceive them. In today’s world of instant communications, the fundamentals instantly show up in price action – so technical analysis simply assumes that all known fundamentals show up in price action instantly.

Some of the largest price moves in history have occurred with little or no change in the fundamentals. These price moves were caused by human psychology – and currency technical analysis is able to study this. This gives a huge advantage – when we accept that ultimately, it’s people that determine the price of anything.

The right price is the market price – so you see the reality, rather than listening to the opinions of others. Currency technical analysis is based on the following assumptions:

3.6.1 Markets Discount
All fundamentals show up quickly in the price. We can see the impact of the fundamentals and how the dealers perceive and react to them at the same time.

1.3. Trends Persist
In the currency trading, trends can be tracked for e.g. Daily, weekly, monthly or yearly intervals. It is based on the premise that History Repeats Itself and assumed that what has happened in the past will happen again as human psychology never changes.

As chart patterns reflect shifts in human psychology, certain patterns and trends will repeat themselves repeatedly. However, we need to keep in mind that charting is an art, rather than a science. While human behavior does repeat itself, humans can be unpredictable as well – so you’re trading the odds, not certainties.

Some tips on using technical analysis for bigger profits:

1.4. Focus on the longer term trends
Currencies tend to reflect the underlying health of the economy. This creates longer-term trends that last for months or years – so focus on the longer-term trends, rather than the short term “market noise”.

1.5. Use a simple system
If an effective Forex trading system need to be developed, it may be better to keep it simple – support and resistance, and a few confirming indicators. In online currency trading, it’s a fact that simple systems work best – as there are fewer elements to break, in the real and brutal world of trading.

1.6. Trade in isolation
This is a key factor that must be learnt as part of Forex trading education. One should not be influenced by the opinions of others, or the news as journalists are not traders. There are chances that when the news is followed blindly or allow emotions take precedence over trading or hedging decisions, the company may end up in as a loser.

1.7. Be patient and be disciplined
Don’t trade all the time. Trade should be done only when the system gives trading signals and then follow the trade with discipline. A proper system to monitor the rate movements, resistant/support level etc. should be put in place.

Technical indicators (TIs)
There are different types of technical indicators which may be used by the traders/finance managers. Few of the TIs are

Moving average - involves a simple formula that analyzes the average price of a security or commodity over a period of time, and when isolating time periods, it is much easier to spot different trends.

Momentum indicators - Stochastic oscillator, Commodity channel index, RSI, Chande momentum oscillator (CMO)

Volatility indicators - Bollinger bands, projection oscillator, average true range, Trading bands (envelope)

Trend indicators - MACD, linear regression, Forecast oscillator

Volume related indicators - Ease of movement, OBV, Demand index
Benefit of TIs

By no means represent a complete analysis, they can offer an opportunity to find areas that are worth closer study based on indication of trends. We need to watch out for which direction the trend seems to be heading.

Caution for using TIs

TIs are by no means 100% accurate as the market is volatile, and anything can happen. Therefore the trends shown by TIs should be used coupled with other tools like interest rates forecast, market leaders’ opinion, forward rates etc. which may give conclusions that would be much more accurate.

Bollinger Bands Analysis with Momentum Indicator

It is used to identify turning points in trend direction. It belongs to the volatility indicators group. It is necessary to add in our Bollinger Bands analysis one or more momentum/strength indicators to determine if the price movement is at the beginning, middle or the end phase. Graph 1 illustrates Bollinger Analysis:

43 http://www.besttradinginfo.com/bollinger-bands-analysis.html
Graph 1

Indicators and Parameters:

**Bollinger Bands (blue)** – period set to 20, deviation set to 2 (default parameters). 98% of price movement will take place inside the bands.

**Momentum indicator (red)** – period parameter set to 20, we will use the ability of this indicator to identify divergence with the EURUSD price movement.

Practical analysis:

**Point A** – To start our Bollinger Bands analysis we must recognize that the EURUSD is in a strong down trend, the price bar penetrate the lower band and closed on the outside. Also, the momentum indicators indicate selling pressure (at point A the momentum indicator is in his lower value).

