CASH AND DERIVATIVES MARKETS IN FOREIGN EXCHANGE

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Cash and Derivatives Markets in Foreign Exchange

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To
Shital and Rahul for a quarter
century of a very pleasant association

Praise for *Cash and Derivatives Markets in Foreign Exchange*

"I started reading the book, intending to go over only the captions, but ended up devouring the whole of it in one sitting! The book provides great entry-level coverage of all topics relevant to the users of the Indian FX and derivatives market."

Sudhir Joshi
Formerly Head, Treasury, HDFC Bank

"To be able to explain complex ideas in simple words, to be of relevance to the policy-makers, professionals and neophytes alike, and to continue to hold the reader's interest, be it in weekly articles or a book—are extremely rare skills. Mr. Rajwade possesses these skills and deserves all the accolades for writing this book… . His vast theoretical knowledge and rich practical experience are once again on display! All readers will find something useful from the wide range of topics that he has covered with consummate ease".

Partho Datta
Former Finance Director, Murugappa Group

"The complex subject of foreign currency risk management and derivatives has been dealt with so lucidly and brilliantly by Mr. Rajwade. His books come as a savior to all financial controllers and regulators who have been perplexed, cheated or badly hit recently. These books are a must read for all Board members, Audit Committee members and advisors who have to deal with Risk and Volatility."

Shailesh V Haribhakti
Chairman, BDO Haribhakti Consulting Pvt. Ltd.

Foreword

I have the pleasure of writing a foreword to the two companion volumes, "*Cash and Derivatives Markets in Foreign Exchange*" and "*Currency Exposures and Derivatives: Risk, Hedging, Speculation and Accounting—A Corporate Treasurer's Handbook*", by Mr. A V Rajwade. The manuscripts gave me an opportunity to partly refresh my memory and partly to know some new aspects, and above all also provoked me to ponder over some of the issues discussed, in relation to the recent developments, consequent upon the global crisis.

The volume on Foreign Exchange and Derivative Markets is of particular interest for getting an overview of the complex subject. Chapter 1 on foreign exchange rates is very informative and presents the topic in a simple as well as objective fashion. It is in the nature of an introduction to the lay person and a guide to the practitioner. The often ill-informed debate on exchange rate management in India would do well to note two statements in the book: "Broadly speaking, the exchange rate of any currency can be determined in two ways: either administered by the central bank, or by demand and supply in the exchange market. Various combinations of the two extremes are not only possible but are more the rule".

"To be sure, the dividing line between 'independently floating' (the dollar, the euro and the yen for example) and 'managed floating' often gets blurred in practice. To the extent a central bank intervenes in the exchange market in pursuance of international economic co-operation or domestic macro-economic objectives, the exchange rate of the independently floating currencies is also managed".

Similarly, those who tend to extensively use the word 'devaluation' or 'up-valuation' are well advised to refer to the section on exchange rate indices, which opens with a clear statement: "Since the dawn of the floating exchange rate era, the terms 'devaluation' or 'up valuation' of a currency have lost much of their significance or meaning: a currency may depreciate against some while simultaneously appreciating against others, that too by varying percentages. It is, therefore, necessary to devise some measure, or index, to determine the appreciation or depreciation of a currency from a base date, against foreign

currencies as a whole, i.e., the effective exchange rate of the currency in question. Various indices are in use for the purpose. Some of the more important ones are described in subsequent paragraphs".

The author refers to the Multilateral Exchange Rate Model (MERM), developed by IMF, which has not been used so far in India. Perhaps, empirical work should begin on this area. I am happy to note a reference in the book to the fact that Reserve Bank of India had provided details of the methodology used for its indices (NEER, REER) in the RBI Bulletin of December 2005.

The chapter on Foreign Exchange Markets is an excellent primer on the subject, and is characterized by clarity and comprehensiveness. It explains why the forex markets are often described as the most primitive among modern financial markets and how there are multiple rates in foreign exchange, particularly to the disadvantage of non-financial and retail customers. The words used by the participants in foreign exchange markets are often misleading: "spot transaction" means one in which cash settlement takes place within two business days and not on the trade data as lay persons may believe.

Detailed references in the books to the surveys of the Bank for International Settlements help not only in a review of the past and an understanding of the current status but also act as a guide to updating the reader. Similarly, the regulatory framework of RBI in regard to foreign exchange markets is presented in a very simple and easily understandable form. Chapters 3 and 4, "*Exchange Arithmetic*" and "*Global Financial Markets: An Overview*" are interesting practical guides to the participants, both the knowledgeable and the lay people.

Chapter 5, "*Exchange Rate Movements and Managing Currency Risks*" contains two passages which I cannot resist reproducing here:

"In Chapter 2, we have discussed the functioning, size and practices in the global and domestic foreign exchange markets. In this chapter, we take an overview of exchange rate movements, in the global and domestic markets; their predictability or otherwise; and the need for and elements of a corporate exchange risk management policy. It is not the intention to discuss these issues at any great length here: the interested reader may like to refer to the companion volume on the subject ("*Currency Exposures and Derivatives: Risk, Hedging, Speculation and Accounting—A Corporate Treasurer's Handbook*").

"Media reports and commentary often give an impression that there are stable and consistent relationships between fundamentals and market movements: too often these are rationalizations after the event, and one should be cautions in putting faith in one's own (or others') ability to predict. Academic research strongly suggests that markets are too 'efficient' to be predicted".

The interesting fact is that no one really knows what appears to be the right foreign exchange rate, but then central banks may have to intervene, with varying degrees of frequency and intensity. This is a problem for central banks, and understandably Mr. Rajwade does not deal with such dilemmas.

The section on 'Derivatives' is of particular interest in view of the recent decision in India to encourage them and in view of the serious concerns on their effect on stability, globally. The treatment of the subject in all the chapters is exhaustive, informative and easily comprehensible. Mr. Rajwade makes a very interesting observation, namely that derivatives are good but only that in moderation and to the extent needed. For example, he says "Relatively simple derivative products provide ample scope for risk transfer. It is not clear why increasingly complex and opaque products are needed other than to increase risk and leverage as well as circumvent investment restrictions, bank capital rules, securities and tax legislation. A central reform proposed is the central clearing house (the central counterparty or CCP) where (so far unspecified) 'standardized' derivatives transactions must be transferred to an entity that will guarantee performance".

The companion volume on hedging, speculating, derivatives, regulations, risk management and accounting is an excellent primer on principles and a fine user's guide for practitioners. At the outset Mr. Rajwade explains in detail the three types of currency exposures, namely transaction exposures, translation exposures and economic exposures, and how all three can affect the bottom line of businesses. There is an inadequate and incomplete appreciation of the economic exposures of business entities in India, both by the analysts and even some framers of public policy. There is an impression that movements in exchange rate impact primarily the exporters, but in reality the impact on domestic industry is considerable, especially with the increasing liberalization of import regime. Perhaps, more academic work and policy analysis is needed on the area of impact of exchange rate on domestic industry. The contents are exhaustive, the treatment of the subject enlightening and very topical in view of recent developments. The developments include the distress experienced by several companies in the real sector in 2008 caused by the derivatives contracts entered into by them. The Reserve Bank of India gave detailed guidelines to banks on how they should offer such products—somewhat unusual practice for central bank. Yet, as Mr. Rajwade points out, many of them were violated by the bankers in pursuit of their business interests. As it turned out, in practice, the corporates have an unequal playing field when they dare to dispute with a banker, unless the corporates happen to be very important customers for the bank.

Yet, another recent development relates to changes in accounting and disclosure norms. There are several complexities and while the devil is in detail, Mr. Rajwade succeeds in superbly bringing together all relevant details in a comprehensive but in an easy-to-understand manner. One must recognize the recent developments, which warrant greater caution at global level in the regulation of derivatives by virtue of their own experience; and the very recent efforts in India to develop derivates market. Mr. Rajwade's treatment of complexities and ground realities of Indian derivatives markets should provide one lesson, namely, that financial markets like economic theory may be universal, but ignoring the institutional and country context would be unwise.

Particular mention needs to be made of Chapters 2 and 3 on Exchange Rate Movements, and herein Mr. Rajwade says "After almost four decades of following international forex market daily, to me it seems that:

- too often, reports rationalize what has happened (contrary results are explained away) by saying that the economic event — interest rate change, trade deficit, etc.— was more or less than 'market expectations');
- that it is unrealistic, if not foolish, to assume stable 'cause and effect' relationship between economic events and their impact on exchange rates;
- that there is no point in looking for 'news' behind every exchange rate change;
- that expectations change exchange rates as much as the rate change affects expectations (George Soros' famous "reflexivity" — see his 'The Alchemy of Finance')".

For those who put faith in forward markets, Mr. Rajwade says: "If fundamentals are useless in predicting exchange rates, if technical analysis is not of much use, the forward rate as a predictor of the future spot rate has proved equally unreliable. Most studies suggest that it is not even an unbiased indicator, that is, one which errs on both sides more or less equally. To cite one of many examples, through the period from 1979 to 1984 over which the dollar doubled in value against most major currencies, it was continuously at a discount in the forward market, given the high interest rates in the US. More recently, between April 1995 and August 1998, when the yen moved for JPY 89 to a dollar to JPY 147, it was continuously at a premium in the forward market". Chapter 5 "*Risk Management Policies*" and Chapter 6 "*Use and Misuse of Derivatives*" provide telling examples of great operational significance.

In this context, it is useful to note some of the observations of Mr. Satyajit Das (who is quoted extensively by Mr. Rajwade) in an article (*Economic Times*, August 5, 2009) "Learn from Global Omissions to Prop up Derivative Sector". Mr. Das expresses some skepticism about Central Counter Party (CCP) as a total solution, in the following words: "While a CCP may help reduce counterparty risk, it is not a panacea for all problems in relation to derivative trading. Mis-selling of "unsuitable" derivative products to investors and corporations remains a problem. Expertise of purchasers is sometime inversely related to the complexity of derivative products". Mr. Das concludes the article with an advice to policy makers in India: "Until international regulators and legislators understand the central issues and are prepared to address them, no meaningful reform in the control of derivative trading will be possible. While derivatives can enhance Indian financial markets, wholesale deregulation and uncritical importation of international practice may not benefit India's economy and financial system. Reformers would do well to carefully consider the siren songs of 'modernity' and 'innovation' that have left the financial systems of many developed countries crippled".

To conclude, I read both volumes with great interest and benefitted from doing so. I have known Mr. Rajwade for nearly two decades, and respect him for his forthright expression and professional competence, combined with total integrity. He has a remarkable quality of drawing upon his vast practical knowledge of financial markets, wherever he was requested to do so, for the larger benefit of Indian economy. He has devoted his time and energy to assist Reserve Bank of India in its work on several occasions,; sometimes formally as a member of high-level committees. I take this opportunity to express my deep appreciation of his commitment and dedication to well informed and broader public debate.

The two books are undoubtedly a boon, to the economists who seek to understand the real world, the analysts who want to be objective, the practitioners in financial markets who want to benefit, the students who want to learn, and the policy makers who are willing to learn.

Dr. Y. Venugopal Reddy
Former Governor,
Reserve Bank of India.

Hyderabad
August 2009

Preface

This is my fourth book on the subject of foreign exchange. The first was *A Handbook of Foreign Exchange*, mainly covering exchange arithmetic, market jargon and practices; the second *Foreign Exchange and International Finance* was based on portions of the first book, and the notes I prepared and used for teaching a paper *International Banking and Finance* at the Indian Institute of Management, Ahmedabad; the third was *Foreign Exchange, International Finance, Risk Management*, which was first published in 1994, has gone into four editions and has sold more than 20,000 copies. It had, however, become bulkier with each edition.

I therefore thought of splitting the content in four separate books. The first two are coming out together (the present volume and *Currency Exposures and Derivatives: Risk, Hedging, Speculation and Accounting—A Corporate Treasurer's Handbook*). While the two books use some material from the earlier work, they have been extensively revised with additional material. I am working on two other books: one on derivatives, with much greater details about hedging and valuations as well as complex derivatives; and the other one on risk management for banks.

This book is divided in two sections: the cash market and the derivatives market. The first section also covers the forward exchange market although, strictly speaking, forward contracts are derivatives. The second section covers the basic derivatives in the forward and option families.

I am grateful to Dr. Y. V. Reddy, former Governor, RBI, for readily agreeing to write a joint foreword for this book and the companion volume. I am touched by the trouble he has so obviously taken and the very kind words and thoughts he has expressed on the books and the author. Thank you, Sir!

Shri Sudhir Joshi, formerly Head, Treasury, HDFC Bank, was kind enough to go through the text and suggested some changes, which I have incorporated. My thanks to him.

My colleagues, who have helped in writing this book, collecting and reviewing data, are Rahul Ghosh, Aniruddha Godbole, and Prajyot Chopda. Shital Lodhavia has almost alone borne the burden of typing, making umpteen changes, endless "cuts and pastes", with her usual commitment and good humor. My thanks to all of them.

I hope that this book will be useful to corporate treasury professionals, bank employees, chartered accountants, management students and all others interested in financial markets in general, and the foreign exchange market in particular.

A.V. Rajwade

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The Cash Market

It is customary to use the word "cash market" to describe the market in an underlying asset, as distinct from derivative contracts based on the prices of the underlying. In this section, we discuss both the domestic and global cash markets in foreign exchange. There is also a chapter devoted to exchange arithmetic.

The fourth chapter covers a somewhat different topic, namely the global financial, as distinct from foreign exchange, market. It is not the intention to cover the topic in detail; the objective is to give to the reader a basic understanding of the global financial market, the practices and terms commonly used in the market, etc. as these will be relevant to an understanding of the derivatives which we discuss in Section 2.

The chapters in this section are as follows:

Chapter 1 : Foreign Exchange Rates
Chapter 2 : Foreign Exchange Markets
Chapter 3 : Exchange Arithmetic
Chapter 4 : Global Financial Markets: An Overview
Chapter 5 : Exchange Rate Movements and Managing Currency Risks

Chapter 1

Foreign Exchange Rates

1.1 Introduction and a Brief History

1.1.1 Historical Background

Before describing the foreign exchange market now existing, it is as well to take a brief overview of its evolution, especially since the end of the Second World War.

1.1.2 Formation of the IMF

Historically, cross border payments had been settled in gold or other precious metals (see Box 1.1). The gold standard, under which a currency's value was fixed in terms of gold (and money in circulation was limited to the availability of gold with the country's treasury), was a more recent development. It worked reasonably well from the nineteenth century to the First World War. During this period, the United Kingdom was the world's premier trading and lender country. After the war, the United Kingdom could no longer play this role. By then, the United States had become the largest economy and had accumulated huge stocks of gold.

In the late 1920s, as the stock market crash pushed the United States into a recession, and its adopted trade protectionist measures, American imports fell and the consequent trade deficits in European countries had to be financed by export of gold. This in turn meant a drop in domestic money supply and deflation. To counter domestic unemployment, many countries resorted to competitive devaluations, multiple exchange rates, and other measures to protect domestic economies. In 1931, the United Kingdom quit the gold standard and 25 other countries followed suit. Overall, the gold standard came to be identified with the 1930s deflation and unemployment. The worldwide depression really ended only with the beginning of the Second World War. But the experience of the 1930s underlined the importance of international monetary co-operation.

The foundation of the post-second world war international monetary system was laid in a conference held at Bretton Woods, New Hampshire, United States, in July 1944. Representatives of 45 governments participated in the Bretton Woods conference and settled the Articles of Agreement of a new international organisation. The International Monetary Fund came into being in December 1945 after 44 countries (other than the erstwhile Soviet Union) signed the Articles of Agreement. The International Bank for Reconstruction and Development ("World Bank") was also formed as a part of the deliberations at Bretton Woods.

Box 1.1 Gold: The First Convertible Currency

For thousands of years, man has been obsessed by gold: we in India even today are, as evidenced by the quantity imported – for jewellery, for hoarding, for dowry. Indeed, purchase of some gold, particularly at the time of marriages, has become such an integral part of our culture, that when gold imports were banned for much of the second half of the 20th century, there was no diminution of demand: it gave birth to smuggling, a huge unaccounted economy, a Hawala (unofficial/illegal) market in foreign exchange, and bred some extremely wealthy and powerful smugglers/gangsters. In retrospect, the decision to ban imports and persist with the ban for decades was probably as economically harmful a decision as Britain's restoration of the gold standard, that too at pre-war parity, in 1925.

But gold has led to any number of irrationalities in human behaviour – across centuries and cultures as diverse as the American Indians, the Egyptians, the Europeans and in the east: no wonder Keynes once described gold as a "barbaric relic of human irrationality" and claimed that gold mining, "not only adds nothing whatever to the real wealth of the world…but is the only pretext for digging holes in the ground which has recommended itself to bankers as sound finance." The comment has the context of Britain's restoration of the gold standard of which he was a persistent critic. No other metal, not even its cousin silver, has mesmerized human psyche so much, and for so long.

But why gold, and not some other metal or commodity? While cowries and other goods were used as money from time to time, none has succeeded in dominating the human mind, and in its acceptability, as much as gold. What is so special about it?

For one thing, it has few intrinsic uses. (The Africans in the middle ages knew this – they were happy to part with an ounce of useless gold for an ounce of salt, without which they could not live.) Secondly, it is not very plentiful (like say iron or coal or even copper), is durable (does not get oxidized), readily recognizable, lustrous and beautiful to look at, and malleable. It is these qualities of the metal which probably made many ancient civilizations, independently of each other, to use gold as ornament, to display wealth. It found acceptance for displaying wealth much before it became money, or medium of exchange, perhaps 700 years BC. Gold as money required standardization of the purity and weight of coins, etc. Stamping of gold coins with the ruler's visage or symbol was the first step to bring "nationality" to what earlier was a global currency; much of cross border trade was initially paid for by barter or in gold – the world's first fully convertible currency.

If gold played a great role in facilitating cross border trade as a medium of exchange, the relationship between the supply of gold in an economy and the price level (or inflation) has also been known since long: also, even in the Middle Ages, rulers knew the technique of "debasing" gold coin, i.e. mixing cheaper ("base") metals in gold coins, when they fell short of gold. This benefited the issuer of the coin through the difference, known as "seignorage". Modern central banks earn seignorage through issue of interest free liabilities in the form of currency notes. Thus, all the basic concepts of modern monetary systems – money supply and inflation, devaluation, seignorage – date back to use of gold as money.

The greed for gold has often led man to inflict great cruelties on others. Perhaps the worst example is what Spanish invaders did to the Incas, native residents of Peru, in Central America, in the late 15th and early 16th century. The King of the Incas was invited for a social function. He came in good faith, and was brazenly kidnapped by the invaders. The Indians were forced to pay a huge ransom in the form of tonnes of gold on false promises of releasing the King on payment. The lust for gold has had a lot to do with the white man's atrocities against the indigenous peoples of America.

Nor did the gold brought in such manner and in huge quantities, do much for the Spanish King or the people of Spain. The King squandered resources in endless wars – and the people suffered because of domestic inflation thanks to the wars and an increase in gold (or money) supply.

(Some of the historical details are taken from Peter L. Bernsteins' fascinating book "The Power of Gold: The History of an Obsession".)

1.1.3 The Fixed Rate System

On foundation, the IMF drew up a detailed code of conduct for member countries which included rules about exchange rates. Article IV of the IMF provided for fixed exchange rates and member countries agreed not to change these rates except in consultation with the Fund. Besides, the Fund would agree to such a change only in the event of a `fundamental (i.e. not temporary) disequilibrium' in the external payments position of a member country. The initiative for changing the exchange rate had to be taken by the member country. The code of conduct also aimed at furthering a liberal multilateral system of international payments and convertibility of currencies for current account transactions.

In pursuance of the fixed exchange rate regime, each country agreed upon a certain par value for its currency, measured in terms of gold. The United States, which emerged as the strongest economy at the end of the war, was however the only country which undertook to convert its currency into gold and vice versa at a fixed price of USD 35 per ounce of gold.

One of the initial achievements of the IMF was to get member countries to eliminate, over the first two decades, the multiple exchange rate systems earlier adopted by some of them. The fixed exchange rate system brought into being by the IMF envisaged that currencies other than the dollar, while having a notional, or theoretical, gold content, were not "convertible" into gold. However, the gold content established a par value for each currency against the US dollar. And, the central bank of each member country was obliged to intervene in the foreign exchange market (by buying or selling dollars against the local currency) to ensure that the actual rate stayed within 1 percent of the parity.

1.1.4 Strains in the Fixed Exchange Rate System

The initial exchange rate objectives of the IMF were well on their way to being achieved by the middle of the 1960s — all members had declared par values, the multiple rates had been mostly eliminated, and an increasing number of currencies, in West Europe for example, had become convertible for current

transactions. As a result, world trade was growing at a rapid pace and led to fast recovery in the economies of Western Europe and Japan.

By then, however, the IMF-administered fixed exchange rate system had started showing signs of strains from different directions. First and foremost, world liquidity, measured in terms of aggregate reserves of the member countries, was not keeping pace with growth in world trade. This led to apprehensions that growth in trade would be hampered if measures were not taken to improve and increase world liquidity.

The second major strain in the system was arising from the sharp increase in dollars held by other member countries of the IMF as a result of the current account deficits of the United States. This was bringing into question the ability of the United States government to meet its undertaking to convert dollars into gold at a fixed rate of USD 35 per ounce of gold. By 1960, the United States external liabilities exceeded its reserves of gold. The outflow of dollars from the United States got a further fillip in the 1960s as a result of the Vietnam War. Central banks, which were the major holders of dollars, were getting worried that should all of them insist on converting their dollar balances into gold, the United States Treasury's stock of gold would be insufficient to meet the demand.

Yet another strain was the result of the rigidity imposed by the fixed exchange rate system—adjustments in par values could not be done quickly enough to reflect changes in economic fundamentals. This was all the more so in the case of countries running a persistent surplus on the current account. The initiative for a change in the par value had to come from the member concerned and, too often, countries with undervalued currencies had little incentive to initiate the change. The export success of Japan and West Germany was based on a significant undervaluation of their currencies during a major part of the fixed rate era.

1.1.5 The Liquidity Problem: SDRs

The liquidity problem was tackled reasonably successfully through the creation in 1969, after six years of intensive effort, of a reserve asset to be allocated by the Fund in proportion to members' quotas. This reserve asset is called special drawing rights (SDRs). Members in need of foreign exchange resources can buy usable currencies from another member, designated by the IMF, against its SDR quota. Successive allocations of SDRs under the scheme now total SDR 21.4 bn, the last allocation having been made on January 1, 1981.

For determining the value of one SDR, a basket of currencies, which is subject to quinquennial review, is used. The basket currently used, based on the last review on January 1, 2006, is as under:

SDR 1.00 = USD 0.6320 + EUR 0.4100 + JPY 18.40 + GBP 0.0903

At the exchange rates ruling on November 20, 2009, SDR 1.00 = $ 1.59720

The SDR is also the unit of account for all IMF transactions.

The role of SDRs as a global liquidity providing mechanism has lost its relevance today: in fact, global reserves as a percentage of trade are today the highest ever, thanks to huge accumulation of reserves by Asian countries and oil exporters.

1.1.6 Collapse of the Fixed Rate System

While the problem of liquidity could be tackled through creation of special drawing rights, the other strains developing in the system were not capable of an easy solution. As the ability of the United States government to exchange dollars for gold came under increasing pressure, some countries, France in particular, started doing exactly that; others were politically pressurized by the United States not to do so. The uneasy situation continued for a few years. In 1968, the United States limited its undertaking to convert dollars into gold and vice versa, at a fixed price, to officially held (i.e., forming part of the reserves of other countries) dollars and gold. In August 1971, even this convertibility was withdrawn. With this, effectively, the fixed rate system in operation for the previous 25 years collapsed. No doubt, there were attempts, notably the Smithsonian Agreement of December 1971, to bring back the fixed rate system without the backing of gold. However, these did not succeed and the world economy has been living in an era of floating exchange rates since the early 1970s. Currencies, outside their home countries, have lost the character of "money", and have become more like commodities.

Box 1.2 The Rupee's Exchange Rate: A Brief History

India was a founder member of the IMF. During the existence of the fixed exchange rate system, the intervention currency of the Reserve Bank was the British pound; the RBI ensured maintenance of the exchange rate by selling and buying pounds against rupees at fixed rates. The interbank rate, therefore, ruled within the RBI band. During the fixed exchange rate era, there was only one major change in the parity of the rupee—a devaluation in June 1966.

After the collapse of the fixed exchange rate system in 1971 also, the RBI continued to maintain the parity with the pound, with some minor changes; the exchange rates against other currencies were determined through their cross rates against the pound.

This link with the pound continued until September 1975. By then, in recognition of the fact that India's trade had substantially diversified in terms of both currencies and destinations and that, therefore, the link with the pound was no longer very logical, the rupee's exchange rate was linked to a basket of currencies. The composition of this basket was kept secret and the pound continued as the intervention currency. Its exchange rate against the rupee was so fixed by the RBI daily, and sometimes changed intra-day, as to ensure that the value of the (secret) basket of currencies remained reasonably steady in rupee terms.

In the early 1980s, the RBI undertook a study of the real effective exchange rate (see paragraph 1.4.3) of the rupee; it was published in the series of Occasional Papers, June 1984, ("The Nominal and Real Effective Exchange Rate of the Indian Rupee 1971-83" by Dr Vijay Joshi). The principal conclusions of the study were that the real effective rate (RER) of the rupee depreciated by 11.5% between 1971 and 1975 and by a further 17% between 1975 and 1979. From 1979 to 1983, however, it showed a sharp 15% appreciation.

It seems that, as a result of the study, the RBI started to depreciate the rupee in nominal terms beginning late 1983, to correct the earlier real appreciation, and continued a modest fall in real terms even thereafter. This policy continued up to June 1991.

In the first week of July 1991, a two-step devaluation of the rupee was engineered (and the cash compensatory support for exports discontinued), and the intervention currency changed to the United States dollar.

The next major change was the introduction of a liberalised exchange rate management system (LERMS) in March 1992. This introduced a dual exchange rate system. One rate was the administered (or official) one at which specified type or proportion of currency exchange had to be transacted. For example, out of the receipts of foreign exchange from exports, 60% could be sold in the market at the market rate and the balance had to be surrendered to the Reserve Bank at the official rate. The foreign currency purchased by the RBI through this mechanism was sold to importers of oil (and a few other products) at the official rate.

The market rate was determined by demand and supply in the market and, as can be expected, the rupee was at a discount in the market, as compared to the official rate. In March 1993, this system was abolished and a single market determined rate is since applicable for all transactions.

1.1.7 Economic and Monetary Union in Europe

One of the more important developments in the international monetary system in the floating rate era, was the establishment of Economic and Monetary Union (EMU) and the introduction of the single European currency, the euro, effective January 1, 1999.

For European countries, intra-European trade is very important. Freely floating exchange rates, and the consequent uncertainties, would have had an adverse impact on the growth of trade and integration of their economies. The first response of the European countries to the collapse of the fixed exchange rate system was the so-called "currency snake" limiting inter se movements of currencies: movements of nominal exchange rates could be on either side of parity, or within a "tunnel" of permitted changes – hence also the term "snake in the tunnel" to describe the mechanism. Should the market rate of a currency threaten to breach the limits, the central bank was obliged to act.

The European Monetary System (EMS) established in 1979 was in effect a strengthening of the earlier currency snake, but, unlike the snake, limited to members of the European Economic Community (now the European Union). One distinguishing feature of the EMS was the introduction of the European Currency Unit (ECU). The ECU, like the SDR, was a basket of the member countries' currencies. The weights given to individual currencies reflected the proportion of the country's GNP in the EEC gross product, and its share of the intra-community trade. The EMS arrangements provided for a quinquennial review of the composition of the ECU basket. The ECU has since been replaced by the euro.

The exchange rate mechanism (ERM) of the EMS established a parity grid with a band for the permissible movement of exchange rates between each pair of currencies. The band was +/– 2.25 percent for most currencies; a few had opted for a wider +/– 6 percent band. If the exchange rate between any

two ERM participating currencies reached either limit, both the central banks were obliged to buy (sell) the two currencies for unlimited amounts to ensure that the limit was not breached. This represented a major strengthening of the earlier snake framework.

Encouraged by the success of the ERM—parities had remained virtually unchanged for five years from early 1987—the EEC started considering a major structural change, namely Economic and Monetary Union (EMU), or a single currency for all EEC countries. Far-reaching proposals on transition to a single currency were adopted at a summit meeting of the EEC heads of government held at Maastricht in the Netherlands in December 1991. The proposals envisaged achievement of monetary union in three stages. Stage I began on July 1, 1990 (i.e. even before Maastricht) with free movement of capital within the EEC. Stage II commenced on January 1, 1994, with the establishment of a European Monetary Institute (precursor to the European Central Bank). Over stages I and II member governments would seek to achieve greater convergence of their economies under designated criteria: inflation, interest rates, exchange rate stability within the ERM, and the sustainability of the fiscal balance. At the start of stage III (earliest in 1997, but not later than January 1, 1999), member states meeting the convergence criteria would irrevocably fix *inter se* exchange rates, and proceed towards a single currency.

As envisaged, the euro was born on January 1, 1999, and the money, exchange, bond and equity markets in the 11 participating countries (Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain) started operating in the euro from that date. Currency notes and coins in the euro started circulating from January 1, 2002, and the participating currencies have ceased to be legal tender. Since then Greece, Slovenia, Cyprus, Slovakia and Malta have joined the euro. Among the older EU members, Britain, Sweden and Denmark have kept out.

1.2 Exchange Rate Arrangements

1.2.1 Fixed and Floating Rates

Broadly speaking, the exchange rate of any currency can be determined in two ways: either administered by the central bank, or by demand and supply in the exchange market. Various combinations of the two extremes are not only possible but are more the rule.

The IMF classifies the exchange arrangements of member countries under three broad heads:

- pegged, to a single currency (the United States dollar and the euro are most common), or a currency composite like the SDR;
- flexibility limited against a single currency or group of currencies (the Danish krone against the euro for example); and
- more flexible arrangements like "managed floating", and "independently floating".

To be sure, the dividing line between "independently floating" (the dollar, the euro and the yen for example) and "managed floating" often gets blurred in practice. To the extent a central bank intervenes in the exchange market in pursuance of international economic co-operation or domestic macro-economic objectives, the exchange rate of the independently floating currencies is also managed.

1.2.2 Currency Boards

There is yet another kind of exchange arrangement, not separately recognised by the IMF in the above classification. This is known as the Currency Board Arrangement, currently in force in Hong Kong and earlier in Argentina. This is a special form of pegged exchange rate in that the central bank has no control over domestic money supply – the Currency Board undertakes to convert domestic currency for foreign currency (United States dollar in the case of both Hong Kong and Argentina) at a fixed rate. The domestic money supply and interest rates depend on the foreign currency reserves available with the Currency Board. In an ideal Currency Board Arrangement, the reserves would be equal to the broad money supply measure. In Hong Kong, for example, specified commercial banks have the right to issue Hong Kong dollar currency notes—but they can do so only to the extent of United States dollars they deposit with the Hong Kong Monetary Authority.

Currency Board Arrangements suffer from two major weaknesses:

- domestic money supply and interest rates become a function of the reserves of foreign exchange, comparable to the old gold standard; and
- there is no lender of last resort for the banking system.

The experience of Argentina illustrates the difficulties and problems in Currency Board Arrangements. The Argentinean economy has been traditionally prone to hyperinflation. In a bid to bring inflation under control, Argentina adopted a Currency Board Arrangement in the early 1990s, at an exchange rate of 1peso=1dollar. Inflation did come under control and the experiment was deemed a success. However, problems started surfacing in late1990s as the United States dollar appreciated sharply on the international exchange market, and so did the peso because of the link with the dollar. The Argentinean economy became increasingly uncompetitive with imports as well as in export markets. The problem was exaggerated by the Brazilian devaluation of 1998. The result was a mounting deficit on the current account and a drop in economic activity by about 12/15% over 1998 to 2001.

Meanwhile, much of the central government debt was in the United States dollar. With mounting deficits on the current account, external lenders lost confidence and it became increasingly difficult to refinance maturing debt. Residents also started converting peso deposits into dollars at the parity level, taking advantage of the Currency Board Arrangement. The peg became

unsustainable and was abandoned in late 2001. The country also defaulted on its foreign currency debt recording, in the process, the largest ever sovereign default—USD 130 bn.

1.2.3 Foreign Currency as Domestic Currency

Panama, Equador and Salvador in Latin America have dollarised their economies; many Caribbean countries including, surprisingly, Cuba, are either legally permitting circulation of dollars, or are at least winking at it. Some of the central European aspirants to European Union membership have started adopting the euro as the domestic currency, well ahead of the membership.

1.3 Exchange Rates

1.3.1 Direct and Indirect Rates

Traditionally, there were two standard ways in which exchange rates are quoted:

A. Direct rates

   Under this system, the exchange rate for a foreign currency is expressed in terms of units of local currency equal to one unit of foreign currency. For example, USD 1.00 = INR 48.50 would be a direct exchange rate for the United States dollar in India.

B. Indirect rates

   Under this system, the exchange rate is quoted in terms of the number of units of foreign currency equal to a unit of local currency. For example, USD 2.0619 = INR 100 would be the corresponding indirect quotation in India for the United States dollar.

The system prevalent in India until August 1993 was to quote exchange rates in the indirect method—all quotations used to be in terms of foreign currency units equal to Rs 100. (The indirect rate system is also prevalent in the London market where quotations are for GBP 1.00.) A switch was made to the direct rate system and consequently all quotations are now in terms of rupees equal to a unit of foreign currency. For the current practice, please see Chapter 2.

1.3.2 Exchange Rate Quotations

If, in London, where the exchange rates are quoted indirectly, the United States dollar is quoted at USD 1.6290-98, it means that while the quoting bank is willing to sell USD 1.6290 per pound, it will buy dollars (i.e. sell pounds) at USD 1.6298. It will be readily appreciated that the selling rate for one currency is the buying rate for the other. The indirect rate system also yields the somewhat odd maxim namely "buy high and sell low". The "buy high and sell low" maxim refers only to the nominal rates—no trader will make a profit if he buys at a higher cost than the yield on selling.

1.3.3 Bid and Offered Rates

The buying and selling rates are also referred to as the bid and offered rates. In the dollar exchange rate referred to above, namely, USD 1.6290/98, the quoting bank is offering (selling) dollars at USD 1.6290 per pound while bidding for them (buying) at USD 1.6298. In this quotation, therefore, the bid rate for dollars is USD 1.6298 while the offered rate is USD 1.6290. The bid rate for one currency is automatically the offered rate for the other. In the above example, the bid rate for dollars, namely USD 1.6298, is also the offered rate for pounds.

1.3.4 Forward Exchange Rates

Exchange rates for exchange of currencies at a specified future date, or within a specified future period, are readily quoted in the foreign exchange market. Contracts can be entered into at such forward rates binding the two contracting parties (counterparties) to exchange currencies at the contracted rate at the specified date/period.

Forward rate quotations are either in the form of outright rates (USD 1.55 per pound for example), or in the form of margins, i.e. difference between spot and forward rates (for definition of spot rates see Chapter 2).

1.3.5 Derivatives

Over the last couple of decades a huge market has grown up in derivatives based on exchange rates (see Chapter 6). In fact, a forward contract is also a derivative.

1.4 Exchange Rate Indices

Since the dawn of the floating exchange rate era, the terms "devaluation" or "upvaluation" of a currency have lost much of their significance or meaning: a currency may depreciate against some while simultaneously appreciating against others, that too by varying percentages. It is, therefore, necessary to devise some measure, or index, to determine the appreciation or depreciation of a currency from a base date, against foreign currencies as a whole, i.e., the effective exchange rate of the currency in question. Various indices are in use for the purpose. Some of the more important ones are described in subsequent paragraphs.

1.4.1 Nominal Effective Exchange Rate Index

The nominal effective exchange rate (NEER) index is based on "nominal", i.e., actual, unadjusted exchange rates, existing during the base period (or date) and the comparison period. Weights are given to each currency in such a way that the total of the weights is 1 (in other words, the index is 1 in the base

period/date), and the index is calculated by applying the weights to the ratio of the exchange rates ruling during the comparison and base periods.

The most common and simple basis for assigning weights is trade (hence, trade-weighted exchange rate, or TWER, index). Thus, the weight to be given to say the dollar in the rupee TWER index would reflect the proportion of our trade with United States as compared to our total trade. If our trade with the United States is say Rs. 500,000 crores a year, and our total trade is Rs. 20,00,000 crores, the dollar's weight will be 25%. Again, as a rule, the currencies of all the countries we trade with may not be used in calculating the index. For instance, we may choose to ignore currencies of countries whose trade with us is less than say 1% of our total trade. In that case, the weights will need to be reworked on the basis of the trade with countries included in the index calculation. For example, in the illustration cited above, if trade with countries not to be included is say Rs. 150,000 crores, the dollar weight will be $(500/1850 \times 100)\%$ or 27.03%.

It is also sometimes useful to calculate separately the export TWER and import TWER indices, using weights based on exports and imports. It is customary to use 100, instead of 1, as the base.