**Point B** – Here a long position at 1.1875 (point B) can be taken, why? Because the technical analysis indicates that:

1. The previous bar low penetrate the lower Bollinger band.
2. The previous bar close = 1.1875 EURUSD.

3. A strong divergence occurred between the EURUSD price and the momentum indicator (purple line ‘AB’).

Now we can determine our stop-loss at 1.1826 (34 pips under the low of the last bar) and set our profit target at the Bollinger bands indicator’s upper band.

**Point C** – The long position was closed at 1.225 (150 pips in profit) when the EURUSD price penetrate the upper band.

**Points D, E and F** – The same formation has occurred, but this time, the conditions triggered a short position.

**Forex day trading strategy rules:**

Normally traders use two time frames, long time frame – 4 hour and short time frame – 15 minute.

**Identifies the support and resistance** price levels on the longer timeframe a day before.

**The stochastic indicator** in both the time frames to determine if we enter long or short position in our next intraday trading.

**Indicators and Parameters:**

**Support and Resistance Price Levels**

**Slow Stochastic Oscillator** : the stochastic oscillator create diversion with the Fx pair price (green line), i.e. the momentum is weakening; plus the stochastic indicates on an overbought situation (above 80 level). So, the next day trader try to find conditions to enter a short position.

**Forex Day Trading Strategy Implementation by FX traders**

Generally traders fix the day trading strategy on any Fx currency pair and sets up rules for the same.
Profitable Japanese Candlestick Trading Techniques

Developed by Fibonacci, this Candlestick gives Retracement Levels and Time Sequence of the historical trades. This Fibonacci retracement levels and time zones/sequence are a must have technical analysis tool in any trader toolkit. According to this approach, it is said that price retrace exactly at Fibonacci levels and change direction in correlation with Fibonacci time sequence periods in Graph 2.

**Graph 2:**

Combining Japanese candlestick chart patterns with geometric price formation is a win-win situation. Descending Triangle chart formation and a Japanese candlestick chart pattern, Bearish Engulfing, is a trigger for a short position used by traders generally.

### 3.7 Forex Money Management Strategy

It is necessary to control the risk exposure and estimate the profit potential when we enter into a trade. The idea is to control traders/ finance managers’ emotions and lack of plan so that proper FX management strategy can be put in place.

#### 3.7.1 Importance of determining stop-loss limits

When a trader lose control the results are often disastrous. Many traders often enter the market with a profit target, but without a clearly defined protective stop-loss. With a
pre-determined profit target and a pre-determined stop-loss, one can know where he will get out if he goes wrong and where he can get out if he is right. **In other words, one should have control.**

### 3.7.2 Diversification – Trade/Hedge more then one currency pair

It would be beneficial if the trader/finance manager do dealing in more than one currency pair, i.e. EUR/USD, USD/JPY, USD/CHF, GBP/USD, USD/INR etc. With multiple currency pairs, each having a different entry and exit points, one can smoothen curve. According to the market information available, it’s important to diversify orders between currencies that have low correlation. Empirical studies indicate that **one should** Never risk more than 2% of account size on any single currency pair, if possible, risk less. Plus, never risk more than 10% in any complex of open positions, on any given day. For any given trade you must know how much you will lose if the market goes against you.

### 3.7.3 Simple Moving Average Strategy

If we combine a simple moving average with strong resistance line we will get a positive expectancy strategy that everyone can execute on any time frame.

### 3.8 USD/INR exchange rate since 1990

The average exchange rate of the Indian Rupee(INR) has moved from a low of 17.883 in 1990 to 45.790 in 2006, to 43.179 for first 5 months of 2007 and touched a peak of yearly average of 48.739 in 2002; as given at Table 1. This indicates the cyclical trend of the INR, with the initial exception of devaluation in 1991 along with the introduction of structural financial reforms and further gradual depreciation till 2002. Since 2003 the INR has started appreciating and depreciating for short periods indicating the volatility and removing the one way of depreciation and start of two way movement of USD/INR rates. This volatility indicates the need for active management of forex exposures by both exports and imports.
<table>
<thead>
<tr>
<th>Year</th>
<th>Average rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>17.883</td>
</tr>
<tr>
<td>1991</td>
<td>23.063</td>
</tr>
<tr>
<td>1992</td>
<td>30.248</td>
</tr>
<tr>
<td>1993</td>
<td>31.785</td>
</tr>
<tr>
<td>1994</td>
<td>31.398</td>
</tr>
<tr>
<td>1995</td>
<td>32.814</td>
</tr>
<tr>
<td>1996</td>
<td>35.956</td>
</tr>
<tr>
<td>1997</td>
<td>36.649</td>
</tr>
<tr>
<td>1998</td>
<td>41.737</td>
</tr>
<tr>
<td>1999</td>
<td>43.296</td>
</tr>
<tr>
<td>2000</td>
<td>45.223</td>
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<tr>
<td>2001</td>
<td>47.448</td>
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<td>2002</td>
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<td>2003</td>
<td>48.851</td>
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<tr>
<td>2004</td>
<td>45.732</td>
</tr>
<tr>
<td>2005</td>
<td>44.420</td>
</tr>
<tr>
<td>2006</td>
<td>45.790</td>
</tr>
<tr>
<td>2007</td>
<td>43.179</td>
</tr>
</tbody>
</table>

Source: Reuters Kobra data base; Pivot run after export data into Excel

The Quarterly average rate of USD/INR (Table 4), gives clearer picture on quarterly movement of the exchange rates. The lowest quarterly average of INR was 49.059 in Q2 of 2002. After touching this lowest level, INR has started appreciating. The rate of 41.795 in Q2 of 2007 reflects the similar levels of 41.487 in Q2 of 1998.
| Year | Qtr2 | 1996 | Qtr3 | 1997 | Qtr4 | 1998 | Qtr5 | 2002 | Qtr1 | 2003 | Qtr1 | 2004 | Qtr1 | 2005 | Qtr1 | 2006 | Qtr1 | 2007 | Qtr1 | 2008 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|      | Qtr3 | 17.797 | Qtr2 | 35.165 | Qtr3 | 35.853 | Qtr2 | 49.059 | Qtr3 | 48.724 | Qtr3 | 48.393 | Qtr3 | 47.928 | Qtr3 | 47.363 |
|      | Qtr4 | 18.247 | Qtr2 | 35.837 | Qtr3 | 36.375 | Qtr2 | 48.393 | Qtr3 | 46.268 | Qtr3 | 45.843 | Qtr3 | 45.456 | Qtr3 | 45.048 |
| 1991 | Qtr1 | 19.179 | Qtr2 | 35.963 | Qtr2 | 36.792 | Qtr2 | 44.68 | Qtr3 | 43.993 | Qtr3 | 43.993 | Qtr3 | 43.993 | Qtr3 | 43.993 |
|      | Qtr2 | 20.842 | Qtr3 | 35.883 | Qtr3 | 36.375 | Qtr3 | 43.763 | Qtr4 | 43.763 | Qtr4 | 43.763 | Qtr4 | 43.763 | Qtr4 | 43.763 |
|      | Qtr3 | 26.288 | Qtr4 | 35.375 | Qtr4 | 36.375 | Qtr4 | 43.763 | Qtr4 | 43.763 | Qtr4 | 43.763 | Qtr4 | 43.763 | Qtr4 | 43.763 |
| 1992 | Qtr1 | 25.944 | Qtr1 | 38.373 | Qtr2 | 38.373 | Qtr2 | 48.393 | Qtr3 | 46.268 | Qtr3 | 45.843 | Qtr3 | 45.456 | Qtr3 | 45.048 |
|      | Qtr2 | 28.438 | Qtr3 | 38.373 | Qtr3 | 38.373 | Qtr3 | 43.763 | Qtr4 | 43.763 | Qtr4 | 43.763 | Qtr4 | 43.763 | Qtr4 | 43.763 |
|      | Qtr3 | 31.253 | Qtr4 | 39.867 | Qtr4 | 39.867 | Qtr4 | 43.763 | Qtr4 | 43.763 | Qtr4 | 43.763 | Qtr4 | 43.763 | Qtr4 | 43.763 |
|      | Qtr4 | 30.741 | Qtr1 | 41.487 | Qtr1 | 41.487 | Qtr1 | 43.932 | Qtr1 | 45.456 | Qtr1 | 45.456 | Qtr1 | 45.456 | Qtr1 | 45.456 |
| 1993 | Qtr1 | 30.560 | Qtr2 | 42.982 | Qtr2 | 42.982 | Qtr2 | 46.138 | Qtr2 | 49.941 | Qtr2 | 49.941 | Qtr2 | 49.941 | Qtr2 | 49.941 |
|      | Qtr2 | 32.866 | Qtr3 | 42.615 | Qtr3 | 42.615 | Qtr3 | 46.790 | Qtr3 | 49.941 | Qtr3 | 49.941 | Qtr3 | 49.941 | Qtr3 | 49.941 |
|      | Qtr3 | 31.501 | Qtr4 | 42.615 | Qtr4 | 42.615 | Qtr4 | 46.790 | Qtr4 | 49.941 | Qtr4 | 49.941 | Qtr4 | 49.941 | Qtr4 | 49.941 |