So calculated, the nominal TWER index is an indicator of the appreciation, or depreciation, of the home currency against the currencies of our trading partners taken together. However, as a measure of competitiveness of our exports or imports, it suffers from two major disabilities:

a. It does not give due weightage to the exchange rates of our competitors in third countries; and
b. The difference in inflation rates is ignored.

To illustrate the first point, let us consider that our exports to, say, Sri Lanka are negligible and therefore that country's currency is not included in our export TWER index. However, Sri Lankan tea exports compete with our tea exports in world markets. If the Sri Lankan currency has depreciated more than the Indian rupee, Sri Lanka gets a competitive edge over us, which is not reflected in our export TWER index.

To make the index a better indicator of price competitiveness, the International Monetary Fund has developed a weighting model known as the Multilateral Exchange Rate Model (MERM). This is a highly complex model and has not so far been used in India.

1.4.2 Real Effective Exchange Rate

The second weakness of the NEER index as an indicator of international price competitiveness is that it does not take account of inflation. The classical purchasing power parity theory of exchange rates (PPP) postulates that exchange rates must move to compensate for inflation differentials, if international price competitiveness is to be maintained. In other words, if our inflation rate is 8% a year, and that in the United States 3%, the dollar should apppreciate

by 4.85% (1.08/1.03) against the rupee to compensate for the higher domestic costs.

The real effective exchange rate index (REER) therefore uses "real" exchange rates, i.e., nominal rates adjusted for relative inflation, to calculate the index. For example, if a dollar was worth Rs. 40.00 at the base date and is worth Rs.50.00 now, in nominal terms the dollar has appreciated by 25%, (or the rupee has depreciated by 20%). Therefore, our goods should be more cost competitive in the United States. However, if our costs have gone up by 40% (in rupee terms) during the period, and the prices in United States by only 10% in dollars, in "real" terms we have become less competitive.

1.4.3 Published Indices

Most central banks publish the NEER and REER indices for the domestic currency. Some, like the Bank of England, publish indices for other currencies as well. In India, the Reserve Bank publishes the NEER and REER indices for the exchange rate of the Indian rupee. In fact, it compiles two series, 36 country and 6-country. The weights are periodically revised to reflect the changing pattern of the country's trade. Rise in indices indicate appreciation of rupee and vice versa. Those interested may refer to RBI Bulletin, December, 2005, issue available on the RBI website, for details of the methodology used.

Chapter 2

Foreign Exchange Markets

2.1 Markets in Financial Assets

Markets in financial assets like stocks and bonds have been in existence in one form or another for the last 400 years or so. Initially, these were in the form of traders/brokers meeting in coffee houses to trade. The first stock exchange started functioning in Amsterdam in the seventeenth century. The London stock exchange followed in 1688. For a long time, trades were in bonds rather than stocks, since there were few traded shares. As a larger number of companies started selling shares to public, the exchanges, generally owned by brokers trading on it, started becoming more organized in terms of business hours, other regulations, rules for admission of new members, etc.

For a long time, indeed until well after the Second World War, trading in stock exchanges was by means of "open outcry"—a system of doing trades on the floor, or pit, of the exchange, with traders using arcane hand signals to make deals. The major role of organized exchanges was not just to bring the traders and brokers in one physical location, but also to frame trading rules, look into and decide on complaints and, increasingly, to ensure that trades are settled i.e. the buyer paying cash and the seller delivering the share or bond traded.

In recent decades, with the rapid improvements in communication and information dissemination and processing systems, the traditional open outcry system is increasingly giving way to electronic trading. Also, exchanges formally guarantee settlement of trades themselves or, more often, through separate clearing companies.

The process of converting one currency into another, historically through the medium of precious metals, has been in existence since times immemorial. On the other hand, foreign exchange markets, in the sense of continuous trading and ready availability of buy/sell prices, are of a much more recent origin. Arguably, the modern foreign exchange market was born after the collapse of the IMF administered fixed rate system.

2.2 Foreign Exchange Market

The process of trading one currency for another has rarely been conducted on exchanges. To be sure, many European countries had *bourses* (French for exchange) where those desiring to buy and sell foreign currencies gathered at an appointed hour and, often with the help of the central bank, arrived at rates at which all the buy and sell orders would be cleared. This was known as the "fixing rate" or "fixing".

Even today, in general, forex trades are not conducted on exchanges. It should be noted however that some derivative contracts based on forex rates are traded on exchanges. In other words, the bulk of the forex market today is "over the counter" (OTC). Trades are effected on telephone/telex/fax, through electronic dealing systems or intermediation of brokers, and not on the floor or pit of an exchange. There are a few corollaries to an OTC market as distinct from an exchange:

- There is less price transparency—but modern information and communication systems have improved the situation;
- In the absence of a guarantor to the trades, there is risk that a counterparty may default;
- The positive side is that trades can be customized in terms of amounts, maturities and currency pairs;
- At a given point of time, there can be—and, as a rule, are—differences in the exchange rates for the same currency pair, for different counterparties depending on the amount of the trade, the counterparty risk, etc. This is particularly so for non-financial customers.

2.2.1 The Global Market: BIS Surveys

The Bank for International Settlements (BIS), based in Basle (Switzerland) and often referred to as the central banks' central bank, has been conducting surveys of the global foreign exchange and derivatives market activity every three years. The first survey was conducted in 1992 and the latest in April 2007. The latter covered 1260 participants across 54 countries. The BIS surveys represent the most authentic information on the global market, and much of the data in this paragraph is drawn therefrom.

a. Global Turnover

BIS classifies foreign exchange trades under three broad types of transactions as follows:

"*Spot transaction:* *Single outright transaction involving the exchange of two currencies at a rate agreed on the date of the contract for value or delivery (cash settlement) within two business days. ….*

Outright forward: *Transaction involving the exchange of two currencies at a rate agreed on the date of the contract for value or delivery (cash settlement) at some time in the future (more than two business days later).*

Foreign exchange Swap: *Transaction which involves the actual exchange of two currencies (principal amount only) on a specific date at a rate agreed at the time of conclusion of the contract (the short leg), and a reverse exchange of the same two currencies at a date further in the future and at a rate (generally different from the rate applied to the short leg) agreed at the time of the contract (the long leg). Both spot/forward and forward/forward swaps are included. Short-term swaps carried out as "tomorrow/next day" transactions are also included in this category."*

The following Table 2.1 summarises the market turnover under the three types of transactions, as reported in the latest (2007) BIS survey.

Table 2.1 Global Foreign Exchange Market Turnover[1]

Daily averages in April, in billions of US dollars

	1992	1995	1998	2001	2004	2007
Spot transactions	394	494	568	387	621	1,005
Outright forwards	58	97	128	131	208	362
Up to 7 days	–	50	65	51	92	154
Over 7 days	–	46	62	80	116	208
Foreign exchange swaps	324	546	734	656	944	1,714
Up to 7 days	–	382	528	451	692	1,329
Over 7 days	–	162	202	204	250	382
Estimated gaps in reporting	44	53	61	26	107	129
Total "traditional" turnover	820	1,190	1,490	1,200	1,880	3,210
Memo: turnover at April 2007 exchange rates[2]	880	1,150	1,650	1,420	1,950	3,210

[1]Adjusted for local and cross-border double-counting. Due to incomplete maturity breakdown, components do not always sum to totals. [2]Non-dollar legs of foreign currency transactions were converted from current US dollar amounts into original currency amounts at average exchange rates for April of each survey year and then reconverted into US dollar amounts at average April 2007 exchange rates.

The data are witness to the remarkable growth in foreign exchange trading over the years: since the surveys began, there has been only one drop in turnover, between 1998 and 2001. This was the result of the introduction of the single European currency on January 1st, 1999, eliminating the trades between participating currencies. At $ 3.2 trillion per day, the global foreign

exchange market is by far larger than any other market—commodities, equities or bonds. To put the number in perspective, **the daily turnover is almost 25 times the annual global trade, and 20 times the global trade and capital flows.**

The foreign exchange market is unique in many ways because of

- its trading volumes,
- the extreme liquidity of the market,
- the large number of, and variety of, traders in the market,
- its geographical dispersion,
- its long trading hours: 24 hours a day (except on weekends),
- the variety of factors that affect exchange rates.

Geographically, the international foreign exchange markets extend from Tokyo and Sydney in the East through Hong Kong, Singapore, Bahrain/Dubai, the European centres, London, New York, and to the west coast of the United States. It extends through all the time zones and, in effect, is a 24-hour market through the week. More technically, the market functions from 9.00 a.m. in Sydney on Monday to 5 p.m. in New York on Friday.

Data about transaction volumes in the major markets are summarized below

Table 2.2 Geographical Distribution of Reported Foreign Exchange Market Turnover[1]

Daily averages in April, in billions of US dollars and percent								
	1998		2001		2004[2]		2007	
	Amt	% share	Amt	% share	Amt	% share	Amt	% share
U.K.	637	32.5	504	31.2	753	31.3	1,359	34.1
U.S.	351	17.9	254	15.7	461	19.2	664	16.6
Switzerland	82	4.2	71	4.4	79	3.3	242	6.1
Japan	136	6.9	147	9.1	199	8.3	238	6.0
Singapore	139	7.1	101	6.2	125	5.2	231	5.6
Hongkong SAR	79	4.0	67	4.1	102	4.2	175	4.4
Australia	47	2.4	52	3.2	81	3.4	170	4.3
India	2	0.1	3	0.2	7	0.3	34	0.9
China[3]	0	0.0	0	0.0	1	0.0	9	0.2

[1]Adjusted for local double-counting ("net-gross").

[2]Data for 2004 have been revised.

[3]For 1998, 2001 and 2004, spot transactions only.

b. The Participants

The participants in the forex market can be classified under four broad categories.

(i) Non-bank entities who wish to exchange currencies to meet or hedge contractual commitments (arising out of, for example, import or export contracts in foreign currencies).

(ii) Banks that exchange currencies to meet client requirements.

(iii) Traders buying or selling currencies in the hope of profiting from price movements. In fact, speculative transactions of this nature are by far the largest proportion of the total activity in the market. The big traders in currencies include large commercial and investment banks, multinationals, and hedge funds (see Box 2.1). While in terms of transaction volumes, the big commercial banks are the biggest traders in the market, the other players sometimes dwarf them in terms of the amounts of speculative positions they take.

(iv) Arbitragers who take advantage of price disparities on a fully hedged basis have a limited role to play in the forex market: communication systems have made the market too efficient to allow many arbitrage opportunities.

The BIS survey data on the point are summarized below:

Table 2.3 Reported Foreign Exchange Market Turnover by Counterparty[1]

Daily averages in April, in billions of US dollars and percent

	1998		2001		2004		2007	
	Amt	% share	Amt	% share	Amt	% share	Amt	% share
Total	1,430	100	1.173	100	1,794	100	3,801	100
With reporting dealers	908	64	688	59	956	53	1,319	43
With other financial institutions	279	20	329	28	585	33	1,235	40
With non-financial customers	242	17	156	13	252	14	527	17
Local	657	46	499	43	674	38	1,185	38
Cross-border	772	54	673	57	1,099	62	1,896	62

[1]Adjusted for local and cross-border double-counting. Excludes estimated gaps in reporting. Due to incomplete counterparty breakdown, components do not always sum to totals.

Two points from the data are worth noting:

- the bulk of the transactions, 83%, are inter se banks and other financial institutions; and
- a majority are between cross-border counterparties.

While a small part of the interbank trades are in support of transactions with non-financial counterparties, a large majority are for "market making"

and trading. To elaborate, market making is aimed at providing both buy and sell prices on a continuous basis. Major banks act as "market makers". Some specialise in certain currencies while others act as market makers in most of the major currencies by offering two-way quotes—a simultaneous quotation of rates at which the bank is willing to buy and sell one currency for another. The United States dollar forms one leg for a preponderant proportion of quotes—in fact, most quotations are for dollar against another currency (see 'd' below). The unit of trading, or market lot, is USD 3 to 5 million (in India, the market lot is $ 1 mn). If a bank gives a two-way quote, it has to be willing to do the conversion at the quoted rate for this amount; if the counterparty desires a much lower (or, indeed, higher) amount, the market making bank is not bound to trade at the quoted rate. The two exchange rates quoted are referred to as the bid and offered rates. The bid rate for one currency is the offered rate for the other. The market maker is looking to make money mainly through the "spread" or difference between buy and sell prices, and not so much on price changes.

On the other hand, traders deliberately buy or sell a currency in the hope of profiting from price movement; in other words, they take directional bets, buying the currency they expect will appreciate and selling the currency they expect will depreciate. When the expectations turn out to be right, they make money—and lose it when they turn out to be wrong. In fact, trading profits, including in foreign exchange, have become a very important source of revenue for major international banks. Trading is, of course, a polite name for speculation.

Box 2.1 Hedge Funds

Hedge funds were originally investment vehicles for wealthy individuals, popular in the United States. Such funds are gaining increasing acceptance amongst other, including institutional, investors. The funds are rarely sold to the general investor through a public offering but are privately placed, minimum subscription often being in seven digit dollars. The funds are registered offshore and are subject to few regulatory or supervisory norms.

Such hedge funds have been in existence for the last fifty years. The name came into being as, initially at least, they were operating on a "hedged" basis and their results were thus independent of market movements. For example, a fund specialising in precious metals may "short" say (overpriced) silver and simultaneously buy an equal amount of say (underpriced) gold. The bracketed terms, "overpriced" and "underpriced" refer to the relative, not absolute, ruling prices of gold and silver in comparison with their historical relationship. The objective of the two (relative value) trades is to make a profit when the prices revert to their historical relationship. Thus, the results of the investment portfolio are independent of whether precious metal prices as a whole rise or fall.

Similar examples from other markets would be :

- *shorting, say, corporate AAA bonds, buying government bonds (results independent of interest rate movement)*
- *shorting say some software stocks, buying others (results independent of general movements of prices of stocks in the software industry).*

Over the years, hedge funds have gone on to take outright, i.e. long or short, positions in the currency, bond, equity, commodity, credit and credit derivatives, distressed debt and other markets, often for huge amounts, and have been blamed for destabilising particularly the currency market. They were also being blamed for the sharp hike in oil prices in 2008. Hedge funds typically take such positions in the market on a highly leveraged basis using the fund corpus as margin money. If margin is say 10%, a USD 100 mn fund could have speculative positions of the order of a billion dollars. Outright positions of course increase the risk, and reward, for those who have subscribed to the fund.

The main differences with the familiar mutual funds are:

- *the far greater degree of risk (and reward) because of leveraging and shorting;*
- *longer lock up of funds, and notice periods for disinvestment;*

The main differences with the familiar mutual funds are:

- *the far greater degree of risk (and reward) because of leveraging and shorting;*
- *longer lock up of funds, and notice periods for disinvestment;*
- *much higher fees, typically 15/20% of the profits, besides a small management fee (1 to 2%) charged on the funds under management (in contrast mutual fund managers fees comprise only the latter, typically 0.5 to 1% of the corpus);*
- *little supervision or regulation;*
- *lack of disclosure. Hedge fund managers generally refuse to disclose the investment strategy, or portfolio, to investors;*
- *fund managers often put a lot of their own money in the fund.*
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In recent years, particularly after the collapse of Long Term Capital Management in 1998, major changes have occurred in the structure of the hedge fund industry. Some of the more important ones are as follows:

- *Currently, there are several thousand hedge funds managing around USD 2 trillion.*
- *Historically, proprietarily managed funds like LTCM, George Soros' Quantum Fund and Julian Robertson's Tiger Funds, dominated the industry. Many of them have been closed after incurring losses. On the other hand, more and more mainstream houses like commercial and investment banks have floated hedge funds.*
- *The investor mix too has undergone a change. On the one hand, institutional investors like pension funds are investing in hedge funds; on the other, some funds are welcoming even relatively small, individual investors. Indeed, a small industry of investment advisers who choose funds, for a fee, has grown up.*

In recent years, some "fund of funds" have also come into being: these are hedge funds investing in other hedge funds. A few have also gone for public listing.

While there have been a few spectacular failures (LTCM 1998; Amaranth, 2006), a majority of funds die in the first year itself. The industry performance therefore suffers from survivor bias. Some academics and investment banks have developed models which, they claim, would replicate hedge fund strategies, at a much cheaper cost to the investor. This is a relatively new development in the fund management industry and its success or otherwise is still to be tested.

Given the huge investment capital the industry commands—with leveraging, the aggregate risky bets of the hedge fund industry could well be of the order of $ 15/20 trillion –, the industry has the potential to pose systemic risks to the global financial system. There are therefore calls for its regulation but so far nothing much has been done on this front.

Do hedge fund managers gamble on investors' money? There is one major difference between gambling and speculative bets: the former cannot change the outcome, the latter sometimes can. To elaborate, gambling on the toss of a dice does not change the face that will turn up: speculating on the fall of the euro, done on a significant enough scale, does influence the exchange rate!

c. Currency Composition

The following Table 2.4 summarises the share of different currency pairs in foreign exchange trading.

Table 2.4 Reported Foreign Exchange Market Turnover by Counterparty[1]

Daily averages in April, in billions of US dollars and percent

	2001		2004		2007	
	Amt	% share	Amt	% share	Amt	% share
Us dollar/euro	354	30	501	28	840	27
Us dollar/yen	231	20	296	17	397	13
Us dollar/sterling	125	11	245	14	361	11
US dollar/AUD	47	4	90	5	175	6
US dollar/Sfr	57	5	78	4	143	5
US dollar/CAD	50	4	71	4	115	4
US dollar/SWD	–	–	–	–	56	2
US dollar/other	195	17	292	16	572	18
Euro/yen	30	2	51	3	70	2
Euro/sterling	24	2	43	3	64	2
Euro/Sfr	12	1	26	1	54	2
Euro/other	21	2	39	2	112	4
Other currency pairs	26	2	42	3	122	4
All currency pairs	1,173	100	1,773	100	3,081	100

[1]Adjusted for local and cross-border double-counting. [2] the US dollar/Swedish krona pair could not be separately identified before 2007, and is included in "other".

It is evident that the US dollar is by far the most actively traded currency in the world: this is also evidenced by the data in the following Table 2.5.

Table 2.5 Currency Distribution of Reported Foreign Exchange Market Turnover[1]

Percentage shares of average daily turnover in April 2007

	2001	2004	2007
Us dollar	90.3	88.7	86.3
Euro	37.6	37.2	37.0
Yen	22.7	20.3	16.5
Pound sterling	13.2	16.9	15.0
Swiss franc	6.1	6.1	6.8

Australian dollar	4.2	5.5	6.7
Canadian dollar	4.5	4.2	4.2
Swedish krona	2.6	2.3	2.8
Hongkong dollar	2.3	1.9	2.8
Norwegian krone	1.5	1.4	2.2
New Zealand dollar	0.6	1.0	1.9
Mexican peso	0.9	1.1	1.3
Singapore dollar	1.1	1.0	1.2
Won	0.7	1.2	1.1
Rand	1.0	0.8	0.9
Danish krone	1.2	0.9	0.9
Rouble	0.4	0.7	0.8
Zloty	0.5	0.4	0.8
Indian rupee	0.2	0.3	0.7
Renminbi	0.0	0.1	0.5
New Taiwan dollar	0.3	0.4	0.4
All currencies	0.4	0.2	0.4
Brazilian real	200.0	200.0	200.0
Emerging market currencies[2]	16.9	15.6	19.8

[1]Because two currencies are involved in each transaction, the sum of the percentage shares of individual currencies totals 200% instead of 100%. Adjusted for local and cross-border double-counting.
[2]Defined as the residual after accounting for the top eight currencies, the Norwegian krone, the New Zealand dollar and the Danish krone.

It will be noticed that the dollar is one currency in the case of 86% of the trades, followed by the euro (37%), the yen (16.5%) and the pound (15%). The dollar's predominance in the exchange market is the result both of the US being the largest economy in the world, and the dollar being the global reserve currency and the currency of pricing in all commodities markets.

If a currency pair is not actively traded (euro/Australian dollar for example), the exchange rate is calculated by "crossing" the exchange rates of the two currencies against the US dollar.

2.2.2 *Market Practices*

a. Rate Quotation

An exchange rate quotation is often described as ABC/DEF: ABC and DEF are the ISO 4217 three letter codes for individual currencies. Some examples of such codes are GBP (British pound); EUR (the euro); USD (U.S. dollar); JPY (Japanese yen); INR (Indian rupee) etc. Some currencies also have standard symbols like £, €, $, ¥, etc.

The number following the identified currency pair is the number of units of DEF which equals one unit of ABC, Usually ABC is the more valuable currency, and hence the rate quotation is generally more than unity. (Students of mathematics would immediately notice an anomaly in this practice: since

the quotation is per unit of currency ABC, mathematically it should be in the denominator and the exchange rate should be expressed as x DEF/ABC, i.e. x units of DEF per unit of ABC, but market practice is otherwise).

A quotation in the interbank market would generally be expressed as follows:

GBP:USD 1.9862/65

It can be interpreted to mean that the bank giving that quotation is charging $ 1.9865 for selling a pound, but would pay a little less, $ 1.9862 in this case, for buying a pound. In other words its "offer" rate for pounds is $ 1.9865, while its bid rate is $ 1.9862: note that the bid rate for one currency is automatically the offered rate for the other.

b. Value Dates

Every forex transaction involves exchange of two currencies by the counterparties to the transaction. One party, for example, receives dollars in New York and pays out rupees in Mumbai. The counterparty pays out dollars and receives rupees in the respective centres. The date on which the exchange of currencies is to take place is the "value date" of the transaction. In theory, the principle of *valeur compensee* (compensated value) requires the currencies to change hands at the same point of time (payment vs payment, PVP). In practice, this is not possible because of time differences in the two centres. Hence the use of "value dates", i.e. currencies must be paid and received on the contracted settlement day. Worldwide, standard nomenclatures and practices are prevalent to determine the value date of exchange contracts, namely the date on which the two currencies involved in an exchange transaction actually change hands. Since money in any currency has a time value, namely interest, the value date of a foreign exchange transaction will have to be a working day in both the centres where the money transfers are to take place, e.g. rupees being paid in Mumbai, and dollars being received in New York. If either of the two centres has a holiday on a particular day, its date cannot be a proper value date for a dollar: rupee transaction.

The standard nomenclatures for value dates are

(i) ready or cash—value today

(ii) tomorrow ("tom")—value tomorrow, or next working day

(iii) spot—value two clear business days after the trading date (one business day for Can$: USD transactions and USD: JPY contracts in the east). Thus, for a spot transaction done Monday, currencies will change hands the following Wednesday assuming this is a working day in both the centres. Similarly, for a spot transaction done Thursday, currencies will change hands the following Monday, there being no forex transactions on Saturdays and Sundays. While the definition of "spot" maturity seems straightforward, in practice some difficulties crop up because of different holidays at different centres, particularly

in case of cross-currency (i.e. neither currency is home currency of the centre) trades. Consider a dollar: euro trade done in London on a Friday. In the normal course settlement will be on the following Tuesday if this is a business day in London, New York and Frankfurt (remember, the euros will change hands in Frankfurt and the dollars in New York). If Tuesday happens to be a holiday in any of the three centres, then settlement will be postponed to Wednesday. But what if Monday, not Tuesday, is a holiday, say in London? In that case a specific settlement date is agreed by the counterparties, generally the "spot" day for the bank initiating the trade.

(iv) Forwards—any value date beyond spot. The rules for determining value dates of standard maturities of forward transactions are as follows–

- In general, **the value date of a one month forward contract will be the date in the next month corresponding to the "spot" value date.** Let us consider a transaction done on Monday, the 18th January 2010. The value date for a spot transaction will be Wednesday the 20th January and the value date of a one month forward transaction undertaken on 18th January will be 20th February .
- **if the value date so calculated happens to be a holiday** in either centre (as it is in the above case, 20th February 2010 being a Saturday), **the subsequent working day**, 22nd February 2010 in this case, **will be the value date** for a one month forward transaction. However, **if this means a change of month, the preceding working day would become the value date**. For example, for a transaction involving rupees done Monday, 25th January 2010, spot date is 28th January, 26th January being a holiday in India. The one month forward transaction will therefore have to be, by rule (i), 28th February 2010 as the value date. But this happens to be a Sunday. The subsequent working day is 1st March 2010, but this means a change of month. Therefore, the preceding working day, namely 26th February 2010, would become the value date for the one month forward contract. **(Note that a trade involving the rupee has been used only to illustrate the global market practice; the practices in the Indian forward market are different, see below.)**
- The rule of "no change in the month" also applies in cases where the month in question does not have a date corresponding to the spot date. For instance, the spot date for a transaction done Wednesday 27th January 2010 will be 29th January. Since there is no such date as 29th February 2010, the one month forward contract will mature on 28th February. But this happens to be a Sunday. So the value date for a one month forward contract done on 27th January 2010 will be 26th February 2010.

- There is another exception in cases where the spot date is the last date of the month. In that case, the value date for a one month forward contract is the last working day of the subsequent month. (If spot is 28th February, one month forward will be 31st—and not 28th—March).

(In the above examples, holidays other than 26th January, Saturdays and Sundays have been ignored.)

The same rules apply to two, three, four and longer standard maturity forwards.

While the rules appear somewhat complicated, it is essential to understand them thoroughly. They govern not only the value dates of standard maturity forward exchange contracts, but also the maturities of one month/two months, etc., deposits in the offshore market.

Forward transactions can also be structured to give one of the parties to the transaction an option to determine any value date within a prescribed period. Such options are required because the party may not know in advance the precise date on which he would be able to deliver the currency. One example of this would be an exporter desiring to sell forward foreign currency to his bank, but not knowing in advance the precise date of shipment, after which he has a foreign currency claim on his buyer. In India, the option period is limited to a month.

2.3 Market Infrastructure

The revolution in information technology has helped strengthening the market infrastructure in recent decades: indeed, transaction volumes on the present scale would not have been possible without this. Some important elements of the infrastructure are discussed below.

a. Dealing Rooms/Treasuries

The part of the bank (or other organizations active in the foreign exchange market) where foreign exchange transactions are originated and concluded, i.e. currencies are traded, is known as the "dealing room". The employee actually undertaking the transaction is the "dealer" and the transaction itself is often referred to as the "deal". The dealing room is also referred to as the "front office".

Banks in the major money markets have invested huge amounts in building up the computer and communication infrastructure necessary for efficient and safe functioning of their trading operations. A major bank's dealing room today may have 100 plus traders active at the same time. The latest trends are towards integrated dealing rooms, which handle not only foreign exchange but also 'derivatives' like swaps, futures and options. The money market and bond trading activities also have links with the forex markets. Indeed, all these different markets are constantly interacting with each other and occasionally present arbitrage opportunities.

The overall treasury management set-up also consists, in the case of active banks, of so- called "mid (or risk) office" and "back office". The functions of these two segments are summarized below:

(i) Mid-office: The principal responsibility of mid-office is to independently measure, monitor and report on the market risk in the bank's trading book.

(ii) Back Office: The back office is generally a part of the accounting set up in a bank and handles the exchange of confirmations of all deals. It is also responsible for accounting, settlement and reconciliation of all transactions, the calculation of trading profit, etc.

It will be evident from the functions that if the front office drives trades and earns profits, the mid office and back office act as controls on the trading activity, as well as performing all post-trade services. Given the divergent objectives, it is important that the three arms report to different executives and operate independently of each other.

While banks remain the major players in the market, a few large multinationals too have treasury operations and dealing rooms comparable to those of major banks, in sophistication and size. They are in the market not only for covering or managing the exposures in various currencies brought about by the commercial operations of the multinational, but actively speculate on currency movements, just like banks. Treasury management has become an independent profit centre for some of the big multinationals.

Smaller companies with limited operations often do not have elaborate dealing room or treasury operations. Typically, transactions are done by a suitable officer in the finance department.

b. Deal Execution

Historically, forex trading used to be done through intermediation of voice brokers who would bring the buyer and the seller together and earn fees for their services. In recent years, with the explosive growth of electronic communication and information services, the percentage of trades done through brokers has been falling. Also, voice broking is increasingly giving way to electronic broking. (Such voice brokers should not be confused with the so-called "Prime Brokers" whose role is entirely different: see Box 2.2.)

Box 2.2 Prime Brokers

Hedge funds, as also some of the smaller trading banks, use so-called "prime brokers" to clear and settle trades, manage cash and, in effect, do much of the work of the back office. Large investment and commercial banks offer prime broker services to hedge funds and other clients. Besides back office work, the service also includes lending securities, offering short-term credit, and providing other types of leverage.

The introduction of the Reuter Monitor service in 1973 was a major change in the traditional market infrastucture. Initially, this was only an information system—giving subscribers to the Monitor video terminals, in real time, the bid and offered quotations of contributing banks. Since then, the services provided by Reuters and its competitors have grown in coverage and sophistication. Bloomberg is the other major real time financial data provider. Increasingly, Reuters and others allow deals to be struck (and settlement instructions given) through the system. The latest version is not only a dealing system but acts as an electronic broker by matching the quoted rates of the subscribing banks. It provides the service at a much cheaper cost than the traditional voice broker.

Apart from forex quotes, these services also give, on different pages, quotations of interest rates, stocks, bonds, commodities, futures and options, latest news, data bases, and other information, all accessible by pressing a few keys.

In January 1990, a group of leading market-making banks decided to fund the development of an electronic broking system (EBS) for interbank foreign exchange, in order to provide effective competition to Reuters. In 1996, EBS took over Citicorp Dealing Resources, a unit of Citibank offering similar services, to become EBS Dealing Resources, which also owns FXNET^{*TM}, an automated bilateral netting service. Later EBS joined hands with Minex in Japan to provide truly global electronic broking services. The rapid growth of cheap, electronic broking (with instantaneous deal confirmation) has led to a continuing fall in the percentage of trades done through traditional voice brokers. Since its launch, EBS Spot Dealing System has captured a significant share of the global foreign exchange spot broking market. Now owned by the big international broker I-Cap it is the world's leading electronic foreign exchange broker.

Reuters, Bloomberg and similar systems are all terminal based and hence costly. An obvious threat would be a much cheaper internet-based system, particularly if it also allows access to non-bank participants. In recent years several such systems have been started but have not so far succeeded in generating volumes. Some of the major platforms include FX Connect (1996), currenex (1999) and FX all (2001), but the transactions overall account for less than 10% of market volumes.

The BIS survey recognizes the following methods for trade execution in the foreign exchange market:

"Interbank direct (inter-

reporting Dealer): *Executed between two dealers participating in the triennial survey and not intermediated by a third party. For example, a transaction executed via direct telephone communication or direct electronic dealing systems such as Reuters Conversational Dealing.*

Customer direct (inter-dealer/customer) :	*Executed between a reporting dealer and either a customer or a non-reporting dealer, and not intermediated by a third party. For example, a deal executed via direct telephone communication or direct electronic dealing systems such as Reuters Conversational Dealing.*
Electronic broking systems :	*Executed via automated order matching system for foreign exchange dealers. Examples of such systems are EBS and Reuters Matching 2000/2.*
Electronic trading systems :	*Executed via a single-bank proprietary platform or a multi-bank dealing system. These systems are generally geared towards customers. Examples of multi-bank systems include FXAll, Currenex, FXConnect, Globalink and eSpeed.*
Voice broker :	*Executed via telephone communication with a foreign exchange voice broker."*

c. Payment and Communication Systems

Once a deal has been agreed upon, or "done" in the market jargon, the dealers will also simultaneously specify where they want the currencies delivered. For a dollar: euro transaction, for example, the buyer of the dollars might require the dollars to be credited to his account with his own New York branch; the receiver of the euros will similarly specify that the euros should be credited to his account with say Deutsche Bank, Frankfurt. These payment instructions are customary in the case of spot transactions; in the case of forwards, the details are sometimes advised later.

Given the volume of transactions—running literally into a few trillion dollars of transfers between banks in New York alone, every day—payment and settlement systems are crucial to the smooth functioning of the market. Paper-based systems, using bankers' cheques for example, would be unable to cope with the volumes. Most major markets therefore have in place electronic or automated interbank funds transfer systems. The best known of these are CHIPS (clearing house interbank payments system) in New York, CHAPS (clearing house automated payment system) in London, and EBA (European Banks Association) and EAF2 in Europe. Besides, there are some central bank run payment systems like Fedwire in the United States and TARGET (Trans-European Automated Real Time Gross Settlement Express Transfer) in Europe.

CHIPS is New York based whereas TARGET and EAF/2 are in Brussels and Frankfurt respectively. CHIPS is used for payments in dollars, TARGET and EAF/2 in euro. Among these various systems some like TARGET are real

time gross settlement (RTGS) systems, whereas others work on a netting basis. On 22 January 2001, CHIPS moved from traditional, net end-of-day settlement to a process involving repeated settlements, throughout the day, of batches of bilaterally and multilaterally offsetting payments. Hong Kong became the first Asian market to introduce "real-time gross settlement" (RTGS) for transactions involving not only local currencies but also American dollars. RTGS has been introduced in India as well. In general, given the huge volumes of money flows, the question of settlement risk has become very important. This topic, and the start of CLS Bank in 2003 for managing the settlement risk, are discussed in 'd' below.

On the communication side, the Society for Worldwide Interbank Financial Telecommunications (SWIFT), a specialised non-profit cooperative owned by banks, is the most important private message courier. SWIFT transmits messages in standarised formats and many interbank funds transfer systems (like CHIPS) have been designed to reformat SWIFT messages electronically for execution through the clearing house. SWIFT has over the years become an integral part of many interbank payment systems. Banks in India along with those in 140 odd other countries are connected to the SWIFT network. SWIFT has started offering services to non-bank entities, and for securities market transactions.

d. Settlement Systems

We have referred in Chapter 1, to the fact that exchanges guarantee the settlements of transactions contracted on them. Since the foreign exchange market has been, and still is, an over-the-counter (OTC) market, for a long time, it did not have any such guaranteed settlement systems: the settlement risk is a major risk in the FX market because of the different time zones in which the currencies change hand. The buyer of dollars against rupees may have paid out rupees in Mumbai, but will have to wait until New York opens to receive dollars from the counterparty. If the counterparty bank, which has received rupees in Mumbai fails before New York opens, the buyer may not get delivery of the dollars. The settlement risks were brought into sharp focus when the German Herstatt Bank failed in 1974: see Box 2.3.

Box 2.3 The Herstatt Case

The most famous example of a bank's failure in the foreign exchange market is that of the Herstatt Bank in Germany in 1974. It exemplifies both the pre-maturity and settlement day risks. In that case, not only the banks, which had unmatured forward contracts with Herstatt, faced major risks, but several suffered losses under contracts which matured on the day Herstatt's operations were shut down by the German authorities. The settlement losses arose from the timing of the action, which was taken after closure of business hours in Germany, but before the business day had opened in New York. Many banks, which had sold marks to Herstatt against dollars, found that while the marks had been delivered, they could not get dollars in New York. The aggregate losses in the Herstatt affair totalled hundreds of millions of dollars.

The first response of the banks active in the market was to introduce bilateral netting: this reduced the number of settlements between two banks to just one per currency, and also the amounts to be settled. In fact, netting of forex transactions for settlement purposes has become increasingly common in foreign exchange markets. This reduces the Herstatt type risks.

Essentially, there are two types of netting: settlement day and the so-called "close out". In turn, **settlement day netting** can be of two types:

(A) Simple payment netting merely replaces a number of receipts and payments due on a given settlement day, by a single transaction, but does not alter the rights and obligations under the individual contracts;

(B) Netting by novation involves that all deals being netted are cancelled and replaced by a new (nova) legally binding deal.

It should be noted, however, that there is no difference between the amounts that would change hands on the settlement day, whichever procedure is adopted—simple payment netting or netting by novation.

Close-out netting is a credit risk management tool at the pre-settlement stage. In the event of breach of covenants or the occurrence of an event of default, as defined in the agreements between the two parties relating to close-out netting, the non-defaulting party has the legal right to liquidate and set off all outstanding transactions between them. Close-out netting involves the calculation of the replacement cost/gain of each transaction to the non-defaulting counterparty; the amounts are then aggregated and netted.

As for multilateral netting, the first arrangement, namely, the Exchange Clearing House Ltd. (ECHO), supervised by the Bank of England, consisting primarily of major banks in London and Europe, started functioning in 1995. It has since been merged with CLS Bank promoted by the Group of Twenty major international banks (CLS stands for Continuous Linked Settlement). All the participating banks have multi-currency accounts with the CLS Bank, which functions only for the limited purpose of settlement of foreign exchange transactions between member banks.

The CLS Bank started functioning in September 2003 and now undertakes netting and settlement function on behalf of the participating banks, which currently number around 60. The way CLS Bank functions is that all currency trades between banks, which are its members, and where both the currencies in the trade are eligible for netting and settlement through the CLS Bank, are reported to it. CLS Bank undertakes multilateral netting and, by mid-night Central European Time, communicates to the member banks the amount in each currency each has to pay at designated times during the following day. Clearing house RTGS systems in most of the major international centers have been integrated with the CLS Bank's system, to facilitate this. Currently, CLS Bank nets and settles more than 50% of the transactions in the global forex market. Clearly, such netting reduces significantly the settlement risk—more so, as each member bank has to maintain accounts with the CLS

Bank in each of the eligible currencies, and provide currency-wise collateral to cover any shortfall in the balance at the time of payment.

2.4 Domestic Market

2.4.1 Legislative Framework

One basic difference between the international foreign exchange market and the domestic market, is the regulatory environment. The international market in major currencies, generally speaking, is free from most regulatory constraints, while the domestic market needs to function within the framework of the regulations framed by the Reserve Bank of India under the Foreign Exchange Management Act, 1999.

2.4.2 Historical Background

Exchange control was introduced in India during the Second World War and the legislative basis was the War Powers Act. The expectation then was that exchange controls would be eliminated after the War was over.

This did not happen. In fact, post-independence, exchange control was made more stringent. The enabling legislation was the Foreign Exchange Regulation Act, 1948. FERA 1973 gave more powers of enforcement, and control on foreign exchange transactions was made even tighter. The period was characterised by very rigid import controls, some of the world's highest import duties and an industrial policy emphasising import substitution. Foreign investment was not encouraged and the Indian economy became, for all practical purposes, a closed one. India continued to incur deficits on current account, financed almost wholly by external debt.

After the 1991 balance of payments crisis, many of these policies underwent major changes. FERA was also replaced by the Foreign Exchange Management Act, 1999, which is now the legislative basis for the controls that remain.

Unlike FERA, FEMA violations are civil, not criminal, offences, attracting monetary penalties, and not arrests or imprisonment.

2.4.3 Regulations

The regulations framed by the Reserve Bank of India under FEMA from time to time, are consolidated once a year in a Master Circular on Risk Management and Interbank Dealings issued in July. One basic legal provision is that one party to all transactions in foreign exchange has to be an authorised dealer, i.e. a bank authorised to act as a dealer in foreign exchange by the Reserve Bank. In other words, a firm (or an individual) has to undertake foreign exchange transactions (i.e. sale or purchase of foreign currencies) only with an authorised dealer.

There are three categories of authorised dealers, as follows, besides money changers:

Classification of Persons Authorised to deal in the foreign exchange

Sr. no.	Present category	Entities	Revised category	Major activities
1.	Authorised Dealer	• Commercial Banks • State Co-op Banks • Urban Co-op Banks	Authorised Dealer – Category - I	All current and capital account transactions according to RBI directions issued from time-to-time.
2.	–	• Upgraded FFMCs • Co-op. Banks • Regional Rural Banks (RRBs) • Others	Authorised Dealer – Category - II	Specified non-trade related current account transactions as at paragraph 3 below as also all the activities permitted to Full Fledged Money Changers. Any other activity as decided by the Reserve Bank.
3.	–	• Select Financial and other Institutions	Authorised Dealer – Category - III	Transactions incidental to the foreign exchange activities undertaken by these institutions.
4.	Full Fledged Money Changers (FFMCs)	• Dept. of Posts • Urban Co-op. Banks • Other FFMCs	FFMCs	Purchase of foreign exchange and sale for private and business visits abroad.

(Source: RBI Circular No. 25 of March 6, 2006)

2.4.4 Structure of the Market

a. Currencies and Instruments Traded

The market spot and forward rates are determined by demand and supply. (Cash and "tom" deliveries are also common.) The market is primarily for exchange of dollars against rupees; other currencies are not actively traded against the rupee in the local market. Mumbai is the biggest centre, followed by Delhi, Calcutta and other markets. At present, the Indian market transacts spot and forward USD: INR trades up to 12 months maturity and forex market swaps (i.e., simultaneous sale and purchase of dollars for different maturities). In recent years, there has also developed an active market in derivatives like cross currency swaps and currency options involving the rupee. Cross currency swaps are different from the forex market swaps: the latter are really a combination of spot and forward transactions (or both forward for different maturities), normally at different exchange rates, one a sale of dollars, the other a purchase, for identical amounts and generally the same counterparty. The two swaps—selling dollars for rupees and buying them back for a later

maturity; and buying dollars for rupees and selling them back for a later maturity—are referred to as sell/buy and buy/sell swaps.

b. Participants

The local exchange market is a two-tier one: non-bank customers have to buy currencies from, or sell currencies to, banks permitted to act as authorised dealers. The second tier consists of the interbank market. (The Central Bank also sells or purchases dollars in the market.) While some authorised dealers restrict their market activities to covering customer transactions, others also trade, or speculate, on their own account. The market lot is USD 1 mn. In the interbank market, actively trading banks act as market-makers quoting two-way prices for the dollar against the rupee. On normal days, the spread is typically half a paisa per dollar but goes up to 2/3 paise, when the market is volatile. A majority of interbank deals take place directly between banks and the rest through brokers. In the Indian market also, progressively lower recourse to voice brokers is being witnessed, with the introduction of electronic dealing and price matching systems. Apart from operations in the interbank market to hedge, or cover, customer transactions, and own account, or proprietary, trading, banks also arbitrage between the money and exchange markets.

As stated above, participants in the market other than authorised traders (for example, importers, exporters, etc.), have to buy foreign currencies from, or sell currencies to, authorised dealers. In other words, an exporter cannot sell his receipts of foreign currency directly to an importer. Similarly, remittances from/to abroad have to go through authorised dealers.

The end-user participants (i.e., non-A.Ds) buy and sell currencies in the spot or forward market on the basis of their underlying commercial transactions (e.g. an importer would buy foreign currency from an A.D. for payment to the supplier). A few of the larger companies also actively trade in the exchange market, to make profits.

c. Size of the Market

The RBI publishes data about different types of trades in the market. The following table gives the monthly turnovers under different categories of transactions for the FY 2008–09.

d. The Reserve Bank of India

At times of volatility in the exchange market, the Reserve Bank influences the market rate by intervening. Such intervention can take various forms:

- Verbal (i.e., statements through media);
- Tightening exchange control to curb speculative activity;
- Tightening money supply or increasing interest rates to make it costlier to short the rupee;
- Actual sale or purchase of dollars in the market through authorised dealers.

Table 2.6 Turnover in the Indian Foreign Exchange Market

(US $ million)

Month	Inter-bank							Merchant						
	Spot			Forward/Swap			Turnover	Spot			Forward			Turnover
	Purchase	Sales	Net	Purchase	Sales	Net		Purchase	Sales	Net	Purchase	Sales	Net	
Apr-08	1,84,994	1,81,839	3,155	1,79,991	1,67,202	12,789	7,14,026	63,989	64,786	–797	83,587	79,020	4,567	2,91,382
May-08	1,85,695	1,80,894	4,801	1,70,095	1,73,636	–3,541	7,10,319	56,698	56,001	697	85,033	88,411	–3,379	2,86,143
Jun-08	1,95,523	1,82,495	13,028	2,14,479	2,12,441	2,038	8,04,939	55,657	57,676	–2,018	76,804	79,001	–2,197	2,69,137
Jul-08	2,17,752	2,06,286	11,465	2,15,086	2,15,849	–763	8,54,973	63,049	62,382	667	89,646	92,976	–3,330	3,08,053
Aug-08	1,93,158	1,88,674	4,484	1,89,557	1,96,369	–6,812	7,67,757	58,737	57,099	1,639	99,515	1,00,093	–578	3,15,444
Sep-08	2,52,887	2,40,806	12,081	2,39,875	2,49,831	–9,956	9,83,399	63,500	68,623	–5,123	1,26,489	1,32,999	–6,510	3,91,611
Oct-08	2,32,276	2,08,666	23,610	2,01,290	2,08,754	–7,463	8,50,986	46,879	56,162	–9,283	1,05,481	1,14,263	–8,782	3,22,786
Nov-08	1,46,556	1,39,344	7,211	1,68,368	1,72,169	–3,802	6,26,436	37,621	39,866	–2,245	71,120	70,630	490	2,19,237
Dec-08	1,54,681	1,50,147	4,534	2,12,784	2,14,745	–1,961	7,32,358	43,263	43,485	–221	77,576	76,808	769	2,41,132
Jan-09	1,35,388	1,33,217	2,171	1,54,120	1,63,074	–8,954	5,85,798	36,724	34,732	1,992	60,866	59,612	1,254	1,91,934
Feb-09	1,18,155	1,15,544	2,611	1,31,078	1,36,591	–5,513	5,01,369	31,585	32,962	–1,377	53,903	55,602	–1,699	1,74,053
Mar-09	1,58,858	1,50,373	8,484	2,06,674	2,12,867	–6,193	7,28,771	43,117	42,311	806	66,507	67,823	–1,316	2,19,758

Note : 1. Merchant turnover includes cross-currency (i.e., foreign currency to foreign currency, both spot and forward) transactions and cancellation of forward contracts.
2. Inter-bank turnover includes cross-currency (i.e., foreign currency to foreign currency, both spot and forward) transactions.
(Source: RBI Annual Report 2008-09)

The RBI has used all these measures, often in combination, to influence the market rate. The following table gives the amounts of sale/purchase of dollars by the Reserve Bank of India in recent months.

Table 2.7 Sales/Purchases of Dollars by the RBI

Sale/Purchase of U.S. Dollar by the Reserve Bank of India							
Month	Foreign currency (US $ million)			Rs. equivalent at contract rate	Cumulative (over end-April 2009)		Outstanding net forward sales / purchase at the end of month
	Purchase	Sale	Net	(US $ Million)	(US $ Million)	(Rs. crore)	(US $ Million)
2009-10							
Apr-09	204	2,691	(2,487)	(12,064)	(2,487)	(12,064)	(1,071)
May-09	923	2,360	(1,437)	(6,902)	(3,924)	(18,966)	131
Jun-09	1,279	235	1,044	4,974	(2,880)	(13,992)	745
Jul-09	570	625	(55)	(217)	(2,935)	(14,209)	800
Aug-09	415	234	181	838	(2,754)	(13,372)	619
Sep-09	260	180	80	377	(2,674)	(12,994)	539

Note : This table is based on value dates.
(Source: RBI Monthly bulletin November 2009)

The exchange rate of the rupee against non-dollar currencies is calculated by crossing the dollar: rupee rate with the dollar: currency rate ruling in the international market.

e. Foreign Exchange Dealers Association of India (FEDAI)

At one time, the Foreign Exchange Dealers Association of India used to play a very important role in regulating bank margins. With progressive liberalisation, however, its role is now increasingly moving away from regulation to market development and to issues like:

(i) Granting accreditation to brokers and monitoring broking activity in general.

(ii) Promoting best practices in the market including those for development and accounting of derivatives, documentation, risk management, etc

(iii) Helping resolve disputes among member banks

FEDAI has also introduced a "Code of Conduct for Bank Dealers and Brokers" operating in the market.

2.4.5 Market Practices

a. Value Dates

While the conventions for determining the maturity of spot market trades are similar to those in the international market, there is a major difference in the practices in the interbank forward market: in the Indian interbank forward market, as a rule, all trades mature on the last working day of the forward month. For example, a spot transaction traded on Monday 9th February 2009 would mature for exchange of currencies, on Wednesday 11th February 2009. In the international market, a one-month forward contract traded on 9th February 2009 would mature on 11th March 2009. In the domestic market it matures on 31st March 2009, the last trading day of the month. However, for forward contracts between customers and authorised dealers, the maturity date is flexible as per the requirements of the customer.

b. Cross Currency Trades

Whenever end-users need to transact dollar: third currency trades, either along with dollar: rupee exchange, or separately, the authorised dealer may not get prices in the local market and may have to put the transaction through, typically, Singapore or Hong Kong markets, which are active in our time zone.

c. Infrastructure

Most banks subscribe to the Reuters or other information and dealing systems. Some of the bigger companies, particularly those that actively manage and trade on their currency exposures, are also now using such services.

While Reuters has the "first mover" advantage, two other dealing systems were introduced in India in 2003: FXDirect and FX Clear. The former "*offers a state-of-art online matching and dealing platform for foreign exchange trading that supports real time anonymous deal matching system for Spot USD/INR trades between banks in the inter-bank forex market in India. FXDirect™ also provides the inter-bank foreign exchange market a separate system for negotiated dealing between the banks on a one-to-one basis.*"

The other system, FX Clear, introduced by the Clearing Corporation of India (CCIL), covers "*the inter-bank United States Dollar–Indian Rupee (USD-INR) Spot and Swap transactions and transactions in major cross currencies (EUR/USD, USD/JPY, GBP/USD, etc)*". It offers "*both Order Matching and Negotiation Modes for dealing.*" (Source: CCIL website)

d. Netting and Settlement of Interbank Transactions: CCIL

Clearing Corporation of India Limited (CCIL), a company owned by banks, has been set up to function as an industry service organisation for clearing and settlement of trades in forex, government securities, derivatives and other debt instruments. In November 2002, CCIL started guaranteed settlements of the rupee/dollar trades (spot and forward) between members. It becomes the

central counter-party to all trades done by its members and achieves multilateral netting through novation. Forward forex trades are taken up for novation two business days prior to the settlement date. This is likely to change shortly and CCIL will become the central counterparty for forward transactions from inception. Multilateral netting also means that the number of transactions being put through accounts in New York has fallen significantly with corresponding cost reduction. The other benefit is guaranteed settlements and hence mitigation of counterparty risks.

CCIL also offers settlement services for cross currency trades (i.e. those not involving the rupee) through the CLS system described earlier.

e. *Non-deliverable Forwards (NDF) Market*

There exists a market in forward dollars against rupees in some of the major international centres. The biggest is probably Singapore. Since actual deliveries of forward rupees cannot take place in the absence of an offshore rupee market, such forward contracts are known as non-deliverable forwards—NDFs. On maturity of the contract, it is in effect cancelled and the difference is settled in USD.

The participants in the NDF market are those not permitted to operate in the domestic forward market by exchange control, in particular non-residents.

f. RBI Reference Rate

The RBI compiles and publishes reference rates for Spot USD: INR and Spot EUR: INR on a daily basis. The rates are arrived at by averaging the mean of the bid/offer rates polled from a few select banks around 12 noon every week day (excluding Saturdays). The contributing banks are selected on the basis of their standing, market-share in the domestic foreign exchange market and representative character. The Reserve Bank periodically reviews the procedure for selecting the banks and the methodology of polling so as to ensure that the reference rate is a true reflection of the market activity. (RBI press release dated 6th August 2008).

The RBI reference rate is used as the rate for settling transactions in the domestic futures and options markets as also for settlements in the non-deliverable forward market abroad on maturity date. Some corporates use the rate for translating foreign currency assts and liabilities into their rupee equivalent, for accounting purposes.

Chapter 3

Exchange Arithmetic

3.1 How Banks Quote Spot Rates to Customers

3.1.1 Exchange Rates for USD

The basic principle is simple: ascertain the going exchange rate in the wholesale market, load a margin and quote a rate to the customer. The underlying theory is that the currency sold to (bought from) a customer is simultaneously bought (sold) in the wholesale market, the margin representing transaction costs (overheads, brokerage, etc.) and profit for the bank. It should be noted that non-bank entities in India can undertake currency exchange transactions only with banks permitted by the Reserve Bank to effect such transactions, the so-called authorised dealers or A.Ds.

In the dollar: rupee interbank forex market, the market lot used to be USD 500,000. Increasingly, however, interbank deals are taking place in lots of USD 1 mn. The going market rate is ascertained either by contacting a broker, who readily gives the rates at which the trading banks are willing to buy or sell dollars, or looking at the Reuter monitor or similar real-time information system. Since the interbank market in India trades mainly dollars against rupees, the exchange rates for non-dollar currencies against the rupee are arrived at by "crossing" the dollar: rupee rate in the Indian market with the dollar: currency rate in the international market. In effect, such transactions are put through in two legs.

Let us consider the spot rate to be quoted to a customer receiving a remittance, for purchase of his dollars, when the inter-bank spot rate is say Rs 49.13/14 per USD. The two-way quotation in the inter-bank market means that there are banks prepared to buy dollars at Rs 49.13 per USD and sell at Rs 49.14. Since we have to quote a rate for purchasing dollars from the customer, we shall have to base it on the rate at which other banks are willing to buy dollars, the cover transaction being the sale in the wholesale market of

dollars purchased from the customer, in this case, at the inter-bank market's buying rate. In other words, the base rate that we have to consider is Rs 49.13. Assuming that a margin of 5 paise is desired, the quotation to the customer would be Rs 49.08.

The margin that the bank charges to a customer is negotiable and is determined by the following factors:

a. Size of the Transaction

A sale of USD 100,000 would be at a finer rate than the sale of USD 100. However, at the other end of the spectrum, a sale of USD 500 mn could also attract a worse rate. This is because the market liquidity is limited and large orders tend to move the market. The bank would, therefore, need to keep a larger margin to ensure that it does not suffer a loss, when it covers the transaction in the interbank market. Indeed, for very large amounts, it is common for the bank and the corporate to negotiate a margin, which would be applied to the rate at which the bank actually buys (or sells) the dollars.

b. Customer Relationship

Obviously, a customer giving large and regular business to the bank would get rates based on finer margins.

c. Customer Awareness

A customer, who knows what is happening in the markets, both domestic and international, would get a better rate. Of late, several big and even medium-sized companies have been subscribing to Reuters or similar information services.

With intense competition among banks for forex business, large customers are able to whittle down the margin to a fraction of a paisa. Major public sector undertakings often invite bids from a number of banks to get the best rate.

To summarise, therefore, the basic principle of rate quotation is to ascertain the exchange rate at which the cover transaction can be done, to load an appropriate margin, and to make a quotation to the customer. The cover transaction for sale of foreign currency to a customer will be its purchase in the wholesale market at the market's selling rate; that for purchase of currency will be its sale in the wholesale market, at the market's buying rate.

Diagrammatically,

Purchase of dollars from customers	Market rate	Sale of dollars to customers
Rs. 49.08 per USD	Rs. 49.13/14	Rs. 49.19 per USD

At this point, it will be worth taking note of what are referred to as "card rates". These are exchange rates calculated by treasury for typically small

value customer transactions, based on the market rates in the morning, and circulated to all branches. Since these rates are generally kept unchanged through the day, they include a significant cushion, or margin, over the morning interbank rates to take care of intraday fluctuations. Please see paragraph 3.5 below.

For larger transactions, or for more competitive rates, branches/customers need to approach the treasury. In that case, since market rates often change rapidly, the bank would generally expect the quoted finer rate to be accepted or rejected immediately. No bank is in a position to keep open a fine rate offered to a customer for any length of time.

"Cash" (same day delivery) and "tom" (next working day delivery) transactions are also quite prevalent in the market.

3.1.2 Exchange Rates–Non-Dollar Currencies

The same process will be used to quote rates for purchasing say the euro against dollars. Assuming that a margin of a quarter cent (25 basis points, or bps) is desired, the quoted rates would be as follows:

Purchase of euro	Market rate	Sale of euro
USD 1.3240 per EUR	USD 1.3265/70 per EUR	USD 1.3295 per EUR

The two sets of quotes, dollar: rupee and euro: dollar can be combined to calculate the **market euro: rupee exchange rates**. These would be as follows:

Purchase of euro	Sale of euro
Rs. 49.13 * 1.3265 = Rs. 65.1709 per euro	Rs. 49.14 * 1.3270 = Rs. 65.2088 per euro

The customer rates will be based on these, after loading the appropriate margin (say 20 ps)—say Rs. 65.41 for sales of euro, Rs. 64.97 for purchase of euro.

3.2 The Forward Dollar Rate in India

3.2.1 The Forward Margin

The forward margin is called a premium on the currency whose forward rate is more expensive than the spot rate and a discount where the forward rate is cheaper. It is expressed in the same currency as the spot rate. Again, if the dollar is quoted at a premium vis-à-vis the rupee, the corollary is that the rupee is at a discount vis-à-vis the dollar.

3.2.2 Forward Rate Quotations

In principle, the domestic interbank market trades forwards for two different maturity patterns:

- "x" month(s) from spot maturity;
- The last working day of the month.

For historical reasons, the latter pattern is far more prevalent and liquid. The market is quite liquid up to one year maturities.

Where an interbank quote for a specific maturity date desired by the client is not available, it is derived by straight-line interpolation between the two nearest available rates.

3.2.3 Delivery Options

The system of option contracts is very much prevalent in the Indian market. **This refers to the option of choosing the value date within an agreed period**. This option period is limited to a month and the actual date can be chosen by the customer within this month vis-à-vis the bank and by the buying bank in the inter-bank market.

The standard rule for rate quotations for option contracts is to quote the worse of the rates applicable for the beginning and end of the option period. Thus, for purchase of a currency **which is at a premium in the forward market**, the premium applicable to the beginning of the option period will be used. And, for selling it, the premium applicable to the end of the period will be loaded in the spot rate, to calculate the option forward rate. The reason underlying this is that, in case of a purchase transaction, the counterparty may choose the first day of the option period as the value date. If premium up to the end of the period had been included, a loss would result. Similarly, for the sale rate, the counterparty may choose the last day of the option period as the value date. Hence, the premium up to that date will have to be considered.

If the currency is at a discount, the worse rate rule will be to load the highest discount in the purchase rate and the lowest in the sale rate.

Diagrammatically, for option forwards,

PURCHASE (OR BID) RATE: HIGHEST DISCOUNT OR LOWEST PREMIUM
SALE (OFFERED) RATE: LOWEST DISCOUNT OR HIGHEST PREMIUM

The basic principle for quoting a forward rate to the customer is the same as for spot rates -- ascertain the wholesale market rate and load a margin. If the interbank spot rate is Rs 49.13/14 and the one-month premium on the dollar (i. e, discount on the rupee) is 12/13 paise, the wholesale market rate for one month forward dollars is Rs. 49.25/27.

The one-month option forward customer rates, assuming a margin of 5 paise, will be selling, or offering, dollars (to importers, etc.) @ Rs. 49.32, and buying, or bidding for dollars (from exporters, etc.) @ Rs. 49.08. The latter rate, it will be noticed, is the same as spot because of the delivery option. On the other hand, the one-month fixed date delivery rate will be Rs. 49.20/49.32.

3.2.4 Bill Buying Rates

One peculiarity of the Indian market should be noted at this stage. It is that the delivery of a claim for foreign currency receivable is considered as delivery of the foreign currency itself, although the currency may be receivable after some time. For example, if a bank buys from an exporter a dollar bill of exchange drawn on the importer abroad, the exchange transaction, namely, the purchase of dollars, is completed when the bill itself is purchased. It will be readily seen that the bank would actually get the dollars only when the buyer abroad has paid the bill in accordance with its tenor of maturity.

Consider the spot purchase of a dollar bill of exchange payable 90 days after presentation to the drawee. The dollars would be realised only some time in the fourth month, having regard to the time needed for physical transmission of the bill to the centre where it is payable and its presentation to the drawee. In this case, therefore, the exchange rate to be quoted to the customer will be based not on the spot rate ruling but the fourth month forward rate now available, as the dollars bought from the customer would have to be covered in the interbank market by a forward sale, delivery fourth month. In effect, in such cases, a spot transaction with the customer has to be covered in the forward market. Carrying the logic further, if the customer wishes to have a forward contract maturing in the second month for sale to the bank of a 90-day bill, the base rate for making the quotation to the customer will have to be the sixth month quotation in the wholesale market.

3.2.5 Interbank Forward Quotations

These quotations are in paise per dollar and apply to end-of-the-month deliveries. For example, on 13th November 2009, the quotations were:

End-of-the month	In paise	% p. a.
November	03–04	1.04%
December	11–13	1.72%
January	21–23	1.99%
February	31–33	2.14%
March	41–43	2.23%
April	58–61	2.61%
May	69–71	2.63%
June	80–82	2.64%
Juy	90–92	2.65%
August	101–103	2.67%
September	111–113	2.66%
October	122–124	2.68%

3.2.6 Cash: Spot and Call Rates

The cash: spot (and cash: tom) margin in the interbank market is generally governed by the call market in Indian rupees. This is because arbitrage is possible between borrowing in the call market at a particular rate and a sell cash/buy spot dollar swap in the exchange market. Since banks would use the cheaper market, there is a strong correlation between the cash: spot margin and the call rate.

3.3 Forward Margin in Free Markets: Interest Parity Principle

In markets, where exchange and interest rates are determined by demand-supply and banks are free to deposit/borrow foreign currencies, the forward margins (i.e., difference between spot and forward foreign exchange rates) are governed by what is known as the interest parity principle. In effect, in an efficient market, the forward margin on an exchange rate will be equal to the interest differential between the two currencies. Let us see how:

Consider a forward contract for the sale of euros to a customer after 3 months. Assume that the spot rate between the euro and the dollar is EUR 1.00 = USD 1.3270. Let us further assume that the interest rates for three-month money are 3% p. a. for euros and 1% p. a. for dollars. The interest rate is relevant because you would need to deliver euros to, and receive dollars from, the counterparty at the rate now fixed only on maturity of the contract three months later: and, the only sure way of calculating the cost of euros three months from now would be to buy euros at the current rate of USD 1.3270 per euro and deposit them for three months. However, you need dollars today to buy the euro while the counterparty to the transaction would deliver the dollars only after 3 months. Therefore, dollars will have to be borrowed (for 3 months) at 1% p.a. in order to buy the euro. Thus, whereas the dollars cost only 1% p. a., the euros earn 3%. The price of forward euros is, therefore, different from today's rate to the extent of the interest differential: forward euros will be cheaper in this case because of the higher interest earned on the euro deposit as compared to that paid on the dollar borrowing. On maturity of the contract, the dollars to be delivered by the counterparty can be used to repay the dollar loan, while the matured euro deposit amount will be paid to the counterparty. In the cited interest rate scenario, the euro is at a discount in the forward market. In general, a currency will be at a premium vis-à-vis a higher interest currency and at a discount vis-à-vis a lower interest one. Forward margins are quoted in the same currency as the spot rate, i.e., if the exchange rate is quoted as USD 1.3270 per euro, the forward margin will be quoted in United States cents per euro.

The relationship between the interest differential and forward margins is a stable one. Should it get disturbed, it will throw open arbitrage opportunities and arbitrage transactions will restore the interest parity.

For example, let us assume that, in the above scenario, the market is quoting a forward rate different from that indicated by the interest parity principle, say equal to the spot rate. This creates an opportunity to make profits without running an exchange risk, by putting through the following cycle of transactions:

- Borrow dollars at 1% p. a.
- Buy EUR at USD 1.3270= EUR 1.00.
- Deposit EUR at 3% p. a.
- Sell EUR principal and interest forward at the assumed forward rate of USD 1.3270 per EUR.

This cycle of transactions would give a 2% p. a. profit without running any exchange risk. In real life, of course, opportunities to make profits without running risks are not available in efficient markets.

For the assumed exchange and interest rate scenario, a number of traders would jump in to put through the cycle of transactions and make a profit. The effect of such arbitrage transactions would be somewhat as follows:

(a) With a number of traders trying to borrow dollars, the interest rate would harden from the going rate of 1% (1.05, 1.10.....).

(b) The demand for spot euros would also tend to make it costlier from the going rate of USD 1.3270 per EUR (USD 1.3272, USD 1.3275.....).

(c) The euro interest rate will soften as the supply of euro deposits increases (2.95, 2.90.....).

(d) The euro would also tend to soften in the forward market as supply increases (USD 1.3265, USD 1.3260....).

The net effect will be to restore the parity between interest differentials and forward margins, when the arbitrage opportunity vanishes. The price arrived at through the interest parity principle is known as the "arbitrage free" price.

It is worth emphasising that the interest parity principle holds good in a market which is free to determine exchange and interest rates purely by demand and supply -- in other words, a market free of all regulations. The offshore market is one such money market and the interest parity principle can best be seen in operation by comparing the forward margins on exchange rates with the interest differentials for the two currencies in the offshore markets.

The interest parity principle does not hold good as far as the forward exchange rate of the rupee against the dollar is concerned. The reason is that Indian exchange control does not permit banks in India to freely borrow, or make time deposits in, foreign currency, which is at the heart of interest parity. Also, there is no liquid, established interbank money market for say 1, 2, 3 or 6 month rupees. The interest parity principle is partly relevant for the

forward rates of non-dollar currencies against the rupee, the forward margin being the combined result of the dollar: rupee and dollar: currency forward margins (see below).

3.4 Cross and Forward Rate Calculations

3.4.1 Cross Rate Calculation

As has been stated earlier, most trading in the world forex markets is in terms of the United States dollar. In other words, one leg of most exchange trades is USD. Therefore, margins between bid and offered rates are lowest for quotations for the United States dollar. The margins tend to widen for cross rates, as the following calculations would show.

Consider the following rate structure:

GBP 1.00 = USD 1.4975/80 EUR 1.00 = USD 1.3265/70

In this rate structure, we have to calculate the bid and offered rates for the euro in terms of pounds. Let us see how the offered (selling) rate for euro can be calculated. Starting with the pound, you will have to buy United States dollars at the offered rate of USD 1.4975 and buy euros against the dollar at the offered rate for euro at USD 1.3270. The offered rate for the euro in terms of GBP, therefore, becomes EUR (1.4975/1.3270), i.e., EUR 1.1285 per GBP. Similarly, the bid rate for the euro can be seen to be EUR 1.1294 per GBP. Thus, the quotation becomes GBP 1.00 = EUR 1.1285/94. It will be readily noticed that, in percentage terms, the difference between the bid and offered rate is higher for the EUR: GBP rate as compared to USD: EUR or GBP: USD rates. In the market, the EUR: GBP pair will trade within this band.

3.4.2 Forward Rate Calculation

The interest parity principle can be used to calculate forward rates. For these calculations, it is essential to remember the way in which the maturity dates of spot and forward transactions are calculated (see Chapter 2) and work out the interest for the actual number of days involved.

On Thursday, January 15, 2009, the spot rate for euros is say EUR 1.00 = USD 1.3264/70. That day's spot transaction would mature on Monday, January 19, 2009, 17th and 18th being Saturday and Sunday. Therefore, a one-month forward transaction (or deposit) contracted on Thursday, January 15, 2009 would mature only on February 19, 2009, i.e. 31 days after the spot date (i.e., the date on which the currency will be deposited).

The one-month offshore market interest rates for spot maturity transactions are say:

USD 1-3/4 / 27/32 % p.a.
EUR 2-7/32 / 11/32 % p.a.

We can now proceed to calculate the forward rates. The steps involved in calculating the offered rate for euros are:

- Borrow USD 1.3270 for one month in the spot market on January 15 at 1-27/32% p.a.
- Buy euro 1.00 spot at USD 1.3270 per EUR.
- Deposit euro for one month at 2-7/32% p.a.

It should be noted that all the above transactions have been done in the spot market on January 15, 2009, and that currencies will change hands on January 19, 2009.You can now calculate the forward rate by equating the maturing amount of principal and interest in the two currencies. Remember that interest has to be calculated for 31 days and, as is the practice for both dollars and euros, on a 360-day year basis.

(Note that for borrowing dollars and buying euros, the rates used are the market's "offered" rates; similarly, the "bid" rate for euro deposits has to be used to calculate the interest on the euro deposit.)

Assuming that USD 1.3270 was borrowed, the principal and interest to be repaid on maturity would be USD 1.3291 on February 19, 2009 as follows:

USD 1.3270 + USD ((1.3270*1.84375*31)/(100*360))
= USD 1.3291

On the other hand, the deposit of EUR 1.00 at 2-7/32 per cent would fetch EUR 1.0019 as follows:

EUR 1.00 + EUR ((1.00*2.21875*31)/ (100*360))
= EUR 1.0019

Equating the two, the offered one-month forward rate for the euro, therefore, comes to USD (1.3291/1.0019) or USD 1.3266.

A contract can now be entered to sell EUR 1.0019, delivery February 19, at USD 1.3266 per euro on a fully hedged basis. The receipt of the dollars from the counterparty can be used to repay the dollar loan and interest thereon, and the maturing euro deposit used to pay out EUR 1.0019.

By borrowing euros at 2-11/32% p.a., buying dollars at USD 1.3264 per EUR and depositing dollars at 1-3/4% p.a., the bid one-month forward rate for euros can also be similarly calculated. It can be seen that this comes to USD 1.3257 per EUR. The one-month forward quotation, therefore, is USD 1.3257/66. It will be noticed that the margin between the bid and offered forward rates is higher than for the spot rate. In practice, this widening of margins can be used to determine whether a forward margin is a premium or discount. Let us see how.

The spot rate is USD 1.3264/70 per EUR and the one-month forward margin is quoted as 0.07/04 cents. We are not sure whether this is a premium or a discount on the euro. If it were a premium on the euro, forward euros would be more expensive. The forward rate would, therefore, be USD 1.3271/74 per

euro, adding the margin to the spot rate. In that case the spread is actually lower (3 "basis" points). Since the spread on forwards has to be wider, the margin cannot be a premium. Considering it as a discount, we get the forward quote as USD 1.3257/66 per euro i. e. a spread of 9 basis points, and this is the correct position.

One other point should be noted as regards the calculation of forward rates using the money market route. Consider how the offered rate for euros was calculated: the money market position was "short" in dollars (represented by the borrowing) and "long" in euros (represented by the deposit). Now, an offer can be made for euros against dollars. The maturing euro deposit can be paid out in meeting the offered euros, whereas the incoming dollars will be used to repay the dollars borrowed, ending up with a square position. In other words, in the money market, you are "long" in the currency you have to pay out and "short" in the currency the counterparty is to pay you. Again, **the amount to be borrowed/deposited has to be such that, together with interest, it equals the contract amount.**

In the above example, if you are writing a contract to offer a million euros at USD 1.3266, the euro deposit plus interest thereon should total EUR 1 mn. Therefore, you need to deposit EUR 998,093, which with interest at 2.21875 % p.a. becomes EUR 1 mn in 31 days. The principal amount of the dollar borrowing needed is, therefore, USD (998,093*1.3270) or USD 1,324,363.

3.4.3 Hedging of Forwards

In most foreign exchange markets, the spot market is much more liquid than the forward market. This is all the more so if a bank needs to hedge an odd-dated, i.e., nonstandard and maturity, forward arising from a customer transaction. (Standard maturities are full months from spot dates -- see chapter 2 for value date conventions.) Again, in many forex markets, the market in swaps -- i.e., simultaneous sale and purchase of one currency for another for different maturities -- is more liquid than outright forwards. The difference in the exchange rates for the two maturities is known as swap points or swap difference. One example of a foreign exchange swap (as distinct from currency swaps discussed later) is sale of spot dollars accompanied by purchase of dollars in the forward market, generally at different exchange rates.

Consider that a bank has sold forward dollars to a customer. Until the transaction is hedged by a corresponding purchase in the market, the bank faces two risks:

- A change in the spot rate (the bigger risk)
- A change in the forward margin or swap points

Very often, banks would hedge the two risks separately, if an exact (i.e., as to amount and maturity) forward purchase is not immediately possible because a counterparty may not be available. Or, if available, the quotation is

much worse than what it should be. The bigger risk is the fluctuation in the spot rate and this is readily hedged by buying dollar in the more liquid spot market. This would then be followed by a swap—sell spot, buy forward. The maturity of the second leg will correspond to the prevalent maturities traded in the swap market and the chosen maturity will be as close to the maturity of the customer transaction as possible. This would still leave a gap between the maturities of the customer transaction and its hedge—which will be covered by another swap, often near the maturity date, or absorbed in the overall gaps. (The two spot transactions—original purchase and subsequent sale as part of the swap—will, of course, mature and cancel each other out on spot date.) Even if the rate has moved between the two spot trades, this does not affect the efficacy of the hedge: what is more important for the hedge, is swap points, not so much the spot rate, which in the cited case has already been hedged.

3.4.4 Hedging of Long-dated Forwards

The basic principles of forward rate calculations are unchanged irrespective of the maturity—the forward margin is derived from interest differentials between the two currencies. However, in practice, a few differences between relatively short (say up to 1 year) and long maturity forwards should be noted:

- It is more difficult to find matching counterparties for long dated forwards.
- The offshore bank deposit market is typically short-term; therefore, the hedging and pricing of long-dated forwards have to be made on the basis of bond market yields in the two currencies. This presents some problems, as outlined below:
- The longer the maturity, the wider the bid offer spreads and higher the credit risks.
- In theory, pricing and hedging could be done by shorting a zero coupon bond in the currency you are going to receive, converting the proceeds to the currency to be paid out under the contract, and buying a zero coupon bond of the required maturity in that currency. Why zero coupon? Because, coupon bonds will be exposed to both interest and exchange rate risks on coupon flows. However, in practice, zero coupons of the requisite maturities may not be available!

Therefore, only banks that have large assets and liabilities in both the currencies will be able to offer long-term forward contracts. They do so through structuring the flows in the two currencies in the respective asset/liability books, thus mimicking the behaviour of a bond market transaction, which is the theoretical hedge.

3.4.5 Forward Rates to Customers: Non-Dollar Currencies

The market one-month forward fixed date delivery euro: rupee rates can be calculated by crossing the one-month forward USD/EUR exchange rates (USD 1.3257/66 per euro) with the one-month forward INR/USD exchange rates (Rs 49.25/27 per USD) calculated earlier, as follows:

Sale, or offered, rate for euros against rupee	Purchase, or bid, rate for euros against rupee
49.27*1.3266 Rs. 65.3616	49.25*1.3257 Rs. 65.2907

The customer rate would be arrived after loading the appropriate margin (say 20 paise) and rounding off (in the banks favour) say Rs. 65.09/65.57.