| 1994 | Qtr1 | 31.395 | Qtr1 | 42.644 | Qtr1 | 42.644 | Qtr1 | 46.790 | Qtr1 | 49.941 | Qtr1 | 49.941 | Qtr1 | 49.941 | Qtr1 | 49.941 |
|      | Qtr2 | 31.395 | Qtr2 | 43.200 | Qtr2 | 43.200 | Qtr2 | 46.790 | Qtr2 | 49.941 | Qtr2 | 49.941 | Qtr2 | 49.941 | Qtr2 | 49.941 |
|      | Qtr3 | 31.139 | Qtr3 | 43.200 | Qtr3 | 43.200 | Qtr3 | 46.790 | Qtr3 | 49.941 | Qtr3 | 49.941 | Qtr3 | 49.941 | Qtr3 | 49.941 |
| 1995 | Qtr1 | 31.408 | Qtr4 | 43.697 | Qtr4 | 43.697 | Qtr4 | 46.790 | Qtr4 | 49.941 | Qtr4 | 49.941 | Qtr4 | 49.941 | Qtr4 | 49.941 |
|      | Qtr2 | 31.380 | Qtr1 | 43.691 | Qtr1 | 43.691 | Qtr1 | 46.790 | Qtr1 | 49.941 | Qtr1 | 49.941 | Qtr1 | 49.941 | Qtr1 | 49.941 |
|      | Qtr3 | 31.382 | Qtr2 | 44.468 | Qtr2 | 44.468 | Qtr2 | 46.790 | Qtr2 | 49.941 | Qtr2 | 49.941 | Qtr2 | 49.941 | Qtr2 | 49.941 |
|      | Qtr4 | 31.424 | Qtr3 | 45.843 | Qtr3 | 45.843 | Qtr3 | 46.790 | Qtr3 | 49.941 | Qtr3 | 49.941 | Qtr3 | 49.941 | Qtr3 | 49.941 |
| 1996 | Qtr1 | 31.645 | Qtr4 | 46.888 | Qtr4 | 46.888 | Qtr4 | 46.790 | Qtr4 | 49.941 | Qtr4 | 49.941 | Qtr4 | 49.941 | Qtr4 | 49.941 |
|      | Qtr2 | 31.461 | Qtr1 | 46.779 | Qtr1 | 46.779 | Qtr1 | 46.790 | Qtr1 | 49.941 | Qtr1 | 49.941 | Qtr1 | 49.941 | Qtr1 | 49.941 |
|      | Qtr3 | 32.823 | Qtr2 | 47.076 | Qtr2 | 47.076 | Qtr2 | 46.790 | Qtr2 | 49.941 | Qtr2 | 49.941 | Qtr2 | 49.941 | Qtr2 | 49.941 |
|      | Qtr4 | 35.328 | Qtr3 | 47.618 | Qtr3 | 47.618 | Qtr3 | 46.790 | Qtr3 | 49.941 | Qtr3 | 49.941 | Qtr3 | 49.941 | Qtr3 | 49.941 |
|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |

Source: Reuters Kobra data base; Pivot run after export data into Excel

**Spot rates and 6 M forward premium since 1993** is shown in Graph 3. It can be observed that the INR was fairly stable at 31.375 for 2 years in 1993 and 1994. Subsequent to allowing INR to be partial convertibility in Aug 1994 (The Government of India allowed INR to be convertible on current account under Article 8 of the IMF), the gradual fluctuation of Dollar and Rupee rates began.
**Graph 3:** 6M USD Forward premium and USD/INR Spot rate Mar '93-Mar '06

Source: RBI Tables

The graphical weekly historical rates since 1990 have been graphed on quarterly basis and are shown in the Graphs 4 to 8 below/following pages.