Earlier, we had calculated the one-month dollar: euro rate as USD 1.3257/66. This was, of course, for delivery on a fixed day, namely, February 19, 2009, and the euro was at a discount vis-à-vis the dollar. If the two-month forward rate was, say, USD 1.3240/45 per EUR, the bid and offered second month option period rates for the euro would be USD 1.3240/66. (i.e., the offer, or selling, rate for the euro, viz. 1.3266 includes the one-month discount on the euro, while the bid, or buying, rate for the euro, viz. 1.3240, factors in the two-month discount) The spread between the bid and the offered rates is now much wider—a cost the counterparty pays for the flexibility of choosing the value date for the transaction on any day in the second month.

3.5 Some Practices of the System in India

Based on the above general principles, banks in India quote spot and forward exchange rates to customers.

The general procedure is for banks to arrive at the "Base Rates" for each currency every morning, based on the ruling interbank spot exchange rates. These are then used to calculate the "card rates" for different types of customer transactions.

Purchase

(i) **Merchant Spot T.T. Purchase Rate**
From the BASE Rate, deduct exchange margin

(ii) **Merchant Spot Bill Buying Rate**
   (a) Deduct/Add on-going forward discount/premium depending upon the normal transit period, tenor of the bill such as sight, usance period, etc.
   (b) Deduct exchange margin

(iii) **Merchant Forward T.T. Buying Rate**
   (a) Deduct/Add on-going forward discount/premium depending upon the delivery period.
   (b) Deduct exchange margin.

(iv) **Merchant Forward Bill Buying Rate**
   (a) Deduct/Add on-going forward discount/premium depending upon the delivery period of the bill, transit period, tenor of the bill such as sight, usance and grace period, etc.
   (b) Deduct exchange margin.

Sale

(i) **Merchant Spot TT Sale Rate**
To the BASE Rate, add exchange margin.

(ii) **Merchant Spot Bill Sale Rate**
To the merchant TT Sale rate as determined, add further exchange margin.

(iii) **Merchant Forward Sale Rate**
For quoting Merchant Forward Sale Rates for import TT/Bill transactions, Authorised Dealers shall base their quotations on the appropriate cover rate to which exchange margins for TT and/or Bills as mentioned above may be added.

There are a couple of other features of the system in India, which should be noted as these are relevant to exchange transactions with customers. In the case of import bills for which no forward contract has been booked, the exchange rate will be the one ruling on the date the customer pays the bill by purchasing foreign currency in which the bill is denominated from the bank. In the case of sight import bills under letters of credit, the customer has to pay the bill within ten days of the receipt of the bill by the bank in India, provided, of course, the documents under the letter of credit are in order. If he fails to do so, on the tenth day, the bank would automatically sell the foreign currency to the customer at that day's exchange rate and grant him a rupee loan to pay for the purchase. In effect, this converts the foreign currency liability into a rupee liability.

In addition to the foreign exchange transaction for payment of an import bill, an interest element would also be involved. This would occur where the letter of credit authorised a foreign bank/branch to negotiate the documents, if in accordance with the terms of the credit, and pay the seller by debit to the letter of credit opening bank's account in that currency. In this situation, the bank is out of pocket from the date its account has been debited to the date the customer pays the bill. Interest for this period is, therefore, recovered at the rupee interest rate.

Similarly, in the case of export bills purchased, interest has to be recovered at the prescribed rate for export credit facilities, from the date of purchase

to the date of payment of the bill. Again, if a purchased export bill remains unpaid for 30 days beyond its due date of payment, the foreign currency purchase has to be reversed by selling the currency back to the customer at the going TT selling rate or original bill buying rate, whichever is higher. When the bill is finally paid, the currency is purchased by the bank at the ruling rate.

3.6 Changes in Contract Terms

3.6.1 Contracts in Rupees

Cancellation of a forward contract really amounts to doing a reverse transaction at the going rate—dollars bought under the contract will be sold for identical delivery and the difference settled. Consider that the original contract done in July is for the sale of USD 100,000 to a customer for November delivery at Rs. 49.85 per dollar. This would have been covered by buying dollars in the interbank market at Rs. 49.85 (ignoring bank margin). If the contract is to be cancelled in September, when the forward rate for November dollars is say, Rs. 49.50, the bank will have to sell the November dollars purchased under the original cover, at this rate. Therefore, in November, in the bank's books, the rupee flows are as follows:

Buy USD 100,000 @ 49.85	Rs. (-) 49, 85,000
Sell USD 100,000 @ 49.50	Rs. (+) 49, 50,000
	Rs. (-) 35,000

The amount of Rs 35,000 is the loss on cancellation. Remember that the cancellation has been effected in September, whereas the cash inflow/outflow takes place in November. Strictly speaking, therefore, if the loss is to be settled in September itself, the present value of Rs 35,000 should be recovered from the counterparty.

Also, from a corporate viewpoint, contracts liable to be cancelled (outright, or for change in delivery date—see below) should not be booked on option delivery basis; it is advisable to book such contracts for fixed date delivery. The reason is that for option deliveries, as explained earlier, one gets the worse of the rates applicable to the beginning and end of the option period. This reduces the profit on cancellation and increases the loss. If the original contract has been booked on option basis, the reverse transaction at least should be done for a fixed date (first or last day of the option period, as the case may be), which would minimise the loss or maximise the profit.

In the above example, let us consider that the decision to cancel was taken on September 1, when the spot rate was Rs. 49.10. Consider further that the forward premium on the dollar was, say, 20 paise a month. If, for cancellation, the dollars are sold for delivery whole of November, the rate would be Rs 49.50 (only two-month premium), as used in the example. However, if the dollars

are sold for delivery on November 30 (fixed date), the rate should be Rs. 49.70 and the loss would come down to Rs. 15,000. Since the original purchase by the customer was for delivery on any day in November, sale on November 30 is sufficient to cancel the contract.

In principle, the cancellation rate would be the cash/spot ruling when the contract is cancelled. The practice of specifying the time for determining the cash flows on cancellation of a contract on its (fixed date) maturity, is not as common in the forward market as it is in the options market.

Given the intra-day volatility in the exchange market and for those arbitraging between the forward and futures market, specification of time for fixation of the settlement price is important. One standard way would be the RBI reference rate two clear working days before the maturity of the contract.

In the cited example, if the contract is to be extended (i.e., delivery period deferred) to say January, the cancellation will have to be accompanied by repurchase of the dollars for January delivery at the going rate. Any extension (or early delivery) is a cancellation and rebooking, done simultaneously.

Given this, in the cited example of USD 100,000 purchased by the bank for delivery to the customer in November @ Rs. 49.85, if the contract is to be extended to January delivery, the "swap" transaction in the interbank market will be

- Sell at the current rate the dollars bought for November delivery.
- Buy at the current rate the same amount of dollars for January delivery.

If the current inter-bank rates for November and January dollars are say Rs. 49.70 and Rs. 50.10 respectively, the first leg will mean recovery of Rs 15,000 from the customer. And, a fresh contract will be entered into to sell dollars to the customer for January delivery, based on the current rate of Rs 50.10. Assuming that the new contract is booked at Rs 50.10, the cost to the customer of changing the delivery date is Rs 40,000, i.e. the swap cost, as follows:

Original cost of USD 100,000:	Rs. 49,85,000
Cost of cancelling the original contract	Rs. 15,000
Cost of USD 100,000 under new contract	Rs. 50,10,000
Total cost	Rs. 50,25,000
Difference — or cost of changing delivery	Rs. 40,000

Strictly speaking, the customer will have to consider the interest on the outflow of Rs. 15,000 incurred while cancelling the original contract, as part of the cost of changing the delivery. A customer who knows his exchange arithmetic will, of course, pay only the present value of Rs. 15,000.

In the above calculations, it has been assumed that the cancellation and rebooking has been done at the interbank rates (i.e. Rs. 49.70 and Rs. 50.10

respectively). If the bank loads any margin to the interbank rates, the cost to the customer will be correspondingly higher.

Consider a Different Rate Scenario:

Interbank rates are Rs. 50.50 for November and Rs. 50.00 for January (i.e., forward dollars are at a discount). The swap will be

- Sell USD 100,000 November delivery at Rs. 50.50
- Buy USD 100,000 January delivery at Rs. 50.00

The swap gain is Rs. 50,000

For the customer (ignoring bank margins), the original contract will be cancelled at Rs. 50.50 (i.e., an inflow of Rs. 65,000), and a new one booked at Rs. 50.00. The overall gain on the change in delivery is now Rs. 50,000 (i.e., the same as the gain on swap, ignoring interest on the inflow) as follows:

Original cost of USD 100,000	Rs. 49,85,000
Gain on cancelling original contract	Rs. 65,000
Cost of USD 100,000 under new contract	Rs. 50,00,000
Total cost	Rs. 49,35,000
Difference – or gain on changing delivery	Rs. 50,000

3.6.2 Dollar/Currency Contracts

The basic arithmetic is identical to changes in contract terms of rupee contracts but with the added complication that the dollar or currency cash flows will have to be translated into rupees at the going rate of exchange. Since extensions of contracts involve cancellation and rebooking, we will use the example of extension to illustrate the calculations.

In the earlier example and ignoring bank's margin, the one-month forward sale rate for euros, for delivery on February 19 was USD 1.3266 per euro. Consider that the customer, who has purchased say EUR 5 mn at this rate, desires to extend the maturity by a month. The ruling rates when the extension is desired are as follows:

Forward rate for February 19	USD 1.3255/62 per EUR
Forward rate for March 19	USD 1.3230/35 per EUR

The swap transaction will thus be:

Sell EUR 5 mn @ 1.3255, delivery February 19
Buy EUR 5 mn @ 1.3235, delivery March 19

The cash flow on February 19 is:

Buy EUR 5 mn @ USD 1.3266; pay out USD 66,33,000
Sell EUR 5 mn @ USD 1.3255; receive USD 66,27,500

This represents a net outflow of USD 5,500, which would need to be recovered from the counterparty on February 19. He could buy the dollars for rupees, delivery on February 19, at the ruling dollar: rupee forward rate for this date and pay the present value of the resultant rupees now. Alternatively, in theory, the counterparty may keep the USD/INR exposure open and pay rupees on February 19 at the then ruling exchange rate. The counterparty also has a contract to buy EUR 5 mn at USD 1.3235 per dollar on March 19. (If, at the time of cancellation/rebooking, the euro has appreciated as compared to the original contract rate, the transaction will result into an inflow of dollars on February 19, which will have to be paid similarly, in rupees, on that day).

3.6.3 Examples of Exchange Arithmetic

We give hereunder various examples of quoting exchange rates to a customer for different types of transactions, based on an identical set of hypothetical interbank rates (holidays other than Saturday & Sunday ignored):

"ABC" is a corporate customer of bank "XYZ".

The interbank foreign exchange market rates on November 16, 2008 were as under:

DATE : November 16, 2008
SPOT DATE : November 18, 2008
SPOT RATE : 48.65/66 INTERBANK

	FORWARD	PREMIA FOR DOLLAR AGAINST RUPEE
November 30 :	48.70/73	5/7 P
December 31 :	48.96/99	31/33 P
January 31 :	49.19/22	54/56 P
February 28 :	49.35/38	70/72 P
March 31 :	49.50/53	85/87 P
April 30 :	49.64/67	99/101 P

USD/JPY SPOT Rate: 90.34/38

	FORWARD RATE	PREMIA FOR YEN AGAINST DOLLAR
November 30 :	90.17/20	17/18 (hundredths of yen)
December 31 :	89.95/98	39/40 (hundredths of yen)
January 31 :	89.79/83	55/55 (hundredths of yen)
February 28 :	89.58/61	76/77 (hundredths of yen)
March 31 :	89.36/39	98/99 (hundredths of yen)
April 30 :	89.13/21	121/117 (hundredths of yen)

BANK MARGIN : 0.25 % ON COVER RATE

(i) ABC receives an inward remittance for USD 500,000 – value spot. The bank will buy USD from ABC and will cover the exposure by selling the USD in the market, both for value SPOT.

The bank will sell USD in the market at market's buying rate for USD, which is 48.65 for value SPOT.

Cover Rate	:	48.65
Margin	:	0.1216
Net Rate	:	48.5284
Customer quote		
After rounding off	:	48.53

(ii) ABC desires to remit an amount of JPY 10,000,000 by T/T value SPOT.

XYZ Bank will need to sell yen (JPY) to ABC and will cover the exposure by buying the currency from the market, both for value SPOT.

XYZ cannot directly buy JPY against rupees (INR) from the market, since JPY/INR is not quoted. XYZ will, therefore, have to buy USD equivalent of JPY 10,000,000 from the domestic market against INR, and then buy JPY against USD in the market abroad at the market's selling rate for JPY against USD. The net result of the transactions will then be a purchase of JPY by XYZ against INR for sale to ABC.

The market is buying USD (i.e., selling JPY) @ 90.34 value spot.
The market is selling USD against INR @ 48.66 value spot.

Cover Rate	:	48.66/90.34 i.e. Rs. 53.8639 per JPY 100
Margin	:	0.1347
Net Rate	:	53.9986
Customer quote		
After rounding off	:	Rs. 54.00 per JPY 100

(iii) ABC tenders to XYZ Bank for negotiation an export bill for USD 500,000. The bill is drawn at sight and covers a shipment to the United States.

XYZ will fix the rate and also give the rupees to ABC today. XYZ will, however, get the USD funds only when the bill is paid. XYZ will cover the exposure by selling USD forward for delivery to match the date payment is expected to be received. However, XYZ will be giving the countervalue in rupees to ABC today. The exchange rate will, therefore, be based on the market rate for the expected payment date of the bill. Interest between the date of negotiation and the date of payment will be charged separately.

XYZ would sell USD for delivery say November 30 because that is the expected date of receiving dollars.

The market buys USD @ 48.70 for November 30 delivery.

Cover Rate	:	48.70
Margin	:	0.1218

Net Rate : 48.5782
Customer quote
After rounding off : 43.57 (or 43.58, if you are in a generous mood!)

(iv) ABC is expecting shipment to take place in respect of import of raw material worth USD 500,000 sometime in the first half of November. To avoid exchange rate risk, ABC decides to buy the USD forward from XYZ Bank for February delivery.

XYZ Bank needs to sell USD to ABC for February delivery. This will be a contract with option of delivery and the right of exercising the option rests with ABC.

Market is selling USD @ Rs 49.38 per USD for delivery end - February.

Cover Rate : 49.38
Margin : 0.1223
Net Rate : 49.5023
Customer quote
After rounding off : 49.51

(v) ABC has sent an export bill denominated in yen for collection and the payment is expected sometime in February. ABC desires to book a forward cover for this exposure and accordingly requests XYZ Bank to book a contract for the amount of the bill, i.e., JPY 10,000,000.

XYZ Bank will cover the exposure by selling the JPY in the market for February delivery against INR. Since there is no direct JPY/INR price, XYZ will have to go through the USD/JPY and USD/INR route. The payment can come at any time during February, i.e., from February 1 to February 28. In order to protect his interest, XYZ will have to assume a worst case scenario. The worst case scenario for USD/INR as well as USD/JPY will be for delivery on February 1.

The market buys JPY against USD @ JPY 89.83 per USD for delivery on February 1. The market also buys USD against INR @ Rs. 49.19 per USD for delivery on February 1. (In the table, both these are January 31 quotes but we can safely use them for February 1, since yen is at a premium against the dollar, and the dollar against the rupee.)

Cover Rate : 49.19/89.83 i.e., Rs. 54.7590 per JPY 100
Margin : 0.1369
Net Rate : 54.6221
Customer quote
after rounding off : Rs. 54.62 per JPY 100

Note: In this example, if the due date of the bill was February 28, then XYZ is sure of the date of payment and there is no need for the worst

case scenario. In that case, the JPY/INR cover rate will be for end-February delivery, i.e., 49.35/89.61 = Rs. 55.0720. per JPY 100 and the rate to ABC would be Rs. 54.93 per JPY 100.

(vi) ABC had earlier bought USD 1,000,000 from XYZ for delivery on December 31 at the rate of Rs 48.78 per USD. The supplier has expressed inability to ship the goods. ABC, therefore, wants to cancel the contract with XYZ.

XYZ will cover the cancellation by selling USD 1 mn, initially purchased for delivery to ABC, in the market for value on December 31@ 48.96.

Cover Rate	:	48.96
Margin	:	0.1224
Net Rate	:	48.8376
Cancellation Rate after rounding off	:	48.83

The contract rate is 48.78 and the cancellation rate is 48.83. In other words, ABC will be selling @ 48.83 the USD which ABC has bought @ 48.78. ABC will, therefore, have a cancellation gain of 5p per dollar, or Rs 50,000.

(vii) ABC had earlier sold JPY 5,000,000 to XYZ Bank against USD for delivery on December 31@ JPY 88.00 per USD. The receipt of JPY is now delayed by one month and consequently ABC desires to extend the contract for delivery to January 31.

XYZ would have earlier covered the exposure by selling JPY in the market for delivery on December 31. In order to give effect to the extension of delivery date, XYZ will have to do the following swap:

- Buy JPY 5mn from the market against USD for value on December 31 @ 89.95
- Sell JPY back against USD for value January 31 so as to coincide with the extended delivery date to ABC @ 89.83.

Having done this, XYZ will cancel the original contract, pay the cancellation gain of USD 1,232 to ABC (see below) and enter into a fresh contract for purchase of JPY 5,000,000 @ JPY 89.83 from ABC, delivery on January 31.

	DATE	JPY FLOWS in Bank books	RATE	USD FLOWS in Bank books
ORIGINAL CONTRACT	Dec 31	(5,000,000)	88.00	56,818
CANCELLATION RATE	Dec 31	5,000,000	89.95	(55,586)
				1,232

Note that both the fresh contract rate as well as the cancellation rate used are interbank rates. In practice, these would be worsened to the extent of the desired bank margin. Also, the present value of USD will have to be paid in rupees at the spot buying rate for dollars.

Chapter 4

Global Financial Markets: An Overview

4.1 Introduction

It is not the intention to discuss the topic of global financial markets, and the process of accessing them for raising resources, at any great length in this book. It is, however, necessary for the reader to have some basic idea about the market, the common terms and benchmarks, etc., the reason is that, for example, as we saw in Chapter 3, forward exchange rates are a function of interest differentials in the offshore market. Again, the most popular benchmark in the derivatives market is the LIBOR—the London Interbank Offered Rate. Derivatives are also used to hedge currency exposures arising from short or medium term credits in foreign currency. Apart from an overview, the chapter also discusses some points and arithmetic needed for analyzing the economics of short term credit, EEFC accounts, etc.

Overall, those not familiar with the basics of global finance may find it useful to go through this Chapter, before going to the next section.

4.1.1 Global Market: Domestic and Offshore

Over the last 50 years, there has occurred an explosive growth in cross-border finance. One way of differentiating cross border finance is by its source, e.g. domestic and offshore. The traditional name for the latter was Euromarket, (hence Eurodollars, etc.). After the birth of the euro, this term has become confusing, and we would use the term offshore market. An example will help clarify the distinction. An Indian Company desirous of raising a dollar debt, could either do it in the domestic dollar market (i.e. the US) or in the offshore dollar market (for example, in London).

In general, the instruments in the domestic and offshore markets are similar.

4.1.2 Different Markets

Some of the more important funding sources are:

- Banks (commercial loans, export credits, structured finance, etc.);
- Capital market (bonds, equities);
- Private equity;
- Multilateral agencies making equity and debt finance available to corporate sector (IFC and ADB); etc.

4.2 Size of the Cross-border Banking Market

The most authentic data on market size is published by the Bank for International Settlements in its Quarterly Review of International Banking and Financial Market Developments. The data reported in the September 2009 issue of the Review evidence that the external loans of reporting banks increased from $ 19 trillion at the end of December 2006 to $ 21.4 trillion at the end of March 2009. While a large proportion of the loans was to developed countries, external loans to developing countries were as much as $ 1.9 trillion as on the latter date (India $ 108.1 bn). Of the aggregate loans to the developing countries, $ 978 bn were to the non-bank sector (India $ 47.5 bn). Obviously a significant proportion of external loans are interbank. Total international claims, i.e. including assets other than loans (like securities for example) of the reporting banks on developing countries were even higher at $ 2.4 trillion (India $ 141.1 bn). In comparison, the aggregate outstanding loans of the World Bank including IDA as on 30 June 2009 were $ 218.6 bn evidencing the growing importance of the commercial market to the developing countries. As for currency breakdown of the reporting banks cross-border positions, out of a total of $ 29.4 trillion at the end of March 2008, $ 11.8 trillion (40%) was denominated in the U.S. dollar and around $ 11 trillion (37.5%) was denominated in the euro.

4.3 Offshore Banking Market

4.3.1 Introduction

The offshore market is the single most important source of commercial bank funds for developing countries. The development and operation of offshore currency markets has played a very significant role in the post-war international financial system. Indeed, the explosive growth in international banking and bank lending could not have come about but for the offshore market.

The offshore market comprises funds deposited in a bank outside the home country of that currency. By their very nature, offshore markets are, broadly speaking, outside the regulatory framework of any monetary authority -- the monetary authority of the place where the deposit is made is not concerned with deposits or loans in foreign currencies, which do not affect the

domestic money supply (its primary concern). Again, it is also outside the control of the monetary authority of the home country of the currency concerned because the transaction takes place outside the country.

The gross size of the market at the end of March 2009 was around USD 15.7 trillion (BIS Quarterly Review, September 2009).

One important aspect of the offshore market needs to be noted. It is basically a short-term market, three- or six-month deposits being the most popular. Also, it is a wholesale market with participants limited to banks, financial institutions, institutional investors, major corporates and high net worth individuals.

4.3.2 Interbank Market, LIBID and LIBOR Rates

There is an extremely active inter-bank market in offshore currencies. Market making banks continuously trade deposits in the inter-bank market, offering two-way quotes—the rate at which they are willing to take a deposit (bidding for deposits), and the rate at which they are willing to place (offer) deposits. The two rates are referred to as bid and offer rates. Hence the terms, London Inter-Bank Bid Rate (LIBID) and London Inter-Bank Offered Rate (LIBOR). The difference between the two represents the trading margin of the bank. Generally, it is of the order of 1/8%. For most major currencies, interest rate quotations are based on a year of 360 days. Thus, the actual interest amount, for a given period, would be worked out on the basis of the number of days in the period divided by 360. As already stated in Chapter 3, the practices for calculating value dates of maturities (receipt and payments) of deposits in the offshore market are identical to those in the foreign exchange market, e.g., the value date of a transaction in the spot market will be two clear working days ahead. A proper value date for a transaction has to be a working day both in the place where the transaction is being done and the home market of the currency concerned.

The bid and offered rates are different not only for different currencies but also for different maturities. Please see the following table of rates ruling on 20th November 2009.

Table 4.1 London Interbank Offered Rates

Currency	LIBOR 1M	LIBOR 3M	LIBOR 6M
Pound Sterling	0.51	0.61	0.83
USD	0.24	0.26	0.49
Euro	0.40	0.67	0.98
Swiss Franc	0.09	0.25	0.35
Japanese Yen	0.16	0.30	0.51

The banking system depends on the inter-bank market to provide the liquidity for investing customer deposits as also for financing loans to customers.

Since LIBID and LIBOR are the rates at which a bank is bidding for and offering deposits in the market, the actual quotations on a given day, and indeed time, can differ from bank to bank. Weaker banks may need to bid for deposits at a higher rate than stronger ones.

LIBOR is the most common floating rate benchmark used for corporate loans as also in interest rate swap agreements. Therefore, bank-specific LIBORs could lead to disputes about the interest to be paid or the amounts to be exchanged under the swap agreements. To avoid such disputes, the LIBOR used in most transactions is that published by the British Bankers Association. Details of the BBA's LIBOR fixation system are at Annexure 4.1. BBA LIBORs are currently available for 10 currencies including the euro: however, Euro LIBOR should not be confused with Euribor, which is the domestic benchmark interest rate for euro-denominated interbank transactions between banks in the eurozone. The methodology used for euribor fixation is also outlined in Annexure 4.1.

Interest on short term trade credits or loans in foreign currency is also often linked to the LIBOR.

4.4 Domestic Markets

Most industrial countries have, over the years, removed exchange controls or other restrictions on non-resident entities borrowing funds in their domestic banking markets. Since the currency is freely convertible, the funds raised can be used anywhere. The benchmark for interest rates in domestic markets is however not LIBOR but could be the prime rate, the CD (certificate of deposit) rate or the treasury bill rate. In the Eurozone, the Euribor is a popular benchmark for Euro-denominated loans (see paragraph 4.3.2 above).

4.4.1 Fixed Rate Loans

Unlike in the offshore banking market, fixed rate institutional loans are possible in the domestic markets in most of the countries. This is because while the resources in the offshore market are essentially short-term, institutional lenders do have access to fixed rate long-term money in the domestic market and can, therefore, make fixed rate medium-term loans without running an interest rate risk. In the Japanese money market, for example, there is a Japanese Long Term Prime Rate (JLTPR) and fixed rate medium-term loans can be raised, based on the JLTPR. Most other money markets do not have a system of quoting a long-term prime rate. However, the yield on government bonds of parallel maturity is the benchmark for all fixed rate loans. Borrowers pay a premium on this, depending on the credit standing.

With the development of very active and liquid interest rate swap markets (see Section 2 of this book), it has become very simple to alter fixed rate loans into floating rate or vice versa.

4.5 The International Bond Market

4.5.1 Foreign and Offshore Bonds

The issue of international bonds to channel cross-border capital flows has a history of more than 150 years. In the 19th century, foreign issuers of bonds, mainly governments and railway companies, used the London market to raise funds.

These days, international bonds are broadly classified under two heads:

(a) The so-called "**foreign bonds**", i.e., bonds floated in the domestic market (and currency) by non-resident entities. As controls over movement of capital got relaxed, many foreign bonds were issued in the domestic markets of Germany, Japan, Netherlands, Switzerland, the United Kingdom and the United States. Modern jargon often refers to these as Samurai bonds (Japan), Bulldog bonds (United Kingdom) and Yankee bonds (i.e., those issued in the United States domestic market).

(b) **Offshore (or Euro) bonds**: As has already been discussed, the term "offshore" has come to signify a currency outside its home country. Offshore bonds (formerly Eurobonds) are, thus, bonds issued and sold outside the home country of the currency of issue. For example, a dollar bond sold in Europe is an offshore bond. The offshore bond market has been in existence for almost 50 years now.

In most domestic markets, where foreign bonds are issued, regulatory requirements like registration of an issue, disclosure of interest and credit rating are far more stringent than in the offshore market. The lower level of regulatory requirements is, in fact, the basic attraction of the offshore market.

4.5.2 Size of the Market

As per BIS Quarterly Review data, at the end of June 2009, the aggregate amount of international debt securities outstanding, both money market and bonds/notes, was $ 25.9 trillion. This includes debt securities totaling $ 1.5 trillion issued in the first half of 2009 ($ 3 trillion in 2007). As in the case of cross border bank debt, a very large proportion of both outstandings ($ 22.7 trillion) and new issues ($ 1.4 trillion in H1 2009), was from issuers in developed countries. Issuers include financial institutions, corporates and governments. Most of the debt securities are in the form of bonds/notes rather than money market instruments like commercial paper.

4.5.3 The Benchmark Rate

The benchmark rate of interest for all fixed interest rate debt, including bonds, is the yield on government securities of corresponding maturity. Thus, the benchmark for fixed interest dollar debt is the yield on United States Government dollar bonds of parallel maturity. Similarly, the benchmark for fixed rate pound debt will be the yield on "gilts" of corresponding maturity. While the benchmark is the yield on government bonds of the home country, the fixed rate borrower pays a premium on this. The premium depends on the borrower's credit standing, maturity of the bond and market appetite for his bonds.

4.5.4 Currencies

The United States dollar has historically been the currency in which the largest proportion of international bonds has been issued. Indeed, the dollar bond market has traditionally been by far the largest bond market in terms of issues, outstanding amounts, secondary market trading volumes and liquidity.

After the introduction of the euro, however, the amount of international bonds issued in the euro has gone up sharply. Since 2002, the two currencies have been more or less equally popular. In first half of calendar year 2009, net international bonds and notes denominated in the United States dollar totalled USD 750 bn; the euro denominated issues were marginally lower at the equivalent of USD 705 bn (BIS data). In terms of amounts outstanding, however, euro-denominated issues were more than dollar denominated bonds/notes (USD 11,790 bn equivalent compared to USD 8,975 bn in June 2009) as a result, at least partly, of the change in the exchange rate. The other major currencies for issue of international bonds are JPY, GBP and SFR.

4.5.5 Bond Indices

As far as emerging market bond issues are concerned, the indices most commonly used as standard benchmarks, are the ones calculated and disseminated by J.P. Morgan. In fact, J.P. Morgan has a family of Emerging Market Bond Indices like EMBI+, EMBI Global and regional indices. These indices are also used by international investors active in emerging market bonds, to structure portfolios, or as benchmarks to compare performance of their own portfolios. The indices are calculated from the secondary market prices of bonds.

4.6 Innovations

4.6.1 Floating Rates

Traditionally, bonds have been fixed rate instruments. One major innovation in the offshore market has been the issue of medium-term securities carrying

a floating rate of interest. The rate is reset at regular intervals, typically quarterly or half yearly, in relation to some predetermined reference rate, usually LIBOR. The floating rate mechanism allows the interest rate risk to be passed from the investor to the issuer of the bonds. Such bonds are called floating rate notes (FRNs) or bonds (also variable rate bonds). The distinction between the terms notes and bonds, both debt securities, is really the time to maturity. For long-term instruments, the preferred term is bond and for shorter term ones, note. But there is no rigid definition uniformly used.

4.6.2 Collared Floaters

Various modifications of floating rate notes have been introduced in a bid to attract investors. For example, the so-called "collared floaters" are FRNs with a floor and a cap applicable to the interest payable. These are also sometimes called minimax FRNs.

4.6.3 Perpetual Bonds

Another innovation that failed to find much popularity is the issue of perpetual floating rate bonds. Perpetuals have no maturity, as the name signifies. In January 2006, the RBI permitted banks to augment their capital funds by issue of Innovative Perpetual Debt Instruments (IPDI) as Tier 1 capital: this was done to provide banks in India additional options for raising capital funds.

4.6.4 Note Issuance Facilities

Note Issuance Facility (NIF) is a medium-term commitment on the part of underwriting banks. It obliges them to purchase any short-term note (or commercial paper) that the borrower is unable to sell in the market, at an agreed spread over a suitable benchmark (the benchmark could be LIBOR, the T-bill rate, etc.). Once a note issuance facility is in place, the borrower can issue short-term paper and sell it in the capital market at a spread lower than that at which the underwriters are committed to buy. This helps to reduce the cost of borrowing. Another major advantage of a note issuance facility is that, since the notes are short-term, this may allow the borrower to access investors, who may not be interested in committing medium-term funds but may be quite happy to buy short-term paper. The NIF can thus be used to diversify the investor base. The NIF is something of a half-way mark between syndicated loans on the one hand and bond issues on the other.

With some marginal variations in the basic structure of the facility, NIFs are sometimes also referred to as revolving underwriting facilities (RUFs), note purchase facilities etc. The NIF commitment is generally for five to seven years, whereas the short-term paper issued under it is typically for maturities of three or six months.

4.6.5 High Yield or "Junk" Bonds

These are bonds rated below investment grade by rating companies. They offer higher returns to attract investors. Hence the name 'high yield'. A number of such bonds have been issued in the United States, often for financing risky takeover bids.

4.7 Equity or Equity-linked Issues

Primary issue of equity to foreign buyers could be done in several ways: straight equity issues in the form of depository receipts, issues of convertible bonds, or issues of bonds attached with warrants allowing the holder to buy the issuer's equity at a pre-determined rate.

4.7.1 Straight Equity Issues

Straight equity issues in the international markets are made in the form of depository receipts. Three types of depository receipts are commonly used:

(a) American Depository Receipts (or ADRs) are meant to facilitate public issues and trading in the United States. ADR issues are, therefore, subject to stringent accounting, regulatory and disclosure requirements of the United States Securities Exchange Commission.

(b) International Depository Receipts (IDRs) are meant to facilitate issues and trading in Europe.

(c) Global Depository Receipts (GDRs) are used in the case of issues in the offshore market combined with private placement in the United States (to professional investors under Rule 144A of the SEC). There are few regulatory requirements for GDR issues. The primary and secondary market is mainly in London. While issues are formally required to be listed in London/Luxembourg, most of the trading is on an over-the-counter basis.

The depository receipts (DRs) are issued, not by the company, but an international bank acting as the depository. Each DR represents a given number of the company's shares. In the company's books, the depository bank's name appears as the holder of the shares. The depository gets the dividends from the company (in local currency) and distributes them to the holders of the DRs. Like offshore bonds, GDRs too are bearer securities. The DRs are exchangeable with the underlying shares either at any time, or after the lapse of a particular period. The exchanged shares could then be traded on the local stock market. The issue price of DRs depends on the market price of the underlying share at the time of issue.

4.7.2 Convertible Bond Issues

In the case of convertible bonds, the conversion can be done, at the pre-determined price, at any time at the investor's option, but generally after a year or

two from the issue date. The typical bond maturity can range up to 10 or 12 years and, if the option to convert into equity is not exercised, the bond has to be redeemed. Most issues are listed either in the London or Luxembourg market, although actual trading is on an over-the-counter basis. Convertible bonds in the offshore markets are also bearer securities.

Many convertible bond issues incorporate "call" and "put" options. For example, the issuer can "call" the bond—in effect, insist upon the holder converting it into equity—if the market value of shares exceeds the conversion price by an agreed percentage for a given length of time. The "put" option in favour of the holder allows him the right of redemption at a price above par so as to give him a yield higher than the coupon rate.

4.8 The Corporate Perspective

4.8.1 Short-term Credit/Loans/Deposits in Foreign Currency

Exchange regulations in India allow:

(i) Importers to avail buyer/supplier credit of up to three years, in foreign currency, to finance imports. Supplier credits are part of the contract between the importer in India and the supplier abroad. Buyer credits are arranged by banks at the instance of the importer. They are not part of the contract with the supplier. Buyers'/suppliers' credits and loans for three years and above come under the category of External Commercial Borrowings (ECB) which are governed by ECB guidelines.

(ii) Exporters to avail pre- and post-shipment credit in foreign currency.

(iii) Indian companies to avail of foreign currency loans from banks in India out of the latter's foreign currency resources in the form of FCNR (B) deposits.

(iv) Exchange earners to keep up to 100% (subject to permissible credits and debits) of receipts in foreign currency accounts.

In principle, one would make a choice between rupee and foreign currency finance (or deposit) depending on what is, or is likely to be, cost-effective. (In the case of some large corporates, finance in foreign currency is necessary also because of the prudential limits on exposures to Indian companies imposed by the RBI.) The economics of these facilities depends on the rupee and the foreign currency interest rates, and exchange rate movements. Some of the more important aspects to be kept in mind are discussed in subsequent paragraphs. The reader is cautioned that regulations regarding import and export credit keep changing and it would be advisable to verify the extant regulations for full details.

4.8.2 Credit on Imports

The economics of importing on credit as compared to sight payment would depend on the:

(i) Rupee and FX interest rates. Foreign currency interest rates will generally be linked to LIBOR of the currency in question;

(ii) Exchange rate movement or the cost of hedging in the forward/option market; and

(iii) Difference in commission charged by banks on sight and usance letters of credit and the stamp duty on usance bills, where applicable.

Again, the interest paid may attract deduction of tax at source, since it is being paid to non-residents. For calculating the amount, the interest may need to be grossed up. The impact of the TDS would be lower, if the credit is taken from a resident of a country with whom India has signed a Double Taxation Avoidance Treaty (since DTAs generally provide for TDS at a lower rate). Inclusion of the interest element in the price of the goods may lead to payment of import duty on the interest element as well.

On a fully-hedged basis, it does not matter in which currency one takes the credit. This is because the forward margin is an arithmetical function of the interest rate differentials in the international forex market. Therefore, if a currency's interest rate is lower than that of the dollar, the currency will be at a premium (which will wipe out the "benefit" of the lower interest rate). If the currency is at a higher interest rate, it will be at a discount.

In general, if the hedging cost is higher than the difference between the foreign currency interest and the marginal cost of (or yield on) rupee funds, it may not be worthwhile to take credit on imports. If credit is taken, the exposure should be managed within the framework of a risk management policy for short-term currency exposures.

4.8.3 Export Credit

The exporter has three options:

(i) Pre-shipment credit in rupees, often below the lending bank's prime rate, followed by post-shipment credit in rupees; or

(ii) Pre-shipment credit in rupees as above, followed by discount and rediscount of export bills in foreign currency; or

(iii) Pre-shipment credit in foreign currency (PCFC) followed by discount and rediscount of export bills in foreign currency at the post-shipment stage.

In theory at least, there is the option of not taking credit at the pre- or post-shipment stages. But few exporters are likely to resort to this, given the below-market cost of export credit. If no credit has been taken, the foreign currency exposure will mature when the export bill is paid by the buyer.

Such exposures would need to fall within the framework of the policy for management of short-term exposures.