**Graph 4:** Weekly INR movement 1990-94
Graph 5: Weekly INR movement 1993-97

Graph 6: Weekly INR movement 1996-2001
3.9 USD 6 Month forward premium trend:

The historical 6 month forward premium of Dollar against Rupee has fluctuated in the wide range from -0.69% to 23.43%. For a short while, in April, May 2004 the forward premium levels were negative (-0.69%) indicating that Rupee was quoting at a premium and Dollar at a discount; contrary to the opinion and expectations of market that Rupee should always be at discount. Also, the annualised premium levels were at 10.13% in March 1993 touched a high level of 23.43% in Mar 1996 and fell down to 2.43% in Mar 2006. The wide fluctuations reflecting the impact of various factors viz. FII inflows, demand and supply, FDI inflow, NRI deposits, trade balance BOP position etc. Thus, the Indian market has become dynamic over the period and indicates that corporate houses needs better management of their foreign exchange exposures.

Graph 9

3.10 India’s Trade Surplus, Import cover, Short term Debt% - 1991-2006

Fundamental factors like Trade surplus, FX reserves, FDI/FII inflows, external debt position, balance of payments and a myriad of other factors can affect the intrinsic value of a currency against another currency. The Graph 10 given below shows the trend of India’s trade plus, Import cover of FX reserves and % of Short term debt for the period 1991-2006.

Graph 10

India’s Trade Surplus, Import Cover, Short term Debt% - 1991-2006

Note: Trade surplus given above is % of GDP and Short term debt is % of Total debt. Source: RBI Tables

3.11 Correlation between India’s Trade Surplus, Import cover, Short term Debt & average USD/INR rate 1991-2005

The historical data of Trade Surplus as % of GDP, ratio of short term external debt to total debt, import cover, external debt amount, Debt service ratio and the average USD/INR exchange rate is given at Table 5. And the same data is plotted to check the trend and study the correlation between these variables in the Graph 11 below. It can
be observed that Rupee has depreciated higher on many occasions corresponding to (a) lower the import cover; (b) higher the external debt service ratio and vice-versa. For e.g. In the years 2003 and 2004 Rupee has appreciated by 3.87% & 2.39% when the debt service ratio fell drastically by 0.61% and 63.03% respectively compared to previous year; (c) Fall of Trade surplus up to the year 2004. Subsequently, Rupee has appreciated due to other factors may be due to high economic growth.

Table 6: FX Variables and USD/INR Rate 1990-2005:

<table>
<thead>
<tr>
<th>Year</th>
<th>Trade Surplus as % of GDP</th>
<th>Import cover of reserves (in months)</th>
<th>Short term Debt/ Total Debt %</th>
<th>Average USD/ INR rate</th>
<th>Debt service ratio (%)</th>
<th>External Debt USD mn</th>
<th>% of change in External Debt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>(3.00)</td>
<td>2.5</td>
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<td>-</td>
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<tr>
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<tr>
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<td>3.9</td>
<td>31.79</td>
<td>25.4</td>
<td>92,695</td>
<td>2.97</td>
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<tr>
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<td>8.4</td>
<td>4.3</td>
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<tr>
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<td>32.81</td>
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<tr>
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<td>3.6</td>
<td>45.22</td>
<td>16.6</td>
<td>101,326</td>
<td>3.12</td>
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<td>2.8</td>
<td>47.45</td>
<td>13.4</td>
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Table 7: Pearson product moment correlation coefficient, r,

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<thead>
<tr>
<th>Trade Surplus% Vs INR rate</th>
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<tr>
<td>Import Cover Vs INR rate</td>
<td>0.831</td>
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<tr>
<td>Ratio of Short term debt to Total Debt Vs INR rate</td>
<td>-0.704</td>
</tr>
<tr>
<td>Debt Service ratio Vs INR rate</td>
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<tr>
<td>External Debt Vs INR rate</td>
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<tr>
<td>% Change in External Debt Vs INR rate</td>
<td>0.197</td>
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</table>

Detailed statistical analysis of FX variables and Exchange rate of USD/INR is given in Appendices 5 to 12.
Graph 11

India's Trade Surplus, Import Cover, Short term Debt% Vs. Av. USD/INR rate - 1990-2006

Note: Trade surplus given above is % of GDP and Short term debt is % of Total debt.