There are important differences between the maturity of exposures, getting the benefit of the forward margin, and the interest rate under the three options outlined above. These are as follows:

- Under full rupee credit, the currency exposure is extinguished at the time of purchase or discount of the bill by the exporter's bank. If the export bill is sent on collection, i.e. not discounted, the currency exposure is open until payment of the bill. In either case, the exporter would get the benefit of, or pay, the forward margin up to the maturity of the bill, if he does a forward sale of the currency. If this has been done at the time of draw-down of the packing credit, the effective cost of the export finance is the rupee interest rate adjusted for the forward margin.
- Under pre-shipment credit in rupees followed by discount and rediscount of the bill in foreign currency at the post-shipment stage, the currency exposure is extinguished on the date of discount of the bill.
- Under PCFC followed by discount/rediscount of the export bill, the currency exposure is extinguished at the time of, and to the extent of, the PCFC draw-down. The interest cost would be at the applicable foreign currency interest rates, and the benefit of the forward margin would not be available beyond the date of draw-down of the PCFC. In short, PCFC is pre-ponement, or leading, of the export receipt.

As will be seen, in each case, there is a trade-off between the forward margin on the one hand and the difference in interest rates on the other. A comparison should be made to choose between rupee and foreign currency finance.

4.8.4 Short-term Loans from FCNR (B) Funds

Companies can avail of such loans for any purpose including repayment of rupee borrowings. Where the repayments are hedged and the total cost (interest plus forward margin) is less than the rupee interest cost, such loans clearly reduce the cost of funds. However, if the exchange exposure is kept open, it should managed within the framework of a risk management policy. Translation losses on unhedged loans, or the proportionate hedging cost as the case may be, may have to be written off in the year in which they occur, and this would impact the reported profit.

4.8.5 Export Earners Foreign Currency (EEFC) Account and Other Foreign Currency Accounts for Residents

While opening an EEFC account, the considerations that need to be kept in mind are as follows:

(i) No rupee credit is allowed to be taken against EEFC deposits, which also carry zero interest. It would be economical to put money into such accounts only if the exchange rate difference compensates for the interest loss.

(ii) Sometimes, such accounts carry high transaction costs. It would be advisable, therefore, to ascertain these in advance.

(iii) In general, it may be advisable to keep monies in such accounts only to the extent of amounts which can be used immediately, thereby saving conversion costs.

4.9 Medium Term Loans

In principle, a company should think of foreign currency loans primarily if it believes that this is likely to be a cheaper source of finance than borrowing rupees at the ruling rates of interest. There are a few other circumstances in which companies may need to look at foreign currency loans. The first is the case of some very large projects, for example, in the infrastructure sector, where the scale of finances needed is so large that it just cannot be met in the rupee market. The second case is of a company desiring to hedge a long position in foreign currency in its revenue account, arising through transaction or economic exposures.

Annexure 4.1 British Banker's Association (BBA) Libor Fixation System

The following information is extracted from the BBA website

The British Bankers' Association (BBA) LIBOR is the primary benchmark used by banks, securities houses and investors to fix the cost of borrowing in the money, derivatives and capital markets around the world.

BBA LIBOR fixing evolved in the early 1980's with the growth of syndicated lending and early developments in the derivatives markets. Since then it has assumed an increasing importance as well over ***20%*** *of all international bank lending and more than* ***30%*** *of all FX transactions take place in London.*

BBA LIBOR is now used to calculate the interest rates applying to a wide range of contracts including OTC instruments such as swaps, loan agreements, FRNs, FRAs and Exchange Traded Short Term Interest Rate contracts traded on LIFFE, CME and DTB amongst others.

BBA LIBOR is fixed for the following currencies:
GBP, CAD, EUR, USD, AUD, JPY, CHF, DKK, SEK, NZD .

In each of the following maturities:
overnight (GBP, EUR, CAD, USD)
spot/next (AUD, CHF, JPY, DKK , SEK, NZD)
1w, 2w, 1m-12m (all BBA Libor currencies)

All currencies are fixed on a spot basis on each London Business Day apart from Sterling, which is fixed for same day value. EUR rates are fixed on each Target Business Day regardless of whether it is a London Business Day.

LIBOR is provided as a free service to the market by the BBA. There is no comprehensive list of all its users or uses, but it is generally acknowledged as a truly international benchmark. BBA LIBOR is published simultaneously on more than 300,000 screens throughout the world, being distributed by, amongst others, the following major information vendors:

- Moneyline Telerate (official fixing agent)
- Thomson Financial
- Reuters
- Bloomberg
- Nomura Research
- S + P Comstock
- Quick

Moneyline Telerate manages the fixing process on behalf of the BBA, collecting data from Contributor Panel Banks, applying quality control tests to it and calculating the Fixing, releasing it just before noon, London time.

The BBA's FX and Money Market Advisory Panel bases its decision about which banks to invite to become Contributors to the BBA LIBOR Panels upon confidenti ally supplied activity data. Candidate banks give their quarterly activity in the currency concerned in both the interbank cash and forward FX swap markets with a maturity of up to one year dealt through their London offices.[A short dated FX swap is analogous to an interbank placement or deposit].

Unlike Euro BBA Libor, EURIBOR, the complementary fixing which has been established by the European Banking Federation and ACI to benchmark in-zone rates, applies a concept of country quota. Each in-country has at least one bank represented on the Panel and smaller countries will rotate membership of the Panel amongst their leading commercial banks every 6 months.

EURIBOR has a panel of 47 reference banks from in zone countries, 4 pre-in banks (HSBC and Barclays are the United Kingdom representatives) as well as up to 6 international banks. Bank of Tokyo-Mitsubishi, Chase, Citibank, JP Morgan Bank of America and UBS have been selected to represent international banks.

The averaging method of LIBOR (wherein the top and bottom quartiles are discarded and the middle 50% averaged to produce the LIBOR fixing) is similar to EURIBOR's although only the top and bottom 15% are rejected in the FBE/ACI process. This differential topping and tailing will result in there being a greater ratio of smaller banks to larger banks in EURIBOR. The degree to which EURIBOR and euro BBA LIBOR are used in the wholesale markets could be determined by differences in perception about the credit quality of the 16 large banks comprising the BBA Panel and the 57 banks on the EURIBOR Panel, some of which are comparatively small.

The Euro BBA benchmark is vested with the same degree of authority and worldwide acceptance as the existing BBA LIBOR fixing series. Banks in London can be sure that the euro BBA LIBOR rate is as representative of activity in Europe's major financial centre and many are likely to prefer it to EURIBOR in their wholesale cash and derivative contracts.

The BBA Libor Fixing—Definition

(i) BBA LIBOR is the BBA fixing of the London Inter-Bank Offered Rate. It is based on offered inter-bank deposit rates contributed in accordance with the Instructions to BBA LIBOR Contributor Banks.

(ii) The BBA will fix BBA LIBOR and its decision shall be final. The BBA consults on the BBA LIBOR rate fixing process with the BBA LIBOR Steering Group. The BBA LIBOR Steering Group comprises leading market practitioners active in the inter-bank money markets in London.

(iii) BBA LIBOR is fixed on behalf of the BBA by the Designated Distributor and the rates made available simultaneously via a number of different information providers.

(iv) Contributor Panels shall comprise at least 8 Contributor Banks. Contributor Panels will broadly reflect the balance of activity in the inter-bank deposit market. Individual Contributor Banks are selected by the BBA's FX & Money Markets Advisory Panel after private nomination and discussions with the Steering Group, on the basis of reputation, scale of activity in the London market and perceived expertise in the currency concerned, and giving due consideration to credit standing.

(v) The BBA, in consultation with the BBA LIBOR Steering Group, will review the composition of the Contributor Panels at least annually.

(vi) Contributed rates will be ranked in order and only the middle two quartiles averaged arithmetically. Such average rate will be the BBA LIBOR Fixing for that particular currency, maturity and fixing date. Individual Contributor Panel Bank rates will be released shortly after publication of the average rate.

(vii) The BBA, in consultation with the BBA LIBOR Steering Group, will review the BBA LIBOR Fixing process from time to time and may alter the calculation methodology after due consideration and proper notification of the planned changes.

(viii) In the event that it is not possible to conduct the BBA LIBOR Fixing in the usual way, the BBA, in consultation with Contributor Banks, the BBA LIBOR Steering Group and other market practitioners, will use its best efforts to set a substitute rate. This will be the BBA LIBOR Fixing for the currency, maturity and fixing date in question. Such substitute fixing will be communicated to the market in a timely fashion.

(ix) If an individual Contributor Bank ceases to comply with the spirit of this Definition or the Instructions to BBA LIBOR Contributor Banks, the BBA, in consultation with the BBA LIBOR Steering Group, may issue a warning requiring the Contributor Bank to remedy the situation or, at its sole discretion, exclude the Bank from the Contributor Panel.

(x) If an individual Contributor Bank ceases to qualify for Panel membership the BBA, in consultation with the BBA LIBOR Steering Group, will select a replacement as soon as possible and communicate the substitution to the market in a timely fashion.

Instructions to BBA Libor Contributor Banks

A. An individual BBA LIBOR Contributor Panel Bank will contribute the rate at which it could borrow funds, were it to do so by asking for and then accepting inter-bank offers in reasonable market size just prior to 1100.
B. Rates shall be contributed for currencies, maturities and fixing dates and according to agreed quotation conventions.
C. Contributor Banks shall input their rate without reference to rates contributed by other Contributor Banks.
D. Rates shall be for deposits:
   - made in the London market in reasonable market size;
   - that are simple and unsecured;
   - governed by the laws of England and Wales;
   - where the parties are subject to the jurisdiction of the courts of England and Wales.
E. Maturity dates for the deposits shall be subject to the ISDA Modified Following Business Day convention, which states that if the maturity date of a deposit falls on a day that is not a Business Day the maturity date shall be the first following day that is a Business Day, unless that day falls in the next calendar month, in which case the maturity date will be the first preceding day that is a Business Day.
F. Rates shall be contributed in decimal to at least two decimal places but no more than five.
G. *Contributors Banks will input their rates to the Designated Distributor between 1100hrs and 1110hrs, London time.*

With the birth of the euro, the European authorities are trying to get the EURIBOR published daily by the European Banking Federation in Brussels, as the accepted benchmark for short term euro interest rates, in preference to the euro LIBOR calculated by BBA. EURIBOR is calculated on the basis of quotations from 57 banks in the 11 countries participating in the euro. 15% of the quotes at both ends (highest and lowest) are ignored and the EURIBOR is based on the remaining quotes. Apart from the number of reference banks, the difference between EURIBOR and euro LIBOR is that the former is a domestic market rate while the latter is based on quotations in the offshore market.

Chapter 5

Exchange Rate Movements and Managing Currency Risks

5.1 Introduction

In Chapter 2, we have discussed the functioning, size and practices in the global and domestic foreign exchange markets. In this chapter, we take an overview of exchange rate movements, in the global and domestic markets; their predictability or otherwise; and the need for and elements of a corporate exchange risk management policy. It is not the intention to discuss these issues at any great length here: the interested reader may like to refer to our separate book on the subject (*Currency Exposures and Derivatives: Risk, Hedging, Speculation and Accounting—A Corporate Treasurer's Handbook*).

5.2 Convertible Currency Movements

The topic of how/why prices in financial markets move has puzzled and intrigued academics and participants for a century and more. For the traders in particular, the prediction of future prices remains vitally important: on that depends their ability to make profits. If prediction with any degree of accuracy or consistency is not feasible, one would have to assume an equal probability of a price rise or fall and, following from this, that **today's price is the best forecaster of tomorrow's**: the random walk model.

There are two broad approaches to analysing and forecasting exchange rate changes: one is based on economic fundamentals, whereas the other is based on previous price movements. In general, forecasting exchange rates based on economic fundamentals like purchasing power parity, current account surplus or deficit, inflation, GDP growth, strength or weakness of asset markets, and monetary policy has not had a great deal of success. Markets perhaps move more on psychological reactions of the players, which are, more often than not, based on emotions like fear, greed and hope—rather than economic

fundamentals. Given the scale and volume of currency trades as described in Chapter 2, it is obvious that a huge proportion of transactions is speculative. And, speculators often have a herd instinct leading to large trend movements: too often, the reason for the dollar's rise today is that it has risen yesterday. If expectations lead to rate changes, the rate changes themselves alter and build up expectations.

Media reports and commentary often give an impression that there are stable and consistent relationships between fundamentals and market movements: too often these are rationalisations after the event, and one should be cautions in putting faith in one's own (or others') ability to predict. Academic research strongly suggests that markets are too 'efficient" to be predicted.

The charting theory, sometimes also referred to as technical analysis, takes an entirely different approach to forecasting exchange rate movements. The two major tenets of the charting theory are:

- All known economic fundamentals are already reflected, or discounted, in the current prices. Therefore, there is no point in looking at fundamentals;
- Prices move in repetitive, recognisable patterns. Therefore, all that is needed to project the future is a record of the past price movements (and, if possible, the transaction volumes which produced them).

Here again, research suggests that it is very difficult, if not impossible, even for the best chartists to forecast future prices even directionally, or to improve upon a simple random walk model, i.e., equal probability of the rate going up or down and, therefore, the present rate being the best forecaster of the future rate.

Thus, for projecting dollar: currency exchange rates

- Fundamentals are rarely any good;
- Forward rate is a poor predictor of the future spot rate, and is not even unbiased; and
- Even the best chartists find it difficult to improve upon a simple random walk model.

5.3 The Rupee Dollar Exchange Rate

The International Monetary Fund classifies the rupee's exchange rate as 'managed floating". In other words, while the exchange rate is broadly determined by the demand and supply of foreign exchange in the market, it is also "managed" by the central bank in pursuance of larger macroeconomic objectives like balance of payments, inflation outlook and control, etc. In the author's view, building up of reserves beyond a needed minimum level does not seem to be an objective; it is more the result of the central bank's intervention in the market to "manage" the exchange rate. On its part, the Reserve Bank has always claimed that it does not have any target for the INR: USD exchange rate but acts in the market to curb volatility.

Over the first nine years or so after the introduction of the unified, market-determined exchange rate in March 1993, generally speaking, the rupee was either steady against the dollar, or depreciated against the U.S. currency. In the process, the rate moved from Rs. 31.50 per dollar in March 1993 to Rs. 49.03 in May 2002. Since then, however, it has moved both ways, initially appreciating to Rs. 39.25 per dollar by November 2007, or by 25%. As of 31 December 2008, the rupee had again depreciated to Rs. 48.70 or by 19.5%, as compared to the November 2007. This represents a paradigm shift in the exchange rate scenario. Throughout this period, however, the rupee's real effective exchange rate, measured by the REER index (see paragraph 1.4.2), has been far steadier: in other words, there is empirical evidence to suggest that the exchange rate against the dollar is so managed as to keep its value in index terms reasonably steady, generally within +/- 5% of the neutral level. Even if this is the policy, on several occasions (for example, August 1997, first quarter of FY 2007–08) the rate has moved way beyond this band. Again, it seems that the central bank rarely intervenes aggressively enough to push the rate in the desired direction; more often, it tries to arrest a trend rather than reverse it.

Apart from the INR: USD exchange rate, the two major influences on the index are

- The dollar's movements in the global markets, against other currencies in the index; and
- Inflation rate in India and in our major trading partners.

In addition, one would need to estimate the fund flows on current and capital accounts, and the likely central bank policy, to project the movements in the rupee: dollar rate in the future. This is a difficult, if not impossible, task with all possible research input.

5.4 Managing Currency Exposures

Given the difficulties in predicting exchange rate movements, it is obviously important for corporates to manage currency exposures arising in the ordinary course of business—imports, exports, borrowings, etc. Exchange rate changes can affect the reported profits of a company and it is therefore necessary for a company to have a risk management policy in place; it is also required under Clause 49 of the Listing Agreement. Before looking at the elements of an exchange rate policy, it will be useful to look at the different types of currency exposures.

5.4.1 Types of Exposures

Financial economists distinguish three types of currency exposures: transaction exposures, translation exposures, and economic exposures. All three can affect the bottom-line of the business.

a. Transaction Exposures

Transaction exposures arise whenever a business has foreign currency denominated receipts or payments. The risk is an adverse movement of the exchange rate from the time the exposure is born until the time the exposure is extinguished by sale or purchase of the foreign currency against the domestic currency.

b. Translation Exposures

Translation exposures arise from the need to "translate" foreign currency assets or liabilities in the home currency for the purpose of finalising the accounts for any given period. The translation exposure becomes a transaction exposure at some stage: for instance, a dollar loan, ordinarily a translation xposure, has to be repaid by undertaking the transaction of purchasing dollars against rupees.

Both transaction and translation exposures affect the bottom line of a company. The effect could be positive as well if the movement is favourable

c. Economic Exposures

Both transaction and translation exposures are accounting concepts whereas an economic exposure is more a managerial than an accounting concept. A company could have an economic exposure to, say, the yen: rupee rate even if it does not have any transaction or translation exposure in the Japanese currency: this would be the case, for example, if its competitors are using Japanese imports. If the yen weakens, the company loses its competitiveness (and, of course, vice versa).

With progressively liberalised trade policy, Indian companies selling in the domestic market in competition with imports are facing economic exposures to exchange rates. In the case of companies producing commodity kind of goods—basic and petro-chemicals, steel, nonferrous metals, etc.—their domestic selling prices have necessarily to follow the landed cost of imports, the so-called import parity pricing and, therefore, are affected by the exchange rate. Since international commodity prices are all expressed in USD, such businesses have an economic exposure to the USD : INR exchange rate. In such cases, the domestic, rupee selling prices are influenced by two separate variables: the international price of the commodity and the exchange rate. And, the two need to be managed separately.

In general, economic exposure to an exchange rate is the risk that a change in the rate affects the company's competitive position in the market, and hence, indirectly, its bottom-line. Broadly speaking, economic exposures affect the profitability over a longer time span than transaction exposures.

5.4.2 Accounting Standards

Accounting Standard 30 recognises transaction (see below) and translation exposures (i.e. recognised assets and liabilities) as being hedgeable but not so economic exposures. (Indian exchange regulations also do not permit economic exposures to be hedged in the cash market but they can be hedged in the currency futures market.) Transaction exposures can be "unrecognised firm commitments" or "highly probably forecast transactions", and AS 30 prescribes differing accounting treatments therefor.

5.4.3 Risk Management

Risk management consists of

(i) Risk identification;
(ii) Risk measurements; and
(iii) risk control.

More specifically, a risk management policy should specify a pre-determined limits on

(a) the net open position (i.e. the difference between unhedged receivables and unhedged payables), as this is the amount subject to exchange rate risk at a given point in time; and
(b) the maximum loss on a portfolio basis, as this represents the risk appetite of the corporate.

If either limit is hit, the exposure must hedged. It should be recognized that hedging is "action taken to reduce risk or market exposure … a form of insurance…It is not speculation, but the avoidance of speculation." (*The Encyclopedia of Banking and Finance*, 10th edition). Hedging is not aimed at either saving costs or earning profits; it is a transaction undertaken to reduce price or exchange fluctuation risks. The actions taken to reduce risks, by hedging, may entail costs. There will be opportunity costs, if the hedge is in the forward market, and the price moves in your favour; or upfront costs, if the hedge is through purchase of an option. While forward contracts have already been described in Chapter 2, option contracts and other variations of derivatives are covered in Section 2 of the book.

5.4.4 General

This chapter, as stated in the first paragraph is only an overview of the issues involved, which are discussed at length in our other book, *Currency Exposures and Derivatives: Risk, Hedging, Speculation and Accounting—A Corporate Treasurer's Handbook*.

Section 2

Derivatives

Derivatives have become an integral part of the global financial markets. The term is defined as follows:

"A derivative is a financial instrument:

(a) whose value changes in response to the change in a specified interest rate, security price, commodity price, foreign exchange rate, index of prices or rates, a credit rating or credit index, or similar variable (sometimes called the 'underlying');

(b) that requires no initial net investment or little initial net investment relative to other types of contracts that have a similar response to changes in market conditions; and

(c) that is settled at a future date."

(This definition is taken from Accounting Standard (AS) 30 and quoted in RBI's Comprehensive Guidelines on Derivatives, April 2007.)

While there are any number of structured derivative products in the financial market, there are only two basic derivatives—forwards and options. Every product is an example, an application, a variation or a combination of the two basic building blocks. The difference between the forward and option families is that the former creates a right and an obligation to exchange the contracted cash flow for both parties to the derivative contract (counterparties); on the other hand, option contracts confer on the buyer of the option contract the right to exchange cash flows, but does not cast an obligation to do so. On the other hand, the seller of the option is obliged to exchange the cash flow if so desired by the buyer.

The traditional forward exchange contract, under which the contracting parties agree to exchange two currencies at a specified future date, at the rate specified in the contract, is a derivative: we have already seen, in Chapter 3,

how its "value" changes with the spot rate and forward margin. The generic derivatives, which can be used in structured products in India, and their definitions, as per the RBI's Comprehensive Guidelines, are as follows:

"Product Definitions

Forward Rate Agreement (FRA)

A Forward Rate Agreement is a financial contract between two parties to exchange interest payments for a 'notional principal' amount on settlement date, for a specified period from start date to maturity date. Accordingly, on the settlement date, cash payments based on contract (fixed) and the settlement rate, are made by the parties to one another. The settlement rate is the agreed benchmark/reference rate prevailing on the settlement date.

Interest Rate Swap (IRS)

An Interest Rate Swap is a financial contract between two parties exchanging or swapping a stream of interest payments for a 'notional principal' amount on multiple occasions during a specified period. Such contracts generally involve exchange of a 'fixed to floating' or 'floating to floating' rates of interest. Accordingly, on each payment date—that occurs during the swap period—cash payments based on fixed/floating and floating rates, are made by the parties to one another.

Interest Rate Future (IRF)

Interest Rate Future is a standardized, exchange-traded contract with an actual or notional interest-bearing instrument(s) as the underlying asset.

Foreign Exchange Forward

A foreign exchange forward is an over-the-counter contract under which a purchaser agrees to buy from the seller, and the seller agrees to sell to the purchaser, a specified amount of a specified currency on a specified date in the future—beyond the spot settlement date—at a known price denominated in another currency (known as the forward price) that is specified at the time the contract is entered into.

Currency Swap

A currency swap is an interest rate swap where the two legs to the swap are denominated in different currencies. Additionally the parties may agree to exchange the two currencies normally at the prevailing spot exchange rate with an agreement to reverse the exchange of currencies, at the same spot exchange rate, at a fixed date in the future, generally at the maturity of the swap.

Currency Options

A currency option is a contract where the purchaser of the option has the right but not the obligation to either purchase (call option) or sell (put option) and the seller (or writer) of the option agrees to sell (call option) or purchase (put option) an agreed amount of a specified currency at a price agreed in advance and denominated in another currency (known as the strike price) on a specified date (European option) or by an agreed date (American option) in the future.

Interest Rate Caps and Floors

An interest rate cap is an interest rate option in which payments are made when the reference rate exceeds the strike rate. Analogously, an interest rate floor is an interest rate option in which payments are made when the reference rate falls below the strike rate."

The scheme of this section is as follows:

Chapter 6 : Markets in Currency Derivatives
Chapter 7 : Futures and FRAs
Chapter 8 : Interest Rate and Currency Swaps: The Global Market
Chapter 9 : USD : INR Swaps
Chapter 10 : Option Contracts
Chapter 11 : Pricing and Hedging Options: Basic Principles
Chapter 12 : Credit and Commodity Derivative

In Chapter 6, we discuss derivatives trading and markets. The subsequent chapters are devoted to the product descriptions, cash flows and valuations of other standard, "plain vanilla" derivatives. Chapter 12 goes on to discuss in brief the salient points of credit and commodity derivatives.

Chapter 6

Markets in Currency Derivatives

6.1 Exchange Traded and OTC

Derivative contracts are traded both over-the-counter and on exchanges, in India as well as in the global markets. There are important differences between the two trading channels. In over-the-counter trades, contracts can be customised to suit the contracting parties. On the other hand, as we describe later in some detail, exchange traded contracts are standardized. Traditionally, over-the-counter trades were agreed on telephone while those on the exchanges were made on the floor of the exchange. In OTC trades over the telephone, there is less price transparency as different prices may be quoted to different counterparties at the same point of time; on the other hand, there is considerable price transparency on trading on exchanges. There are also differences in another important respect—namely counterparty credit risks.

In OTC markets, trading is bilateral, between two dealers/principals; the prices and other terms of any contract—amount, maturity, other terms, etc.—are customized; and are rarely disclosed. In traditional (telephone-based, for example) OTC trades, price discovery was/is less than transparent (OTC trading on electronic platforms is of course much more transparent). And, in the absence of market makers, when prices are volatile, bid offer spreads widen and markets become ill-liquid.

In contrast, on exchanges, trading is multilateral, one buy order may lead to 'n' sellers and vice versa. Trading is between members of the exchange, and non–members need to go through them and cannot (and need not) know who the final counterparty/ies is/are. Rules often require market makers to quote prices even in ill-liquid markets.

Contracts traded on exchanges are standardized. The two most important elements of the specification are the settlement price and the notional principal. For example, a futures contract on the 3-month LIBOR may specify the BBA LIBOR ruling two clear working days before the maturity of the futures contract as the settlement price which will determine the settlement

amount, i.e. cash flow to be exchanged. A currency contract may specify not only the time (and date) at which the settlement price will be determined – but also the source of the information (e.g., USD: JPY spot rate ruling at 3.30 p.m., Tokyo time, as reported on Reuter's page number…). The other important parameter for determining the settlement amount is the notional principal of the contract. This is the amount with reference to which the settlement cash flows will be calculated. Some of the other important specifications include:

(a) The asset (share, commodity, bond, etc.) to be delivered under the contract. In respect of certain assets, bonds for example, there is some flexibility. For example, the Chicago Board of Trade 5-year United States Treasury Notes futures contract permits delivery of "United States Treasury notes that have an original maturity of not more than 5 years and 3 months and a remaining maturity of not less than 4 years and 3 months as of the first day of the delivery month. The 5-year Treasury note issued after the last trading day of the contract month will not be eligible for delivery into that month's contract." The choice of bond to be delivered has given birth to the concept of cheapest-to-deliver (CTD) bond.

(b) The quantity of the asset to be delivered under one contract.

(c) Settlement arrangement/method, e.g., "Federal Reserve book-entry wire-transfer system".

(d) Delivery month (which also fixes the maturity date, for example, the third Wednesday), last trading and delivery days, etc.

(e) Daily price movement limits.

(f) Other parameters—strike rate in the case of options.

The definition of settlement prices/benchmarks is also very important in the OTC market. Benchmarks calculated from USD interest rates and the domestic foreign exchange markets (like MITOR, MIFOR, etc.) are being used in the Indian rupee derivatives market. The daily benchmarks are available on the FIMMDA website and calculated and distributed by Reuters.

The following table summarises the trading systems for the more important derivatives. (The various products are discussed in subsequent chapters.)

Item	Trading
Forex forward	OTC
Currency future	Exchanges
FRA	OTC
Interest future	Exchanges
Option	Both OTC and exchanges (But exchange trading restricted to short term options[1]).
Swap	OTC
Swap future	Exchanges

[1]Exchange traded currency options are mostly American style.

6.2 Trading Volumes

There has been an explosive growth in derivatives trading in both over-the-counter market and on exchanges. This is the experience in both the global and domestic markets, as the following data witness:

Table 6.1 Derivatives Trading Volumes

	Notional amounts outstanding (in $ billion)		
	Dec-06	**Dec-07**	**Jun-08**
OTC derivatives	**418,131**	**595,341**	**591,963**
Foreign exchange	40,271	56,238	49,753
Interest rate	291,581	393,138	418,678
Equity linked	7,488	8,469	6,494
Commodity linked	7,115	8,455	4,427
Credit default swaps	28,650	57,894	41,868
Unallocated	43,026	71,146	70,742
Exchange traded derivatives	69,406	79,078	57,864
Foreign exchange	240	291	225
Interest rate	62,593	71,051	52,711
Equity linked	6,574	7,735	4,929

(Source: BIS Quarterly Review, September 2009)

In the Indian market, historically currency and interest rate derivatives were traded only over-the-counter (OTC). Currency futures (USD : INR exchange rate) have started trading on the National Stock Exchange (NSE), Bombay Stock Exchange (BSE) and MCX Stock Exchange Limited (MCX–SX) since August 2008. An interest rate futures contract was also introduced a year later on the NSE.

The Indian OTC market in currency and interest rate derivatives has witnessed very rapid growth in trading volumes. The aggregate notional principal of all outstanding derivative contracts on the books of banks in India, including foreign currency derivatives, has gone up from Rs. 16,00,000 crores at the end of March 2005 to Rs. 85,00,000 crores as at the end of March 2008. This is more than two and half times of the aggregate deposits of the scheduled banks in India and includes derivatives used for balance sheet management (hedging), own account trading, and transactions with customers. (It should be noted that this is the notional principal of the outstanding contracts, and not the market value.)

In India, commodity and equity derivatives are traded on exchanges and such trading too has witnessed spectacular growth in recent years, as the following data evidence:

Table 6.2 India's Equity and Commodity Derivatives Trading Volumes

(Turnover Rs. Crore)

Year	NCDEX	MCX	NSE	BSE
2003–04	2,313	1,483	2,130,610	12,075
2004–05	166,213	266,375	2,546,982	16,113
2005–06	951,888	1,091,714	4,824,174	10
2006–07	2,293,724	1,167,278	7,356,242	59,005
2007–08	3,125,959	775,591	13,090,478	221,850
2008–09	4,588,094	533,829	11,010,482	12,288
2009–10 (till October)	3,376,752	464,220	9,848,546	10

(Source: BSE, NSE, NCDEX, MCX websites)

6.3 Contracting Trades

Derivatives trades in the OTC market are contracted in different ways as in the case of the foreign exchange market. As for exchanges, the traditional "open outcry" system of doing trades on the floor, or pit, of an exchange uses arcane hand signals by traders for settling trades, requires huge trading floors, with prices of trades displayed on boards on the floor, etc.

But in both OTC and exchange trading, electronic platforms have become very popular and have largely overtaken the traditional telephone-based (OTC market) or open outcry system on exchanges, because electronic trading is cheaper, faster and more transparent, thereby helping to lower transaction costs.

Electronic platform based trading is itself of two types:

(a) Order-matching. Every dealer enters (anonymously) his/her sale/purchase order specifying the quantity, price, etc. When sale/purchase orders match, a trade is transacted.

(b) Market-making. Market makers are continuously displaying their bid and offer prices for trades, and anyone wishing to do a deal is free to "hit" the market maker and contract his trade.

In the Indian market, currency and interest rate derivatives are traded over-the-counter (but exchange traded currency futures have been introduced in 2008) and contracted by telephone or voice brokers.

6.4 Derivatives Exchanges

6.4.1 Organisation and Functions

While both OTC and exchange trading is shifting to electronic platforms, the major difference is the counterparty risk inherent to all trading: what happens if one of the counterparties fails and is unable to honour the contract? In OTC trading, quite often (i.e. in the absence of any collateral), if there is a settlement amount due from the failed party to the contract, the counterparty may

suffer a loss. (On the other hand, if the settlement amount is due to the failed party, the non-defaulting counterparty will have to pay it to the receiver.)

Trading on exchanges eliminates counterparty credit risks through a system of collecting margins, described later.

The exchanges are also responsible for fixing trading rules like contract amounts and maturities, other terms and conditions, contract confirmation procedures, etc. Exchanges are sometimes, but not always, owned by its members, and their functioning is supervised by a regulatory authority—the Commodity Futures Trading Commission (CFTC) in the United States, SEBI in India and their counterparts in other countries.

Besides setting trading rules, the exchanges also

- Establish accounting standards and other practices to be followed by members;
- Review the activities of members with the help of their own audit and investigation divisions;
- Have disciplinary powers over members;
- Nominate a clearing house to settle all contracts. The clearing house is a subsidiary of the exchange or an independent body.

6.4.2 Counterparty Risks and the Margin System

Given the enormous volumes of trading on derivatives exchanges as given above, the question of counterparty risks and their management is of crucial importance. The system of margins is at the heart of eliminating the counterparty risks. Indeed, the system has worked so well that there have been hardly any cases of losses being suffered because of counterparty failures. The system was perhaps tested most severely at the time of collapse of Barings Bank, when it suffered huge losses on its positions on the Singapore Monetary Exchange (SIMEX), and went insolvent. No counterparty suffered and all trades were honoured.

In general, the margin system is operated through the clearing house, which settles the trades on the exchange, and operates in three tiers:

- Between a buyer/seller and his broker;
- Between the broker and a member of the clearing house (if the broker himself is not a member of the clearing house); and
- Between clearing house members and the clearing house.

As for the first tier, the margin requirements can be higher, but in any case not lower, than the margins imposed by the clearing house. Margin moneys generally carry interest.

Again, margins are generally of three types:

- The initial margin is prescribed by the exchange/clearing house for each contract traded. It can be as low as 0.5% of the amount of the contract or as high as 10% or more. The initial margin depends on

the volatility of the price of the contract in question; the higher the volatility, the higher will be the margin.

- The maintenance margin, typically, say, 75% of the initial margin, is the amount that must remain deposited, when the initial margin amount falls because of adverse movement in the price of the contract (see below). When the initial margin falls below the maintenance margin, additional margin moneys have to be deposited to restore the initial level.
- The variation margin is the result of the outstanding contracts getting "marked to market" at the settlement, or closing, price of the contract each day, and the difference debited/credited to the initial margin account. To give an example, if A has a long position in a contract and the price falls, the difference will be recovered from the initial margin. If this leads to the initial margin falling below the maintenance margin, A will have to deposit additional margin. If he fails to do so, the contract will be liquidated.

While this is the general way in which the margin system operates, there are variations in the rules and practices of different exchanges on issues such as:

- The way margins can be deposited, i.e., in cash or collateral;
- Whether margins are to be paid on gross positions (long plus short) or only on the net;
- Margins on intra-day transactions;
- When actual margin held exceeds the initial margin through a favourable movement in the price of the contract, whether the excess can be refunded, or must be retained.

Again, most exchanges have the right to call for "advance margins" intra-day in the event of unusual price volatility. Such advance margins are adjusted against the end-of-the-day variation margin. There are also limits on intra-day price movements of each contract traded. When the limit is reached, trading in the contract is suspended.

The objective of the elaborate margin system is to ensure that the clearing house vis-à-vis every member (and broker vis-à-vis his client) always has enough margin money to honour all outstanding contracts at the settlement, or end-of-the-day, price. This allows the clearing house to step in between the buyer and the seller as soon as a trade has been done. For both, the clearing house becomes the counterparty to the contract, thus eliminating the counterparty risk.

In general, exchange trading is far safer than OTC trading. In India, while the bulk of the trading in currency and interest rate derivatives is OTC, there is a move to introduce guaranteed settlements through the Clearing Corporation of India Ltd.

6.5 Structured Products

As far as derivatives are concerned, given the need for standardization of contracts, only generic, "plain vanilla" contracts are traded on exchanges. All structured, customized products are necessarily traded over-the-counter. We would discuss structured products in a later chapter.

Chapter 7

Futures and FRAs

7.1 Futures

Futures contracts, in terms of the rights and obligations of the counterparties, are exchange traded versions of forward contracts. Forward Rate Agreements (FRAs) are forward contracts on interest rates. In this chapter we discuss some important features of currency and interest rate futures contracts and FRAs.

7.1.1 Features of Futures Contracts

While commodity futures trading and markets have been in existence for a long time, particularly in the United States, the trading of financial futures contracts on exchanges is of a more recent origin. It is a product of the floating exchange rate era, which has witnessed extreme volatility in exchange and interest rates.

A futures contract has been defined as "the simultaneous right and obligation to buy/sell a standard quantity of a specific financial instrument (or commodity or currency) at a specific future date and at a price agreed between the parties at the time the contract was signed". What distinguishes a futures contract from a forward is the "standard quantity" of the underlying asset. Again, futures contracts have standard maturities, in accordance with the rules of the exchange on which it is traded. (In the forward market, the quantity (and the maturity) can be whatever the two contracting parties agree.) Such standardization is necessary for trading on the exchange.

The forward and future contract prices, where the underlying is a financial asset (currencies, shares, bonds or interest rates, etc), follow the same basic principle: they are derived from today's price, adjusted for the "cost of carry". (We have seen one application of this principle in the pricing of forward foreign exchange contracts). The cost (or indeed, yield) on carry can be defined as the interest cost of buying the asset at today's price adjusted for the income on the asset in question. Forward/futures prices of commodities do not conform to this principle – but this book does not cover commodity derivatives.

7.1.2 Forwards and Futures: A Comparison

The important differences between exchange traded futures contracts and over-the-counter forward contracts are summarised in the following table:

Feature	Forward Contract	Futures Contract
1. Amount	Flexible, practically any amount	Standard Amount
2. Maturity	Flexible	Standard
3. Trading	Over the counter (OTC), by telephone/fax/telex/ electronic dealing system, etc.	On the exchange, whether on the floor or on electronic trading platforms. Therefore, same price for everybody at a given point of time.
4. Honoring Contract	Often by taking and giving delivery	Mostly by cash settlement of the price difference, on maturity in the case of currency and interest rate futures; through a reverse transaction at any time before maturity
5. Counter-party risk	Present	Practically none because of (a) mandatory margin requirements, (b) daily adjustment of the margins depending on the price movements, and (c) the clearing company becoming a party to every contract.