Source: RBI tables

3.12 Analytical charts of USD/INR

Technical analysis (TA) is the use of past price behaviour to guide trading decisions in asset markets. For example, a trading rule might suggest buying a currency if its price has risen more than 1 percent from its value five days earlier. Such rules are widely used in stock, commodity, and (since the early 1970s) foreign exchange markets. More than 90 percent of surveyed foreign exchange dealers in London report using some form of technical analysis to inform their trading decisions (Taylor and Allen, 1992). In fact, at short horizons, less than a week, technical analysis predominates over fundamental analysis, the use of other economic variables like interest rates, and prices in influencing trading decisions.

The technical charts of USD/INR are shown in Graphs 12 to 24 in the following pages. These charts indicate that the volatility of the Rupee market has gradually increased and gave uncertainty to corporates and forex dealers like banks who do trade and provide hedging and enhances the need to be on top of the FX movements.

**Graph 12 : USD/INR : Q4’90- Q1’92**

![Graph 12: USD/INR Q4’90- Q1’92](image)

**Graph 13 Weekly & MACD –INR Q1’91 –Q4’92**

![Graph 13: Weekly & MACD –INR Q1’91 –Q4’92](image)
Graph 14 Weekly & MACD – Weekly INR Q3'92 – Q4'94

Graph 15 Weekly & MACD – Weekly INR Q1'94 – Q4'95
Graph 19  Weekly & MACD –Weekly INR Q2’05 –Q4’06

Graph 20  Weekly & MACD –Weekly INR Q4’06 –Q4’07
Graph 21 Daily & MACD - INR Nov'06 – May’07
Graph 22: Daily & MACD - INR Oct'95 – Mar'06

Graph 23: Weekly & Candlestick - INR Mar'07 – May'07
### 3.13 FX Reserves and USD/INR Rates

Table 7 and Graph 25 given below indicates the Foreign Exchange reserves during Mar 92 and Nov 2006. It can be observed that INR strengthen against USD as and when there is accretion to FX Reserves and it has a Pearson Correlation R=0.61 pointing out strong relationship between these two variables. Details at Appendix 12.

#### Table 8: FX Reserves and USD/INR Rates

<table>
<thead>
<tr>
<th>Month</th>
<th>FX Reserves USD mn</th>
<th>Av USD rate</th>
<th>Month</th>
<th>FX Reserves USD mn</th>
<th>Av USD rate</th>
<th>Month</th>
<th>FX Reserves USD mn</th>
<th>Av USD rate</th>
<th>Month</th>
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<th>Av USD rate</th>
<th>Month</th>
<th>FX Reserves USD mn</th>
<th>Av USD rate</th>
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<td>Jan-95</td>
<td>23,790</td>
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<td>Nov-97</td>
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<td>37.24</td>
<td>Sep-00</td>
<td>35,438</td>
<td>45.89</td>
<td>Sep-03</td>
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<td>Oct-03</td>
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<td>27,838</td>
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<td>34,896</td>
<td>43.55</td>
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<td>71,110</td>
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<td>Feb-06</td>
<td>142,400</td>
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<td>Jun-94</td>
<td>20,510</td>
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<td>Apr-97</td>
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<td>May-97</td>
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<td>Sep-94</td>
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<td>31.37</td>
<td>Jul-97</td>
<td>29,789</td>
<td>35.74</td>
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<td>37,245</td>
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<td>30,228</td>
<td>35.92</td>
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<td>44.69</td>
<td>May-03</td>
<td>82,308</td>
<td>47.08</td>
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<tr>
<td>Nov-94</td>
<td>23,578</td>
<td>31.39</td>
<td>Sep-97</td>
<td>29,435</td>
<td>36.43</td>
<td>Jul-00</td>
<td>36,231</td>
<td>44.78</td>
<td>Jun-03</td>
<td>83,221</td>
<td>46.71</td>
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<tr>
<td>Dec-94</td>
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<td>31.39</td>
<td>Oct-97</td>
<td>30,022</td>
<td>36.23</td>
<td>Aug-00</td>
<td>35,619</td>
<td>45.68</td>
<td>Jul-03</td>
<td>85,551</td>
<td>46.23</td>
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Table 9: Statistical analysis of FX Reserves and USD/INR Rates 1992-2006