The advantages of standardised amounts and maturity are tradability and liquidity. The disadvantage, of course, is that the futures market does not, in general, provide a perfect hedge since the amount and maturity of the exposure one is trying to hedge will rarely coincide with the standardised amounts and maturities of the contracts traded on the exchange. It will be appreciated that prices of the currency futures contracts will run in close tandem with the forward rates in the "cash" market. Discrepancies will lead to arbitrage opportunities, and arbitrage trading will correct them. Also, on the maturity date, the currency and interest rate futures contracts will be settled at the specified price in the cash market.

While futures contracts rarely provide perfect hedges because of standardised maturities and amounts, they also have some significant advantages over their counterparts in the over-the-counter market, namely, forward contracts. The most important are transparency of prices, ease in taking and unwinding of positions, and the absence of counterparty risks. Forward contracts are generally dealt over the telephone. The result is that at the same point of time, a bank may quote different prices for the same currency and maturity, for different counterparties. This is not the case in the futures exchange. At a given point of time, there will be only one price for a particular contract.

Liquidity in the futures exchange also facilitates the taking and unwinding of positions, that too at market rates. This is all the more important as most positions in the futures market are unwound well before maturity, by

doing a reverse transaction, and not by exchange of the underlying currencies, as in the case of many forward contracts.

The elimination of counterparty risk comes through the system of initial margin and its adjustment daily to reflect change in the price of the contract. Another difference between forwards and futures should be noted. The cash flow exchange under a forward contract arises only at one point of time (when it is cancelled or utilised). On the other hand, in the case of a futures contract, the cash flow exchange arises daily through the mark-to-market margin system. And, for a strict comparison of the two instruments, even if they are identical in terms of maturity and the contract rate, the interest on such cash flows needs to be taken into account. In this respect, futures contracts are comparable to forward contracts cancelled and rebooked daily but with zero transaction costs. Another way of looking at the same issue is that the cumulative receipt/payment of mark-to-market margin under a futures contract is also the *value* of the forward contract, (i.e., what you will receive/pay by canceling it), at the time of the last margin adjustment.

Box 7.1 USD: INR Futures Contract

The first USD: INR futures contract was introduced in the Dubai Financial Exchange in mid-2007. It has a face value of Rs. 2 mn and was cash settled in USD, the settlement price being the RBI reference rate for expiry of the contract.

The first USD: INR futures contract was introduced in India on 29 August 2008 and was traded on the National Stock Exchange. At the time of writing two other stock exchanges–the Bombay Stock Exchange and the MCX Stock Exchange–are also trading the contract. The specifications are as follows:

Category	Description
Underlying	Rate of exchange between 1 USD and INR
Contract Size	USD 1000
Contract Months	12 near calendar months
Expiration Date and Time	Last business day of the month
Min Price Fluctuation	0.25 paise or INR 0.0025
Settlement	Cash settled in INR at relevant RBI reference rate

The settlement is in cash, and in rupees. Any resident Indian can trade the contract with no requirement of an underlying exposure to foreign currency, subject to specified limits on the open position. At the time of writing the limits are as follows:

- *For clients, 6% of the open interest or $ 10 mn whichever is higher.*
- *Trading member, 15% of open interest or $ 50 mn, whichever is higher (the limit is $ 100 mn if the trading member is a bank).*
- *Clearing member, no separate position limit prescribed.*

In late 2009, the daily trading volume was of the order of $ 1500 mn.

7.1.3 Currency Futures as a Hedging Tool

A United Kingdom importer having an unmatured dollar payable could either buy dollars in the forward market, or sell sterling futures contracts

approximately equal in amount to the dollar exposure, and maturing as near as possible to the due date of payment. His profit or loss in the cash market will be compensated by the loss or profit in reversing the futures transaction. In effect, he will get the exchange rate that he had contracted while selling the sterling futures contracts.

An Indian importer has to pay USD 6,500 to his creditor on April 20 for imports made in January. In February, he is worried that the dollar may appreciate against the Indian Rupee and desires to cover the exchange risk in the futures market. The amount of the NSE USD: INR contract is $ 1,000 and the maturity is the last working day of the month. The current spot rate in the cash market is INR 47.00 per USD, the forward rate for delivery April 20 is INR 47.60, and the April delivery contract is being traded at say INR 47.80.

He, therefore, decides to buy six April contracts at INR 47.80. On April 20, the spot rate in the cash market is INR 48.00 and the April futures contract is now trading at say INR 48.10. The purchase of USD 6,500 in the cash market will now cost him INR 312,000 or a loss of INR 2,600 compared to the forward rate of INR 47.60 ruling when he decided to hedge the risk.

In the futures market, he can now sell back the six contracts bought at INR 47.80, at the current price of INR 48.10, or a profit of 0.30 Rupee per USD or INR 1,800. This profit substantially compensates him for the loss. The example also evidences that the hedge is not perfect—the profit and loss do not match exactly because the amounts and maturities of the hedge and the underlying do not coincide. For one thing, the entire USD 6,500 was not hedged. Secondly, the spot rate and futures contract price have not moved by the same amount, because of changing forward margin with passage of time or otherwise. This is referred to as the "basis risk" and its existence has led to the definition of hedge effectiveness standards.

7.1.4 Price Quotations

The following table illustrates the way the USD : INR currency contract was quoted on NSE on 30th October, 2009.

Table 7.1 INR : USD Exchange Traded Currency Contract

Maturity	Open	High	Low	Close	Settlement	Open interest	No. of contracts	Value (Rs. Lakhs)
Nov-09	46.98	47.22	46.92	47.07	47.07	339,597	1,714,161	806,935
Dec-09	47.02	47.33	47.02	47.15	47.15	78,239	56,433	26,620
Jan-10	47.78	48.16	47.13	47.30	47.30	13,994	9,042	4,284
Feb-10	47.24	47.49	47.22	47.40	47.40	8,244	1,794	849
Mar-10	47.35	47.52	47.34	47.46	47.53	2,685	1,273	604
Apr-10	47.61	47.61	47.53	47.54	47.54	1,170	305	145
May-10	47.71	47.71	47.60	47.61	47.61	1,243	105	50
Jun-10	47.81	47.81	47.81	47.81	47.87	2,071	5	2
Jul-10	47.91	47.91	47.91	47.91	47.98	330	5	2

(Contd.)

(Contd.)

Aug-10	49.50	49.50	47.23	47.23	48.09	90	2	1
Sep-10	0.00	0.00	0.00		48.22	149	–	–
Oct-10	0.00	0.00	0.00		48.33	–	–	–

Open interest denotes the number of contracts outstanding at the settlement time on that day.

7.2 Forward Rate Agreements (FRAs)

7.2.1 FRA Contracts

A forward rate agreement is a forward contract on interest rates traded over-the-counter. An FRA is an agreement between two parties, typically a bank on the one hand and a borrower or a depositor on the other, the former guaranteeing to the latter, the specified benchmark interest rate on an agreed future date. The party which gains from an FRA if interest rates fall is often referred to as the "lender" or "seller" of the FRA, and the counterparty, who benefits from the FRA if interest rates rise, is the "borrower" or "buyer". The amount on which interest (or the difference) is calculated is the notional principal of the FRA. The agreement specifies that the difference between the agreed rate and the actual rate that may be ruling on the specified date will be made good by one party to the other. For example, if the agreed six-month LIBOR rate under an FRA is 9% per annum on a given future date, and the actual rate happens to be 10% per annum, the bank will reimburse to the buyer of the FRA the difference of 1% p.a.; on the other hand, should the LIBOR happen to be 8%, the borrower/buyer will have to pay the difference to the bank. One point should however be noted. Interest is paid in arrears: therefore, the difference is payable not on maturity of the FRA, but at the end of the interest period beginning on that day. In practice, parties do not wait for the end of the interest period to exchange the difference: its present value changes hands on maturity of the FRA.

7.2.2 Pricing and Hedging

The pricing of an FRA is based on the "yield curve" in the interest rate market, and it can be hedged through a mismatch, or gap, in the asset/liability maturity structure. Let us assume that the bank is writing/selling an FRA on the three-month LIBOR to rule six months hence (6x9). It can hedge the FRA by borrowing nine months' money at the ruling rate and placing it for six months. This mismatch gives a hedge for the FRA as any payment or receipt arising from the FRA would be compensated by the interest rate on the rolled over deposit.

Consider the calculation of the 6-month forward 3-month LIBOR on the basis of the following spot market interest rates in the offshore dollar market:

6-month interest rate 5 5/8 / 5 11/16 % p.a.
9-month interest rate 5 13/16 / 5 7/8 % p.a.

The hedge for writing a 6-month forward rate agreement for the 3-month LIBOR will be

Borrow 9-month money at 5 7/8 % p.a.
Deposit it for 6-months at 5 5/8 % p.a.

(In turn, an existing maturity mismatch of this nature can be hedged by selling an FRA.)

This enables the calculation of the three-month LIBID rate six months forward, which is needed in order to break even. The steps are as follows:

A. Assuming that the notional principal is USD 1 mn, the first step is to calculate the amount you need to borrow. It should be such as to compound to USD 1 mn after six months at the deposit rate of 5 5/8 % p.a.
B. The amount to be borrowed is thus USD 972,644.38 and you need USD 1,015,501.52 in nine months to repay the borrowing at 5 7/8 % p.a.
C. The maturing deposit of USD 1 mn, therefore, needs to be invested at 6.200609% p.a. for three months in order to break even. This is the six-month forward three-month LIBID rate implicit in the interest rate structure.
D. Given a LIBID: LIBOR spread of 1/16%, you can write a forward LIBOR rate agreement at 6.263109% p.a.

Let us see what happens if the actual LIBOR after three months is 6 13/16% p.a. In that case, the writer of the agreement will pay the buyer the difference between 6 13/16% and the contracted LIBOR (6.2631%) on USD 1 mn for three months, which is USD 1,373.48, as follows:

Interest on USD 1 mn for three months @ 6.8125 is	USD 17,031.25
Interest on USD 1 mn for three months @ 6.2631 is	USD 15,657.77
Difference payable by the writer is	USD 1,373.48

Since this will be paid in arrears, that is, at the end of the period, the writer will need a total of USD 1,016,875 (USD 1,015,501.52 to repay the borrowing + USD 1,373.48) as proceeds of the rolled over deposit. This is exactly what he will get since the deposit rate would have gone up to 6.75% (LIBOR - 1/16%). In practice, the settlement of the difference is not done in arrears (i.e., at the end of six months in the cited example), but on maturity of the FRA, by paying the present value of the difference of USD 1,373.48, calculated at the ruling LIBOR. This works out to $ 1,350.48.

On the other hand, if the LIBOR is 4 1/16%, the buyer has to pay to the writer the present value of USD 5,501.52, in settlement. This, together with the USD 1 mn now deposited at 4%, aggregates to the required sum of USD 1,015,501.52.

Note that the above calculations have been done on the simplified assumption of each quarter being 90 days: in practice, the day count convention ruling in the market (actual/360 in this case) will have to be used for the calculations.

In practice, the break-even rate will be rounded up to the next decimal point (6.27% in the above case) and increased to provide a profit margin.

The following table summarises how FRAs are typically quoted.

Table 7.2 Forward Rate Agreements (FRAs) USDFRA

3*6	1.25
6*9	1.29
9*12	1.42

We have calculated, in the illustration, the sell price of the FRA. The buy price can also be calculated, using similar logic—except that the mismatch will now be borrow for 6 months and deposit for 9 months. The reader may like to do the calculation to grasp the mechanics fully. The answer is 5.8948% p.a. as the LIBOR.

7.3 Interest Futures

An interest futures contract is the exchange traded version of an FRA. One of the most popular futures contract is the 3-month Eurodollar contract. This is a contract on the 3-month LIBOR expected to rule on maturity of the contract. On the Chicago Mercantile Exchange, for example, such contracts have maturities extending up to 10 years!

Under the USD 1,000,000 three month offshore dollar deposit interest futures contract,

(a) The seller undertakes to find a bank, which will accept the buyer's USD 1 mn, 3-month offshore dollar deposit on the maturity date of the contract at the interest rate now agreed.

(b) The buyer undertakes to place the deposit at this rate (irrespective of the market rate ruling on the date of maturity of the contract).

The price of the contract is quoted as (100—the rate of interest agreed). Thus, a price of 95 means an interest rate of 5% p.a.

A couple of other technical issues should be noted. The contract pricing is based on 30/360 day count convention, not on the actual number of days in a given quarter. (In the application of interest based on LIBOR, the convention is actual/360). Therefore, a change of 0.01 in the price of the USD 1 mn 3-month interest futures contract leads to a change in the value of the contract of USD 25. This is the actual change in the interest amount for three months arising from a basis point change in the interest rate on a USD 1 mn deposit

calculated as (USD 1,000,000*0.0001*0.25). This amount will also be the change in the margin amount per 1 cent change in the price of the contract.

The following table gives the three-month offshore dollar interest futures contract prices on 28th January, 2009:

Table 7.3 Three-month Offshore Dollar Interest Futures Contract

Month	Open	High	Low	Last	Change	Prior settle	Volume
Feb-09	98.91	98.92	98.90	98.90	–0.02	98.92	1066
Mar-09	98.95	–	98.93	98.96	–0.02	98.98	12731
Apr-09	98.99	–	–	98.96	0.05	98.98	755
May-09	98.98	–	–	98.97	0.03	98.98	163
Jun-09	98.94	–	98.94	98.96	–0.02	98.98	11542
Jul-09	–	–	–	98.93	–	98.94	–
Sep-09	98.84	–	98.82	98.85	–0.02	98.87	10780
Dec-09	98.64	–	98.62	98.65	–0.03	98.68	8917

7.3.1 Interest Futures as a Hedging Tool

Consider the use of interest futures for hedging purposes. Let us assume that a borrower has a loan of USD 5.2 mn, six-monthly rollover, the next one due on, say, April 10. Note that the borrower has a six-month rollover, while the traded futures contract is for three-month deposits. To hedge interest for six months, he will, therefore, have to hedge double the amount. He, therefore, decides to sell ten, April (the nearest following maturity) delivery, USD 1 mn interest futures contracts at the current price of say 93.75. His worry is that interest rates may rise beyond the 6.25% p.a. rate hedged by him. Let us consider two possibilities:

(a) Actual LIBOR on April 10 is 7% p.a. Extra interest on USD 5.2 mn for six months as compared to the hedged rate of 6.25% is, therefore, USD (5,200,000*0.75)/(100*2) or USD 19,500 payable at the end of the six months. Meanwhile, with the rise in interest rates, the April contract price would have fallen to say 92.75. He can now buy back the ten contracts at 92.75, at a profit of USD (10,000,000*1.0)/(100*4) = USD 25,000, which more than compensates for the extra interest cost and is received up front.

(b) If the actual LIBOR was say 5.5% p.a. and the price of the April contract say 94.25, the lower interest cost on the rollover, as compared to the hedged rate, would be USD 19,500 and the loss on buying back the 10 contracts USD 12,500.

It will be seen that the hedge works but is not perfect – unlike in the illustrated cases, the gain/loss on canceling the hedge can be less/more than the loss/gain on the underlying. (Transaction costs, interest on margin and the differing day count conventions—90/360 and actual/360—have been ignored in the above calculations.)

Apart from borrowers or depositors wishing to hedge the interest fluctuation risk, treasury managers in banks use interest futures to hedge interest fluctuations on mismatched assets and liabilities. For example, if you are funding a three-month fixed rate loan through one-month money market borrowings, you would like to hedge against a rise in interest rates. Interest futures might provide an answer.

7.3.2 Documentation

As would have been noted from the above discussion, FRAs are used not only to hedge interest fluctuation risks on future loans/deposits, but also to hedge mismatches in the maturity of assets and liabilities in the books of banks. Therefore, a large proportion of FRAs are interbank.

The British Bankers' Association has introduced a standard document (FRA–BBA) specifying the terms on which FRAs may be traded between banks. Any variation from the FRA–BBA terms desired by one counterparty, has to be specifically brought to the notice of, and agreed to by, the other counterparty at the time a deal is struck. FRA–BBA terms are also used as the basis for non-bank counterparties.

7.4 FRAs and Interest Futures

While both the instruments can be, and often are, used to hedge the interest fluctuation risk, the two display different characteristics and are not synonymous with each other even if the underlying and the maturity date are the same. Arbitrage between the two instruments is possible, when the futures contract price is outside the FRA band i.e. pay/receive prices.

The important differences are as follows:

(a) In common with other OTC and exchange traded derivatives, there is a difference in the timing of exchange of cash flows. In the case of futures, margin receipt/payment is on a daily basis, whereas cash flow changes hand only once in respect of an FRA. The daily mark-to-market margin receipt/payment also leads to a price distortion referred to as the convexity effect: the seller of the interest futures contract benefiting more, or losing less, than the buyer, for a given change in interest rates. To understand this phenomenon, remember that the seller of an interest futures contract gains if interest rates rise (i.e., when the price of the contract falls)—and vice versa. Therefore, if interest rates are rising, he receives cash through the mark-to-market mechanism, which can now fetch higher returns precisely because of the rise in interest rates. In the contrary scenario of falling interest rates, the seller has to deposit additional margin but the cost of the margin is less because interest rates are low. In short, the short seller's gains are more and losses lower. The buyer is of course in exactly the opposite situation. The playing field is not quite level!

This phenomenon is referred to as "convexity adjustment" or "convexity effect" and parallels the convexity effect on bond prices.

(b) The other difference is that the actual amount to be exchanged in settlement also differs. The futures contract assumes a 90-day quarter, i.e., a value change of USD 25 per contract price change of 0.01. On the other hand, settlement of the FRA would be done on the basis of the actual number of days over which the LIBOR is applicable which, as a rule, would be different from 90. Therefore, even if the FRA and the futures contract have the same maturity and underlying, their settlement values are not necessarily identical.

(c) Futures contracts are settled on the date of maturity, while, under an FRA, the settlement amount is first calculated for the end of the period to which the LIBOR is applicable, and its present value is paid on maturity of the FRA.

In short, while similar to each other, an FRA and an interest futures contract are not identical in all respects.

7.5 Bond Forwards and Futures

7.5.1 Forward Prices of Bonds

The basic principle of arriving at the forward price of bonds is the same as for currencies. The forward price should reflect today's full price (i.e., quoted price plus accrued interest) and the "cost of carry", i.e., interest on the investment at the current rate for the maturity of the forward contract. Assuming that there are no coupon inflows during the currency of the forward contract, i.e., before it matures, and if,

Po = the full price (i.e., "dirty" price, or "clean" price plus accrued interest) of the bond on date zero, i.e., at inception of the forward contract;
r = ruling interest rate expressed as a fraction (p.a.);
f = maturity of the forward contract expressed in years; and
Pf = the (full) forward price; then
$Pf = Po * (1 + r * f)$

This equation will need to be modified if

- the contract is on the quoted (i.e. clean) price of the bond; or
- there is a coupon inflow in between.

The modification in the first case is relatively simple: while the equation for the full price remains valid, an adjustment will have to be made to arrive at the quoted price. If

t = period in years from the last coupon date to the maturity of the forward contract and
C = coupon rate (in fraction, p.a.)

Then the forward clean price is at $Po * (1 + r * f) - C * t$

If there is a coupon inflow ($C/2$) $t1$ years from the inception of the contract ($t1 < f$), then the basic forward price equation will need to be modified as follows:

$$Pf = (Po - (C/(2 * (1 + r * t1)))) * (1 + r * f)$$

(The deduction from Po is the present value of the coupon inflow at the inception of the forward contract.)

This will need a further adjustment if the forward contract is to be on the quoted, not full, price of the bond.

7.5.2 Treasury Bond Futures in the United States

Because of the complexities in the forward prices of bonds discussed in the previous paragraph, the treasury bond/note futures contracts traded in the United States have several special features:

- The CBoT contract, for example, is not on a specific bond, but any bond conforming to given specifications (e.g., for the 30-year treasury bond contract, any bond with maturity longer than 15 years on the first day of the delivery month can be delivered).
- The seller of the contract has the right to choose the bond to be delivered (and hence the cheapest-to-deliver, CTD, concept).
- Bonds with a face value of USD 100,000 have to be delivered against one contract.
- There is a "conversion factor" for each bond that can be delivered under the contract, calculated under a complicated formula.
- The conversion factors (and futures prices) are for the quoted, not full, prices of bonds.

7.6 Basis Risk and Hedge Ratios

As we have seen derivatives like futures (or even interest rate swaps used to hedge price risk on bonds) rarely provide a perfect hedge. This has given rise to the concept of the "basis risk".

Basis risk arises when the prices of the hedge and the underlying exposure do not change equally. This can arise because of maturity differences, or for other reasons like the exposure (say LIBOR) and the hedge (say, T-bill future) being in different markets/asset classes.

Basis risk can be mitigated by keeping the ratio of the amount of the hedge to the amount of the underlying exposure different from 1:1. Such a hedge ratio can be so calculated as to minimise the likely difference between the price change in the hedge and in the underlying, having regard to the historical correlation between the two variables (i.e., prices) and their respective volatilities.

7.7 Arbitrage Free Forward Prices

In Chapter 3, we have seen how the forward exchange rate, in markets where there are no exchange restrictions, is an arithmetical function of the spot exchange rate and the interest rate in the two currencies. We also saw that any other forward price would provide an exchange risk-free arbitrage opportunity: therefore, the forward price based on interest differentials is known as the "arbitrage-free" price.

The method for calculating of forward interest rates and bond prices we have discussed above, also give arbitrage free forward prices: any other forward price will provide an arbitrage opportunity. Consider that a dealer is quoting a price of 5.95 % p.a. for selling a 6 × 9 FRA on the LIBOR in the interest rate scenario outlined in paragraph 7.2.2 above. This will provide an interest rate-risk free arbitrage profit by putting through the following transactions:

(a) Borrow $ for 6 months
(b) Deposit $ for 9 months
(c) Buy FRA @ 5.95% p.a.

If actual 3-month LIBOR after 6 months is say 5% the seller of the FRA will need to be given 0.95% p.a. which is less than the interest saving on the borrowing being rolled over at 5% instead of the break-even rate of 6.27%. On the other hand, if the actual 3-month LIBOR after 6 months is 7% the borrowing will be rolled over at a higher than break-even rate, but the seller of the FRA will more than compensate for this loss.

Chapter 8

Interest Rate and Currency Swaps: The Global Market

8.1 Introduction

A swap has been defined as "a financial transaction in which two counterparties agree to exchange streams of payments, or cash flows, over time" on the basis agreed at the inception of the arrangement. From the definition itself, it is evident that a swap is like a series of forward contracts. Under a forward exchange contract too, the counterparties agree to exchange "x" units of one currency for "y" units of the other. Similarly, under a forward interest rate contract (FRA) described in the previous chapter, future LIBOR is exchanged for a rate specified now. Swaps involve a series of such exchanges at specified future dates. While the two main types are interest rate swaps and currency swaps, equity, credit and commodity swaps have also gained acceptance and witnessed huge growth in trading in recent years.

Under an interest rate swap, interest payment streams of differing character are periodically exchanged. There are two main types:

(a) Coupon swaps: fixed for floating rates; and
(b) Basis, or floating to floating, swaps: the exchange of one benchmark for another under floating rates (e.g. LIBOR for T-bill rate)

Under a currency and interest rate swap, the two counterparties agree to exchange interest and principal in one currency for interest and principal in another currency. These exchanges are generally done at the spot exchange rate ruling when the swap was entered into, and would involve:

(a) an initial exchange of principal in the two currencies; and
(b) exchange of interest and repayment obligations (in instalments or in the form of re-exchange of the principal amount, i.e. bullet repayment); or
(c) debt service obligations alone (i.e. b)

The interest rates for the two currencies would differ, and may be fixed or floating.

(Such currency swaps should not be confused with buy/sell or sell/buy short-term foreign exchange swaps, which involve buying a given amount of currency X for Y for one maturity, and selling an equal amount of currency X for (a slightly different amount of) currency Y for a different maturity, both contracts being entered into simultaneously. This is also referred to as a swap in the foreign exchange market.)

Two variations of the basic currency and interest rate swap should be noted: principal only swaps (POS) and coupon only swaps (COS), which we would discuss later (see paragraph 8.6 below).

8.2 Overview of the Swap Market

Historically, the origin of the swap market was the comparative advantage of different borrowers in different markets.

While a few currency swaps had been done in the London market since 1979, the first to attract attention and establish currency swaps as an integral part of the international financial market was the one between World Bank and IBM (see genesis below) undertaken in 1981. The transaction also illustrates the principle of comparative advantage. That year also saw the birth of interest rate swaps, again in London. Once initiated, the market in swaps grew rapidly and the International Swap Dealers Association was formed by major banks in 1985. ISDA's principal objective was to standardise practices, documentation, definitions, etc. ISDA has since changed its name to International Swaps and Derivatives Association, managing to keep its established acronym unchanged.

8.2.1 The World Bank: IBM Swap

It would be interesting to look at the genesis of the World Bank/IBM currency swap transaction. At that time (1981), the World Bank was looking for a Swiss franc issue as part of its overall funding operations. However, prior to that point of time, the World Bank had made several Swiss franc issues in the comparatively small Swiss market, and it was feared that another major issue may require the World Bank to pay a higher coupon rate than justified by its rating, in order to make the issue attractive to Swiss investors. At the same time, IBM, the giant computer company, was looking for a dollar issue. Incidentally, IBM had not accessed the Swiss franc market for quite some time. Given this, an IBM issue in the Swiss franc market was cheaper than a World Bank floatation, although the credit rating of both was identical. Thus, given the scarcity of its paper **in the Swiss market, IBM had a comparative advantage over the World Bank** in raising money there. It is worth noting that this advantage is independent of the absolute level of interest rates. It arose from the differing appetite of Swiss investors for World Bank (low) and IBM (comparatively

high) paper. What was done, therefore, was that IBM issued a Swiss franc bond and the World Bank floated a dollar issue. The liabilities were swapped and the comparative advantage of IBM in the Swiss market split between the two institutions so that, after the swap, both raised the kind of funding they needed **at a cheaper cost than otherwise**.

8.2.2 Using Comparative Advantage

As in the above case, a liability swap would involve a borrower raising money in the market in which he has a comparative advantage, and swapping, or exchanging, the principal and the servicing obligations with a counterparty, which has raised a loan in a different market in which he has a comparative advantage. Note that we are referring to comparative, not absolute, advantage. To elucidate, consider a United States company which can make a USD bond issue at an effective cost of say 6% p.a., when an identically rated European company can make an issue in the euro for the same maturity at, say, 4% p.a. In absolute terms, the latter's costs are clearly lower. But the comparative advantage would depend on the benchmark yields in the two currencies. If these are, say, 5.5% and 3.25%, respectively, the US company has a comparative advantage despite the absolute cost being higher, as it is paying a lower premium over the benchmark. (The benchmark for all fixed rate obligations is the yield on government bonds of parallel maturity.)

Appropriately structured, a swap based on comparative advantage results in reducing the borrowing costs of both parties, **compared to what they otherwise would have been.** Such swaps involve the exchange of the principal as well as the servicing obligations. In such cases, the economics and rationale of swaps arise through the counterparties exploiting their relative acceptability, or comparative advantage, in different markets. Swaps of servicing obligations under existing debts facilitate optimisation of the liability portfolio, and serve as an alternative to a series of forward contracts.

8.2.3 Interest Rate Swaps

The origin of interest rate swaps was also in the comparative advantage of different borrowers in different debt markets in the same currency: for example, in banking and bond (i.e. capital) markets or, to put it another way, the floating and fixed rate markets.

Historically, in the cross-border debt markets, medium/long term fixed rate lenders were individuals or institutions like insurance companies or pension funds who could either take the interest rate risk (individuals), or had access to long term fixed rate funds or liabilities. The pricing of bonds, therefore, depends on the acceptability of the borrowing company to investors in the fixed rate market, based on its credit rating and other factors. On the other hand, banks have access to short term funds and, as we saw in Chapter 4, are more comfortable in lending for medium term, at (say LIBOR-based) floating

rates. Bank also often have long standing relationships with the borrowers and their countries and price the loans based on their analysis. In general, therefore, a greater premium is demanded from a lower rated, or unfamiliar, borrower in the fixed rate (say bond) market than in the floating rate (say syndicated loan) market. A fairly typical example is given in the following table:

Table 8.1 Interest Rate Comparison

	AAA borrower from an industrial country	**First class company from, say, India**
Floating rate	1/8% over LIBOR	2% over LIBOR
Fixed rate	½ % p.a. over United States Treasury yields	3% over United States Treasury yields

It will be noticed that while the Indian company pays a higher rate of interest than the AAA company in both the cases, the premium is 1.875% p.a. in the floating rate market, but a much higher 2.5% p.a. in the fixed rate market. Traditionally, if the Indian company wanted a fixed rate loan, it had to pay a higher cost. However, it can borrow in the floating rate market, where it enjoys a comparative advantage (i.e., a lower premium over benchmark), and swap the interest liability with a suitable counterparty to get, in effect, fixed rate funding at less than 3% p.a. over United States Treasury yields. Let us see how:

In the rate structure cited above, let us refer to the Indian company as ABC. The sequence involved would be as follows:

(a) ABC requires seven-year fixed rate funding.

(b) ABC raises a seven-year floating rate debt at 2% over LIBOR (i.e., in the market where it has a comparative advantage or a lower disadvantage).

(c) ABC locates XYZ, a AAA rated company from an industrial country, which needs seven-year floating rate funds (same amount and parallel repayment), and has a comparative advantage over ABC in the fixed rate market.

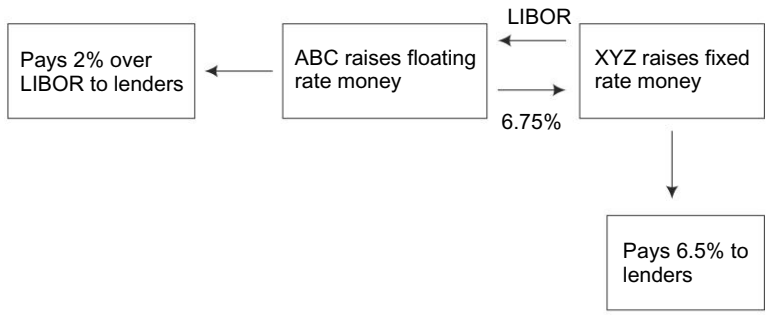
(d) XYZ raises seven-year fixed rate debt at 6.5% p.a. (United States Treasury yield being 6.0% p.a.).

(e) XYZ and ABC swap interest liabilities: XYZ agrees to pay interest at say LIBOR to ABC and ABC agrees to pay interest at say 6.75% to XYZ.

(f) XYZ has now got floating rate funds at an effective cost of LIBOR – 0.25% (it pays LIBOR to ABC but makes a profit of 0.25% on the fixed side), or 0.375% below what it would have otherwise paid for floating rate funds.

(g) ABC has now got fixed rate funds at an effective cost of 8.75% p.a. (it pays 6.75% to XYZ and makes a loss of 2% on the floating side), or 0.25% below what it would have otherwise paid for fixed rate funds.

Diagrammatically,



(Note that, in practice, only the difference between LIBOR and 6.75% would be exchanged between ABC and XYZ.)

Table 8.2 Cost Comparison

	ABC	XYZ
Cost without swap	9.0% fixed	LIBOR + 1/8%
Cost post-swap	8.75% fixed	LIBOR - 0.25%

It is evident that both counterparties have reduced their borrowing costs by a total of 0.625% which, incidentally, is the comparative advantage of ABC in the floating rate market—or XYZ in the fixed rate market.

The cited swap, LIBOR for 6.75%, can also be looked upon as being conceptually similar to a series of forward rate agreements on the future LIBOR, at an identical price of 6.75%. Effectively, ABC has now hedged the LIBOR fluctuation risk through the swap. The principal differences between a series of FRAs on the LIBOR and an interest rate swap (receive LIBOR, pay fixed) are:

- In general, FRAs are for relatively shorter maturities, swaps for longer.
- The forward rates under FRAs would, in general, be different for different maturities, while the swap rate is identical for all maturities. In efficient markets, the effective cost of both, i.e., a series of FRAs and an interest rate swap, **in present value terms**, is identical.

It need hardly be mentioned that the exchange of interest payments are on an agreed principal amount (which may be constant through the life of the swap, or may reduce with instalment payments), and on agreed dates. (The principal amount on which interest calculations are to be made is referred to as the "notional principal".)

8.2.4 Bank Intermediation

In practice, it is difficult for a corporate to locate a counterparty for a swap because of the requirements outlined in the previous paragraph. It also needs to be satisfied about the counterparty's financial strength (over the period of the swap) to meet its obligation. Therefore, major international banks step in and make two separate swaps (with ABC and XYZ). With an intermediary, the comparative advantage gets split three ways—XYZ, ABC and the intermediate bank.

Diagrammatically,

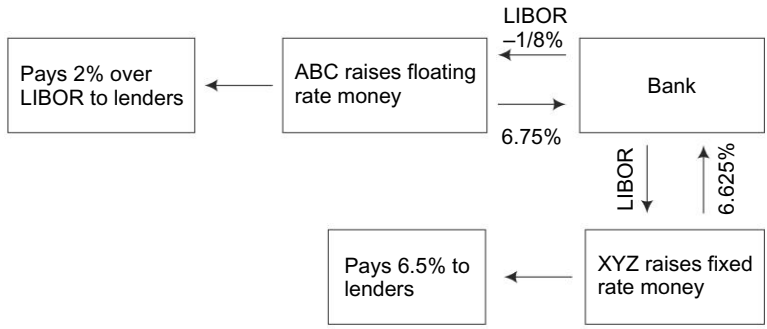


Table 8.3 Post-swap Costs

ABC post-swap cost	Bank swap spread	XYZ post-swap cost
8.875%	¼ %	LIBOR - 0.125%

The structure of basis swaps is similar. Instead of exchanging LIBOR for a fixed rate, the swap could be LIBOR for T-bill rate (or the CD rate).

8.3 The Swap Market

8.3.1 Development

While banks/financial institutions initially entered the swap market as brokers or intermediaries, once it was realized that swap cash flows exactly parallel cash flows under a portfolio of bonds—one issued, the other invested in—a very active swap market developed. To elaborate, a receive LIBOR, pay fixed swap has exactly the same cash flows as under

(a) Issue of a fixed rate bond; and

(b) Invest the proceeds in the LIBOR market, and roll the deposit over.

Note that on maturity of the swap the principal amount of the LIBOR-based deposit can be used to honour the bond issued.

(Similarly, cross-currency swap cash flows (see paragraph 8.4 below) are exactly parallel to cash flows arising from the issue of a bond in one currency,

and using the proceeds to buy a bond in another currency. Clearly, banks that want to run swap books need to have a good credit rating and the global standing to be able to access the floating and fixed rate debt markets in all the major currencies.)

The next step in the growth and deepening of the swap market was to quote prices on the basis of bonds, but to manage the cash flows not by issuing or investing in bonds, but structuring and managing them as part of the overall asset-liability book of a bank.

Today, banks use swaps for one or more of the following:

(i) Hedging asset liability mismatches in the banking book;
(ii) Offering to customers; and
(iii) Own account trading.

8.3.2 Market Size

The market has grown so rapidly that today the interest rate swap market is probably the single largest financial market. The aggregate notional principal of the outstanding interest rate swaps was as high as $ 458 trillion at the end of June 2008, as per BIS data.

8.3.3 Swap Quotations

The following is the table of swap quotations taken from the *Financial Times* dated 31st Dec. 2008.

Table 8.4 Interest Rates Swaps

31-Dec	USD		EUR		GBP		Yen		CHF	
	Bid	Ask	Bid	Ask	Bid	Ask	Bid	Ask	Bid	Ask
1 Year	1.27	1.30	2.66	2.71	1.98	2.01	0.77	0.83	0.76	0.82
2 Year	1.42	1.46	2.73	2.78	2.58	2.62	0.73	0.79	1.07	1.15
3 Year	1.71	1.76	2.94	2.99	3.83	2.87	0.78	0.84	1.42	1.50
4 Year	1.93	1.97	3.10	3.15	3.00	3.05	0.84	0.90	1.69	1.77
5 Year	2.09	2.13	3.21	3.26	3.12	3.17	0.90	0.96	1.92	2.00
6 Year	2.23	2.26	3.33	3.38	3.22	3.27	0.96	1.02	2.10	2.18
7 Year	2.31	2.34	3.44	3.49	3.29	3.34	1.02	1.08	2.25	2.33
8 Year	2.39	2.42	3.54	3.59	3.34	3.39	1.09	1.15	2.38	2.46
9 Year	2.46	2.49	3.63	3.68	3.39	3.44	1.16	1.22	2.48	2.56
10 Year	2.50	2.53	3.71	3.76	3.42	3.47	1.22	1.28	2.57	2.65
12 Year	2.62	2.65	3.82	3.87	3.52	3.59	1.31	1.39	2.70	2.80
15 Year	2.75	2.78	3.87	3.92	3.62	3.71	1.44	1.52	2.79	2.89
20 Year	2.76	2.79	3.83	3.88	3.52	3.65	1.63	1.71	2.75	2.85
25 Year	2.71	2.74	3.65	3.70	3.37	3.50	1.69	1.77	2.57	2.67
30 Year	2.69	2.72	3.52	3.57	3.26	3.39	1.69	1.77	2.44	2.54

Note: Bid and ask rates as of close of London business, US $ is quoted annual money actual/360 basis against 3 months Libor, £ and Yen quoted on a semi-annual actual/365 basis against 6 months Libor, Euro/Swiss Franc quoted on annual bond 30/360 basis against 6 month Euribor/Libor with the exception of the 1 year rate which is quoted against 3 month Euribor/Libor.