SUMMARY OUTPUT

<table>
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<tr>
<th>Regression Statistics</th>
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<tbody>
<tr>
<td>Multiple R</td>
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<tr>
<td>R Square</td>
<td>0.37</td>
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<tr>
<td>Adjusted R Square</td>
<td>0.36</td>
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<tr>
<td>Standard Error</td>
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<tr>
<td>Observations</td>
<td>166.00</td>
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</table>

ANOVA

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<tr>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>Significance</th>
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</thead>
<tbody>
<tr>
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<td>109,237,483,108</td>
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<tr>
<td>1.00</td>
<td>Residual</td>
<td>187,516,300,574</td>
<td>1,143,392,077</td>
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<tr>
<td>164.00</td>
<td>Total</td>
<td>296,753,783,681</td>
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</tr>
<tr>
<td>165.00</td>
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</table>

Coefficients

<table>
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<tr>
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<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
<th>Lower 95%</th>
<th>Upper 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>(110,875.09)</td>
<td>16.66</td>
<td>(6.65)</td>
<td>(143,777.23)</td>
<td>(77,972.95)</td>
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<tr>
<td>29.46</td>
<td>4,016.74</td>
<td>411</td>
<td>9.77</td>
<td>3,205.31</td>
<td>4,828.17</td>
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</tbody>
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F-Test Two-Sample for Variances

<table>
<thead>
<tr>
<th>Variances</th>
<th>FX Reserves</th>
<th>USD/INR Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>49,964.54</td>
<td>40.04</td>
</tr>
<tr>
<td>Variance</td>
<td>1,798,507,779.89</td>
<td>41.03</td>
</tr>
<tr>
<td>Observations</td>
<td>166.00</td>
<td>166.00</td>
</tr>
<tr>
<td>Df</td>
<td>165.00</td>
<td>165.00</td>
</tr>
<tr>
<td>F</td>
<td>43,830,011.55</td>
<td></td>
</tr>
<tr>
<td>P(F&lt;=f) one-tail</td>
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<td>-</td>
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<tr>
<td>F Critical one-tail</td>
<td>1.29</td>
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</tr>
</tbody>
</table>

F-Test: Two-Sample Assuming Unequal Variances

<table>
<thead>
<tr>
<th>Variances</th>
<th>FX Reserves</th>
<th>USD/INR Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>49,964.54</td>
<td>40.04</td>
</tr>
<tr>
<td>Variance</td>
<td>1,798,507,780</td>
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</tr>
<tr>
<td>Observations</td>
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<td>166.00</td>
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<tr>
<td>Hypothesized Mean</td>
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</tr>
<tr>
<td>Difference</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Df</td>
<td>165.00</td>
<td></td>
</tr>
</tbody>
</table>
The trend and correlation is given in Graph 25 A and Graph 25 b above. At an alpha level of 0.05 (i.e. 5% probability/significance level), the P value is 0.00 which is below the alpha; and therefore statistically it is more significant. Thus the null hypothesis that with the accretion of FX reserves, the Indian Rupee shall become strong is not true and gets rejected as summarized below:

<table>
<thead>
<tr>
<th>p-value</th>
<th>Outcome of test</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 0.001</td>
<td>Reject H₀</td>
<td>Very strong evidence to reject H₀ (Null Hypothesis)</td>
</tr>
</tbody>
</table>

Statistical analysis in detail is at Appendix 12.

3.1.4 Summary

The historical movement of Indian Rupee since independence inter-alia pegging to Pound sterling initially and to USD and basket of currencies later has been lucidly covered. FX market developments since the introduction of financial sector reforms in 1991 upto 2006 including introduction of FEMA 2000 explained. Factors affecting the exchange rates and volatility has been explained with the support of technical analysis and trend analysis. Various FX instruments available in the market for FX risk management have been illustrated. The Hypothesis formulated as part of the study that ‘INR shall become strong with the increase of forex reserves’ has been disproved.

In the next chapter, 4, analysis and discussions on how the forex exposure management processes are done and practices followed in select countries and in India shall be covered.