Note that only the fixed rates are quoted for each currency; the floating rate is LIBOR as specified in the footnote. Again, two rates are quoted—bid and offer. Consider the three-year swap rates for the United States dollar, which are 1.71 (bid) and 1.76 (ask). This means that the market rate for receiving fix is 1.76% p.a.; the payout would be three-months LIBOR. The reverse swap, i.e., pay fix, receive floating is quoted at 1.71%. It should be noted that the quoted rates are for market lots (USD 10 mn plus) and for top-class counterparties. For others, the spreads will be wider (pay less, receive more), reflecting the credit risk.

In normal market conditions, swap rates rule very close to yields on AA bonds of the respective currency.

8.3.4 Currency Swap Quotations

Table 8.4 also gives an approximate idea of the prevalent currency swap quotation. For example, a 0.78% p.a. three-year yen loan could be swapped for 1.76% dollars. If the actual yen rate on the loan is say 1% p.a., i.e., 0.22% above the swap rate, the dollar quote would be around 1.98 % p.a., i.e.,0.22 % p.a. premium to the swap quote. Similarly, the 1% yen could be swapped into floating rate dollars at around 0.22% over LIBOR.

8.3.5 Swap Trading

Most interest rate swaps are traded over-the-counter, often through inter-dealer brokers. Two derivatives exchanges, the London International Financial Futures Exchange (LIFFE) and the Chicago Board of Trade (CBoT) have introduced futures contracts on 2-, 5- and 10-year swap rates. But these have not proved very popular.

8.4 More on Currency Swaps

8.4.1 Cash Flow Exchanges

Currency swaps involve exchange of cash flows (principal and repayments, or repayments alone) in two currencies. The exchange rate generally used is **the spot rate ruling** between the two currencies, at the time of entering the swap contract. Such swaps, when limited to exchange of repayment obligations under an existing loan, allow a corporate borrower to change the liability currency to one that is more suited to its cash flows and risk: reward perception. Alternatively, it could raise funds in the market (currency, interest rate, etc.) in which it has a comparative advantage, and use currency and/or interest rate swaps to achieve the desired liability portfolio, at a lower cost than otherwise. In other words, currency swaps transform an asset or a liability from one currency into another – the interest payments also change.

Consider a shipping company, whose cash flows are in dollars, and which has a billion yen loan taken for purchase of a ship from a Japanese shipyard. A conservative management may prefer to have a dollar loan to eliminate the

yen: dollar exchange fluctuation risk. A currency swap would allow it to do so. Assuming that the loan is repayable in 10 equal half-yearly installments of JPY 100 mn each, and a spot rate of JPY 100 to a dollar, the swap would involve receiving JPY 100 mn and paying out USD 1 mn every six months for the next five years.

What about the interest on the loan? This would depend on the swap rates in the two currencies. Consider that the yen loan carries an interest rate of 6% p.a., while swap rates in the two currencies, for the maturity of the loan are say 4% in JPY and 6% in USD. (Note that the loan has instalment repayments while quoted prices of swaps assume principal exchange only the maturity of the swap. Therefore, the swap rates to be used are for the **same duration, or weighted average maturity,** as the loan: if necessary, the price may have to be worked out by interpolation.)

Since the existing JPY loan has an interest rate higher by 2% than the swap rate, the dollar swap would carry an interest rate at a similar premium over the dollar benchmark—or, say 8% plus. (The "plus" would cover the bank's margin and compensation for the counterparty risk it is taking.)

Using 8% as the interest rate on the dollar leg, the cash flow exchange every six months would be as follows:

8.4.2 *Swaps and Forward Contracts*

A currency swap is similar to a series of forward contracts. Consider the debt servicing cash outflows under the existing yen loan **every six months**:

Table 8.5 Debt Servicing of Yen Loan

Installment number	Principal repayment JPY (mn)	Interest on outstanding principal JPY (mn)	Total JPY (mn)
1	100	30	130
2	100	27	127
3	100	24	124
4	100	21	121
5	100	18	118
6	100	15	115
7	100	12	112
8	100	9	109
9	100	6	106
10	100	3	103

To eliminate the JPY: USD exchange risk and to convert the exposure into a dollar one, you could enter into 10 forward contracts, buying yen against dollars, the first for JPY 130 mn maturity six months, and the last for JPY 103 mn maturity five years. The forward rates would vary—and depend on interest differentials as we saw in an earlier chapter. Calculating the forward rates on the assumed 2% p.a. interest differential and a flat yield curve, the following table summarises the dollar outflows under the ten forward contracts.

Table 8.6 Cash Flows under Ten Forward Contracts (amounts in mn)

Installment number	Principal repayment (JPY)	Interest outstanding or principal (JPY)	Total (JPY)	Forward JPY/USD ex rate	Total (USD)	Principal (USD equivalent at forward rate)	Interest (USD equivalent at forward rate)
1	100	30	130	99.04	1.3126	1.0097	0.3029
2	100	27	127	98.09	1.2947	1.0195	0.2752
3	100	24	124	97.14	1.2765	1.0294	0.2471
4	100	21	121	96.21	1.2577	1.0394	0.2183
5	100	18	118	95.28	1.2385	1.0495	0.1890
6	100	15	115	94.37	1.2159	1.0570	0.1589
7	100	12	112	93.46	1.1984	1.0700	0.1284
8	100	9	109	92.56	1.1776	1.0804	0.0972
9	100	S6	106	91.67	1.1563	1.0909	0.0654
10	100	3	103	90.79	1.1345	1.1014	0.0331
	NPV @ 8% p.a. $ mn				10.00		
					Total:	10.5472	1.7155

If, instead of ten forward contracts, the yen: dollar exposures were to be eliminated through a currency swap, the dollar outflows would be as follows:

Table 8.7 Cash Flows under Currency Swap

	Principal repayment USD (mn)	Interest on outstanding principal at 8% p.a. USD (mn)	Total USD (mn)
1	1	0.40	1.40
2	1	0.36	1.36
3	1	0.32	1.32
4	1	0.26	1.28
5	1	0.24	1.24
6	1	0.20	1.20
7	1	0.16	1.16
8	1	0.12	1.12
9	1	0.08	1.08
10	1	0.04	1.04
Total	**10**	**2.20**	**12.20**
	NPV @ 8% p.a. $ mn		10.00

Since the two alternatives—series of forward contracts and the currency swap—achieve the same objective of eliminating the JPY: USD exposure, and the prices of both are based on the ruling exchange and interest rates, **in an efficient market**, the present values of dollar outflows under both the options would be identical as, indeed, they are in the above tables. (It should be noted, however, that the swap market is far more liquid than the long-term forward market, and is, therefore, likely to have lower transaction costs.) Hence, like an interest rate swap, a currency swap can also be looked upon as a series of forward contracts.

While the present values of the dollar cash outflows under the two mechanisms—currency swap and ten forward contracts—are identical, there are important differences between the structures of the cash flows, as follows:

	Currency swap	Forward contracts
1	Outflows higher in earlier years	Outflows higher in later years
2	Total interest cost higher at USD 2.20 mn	Total interest cost lower at USD 1.7155 mn
3	Total capital cost lower at USD 10 mn	Total capital cost higher at USD 10.55 mn

Clearly, these differences have implications for the company's cash flows on a year-to-year basis, as also on the reported profits. The choice of the mechanism to be used would, therefore, depend on a consideration of these factors.

8.5 Swap Valuation and Counterparty Risks

By definition, a swap done at the market price has a zero value at inception: simply stated, the value of a swap is the cost or gain of replicating its remaining cash flows at the ruling prices (hence the zero value at inception). With passage of time and changes in market prices, a swap (or any derivative for that matter) acquires a negative or positive value. It is the valuation of the swap which creates counterparty credit risk for the party for whom the value is positive: if the counterparty fails, the solvent, non-defaulting party would suffer a loss to the extent of the positive value of the swap.

Swap value is also the gain/loss on unwinding or cancellation of a swap.

8.5.1 Interest Rate Swap Valuation

Consider an existing USD Interest rate swap, with a remaining maturity of say three years, pay 5% p.a. receive LIBOR every 6 months.

To value it, we need to first calculate from Table 8.4 what fixed rate we can get for a pay LIBOR, receive fix swap for the balance maturity (1.71%). Entering into such a swap would mean that the floating rate legs cancel each other, and we are left with the two fixed rate legs (receive 1.71%, pay 5%). The

present value of the difference in the cash flows of the two fixed legs (+1.71; -5 % p.a.), calculated on the notional value of the swap, is the value of the swap: In this case, it is negative because swap rates have gone down since inception of the "pay fix" swap. This is also the amount that will have to be paid for cancellation or unwinding of the swap.

We have already seen that a swap can be considered as a portfolio of two bonds, one issued and the other invested in. The process and mathematics of valuation of swaps can also be looked upon as the process of valuing the two bonds at ruling rates for the balance maturity. The difference between the (positive) value of the bond invested in and the (negative) value of the bond issued is the value of the swap. In fact, standard treasury computer systems value all swaps using this logic.

8.5.2 *Valuing Currency Swaps*

In respect of currency swaps, one more variable comes into play, namely, changes in exchange rates. In general, the cash flows to be exchanged under a currency swap are determined at the spot rate ruling, when the swap is done: these are unaffected by any subsequent change in exchange rates. But, for the counterparties to a swap, the value of the swap (i.e. the amount at risk in the event of counterparty failure) keeps changing with the exchange rates between, and the ruling swap rates for, the two currencies. The amount at risk is thus the difference, **at the ruling spot rate**, between the present values of

- The amounts in one currency to be paid by the first counterparty to the second; and
- The amounts in the other currency to be paid by the second party to the first.

The following example will help clarify the calculations.

Consider a dollar: yen currency swap done some time back when the spot rate was JPY 125. The amount swapped was JPY125 mn payable three years from now, and the interest rates were 8% for the dollar and 6% for the yen, payable annually. The cash flows remaining to be exchanged are as follows:

Table 8.8 Balance Cash Flows under the Swap

End of year	Counterparty A to pay	Counterparty B to pay
1	USD 80,000	Y 7,500,000
2	USD 80,000	Y 7,500,000
3	USD 1,080,000	Y 132,500,000

Currently, the spot exchange rate is, say, JPY 110, and the three-year swap rates, say, 7% for the dollar and 8% for the yen (bid/ask differences ignored). Discounting the swap cash flows at the ruling swap rates, the net present values of the obligations of the two counterparties are:

Counterparty A to pay USD 1,026,243
Counterparty B to pay JPY 118,557,258

The latter amount, at the exchange rate of JPY 110, is USD 1,077,793. Thus, the amount at risk for counterparty A, should B default now, is USD 51,550 (USD 1,077,793 - USD 1,026,243). Incidentally, this is also the amount that B will have to pay to A for unwinding, or cancelling, the swap at today's interest and exchange rates.

8.5.3 Counterparty Risk: Pricing and Managing

Given the existence of counterparty risk, weaker counterparties may not be able to get swap quotes for longer maturities. Alternatively, the counterparty may be called upon to deposit a margin, or collateral, which will have to be adjusted periodically depending upon the movement in market rates. A third variation for weaker counterparties could be that the swap is long term, but is "marked to market", say, every year, with an option to either party to cancel, or "put", the swap at the end of each year.

Compensation for the credit risk will also be reflected in the pricing of the swap.

8.6 Variations

We have so far discussed the basic structure of interest rate and currency swaps. Several variations of the basic structure are marketed by active banks. Some of the more popular ones are described in the following paragraphs:

8.6.1 Principal Only Swaps (POS)

Cross-currency swaps can also be structured so that the exchange of cash flows relates only to the principal amount of the asset or liability. Principal only swaps are no different from the good old forward exchange contract, with one difference. In a forward exchange contract, the forward margin is embedded in the forward price itself. In a principal only swap, the currency exchange would take place at the spot rate on the date of the swap, with the forward margin being paid or recovered separately, on a percent per annum basis at say half yearly intervals.

8.6.2 Coupon Only Swaps (COS)

Coupon only swaps exchange only the interest payments in one currency for interest payments in another currency. The pricing principles are as follows:

(a) If the coupon to be exchanged is at floating rate, notionally convert it into a fixed rate at the ruling swap rate;
(b) Ascertain the forward prices of the fixed coupon flows at the ruling forward rate in the second currency;

(c) Convert the forward prices into a uniform rate by equating the present values;
(d) If necessary convert the coupon into floating rate using the swap rate in the currency in question.

8.6.3 Currency Swaps at Off-Market Rates

In general, currency swaps are done at the spot rate ruling at the inception of the transaction. However, currency swaps at off-market rates are also undertaken, and may suit companies in certain circumstances. Consider the example of the yen: dollar swap in Table 8.5. We assume that the spot rate at the time of the company's last balance sheet was JPY 90. Therefore, the liability would have been translated at JPY 90 for finalisation of the accounts. While today's spot rate is JPY 100 and, therefore, there is a translation gain, the company may like to forego it and do the swap at the translation (i.e., off-market) rate to reduce the revenue costs and thereby inflate the reported profits.

What interest rate would it have to pay on the dollar swap, if it is done at an off-market rate of JPY 90? Remembering that the present value of the dollar outflow has to remain unchanged, we can calculate the dollar interest rate.

The following table summarises the calculations:

Table 8.9 Swap at Off Market Rate

Break-even USD Interest Rate		3.77% p.a.		
Based on current spot		**Based on off market rate**		
	Total USD mn.	**Principal USD mn.**	**Interest USD mn.**	**Total USD mn.**
1	1.4000	1.1111	0.2094	1.3205
2	1.3600	1.1111	0.1885	1.2996
3	1.3200	1.1111	0.1676	1.2787
4	1.2800	1.1111	0.1466	1.2577
5	1.2400	1.1111	0.1257	1.2368
6	1.2000	1.1111	0.1047	1.2158
7	1.1600	1.1111	0.0838	1.1949
8	1.1200	1.1111	0.0628	1.1739
9	1.0800	1.1111	0.0419	1.1530
10	1.0400	1.1111	0.0209	1.1320
Total		11.1111	1.1529	12.2639
NPV @ 8% 10.0000				10.0013

Note that

A. Since the company is willing to take a worse-than-current spot exchange rate, the payments on account of principal will be higher.

B. Therefore, its interest cost comes down. The rate would be such that the NPV of the two cash flows (at the current spot and at the off-market exchange rate) will be equal. The counterparty may prefer this to reduce revenue cost by increasing capital cost in its books.

In the cited example, compared to the swap at the spot rate of JPY 100, the capital cost of servicing the debt has now gone up to USD 11.1111 mn and the revenue cost has come down to USD 1.1529 mn. This is the direct result of the change in the interest rate post-swap from 8% p.a. to 3.77 % p.a., and the off-market exchange rate used.

8.6.4 Forward Starting Swaps

The standard, plain vanilla swaps we have discussed so far come into operation from the time a deal is struck. (To be sure, most transactions are on "spot" basis and, therefore, the interest calculations etc. start two days later.) Forward starting swaps would come into operation at a specified future date which can be months or even years ahead of the trade date: the cash flow exchanges will begin from such specified future dates, and not from the trade date itself. Forward starting swaps are used for example in hedging the currency risk on a contracted loan which is still to be drawn.

8.6.5 Swaption

A swaption is an option on an interest rate (or currency) swap. It gives the buyer of the swaption the right (but not the obligation) to enter into a swap of specified parameters (maturity, notional principal, swap rate), on maturity of the swaption. Swaptions are traded over the counter, for both short- and long-maturity expiry dates, and for a wide range of swap maturities; for example, a three-month option on a ten-year swap, to a five-year option on a five-year swap.

The price of a swaption depends on the strike rate, maturity of the option, and expectations about the future volatility of swap rates.

8.6.6 LIBOR-in-Arrears Interest Rate Swaps

LIBOR in arrears (LIA) swaps are sometimes preferred when interest rates are expected to fall. In the standard swap, LIBOR is fixed at the beginning of the interest period, while the exchange takes place at the end of the period. Thus, LIBOR is fixed in advance. Under the arrears swap LIBOR ruling at the end of the interest period, is used for exchanging cash flows. This has repercussions for the pricing of the swap – indeed, the LIA swap is attractive when the yield curve is positive (i.e. the market expects interest rates to rise) but the buyer of the swap has a opposite view.

8.7 Cross Currency and FX Interest Rate Swaps in India

Banks in India act as intermediaries between the international markets and their corporate customers in India. Thus, they work on a fully hedged basis, charging a spread for their services over the quotations that they get from their correspondents abroad, who run swap books in major currencies.

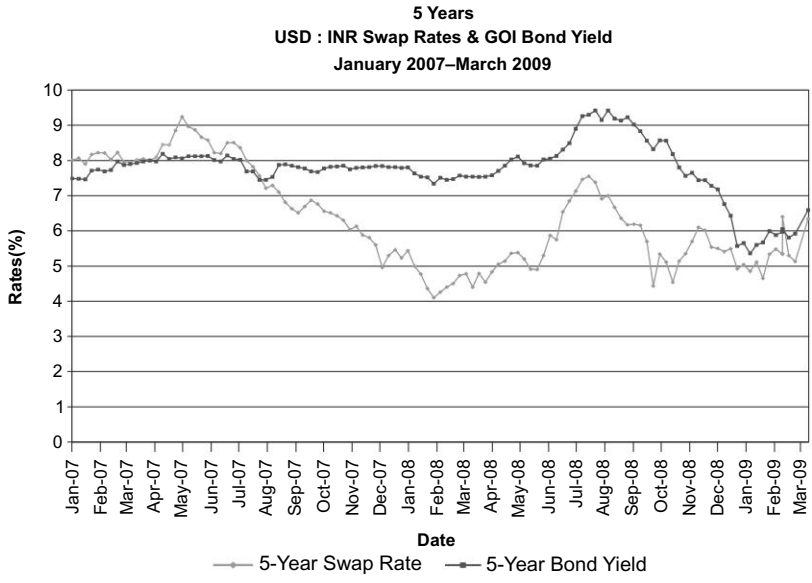
Chapter 9

USD : INR Swaps

9.1 Introduction

One basic difference between the swap market in major currencies and the USD : INR swap market in India, needs to be noted at the outset. While the product cash flows are similar—exchanging cash flows in one currency for cash flows in another currency on the basis agreed at inception—the pricing is different. In the major currencies, swap prices closely follow the yields on AA bonds, since a swap is a portfolio of two bonds—one issued, the other invested in. In the Indian market, the prices of the USD : INR currency swap rates are influenced more by demand and supply than the bond prices. See the following graph:

Graph 9.1 USD : INR Swaps Rate and GOI Bond Yield



As we have seen in Chapter 3, forward margins in the USD : INR forward exchange market also do not follow the interest differential model. The reasons are:

(a) the absence of a liquid term interbank market in India; and
(b) exchange regulations inhibiting, if not precluding, arbitrage between the forward margin and interest differential.

Since a currency swap is very similar to a series of forward contracts as we have already seen, the currency swap market in India also suffers from the same constraints.

The banking system has endeavored to overcome at least the first constraint through the introduction of an INR interest rate swap known as the Mumbai Interbank Forward Offered Rate (MIFOR) swap.

9.2 The MIFOR Swap

MIFOR is the sum, in percentage per annum terms, of the USD LIBOR and the forward margin on the US dollar in the Indian forex market, both for a given maturity (see below for a more technical definition). This acts as a proxy for the cost of raising term INR funds as, in theory, a bank could

(a) borrow USD internationally at LIBOR;
(b) sell the amount borrowed at the ruling spot rate; and
(c) buy USD (plus the interest on dollars borrowed) in the domestic forward market, for repaying the dollar loan, thereby eliminating the exchange risk.

This is a fully hedged transaction and the cost of rupees generated at (b) is USD LIBOR plus the forward premium on USD principal and interest.

The more formal definition, taken from the FIMMDA Handbook (www.fimmda.org) is as follows:

INR-MIFOR

"INR-MIFOR" means that the rate for a Reset Date will be the Mumbai Inter-Bank Forward Offered Rate for a period of the Designated Maturity which appears on Reuters Screen "MIFOR=" as of 16:30 p.m. India Standard Time on the day that is two Mumbai Business Days preceding that Reset Date or from the Benchmarks Menu from the Home Page of FIMMDA (www.fimmda.org).

If such rate does not appear on the Reuters Screen "MIFOR=" prior to 17:30 p.m. India Standard Time on such date, the rate for that Reset Date will be determined as if the parties had specified "INR-Reference Banks" as the applicable Floating Rate Option. In such case the Calculation Agent will ask each of the Reference Banks to provide a quotation of their offered side of INR/USD forward points for the forward sale of INR against USD for settlement on the last day of a period equivalent to the Designated Maturity

and commencing on the Reset Date and the forward points so determined by the Calculation Agent shall be the "Forward Points" for purposes of the following formula. The Calculation Agent will then determine the rate for that Reset Date by applying the following formula:

Floating Rate = {[(Spot Rate + Forward Points)/Spot Rate * (1 + LIBOR * *N*1)] – 1} * *N*2 * 100

where:

"Spot Rate" means the Reserve Bank of India's published USD/INR spot rate (expressed as a number of INR per one USD) which appears on Reuters Screen "RBIB" as of 13:00 p.m. India Standard Time on that Reset Date (if such rate is not available the Calculation Agent will ask each of the Reference Banks to provide a quotation of such rate);

"LIBOR" means USD-LIBOR-BBA for a period of the Designated Maturity commencing on the Reset Date;

"*N*1" means the number of days in the Calculation Period divided by 360;

"*N*2" means 365 divided by the number of days in the Calculation Period."

In practice, the theoretical basis of MIFOR as a proxy benchmark for term rupee funds, suffers from several technical weaknesses:

- the timings of fixing the three elements in the MIFOR viz., BBA LIBOR, spot rate and forward margin are not identical;
- MIFOR includes forward margin calculated on the principal amount only while, in theory, a fully hedged raising of rupee funds will require the USD interest also to be hedged;
- hardly any Indian bank can borrow term USD internationally, at LIBOR.

Nevertheless, the benchmark has been accepted by the market; in effect, the derivative market exists in the absence of an underlying.

The floating rate benchmark for the MIFOR swap is the 3 or 6 months MIFOR, as the case may be: 3 months LIBOR for swaps up to and including 1 year maturity and 6 months MIFOR for longer maturity swaps. Under the swap, the floating exchange rate is periodically exchanged with the fixed rate. The cash flow exchanges are in INR, and so is the notional principal of the swap.

9.2.1 Pricing MIFOR Swaps

Consider a pay 6-month MIFOR, receive fixed three-year swap. The basic, elemental hedge will be

(a) Borrow three-year maturity INR funds, equal to the notional principal of the swap;
(b) Sell the INR notional principal, and buy USD spot at the ruling rate;

(c) Deposit for 6 months at LIBOR;
(d) Sell USD six months forward, principal amount;
(e) Repeat (b), (c) and (d) every six months;
(f) At the end of three years, use rupees generated by USD sale to repay borrowing at (a).

The **fixed rate inflow under the swap can now be priced on the basis of the cost of (a).** The floating MIFOR payment is replicated by (c) and (d) together. This is not, however, a perfect hedge as there are two residual elements which this pricing methodology does not take into account. These are:

- interest on rupee funds inflow or outflow, as the case may be, when the deposit is rolled over as per (e) above. This arises from
- exchange rate difference on the interest amount. MIFOR is an INR interest rate swap and the floating rate amount thereunder gets determined at the start, while interest on the dollar funds will be realised at end of the period and will need to be converted into INR at the then ruling spot rate. This could therefore be different from the interest at LIBOR on the notional principal, included in MIFOR.

A question could be asked whether this problem can be overcome by selling forward the USD principal **and interest**. The answer is: "not fully or exactly", because then the difference in the rupee amount generated by the forward sale of USD and the notional principal of the swap, will not exactly equal the MIFOR amount. The reason is that **the swap margin included in MIFOR is on the principal amount only**. (Those interested in understanding the basis risk in the theoretical hedge may like to go through the INR cash flows and calculations in the annexure to this Chapter.)

A variation with better economics will be possible **if 6-month rupee investments yield more than MIFOR**. In that case, instead of (b), (c) and (d), one could undertake the rupee investment, and use the surplus over MIFOR to reduce the cost of borrowing as per (a). At the end of 6-months, MIFOR can once again be compared with six month rupee yields and the more economic option between rupee and dollar market investment, chosen.

For the reverse swap (receive MIFOR, pay fixed), the elemental hedge will be

(a) Borrow USD equal, at the spot rate, to the INR notional principal, for six months at LIBOR;
(b) Buy spot INR by selling the dollars borrowed—the rupee amount is the notional principal;
(c) Invest INR for three years at fixed rate;
(d) Buy six months forward, the USD principal amount borrowed;
(e) Repeat (a), (b) and (d) five times;
(f) At the end of three years, use the principal amount of (c) to pay for the dollar purchase needed to repay the principal amount borrowed.

The MIFOR inflow pays for cost of (a) and forward margin on (d). The fixed rate INR payment will be based on yield on (c). This model also leaves unhedged the same residual risks as in the receive fixed swap, described earlier.

If MIFOR is greater than cost of six month INR borrowing, then borrow INR instead of (a), (b) and (d), and invest proceeds as per (c). The difference between the MIFOR inflow and the borrowing cost will help quote a higher fixed rupee outflow under the swap.

The above analysis assumes that the bank will be able to borrow or deposit USD at LIBOR. In practice, no Indian bank is really in a position to borrow at LIBOR (it may have to pay a spread above LIBOR), and may receive only the LIBID on its deposit. In either case, the difference with LIBOR will have to be factored in the pricing of the fixed leg. In the case of MIFOR swaps also, no active bank would hedge individual swaps on the lines discussed above. It would manage the exposures as part of the totality of its forward book, and INR and USD assets and liabilities.

9.2.2 *Market Prices*

Market prices of MIFOR swaps have often differed from the theoretical model discussed above: in fact, these have, for extended periods, ruled below G-Sec yields because pricing is demand-supply driven—rather than based on models.

9.3 USD : INR Swaps

In the normal course, and in the absence of the limitations described in paragraph 9.1 above, USD: INR swaps would have been hedged and priced in the same way as they are in the international market—as a portfolio of two bonds, one issued (in one currency) and the other invested in (in another currency). In practice, they are priced and hedged differently, making use of the MIFOR swap.

Consider that a bank wants to price and hedge a three-year maturity USD: INR currency swap with the following exchange of cash flows:

(a) Pay USD LIBOR every six months, and USD principal at the end of three years; and

(b) Receive INR fixed rate every six months and INR principal at the end of three years, the amount being calculated at the spot exchange rate on the trade date.

For hedging the currency swap using the MIFOR swap, the steps would be

(c) Buy USD forward for six months;

(d) Enter into a MIFOR swap, receive six months floating, pay fixed for three years; and

(e) Rollover (c), five times, by undertaking sell buy exchange market swaps.

The premium on USD paid under (c) and the LIBOR to be paid to the swap counterparty will be received under (d). The fixed rate payment under (d) will be the base for quoting the INR fixed rate. There is a residual risk, namely, the USD : INR exchange risk on the USD interest amount, which will be received in INR but will have to be paid out in USD.

There is another residual risk. The notional principal of the MIFOR swap is fixed in rupees. Therefore, the MIFOR you pay out or receive will be calculated on the USD equivalent **at the spot rate ruling** on the date of determination of the MIFOR: in principle, this would differ from the USD notional of the cross-currency swap which is constant. Therefore, banks using MIFOR swaps to hedge cross-currency swaps will need to

(a) Monitor and place a prudential limit on the gap between the notional principals of the MIFOR swaps used as hedges, and the rupee equivalent of the USD notional of the hedged cross-currency swaps; and

(b) Periodically rebalance the notional principal of the MIFOR swaps used as hedge to keep the gap within the prudential limit.

There is always a basis risk in hedging USD : INR cross-currency swap with a MIFOR swap, and this should be reflected in the pricing.

9.4 Principal Only Swaps (POS)

Such currency swaps are becoming popular in recent years. In effect, these hedge (or create) exchange risk on the principal amount alone, leaving the interest payments in the original currency. In effect, POS swaps are identical to the traditional forward contract. But the swap route is used as the INR: USD forward exchange market does not quote prices beyond 1 year maturity.

The theoretical pricing and hedging will be as follows:

Consider a USD 100 5-year bullet repayment loan, the spot rate being INR 50 per USD. The borrower desires a principal only swap into INR at the spot rate.

The exchange of currencies is as follows:
Initial exchange of principal (which may not always take place)
Bank pays INR 5,000
Borrower/client pays USD 100.

On loan maturity
Bank pays USD 100
Borrower/client pays INR 5,000.

How would the bank hedge and price the transaction? Conceptually, the steps involved would be as follows:

(a) Bank invests a part of the USD 100 it receives in the initial exchange, in a 5-year zero coupon bank paper with a face value of USD 100. If the yield is 4% p.a., this requires USD 82.035. (i.e., 100/1.02^10).
(b) The balance amount of USD 17.965 is sold in the market at INR 50 to get INR 898.25.
(c) The remaining amount of INR needed for the initial exchange of principal, is generated by issuing a 5-year zero coupon INR bond yielding, say, 8% p.a., for a market price of Rs 4,101.75 (face value Rs 6,071.58 at the assumed yield, i.e.., 4101.75*(1.04 ^10)).
(d) Thus, on maturity, the bank's cash flows are:
    (i) Receive USD 100 from proceeds of zero coupon purchased per (a);
    (ii) Pay USD 100 to borrower/client under swap;
    (iii) Receive INR 5,000 from borrower/client;
    (iv) Pay INR 6071.58 being the face value of the INR zero coupon short sold;
    (v) (iii) and (iv) together means a shortfall of INR 1071.58, which can be recovered by pricing the swap at 3.92% p.a. payable half-yearly, on the notional principal of INR 5000.

This would be the methodology to be used for pricing and hedging principal only swaps. The alert reader would have noticed that this still leaves one risk uncovered—reinvestment yield on 3.92% p.a. received half-yearly; the mathematics of yield calculations assumes that the reinvestment is also at 3.92% p.a.

It can be seen that even if there is no initial exchange of principal, the pricing remains the same. The steps for hedging the transaction would be

(a) Issue an INR 5-year zero coupon as above with a face value of INR 6071.58 to generate INR 4,101.75
(b) With the rupee proceeds, buy USD 82.035 with which to buy a five-year zero coupon USD with a face value of USD 100
(c) Since you will receive only INR 5,000 under the swap on its maturity, and need INR 6071.58 being the face value of the bond issued, the balance amount can be generated by quoting a premium of 3.92% p.a., payable half-yearly, on the notional INR principal of INR 5,000.
(d) With the hedge in place, you pay out, on maturity of the swap, USD 100 being the proceeds of the zero coupon, and receive INR 5,000 which, together with the premium of 3.92% p.a., is used to pay out the face value of the INR bond short sold.

If, instead of a bullet payment, installment payments are involved, each instalment can be conceptually considered separately and hedged and priced like a bullet repayment loan.

In practice, banks use MIFOR swaps to price/hedge principal only cross-currency swaps also.

9.4.1 Using the MIFOR Swap Market

Consider that you wish to price and hedge a three-year maturity, receive USD, pay INR principal only swap or a long-term forward contract of similar maturity. This could also be done by using the MIFOR swap market. The steps will be:

(a) Sell USD six months forward
(b) Enter into a MIFOR swap: Pay 6 months floating, receive fixed
(c) Enter into a USD IRS: Receive 6 months LIBOR, pay three-year fix.
(d) Rollover (a), 5 times

It will be noted that the premium on USD received under (a) plus the LIBOR receipt under (c) together hedge the MIFOR payout under (b). The residual flows, both fixed, are

(i) Fixed rate INR receipt under (b); and
(ii) Fixed rate USD payment under (c)

The difference is the premium on the swap which will be charged/paid on % p.a. plus basis at half yearly intervals. This still leaves the residual risks described earlier.

9.4.2 Valuing MIFOR Swaps

The basic principle of valuation is to replicate the floating rate cash flows at the ruling swap prices; the present value of the difference in the fixed rate flows is the value of the swap. Please refer to Annexure 9.1 for specimen calculations.

9.5 Coupon Only Swaps (COS)

Coupon only swaps merely exchange interest payment(s) in one currency (INR) for interest payment(s) in another currency (USD): the principal amount remains outside the scope of the exchange or swap.

Most such transactions in India have involved the bank paying a fixed interest on the notional principal in INR, and receiving USD LIBOR + x% p.a. on the USD notional principal calculated at the spot rate ruling on the trade date of the swap. Such COS are attractive to corporates only when the interest they receive is more than the interest they pay out, at least initially: in other words the attraction is in the initial positive "carry". Consider the steps involved in pricing a pay 10% INR, receive a 6 months USD-LIBOR + x%, coupon only swap:

(a) Undertake a pay LIBOR, receive fix, USD interest rate swap.
(b) You need to sell the fixed USD receipts forward to generate INR (The forward rates will as we have worked out in the POS example above).
(c) To the extent the proceeds of forward sales fall short of the INR pay outs of 10% p.a. increase the margin over USD LIBOR to be received from the counterparty.

(d) 'x' will be determined by 'c' and the desired profit margin.

9.6 Leveraged Swaps

Exchange control in India permits the use of derivatives for management of the currency and/or interest rate risks on corporate debt. Two important limitations placed by the Reserve Bank of India on the use of derivatives are that the notional principal should not exceed the amount of the loan, nor should the maturity of the derivative extend beyond the maturity of the underlying.

In late 2002, the Reserve Bank banned the use of leveraged swaps. To understand the mechanics of leveraging, consider a company having a fixed rate loan and undertaking a swap into floating rates. In a normal, positive yield curve scenario, the initial cash flows under the swap are likely to represent inflows for the company undertaking the swap (pay floating, receive fixed). Under the extant exchange control regulations, the notional principal of the swap cannot exceed the principal amount of the loan.

If a company has a strong belief that future LIBORs would remain less than the forward interest rates implied by the swap curve, it may like to take a bigger bet than permitted by the outstanding amount of the loan. This could be done, while nominally not exceeding the limit on the notional principal, by leveraging, or multiplying, the interest to be exchanged on the same principal. For example, instead of receiving 4% fixed (say), and paying LIBOR on a notional principal of say USD 100 mn, the leveraged exchange could be receive 12% fixed and pay (3* LIBOR). Clearly, so long as LIBOR remains below the swap rate, the leveraged swap would lead to three times the cash inflow of the simple, plain vanilla interest rate swap: but so would be the outflow if the interest rate view goes wrong and LIBOR crosses the fixed rate. In effect, this is a market rate swap on a notional principal of USD 300 mn, rather than USD 100 mn!

Another variation of a leveraged swap would be where the notional principal for payment of interest is different from the notional principal on the interest to be received. Clearly, such swaps are speculation on interest rate movements rather than hedging transactions.

As stated above, the Reserve Bank has barred authorised dealers from undertaking leveraged swap transactions with clients.

Annexure 9.1 MIFOR Swaps

A9.1.1 Elemental Hedge for a 2-year MIFOR Swap: Basis Risk

Receive fixed, Pay MIFOR; Maturity 2 years

Notional	INR 100,000.00
Spot rate	INR 45.00 per $
On deal date	
Forward premium	5.00% p.a.
6-month LIBOR	2.00% p.a.
MIFOR is	7.00% p.a.

The elemental hedge is borrow fixed rate INR (borrowing cost to come from the receive fix leg), buy and deposit USD for 6 months and sell USD forward (interest and forward margin together will hedge the pay MIFOR leg). The transaction will be rolled over three times—at the end of 6, 12 and 18 months respectively.

Initial Hedge

Borrow	INR 100,000.00	for 2 years by issuing bond at say 7.50% p.a.
buy	USD 2,222.22	by paying INR 100,000.00
Invest	USD 2,222.22	for 6 months at LIBOR
and sell	USD 2,222.22	forward for 6-months at 5% p.a. i.e. for INR 46,125

After 6 Months

Spot rate		INR 45.50 per $
Forward premium		4.00% p.a.
6-month LIBOR		2.80% p.a.
MIFOR is		6.80% p.a.
cash flows in INR		
Receive under forward contract		102,500.00
Pay under MIFOR		– 3,500.00
$ interest converted at spot rate		+ 1,011.11
Buy USD equal to notional		– 100,000.00 ($ 2197.8022)
Net		INR 11.11
deposit	USD 2,197.80220	at LIBOR
Sell	USD 2,197.80220	forward

After 12 Months

Spot rate		INR 44.50 per $
Forward premium		4.50% p.a.
6-month LIBOR		3.50% p.a.
Forward Rate		45.501
cash flows in INR		
Receive under forward contract		102,000.00
Pay under MIFOR		– 3,400.00
$ interest converted at spot rate		+ 1,369.23
Buy USD 2,247.19 equal to notional		– 100,000.00
surplus/deficit brought forward		INR 11.11
Net		– INR 19.66
New $ notional =		USD 2,247.19
deposit	USD 2,247.19	at LIBOR
Sell	USD 2,247.19	forward

After 18 Months

Spot rate		INR 46.50 per $
Forward premium		4.20% p.a.
6-month LIBOR		3.75% p.a.
MIFOR is		7.95% p.a.
Forward Rate		47.477
cash flows in INR:		
Receive under forward contract		102,250.00
Pay under MIFOR		– 4,000.00
$ interest converted at spot rate		1,828.65
Buy USD equal to notional		– 100,000.00
Rupee surplus/deficit		– 19.66
Net		INR 58.99
New $ notional =		USD 2,150.54
deposit	USD 2,150.54	at LIBOR
Sell	USD 2,150.54	forward

After 24 Months

Spot rate	INR 45.75 per $
cash flows in INR:	
Receive under forward contract	102,100.00
Pay under MIFOR	– 3,975.00
$ interest converted at spot rate	1,844.76
repay INR borrowing	– 100,000.00

Rupee surplus/deficit brought forward	58.99
Net	– 49.33

1. Note that there is fluctuating surplus or deficit on each rollover
2. In short, there is no perfect hedge for a MIFOR swap.
3. Selling principal and interest forward also does not provide a perfect hedge as the following calculations show.
4. Interest on rupee surplus/deficit has been ignored.

A9.1.2 Elemental Hedge for a 2-year MIFOR Swap, by Selling Forward Principal + Interest: Basis Risk

Receive fixed, Pay MIFOR

On deal date

Notional	INR 100,000.00
Spot rate	INR 45.00 per $
Forward premium	5.00% p.a.
6-month LIBOR	2.00% p.a.
MIFOR is	7.00% p.a.

Initial Hedge

Borrow Rs	INR 100,000.00	for 2 year by issuing bond at say 7.50% p.a.
buy	USD 2,222.22	by paying INR 100,000.00
Invest	USD 2,222.22	for 6 months at LIBOR
and sell	USD 2,244.44	forward for 6-months (i.e. principal + interest) at INR 46.125

After 6 Months

Spot rate		INR 45.50 per $
Forward premium		4.00% p.a.
6-month LIBOR		2.80% p.a.
MIFOR is		6.80% p.a.
Forward Rate		46.410
cash flows in INR:		
Receive under forward contract		103,525.00
Pay under MIFOR		– 3,500.000
Buy USD equal to notional		– 100,000.00
Net		INR 25.000
New $ notional =		USD 2,197.80220
deposit	USD 2,197.80220	at LIBOR
Sell	USD 2,228.57143	forward

After 12 Months

Spot rate		INR 44.50 per $
Forward premium		4.50% p.a.
6-month LIBOR		3.50% p.a.
MIFOR is		8.00% p.a.
Forward Rate		45.501
cash flows in INR:		
Receive under forward contract		103,428.000
Pay under MIFOR		– 3,400.000
Buy USD equal to notional		– 100,000.00
Rupee surplus/deficit		25.000
Net		INR 53.000
New $ notional =		USD 2,247.19101
deposit	USD 2,247.19101	at LIBOR
Sell	USD 2,286.51685	forward

After 18 Months

Spot rate		INR 46.50 per $
Forward premium		4.20% p.a.
6-month LIBOR		3.75% p.a.
MIFOR is 7.95% p.a.		
Forward Rate		47.477
cash flows INR:		
Receive under forward contract		104,039.375
Pay under MIFOR		– 4,000.000
Buy USD equal to notional		– 100,000.00
Rupee surplus/deficit		53.000
Net		INR 92.375
New $ notional =		USD 2,150.53763
deposit	USD 2,150.53763	at LIBOR
Sell	USD 2,190.86022	forward

After 24 Months

Spot rate	INR 45.75 per $
cash flows in INR:	
Receive under forward contract	104,014.375
Pay under MIFOR	– 3,975.000
repay INR borrowing	– 100,000.00
Rupee surplus/deficit	92.375
Net	INR 131.750

In the cited scenario there is always a positive cash flow. But, this will not be the case if the forward margin is a discount or if the notional principal is fixed in dollars, as is the case while using MIFOR swaps to hedge risks on cross currency swaps.

A9.1.3 MIFOR Swap: Valuation/Cancellation

Notional INR 100

Original swap: receive fixed (7.50%), pay MIFOR (next exchange due in 4 months, current MIFOR 7%p.a.)

Balance maturity 1 year 4 months (i.e. 1.3333 years)

Since market quotations are not available for 1 year 4 months or 4 months LIBOR, we use interpolation of quoted rates to arrive at the prices.

Today's rates

MIFOR Swap rate	
year	rate (% p.a.)
1.00	6.00
2.00	7.00
1.33#	6.33

LIBOR and forward margin (%p.a.)		
month	LIBOR	fwd margin
3	4.0000	1.5000
6	4.6000	2.0000
4#	4.2000	1.6667

#Interpolated rates on 30/360 day basis

MIFOR swap rate 1.333 years = 6.3333% p.a.

MIFOR 4 months = 5.8667%p.a. (i.e. 4.20 + 1.6667)

Zero coupon swap rates*			
months	year	rate %p.a.	disc fctr
4	0.333	5.912	0.9807
10	0.833	6.057	0.9520
16	1.333	6.446	0.9209

For valuing the swap at the ruling rate, we need to consider the difference in cash flows between the existing swap and a new (hypothetical) pay fix MIFOR swap for 1 year and 4 months. These are as follows:

months	original	Fixed leg of the swap at current swaps rates of 6.33	difference	disc fctr	PV
4	3.7500	–2.1111**	1.6389	0.9807	1.6072
10	3.7500	–3.1667	0.5833	0.9520	0.5553
16	103.7500	–103.1667	0.5833	0.9209	0.5372
				total	2.6997

months	original	Floating leg of the swap at current rates	difference	disc fctr	PV
4	-3.5000	1.9556**	-1.5444	0.9807	-1.5146

Value of swap = 2.6997 – 1.5146 = INR 1.1851

*based on bootstrapping of swap rates and interpolation

**while under the original swap INR 3.75 is receivable after 4 months, followed by 6 monthly interest payments, a fresh/offsetting swap will involve the 1st interest payment period of only 4 months, for INR 2.1111 (i.e. 6.3333*4/12)

Similarly, reverse cash flow for the floating leg of the swap will also involve a 1st interest period of only 4 months, for INR 1.9556 (i.e. 5.8667*4/12). Note that subsequent MIFOR flows need not be considered as they cancel it each other out. The value is also the amount to be recovered from the counterparty if the original swap is to be calculated.

Chapter 10

Option Contracts

10.1 General

10.1.1 Definition

An option contract has been defined as an agreement between two parties in which one grants to the other the right to buy ("call" option) or sell ("put" option) an asset under specified conditions (price, time), and assumes the obligation to sell or buy it. The party who has the right, but not an obligation, is the buyer of the option, and pays a fee, or premium, to the "writer" or seller of the option. The "asset" could be any asset, including a currency, bond, share, commodity or a futures contract.

In practice, more often than not, option contracts are settled not by sale or purchase of the underlying asset, but by the seller paying to the buyer the difference between the market price of the asset and the agreed price ("strike price"), on exercise of the option (in other words, its "intrinsic value"—see below).

10.1.2 Common Terms

Some of the terms commonly used in the option market are:

a. Parties to an Option Contract

WRITER OR SELLER OF THE OPTION	:	The party who has the obligation to buy/sell the asset underlying the contract, at the agreed price and time, if the option is exercised by the buyer of the option.
BUYER OF THE OPTION	:	The party who has the right, but not the obligation, to sell/buy the asset underlying the contract, at the agreed price and time.

b. Types of Option

CALL OPTION	:	The right, without the obligation, to buy an asset
PUT OPTION	:	The right, without the obligation, to sell an asset
AMERICAN OPTION	:	An option, which can be exercised at any time until the expiry date
EUROPEAN OPTION	:	An option, which can be exercised only on expiry
BERMUDAN OPTION	:	An option which is exercisable only during a predefined portion of its life.

c. Expiry

EXPIRY	:	The last date on which the option may be exercised.
EXPIRATION TIME	:	It is specified in the contract. Current practice generally specifies it as 10.00 A.M. New York time, or 3.00 P.M. Tokyo time for contracts entered into in the Pacific Rim countries.

d. Exercise or Strike Price

EXERCISE, OR STRIKE PRICE	:	The specified price at which the buyer of the contract can exercise his right to buy or sell the asset
AT-THE-MONEY (ATM)	:	An option with a strike price equal to the current price of the asset. In currency options, this can refer to the current spot rate (at-the-money-spot) or the forward rate ruling for the expiry date of the option (at-the-money-forward).
IN-THE-MONEY (ITM)	:	The strike price is more favourable to the buyer of the option than the current market rate. The premium is, therefore, higher than for an at-the-money option.
OUT-OF-THE -MONEY (OTM)	:	The strike price is less favourable to the buyer than the current market exchange rate. Therefore, the premium is lower than for an at-the-money option.

e. Value/Price of an Option

OPTION PREMIUM	:	Fee or price paid by the buyer of the option to the seller of the option
VALUE OF AN OPTION	:	The market price of the option
INTRINSIC VALUE	:	The difference between the strike price and the current market exchange rate, in the case of an "in-the-money", American style option, intrinsic value is the profit available on immediate exercise of the option. While this is the strict definition of intrinsic values, sometimes the term is also used in relation to European options which may not be exercisable immediately.
TIME VALUE	:	The difference between the option premium and the intrinsic value, reflecting the value arising from the time left until its expiry.

f. Miscellaneous

CASH MARKET	:	The market in the actual financial instrument on which an option contract is based.

One point is worth emphasizing. Since time value is always positive, the price of an option will always be more than its intrinsic value. In other words, as for the option prices, no purchased option would assure a net exchange rate (i.e. strike adjusted for option fee) better than the forward rate. The difference is the price you pay for benefiting from the possible improvement in the exchange rate over the forward rate.

10.1.3 Option Markets and Prices

Currency options are traded both over-the-counter and on exchanges. (In India, USD INR options are traded only in the OTC market).

The first currency option contract (incidentally, on the GBP: USD exchange rate) began trading in December 1982 on the Philadelphia Stock Exchange. In the spring of 1983, the other liquid G7 currency option contracts were introduced. Since then, volumes and trading centres have grown rapidly. While traded options are essentially short-term (maturity of up to one year), in the over-the-counter market long-term maturities are also available. Another difference may be noted: exchange traded options are mostly American and OTC options generally European.

The general topic of option pricing is discussed in the next chapter.

The following table gives the forward rates prevailing on 28th December 2008. The Spot rate was INR 48.80 (opening rate).

Table 10.1 Forward Rates

Maturity	Forward Rates
30-Jan-09	49.10
27-Feb-09	49.39
30-Mar-09	49.55

The following table gives the indicative prices of USD:INR currency option contracts on that day.

Table 10.2 Option Prices at Different Maturity

Strike Price↓	Calls			Puts		
/Maturity→	30-Jan-09	27-Feb-09	30-Mar-09	30-Jan-09	27-Feb-09	30-Mar-09
47.00	237	274	295	33	50	57
48.00	167	209	232	63	70	92
49.00	112	155	179	107	129	138
50.00	74	140	158	168	187	195
51.00	48	70	106	242	255	262
52.00	16	20	48	324	332	336

From the table, it will be seen that the price of a call on $1,000, strike price INR 49.00, expiry 27th February 2009, is INR 1,550 [INR (1,000*155/100)].

A few other points will be readily noticed from the table of quotations:

- The fee for buying an option falls, as the strike price becomes more unfavourable. Consider the 27th February 2009 calls. The fee falls from INR 2.74 per USD for a strike of INR 47.00, to INR 0.20 for a strike of INR 52.00. The same holds good for the put options as well. Note that a strike of INR 52.00 is more favourable for the buyer of the put option than INR 47.00. Options provide flexibility in terms of choice of strike rate, unlike forward contracts.
- The changes in option prices are not proportionate, or linear, to the changes in the strike rate. Take the 27th February 2009 calls: the price falls by 54 paise, when strike changes from INR 48.00 to INR 49.00, but by only 15 paise for an equal change from INR 49.00. Nor are the changes identical across maturities for the same pair of strike rates.
- Prices increase with maturity.

In general, the greater the probability of exercise of an option, or the higher the uncertainty because of the longer maturity (or exchange rate volatility), the higher would be the price. Consider two put options, with strikes of INR 48.00 and INR 50.00. The probability of the put at the strike rate of INR 48.00 being exercised is clearly lower than the one at INR 50.00, as the former will be exercised only if the spot rate on maturity is less than INR 48.00; the latter if it is less than INR 50.00. (In other words, if spot rate is INR 48.00

< spot rate < INR 50.00, only the 50-strike option will be exercised, not the 48-strike). Therefore, the price of the 50-strike option will be higher than the 48-strike put option.

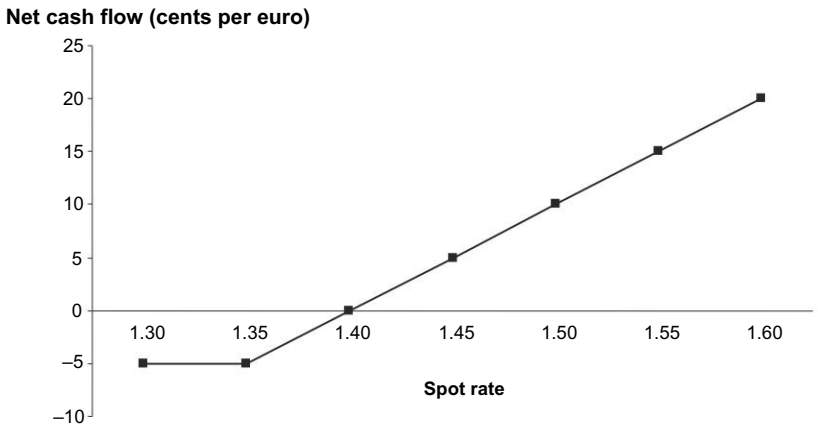
10.1.4 Option Pay Offs

In many ways, the pay offs under option contracts are comparable to those under insurance policies. Take for instance a car insurance contract. For the buyer/insured, the maximum outflow is the premium paid; on the other hand, for the seller, the outflow can be theoretically unlimited (under third party claims for example). Again, for the insurance company, the gains from an insurance contract are limited to the premium received (less overhead costs) even if there is no claim. On the other hand, for the insured, while the claim to be received can be very large, the insured cannot make any "profit" on buying insurance: only his costs are recoverable. In other words, the risk reward relationship is altogether different for the buyer and the seller of car insurance.

This is exactly parallel to the risk reward relationship between buying and selling option contracts. The downside for the buyer is limited to the fee/premium paid for buying the option—while the upside on the exercise can be large. On the other hand, the seller is in the position of the insurance company: the only inflow is the premium, and the outflow can be very large.

Consider that you have purchased a European call on the EUR with a strike of USD 1.35, by paying say 5 cents per EUR. Your net cash flow on expiry of the option, including the fee paid and the pay off (but ignoring interest on the fee) will be as follows:

Graph 10.1 Options Pay Offs



The following points should be noted:

- While the pay off is determined on expiry of the option, the amount payable, if any, is settled two clear working days later (as in spot market trades in the foreign exchange market).

- OTC options, if exercised, will be settled by either the seller paying the intrinsic value to the buyer, or by transacting the underlying currency exchange at the exercise price. Exchange-traded options are generally settled only by payment of the intrinsic value on maturity.
- The purchase of a call on the euro is identical to purchasing a put option on the other currency, USD in this case. The call on the EUR gives the buyer the right to buy EUR at USD 1.35. This is identical to a right to sell USD for EUR at USD 1.35. Both will be exercised, if the market rate is higher than USD 1.35, and the pay offs are identical.

10.1.5 Counterparty Risk

In general, the writer or seller of an option has little counterparty risk on the buyer, once the fee has been recovered. (To be sure, there may be a settlement risk at the time of exercise of the option if the underlying asset is to change hands.) On the other hand, the buyer has a counterparty exposure on the seller. Should the latter become insolvent before the expiry of the option, the contract may become worthless.

10.2 "Zero Cost" Structures

As we have seen, the buyer of the option has to pay a fee/premium for buying it. End-users are often reluctant to pay the fee upfront: the mental comparison is with entering into a forward contract, where no such fee is payable, rather than with buying an insurance policy, which is the more valid comparison.

Whatever the rationale for the reluctance to pay a fee, this has led to the introduction of a number of so-called "zero-cost" structures: these are, in effect, combinations of bought and sold options, their notional amounts and strike rates so chosen as to zero-ise the upfront cash flow. In other words, the fee payable by an end-user for buying an option is compensated by the market maker buying from the end-user, an option of the same value. While these structures are often referred to as "zero cost", they should be more correctly described as zero (up front) cash flow than zero cost: the structures acquire a positive or negative value as soon as any of the underlying variables change. Another implication should be noted: since such structures involve more than one option, the end-user is paying a higher, transaction cost, i.e. bank margin.

Some of the more common and simple structures are described below. They all have one feature in common: they involve giving up some potential gains for saving up-front costs.

10.2.1 Range Forward

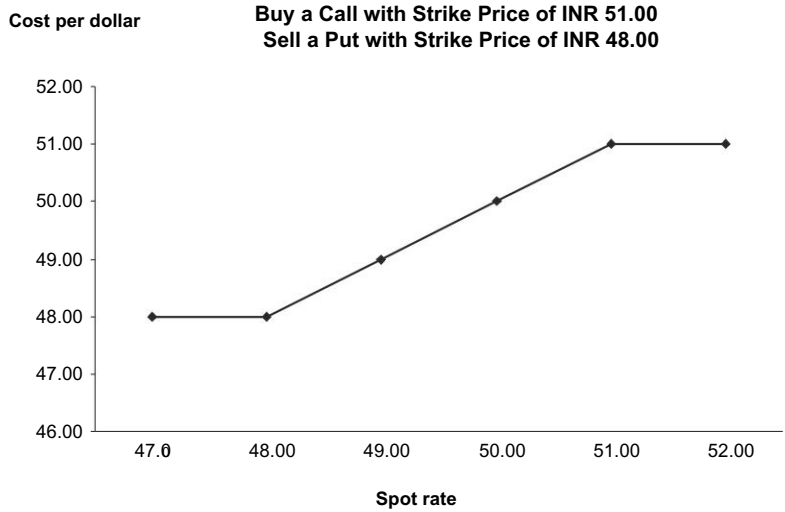
In a range forward (also called a tunnel option) you buy a call to hedge a payable, and simultaneously sell a put to reduce/zeroise costs. The two strike rates

will be different, and both will be out-of-the money. Effectively, one is giving up the potential gains if the exchange rate moves below the strike rate of the put option sold, in order to reduce/zeroise upfront cost of buying the option. The worst exchange rate is, however, capped at the strike of the call bought.

For example,

- for hedging a $ 100 payable maturing February 27, you would buy a call option on payment of a premium of 70 paise per dollar (from Table 10.2) with a strike of INR 51.00 per USD, The cost would be zero-ised by selling a put option of the same maturity i.e. strike of INR 48.00 per USD. (Both the strike rates are out-of-the money in relation to the forward rate.)
- on expiry, if the spot INR/USD rate is INR 53.00 per USD, the importer would exercise the call option and receive USD 100 at INR 51.00 per USD, whereas the buyer of the put option would not exercise it.
- on expiry, if the spot INR/USD rate is INR 46.00 per USD, the importer would not exercise the call option, but the buyer of the put option sold by the importer would exercise it and sell USD 100 to the importer at INR 48.00 per USD.
- on expiry, if the INR/USD rate is in the range of INR 48.00–51.00 per USD, neither of the options would get exercised and the importer would buy the required USD at the market rate.

Graph 10.2 Range Forward for a USD Payable



If a range forward has to be cancelled before maturity, such cancellation may not be zero cost, as the prices of the two options are unlikely to have changed identically. There could therefore be an inflow or outflow of money.

For an exporter wanting to hedge receivables, the range forward will be to buy a put and sell a call – both with strike rates that are out-of-the-money.

10.2.2 Ratio Range Forward

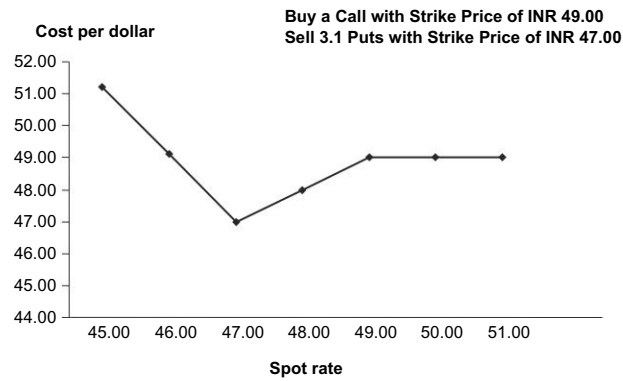
As we saw in the previous paragraph, under a plain vanilla range forward the notional principal of both the bought and sold options are identical—and both are out-of-the-money (As we shall see in the next chapter, the prices of call and put options, **with an identical strike**, are equal only when the strike is equal to the forward rate). If the end-user desires a better strike rate for the bought option (say in-the-money forward), then the options he would need to sell will necessarily have a higher notional principal than the option bought. This is known as the ratio range forward.

Suppose in the above (range forward) example (call at INR 51.00 and put at INR 48.00), if the end-user desires a strike price of call option say INR 49.00, he would have to pay a higher premium: 155 paise per dollar (as per Table 10.2). Now, if the end-user wants to zeroise the upfront cost he would have to sell 3.1 puts of strike INR 47.00, for each call bought.

If spot rate is above INR 49.00, the call purchased will be exercised and when spot rate is between INR 47.00 and INR 49.00, neither option will be exercised. However, if spot is below INR 47.00 suppose at INR 46.00, the put for $ 310 will now be exercised. As a result, the end-user will receive $ 310 and pay INR 14,570 [INR (310*47)]. As end-user need only $ 100, the surplus of $ 210 would be sold at spot of INR 46.00 and he would receive INR 9,660 [INR (210*46)]. Effectively, $ 100 has been purchased for INR 49.10 [INR (14,570 – 9,660)]. Similar calculations show that if spot rate is INR 45.00, the effective exchange rate works out to INR 51.20. In other words, pay offs under a ratio range forward do not cap the exchange rate at the strike of the purchased call.

Diagrammatically, the cost per dollar for the buyer of the call/seller of the put is as follows:

Graph 10.3 Ratio Range Forward for a USD Payable



10.2.3 Strips

"Strips" are a series of option pairs, one bought and the other sold, maturing at say monthly intervals, but with the strikes of the bought and sold options being identical: not only in each pair, but generally across all maturities. Strips are zero (upfront) cost structures. For an underlying payable in foreign currency, the bought option will be a call on the foreign currency, put on the rupee, and the sold option will be a put on the foreign currency, call on the rupee. It will be readily seen that a strip is really like a series of forward contracts, maturing at monthly intervals, but with the same forward rate.

What is the rationale for an option based structure compared to a series of forward contracts? It is that the strike can be better than the ruling (average) forward rate, provided you are willing to write options for a higher notional than that of the bought options. The net fee earned is factored in the strike which can then be better than the forward rate. In other words, if the strike is in-the-money compared to the forward rate, the notional principal of the options sold will be higher than that of the options bought. (If the notionals are identical, the strike will have to equal the forward rate, according to the call: put parity principal.) Typically, the attraction of a strip lies in the initial few months strikes being in-the-money compared to the forward rate.

The disadvantage is that the opportunity cost of a strip is more than the opportunity cost of a forward. To elaborate, consider one element of a strip with the strike 50, entered into when the forward price for selling dollars was, say, Rs. 49. Given that the strike is better than the forward, the notional of the sold option will be higher than the notional of the bought option: assume that the notional of the former was $ 1000 and the ratio 1:2.

Consider what happens on maturity when spot was, say, Rs. 52. The forward has an opportunity cost of ((52 – 49) * 1000)) i.e. Rs. 3,000. Under the strip now you will need to surrender double the dollar amount – at Rs. 50, thus increasing the opportunity cost to ((52 – 50) * 2,000) or Rs. 4,000. Strips running to several years have become quite popular in the Indian market.

10.2.4 Participating Forward

This is a zero-cost combination of a forward contract with the end-user also participating in part of any favorable movement of the exchange rate. In such a structure, the forward contract will be at a rate worse than the market forward rate. To elaborate, consider the following rates for February 27th:

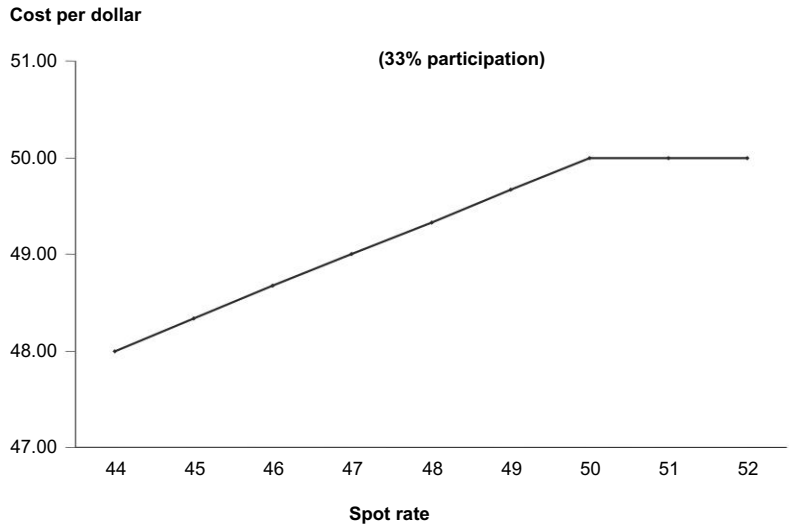
Forward rate (Table 10.1)	Rs. 49.38/$
Price of put with a strike of 50 (Table 10.2)	Rs. 1.87/$

A participating forward for an underlying payable can now be structured with a forward rate of, say, 50, and participation in a favorable movement from

50 to the extent of 33.33%. In effect, the margin over the forward rate (62 paisa per $ in this case), has been used as the fee for a put option with a notional equal to 1/3rd of the contract and a strike of 50—hence the 33.33% participation. If spot on 27th February is say 46, the put option will be exercised with a pay-off of Rs 4/$. Since this pay-off is on 1/3rd of the amount of the participating forward contact, the effective cost of buying dollars comes to (50 – (4/3)), or 48.67. (Interest on the option fee has been ignored in the illustrative calculations.)

Diagrammatically,

Graph 10.4 Participating Forward for a USD Payable



It should be noted that larger the participation desired, worse will be the rate! A participating forward can also be structured as the sale and purchase of a call and put, both with the same strike. For the end-user, the notional of the sold option would be lower than the notional of the bought option. In principle, both the methods should give the same participation. (The illustrative option prices in Table 10.2, however, may give a somewhat different level of participation.)

10.2.5 Seagull

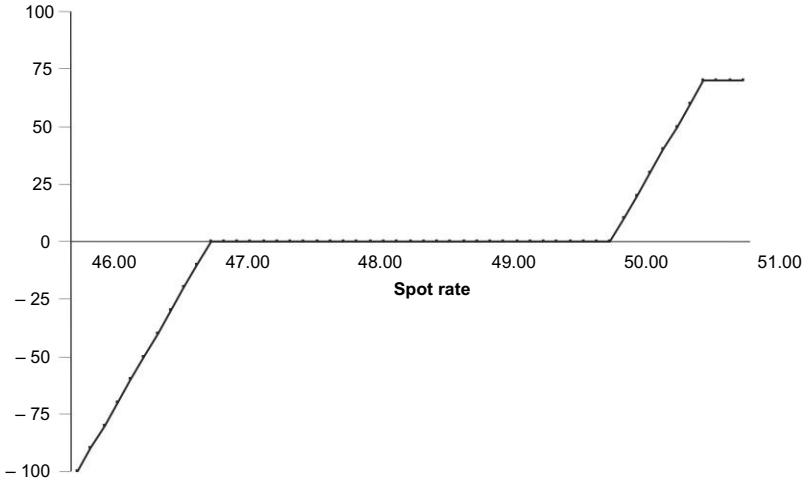
A "seagull" is also a zero cost structure but somewhat more complicated than the simple range forward. To illustrate the combination, consider the same example as in 10.2.1 above. A simple range forward, as explained above, would involve buying an out-of-the-money call (strike say INR 51.00) and selling an out-of-the-money put (strike say INR 48.00). As the prices of both the options are equal, this becomes a zero cost structure.

Often, the corporate treasurer desires to improve upon the zero-cost range forward. This could be done by lowering the strike rate of the call purchased. But this would involve his having to agree to a higher (i.e. less out-of-the-money) strike for the put, or enter into a ratio range forward. An alternative in is to sell another option: the three legged seagull structure embodies one purchased and two sold options, as follows, the portfolio being zero cost: (all prices for February 27th maturity)

- buy call at INR 50.00 (outflow INR 1.40), lowering the strike of the call bought;
- sell put at INR 47.00 (inflow INR 0.50), lowering the strike of the put sold; and
- sell call at INR 50.70 (inflow INR 0.90, estimated by interpolation).

In the above structure, you are better off compared to a range forward, if the spot on maturity is below INR 48.00, or between INR 50.00 and INR 50.70; but worse off if it rises over INR 50.70. The name of the structure derives from the shape of the pay off curve (see Graph 10.5).

Graph 10.5 Seagull



Note that for spot between INR 50.00 and INR 50.70, the call option bought by you will be exercised, but not the call sold—hence the positive pay off. For spot above INR 50.70 both calls will be exercised and the pay off stabilises at 0.70, the actual cost therefore being (spot – 0.70).

The following table summarises the effective exchange rate under different spot rates.

Table 10.3 Effective Exchange Rate Comparison of Range Forward with Seagull

Spot rate	Range forward	Seagull
≤ 47.00	48.00[1]	47.00[1]
48.00	48.00[2]	48.00[2]
50.00	50.00[2]	50.00[2]
50.70	50.70[2]	50.00[3]
50.70 < Spot Rate < 51.00	Spot Rate	(Spot-0.70)[4]
> 51.00	51.00[3]	(Spot-0.70)[4]

[1]the put sold by you is exercised
[2]no option is exercised
[3]the call bought by you will be exercised
[4]both the call, one bought, the other sold, will be exercised, with an inflow of 70 paise.

10.2.6 Numerical Examples

Consider the following table of ruling prices of European style USD/INR options, maturity 1 month.

Table 10.4 Option Prices, 1-month Maturity

Strike	Call	Put
48.00	167/170	62/65
48.25	144/147	69/72
48.50	138/141	83/86
48.75	121/124	94/97
49.00	112/115	104/107
50.00	74/77	165/168
50.25	61/66	172/175
50.50	59/62	201/204
50.75	50/53	219/222
51.00	45/48	241/244

(The two rates are the quoted bid and offer rates: bank will ask the higher price for selling, and pay the lower price for buying.)

Ignoring bank margin, answer the following questions:

(i) What is the approximate forward rate?

(ii) Which option should an exporter buy if he wants to have a minimum net realisation of INR 48.50 per $?

(iii) (a) What range forward can an importer get which will not involve any receipt/payment of premium?

(b) If the spot exchange rate on maturity of the same range forward is INR 51.00 per $ what will be the cash flow to be exchanged (assume that underlying exposure is not due that day)?

(iv) Under a range forward of INR 48.00 – 48.75, to zeroise the option cost what will be ratio of call bought to put sold for an importer .

(v) At a minimum realization of INR 48.25 what level of participation can an exporter expect under a participating forward structure, with actual forward rate being INR 49.10?

(vi) What seagull can be structured for an exporter where no premium will be paid/received?

(vii) An importer with existing range forward of INR 48.00–51.00 wants to cancel the contract when the above prices are prevailing. What will be his net inflow/outflow on $ 1 mn?

Answers

(i) Slightly above INR 49.00, say INR 49.10 per $.

(ii) Put option with a strike of INR 50.25 paying 175 ps as premium.

(iii) (a) INR 48.00 – 50.50

(b) Importer will receive INR 0.50 per $.

(iv) The ratio is 1:2. For every call option bought for INR 1.24 (strike 48.00), the importer has to sell 2 puts (strike 48.75) hence the ratio is 1:2.

(v) The participation will be (1- 85/147)*100 = 42.18%. (85 p is the margin in the forward rate, and 1.47 the cost per dollar of buying a call at 48.25.)

(vi) Strike

	Buy Put	49.00	– 107ps
	Sell Call	51.00	+ 45ps
	Sell Put	48.00	+ 62ps
(vii)	Sell Call	51.00	+45ps
	Buy Put	48.00	– 65ps
			– 20ps

Outflow will be INR 2,00,000 (– 20 ps * $ 1mn)

10.3 Packages

Packages (also often sold as "zero cost structures") involve different combinations of the underlying exposure/asset and an option, or different options. These need to be distinguished from the combinations described in paragraph 10.2 above, as packages cannot be used, strictly speaking, as hedges and are aimed at making profit. Some of the more popular packages are described below.

10.3.1 Covered Calls and Puts

This package consists of writing/selling an option based on are underlying exposure. An end-user with an underlying payable ("cover") say in USD, may write a put option on the dollar, giving the buyer of the option the right to sell

dollars at the strike rate. The implication is that the strike rate is an acceptable rate of exchange for the end-user, and the hope of the writer of a covered put is

(a) the option expires out of the money; and
(b) the writer gains the fee received.

In the opposite scenario, the option would be exercised and the writer would have to give up the potential gains from a cheaper dollar prevailing in the market at the expiry of the option. Thus the end-user has to pay a higher price for the dollars if the currency strengthens (option not exercised), but cannot gain from its weakening beyond the strike. There is a net gain **compared to the strike rate** only if the spot rate on maturity is within a range of strike +/- the option fee.

A covered call is a package consisting of writing a call option on the dollar, based on a receipt in the currency.

10.3.2 Spreads

A bull spread is used when the expectation is that the price of the underlying is likely to go up, and consists of

(a) Buying a call, and
(b) Selling a call with a higher strike.

There is obviously a net cost to the package. There are three possibilities and payoffs:

(a) Neither option is exercised—net loss to the extent of the cost of the package;
(b) The bought option is exercised, but the sold option expires out-of-the money—net gain/(loss) to the extent the pay-off from the bought option is more/(less) than the cost of the package; and
(c) Both options are exercised—net gain (loss) to the extent the difference between the two strikes is more (less) than the cost of the package.

A bear spread can be used when there are expectations of a fall in the price of the underlying and consists of the

(a) Purchase of a call option; and
(b) Sale of a call with a lower strike rate.

This package will lead to a net receipt of fee and it will be useful for the reader to calculate the pay offs under this package under different scenarios as done above in the case of the bull spread.

10.3.3 More Complex Packages

These include butterfly spreads, calendar spreads, straddles and strangles.

10.4 Other Options

These include barrier options, binary options and others where the payoff is different from the difference between the strike and spot rates on maturity, and/or depends on other variables.

10.4.1 Barrier Options

The term barrier option is used to describe options that become operative (knock in) or in-operative (knock out) if the market price of the underlying variable touches a specified level (i.e. barrier). Barrier options have become quite popular with the corporate world because the fee the buyer pays for such an option is less than the fee on an option without the barrier, but with otherwise similar parameters.

Barriers can be of various types:

- American style, i.e. any time up to maturity of the option;
- European style, i.e. on specified day/hour; or
- American style but during specified periods during the validity of the option.

The barrier is generally a specified level of the underlying variable. KI options become operative only if the specified barrier is touched. Sometimes more than one barrier is specified. An example would be a call on the pound with a strike price of USD 1.50, which becomes operative only if, before its expiry, the spot rate goes above say USD 1.55 ("up and in") or below, say USD 1.45 ("down and in").

On the other hand, KO options become inoperative if the specified barrier is touched. An example would be a call on the pound at say USD 1.50, which lapses if, at any time, the spot rate falls below, say, USD 1.45 ("down and out") or above, say , USD 1.55 ("up and out").

As can be expected, barrier options are cheaper than plain vanilla products with identical other parameters (strike, maturity etc.). The reason is that the probability of exercise of a barrier option is less—it may not become operative at all (if the KI barrier is not touched), or may become inoperative before expiry (if the KO barrier is touched).

There are two types of barrier options:

- **Regular knock in or knock out** options where the barrier is out-of-the-money in relation to the strike.
- **Reverse knock in or knock out** options where the barrier is in-the-money in relation to the strike.

In general, reverse barrier options are far riskier than regular options. For example, a reverse knock out barrier option becomes in-operative precisely when it is extremely valuable for the buyer; on the other hand, reverse knock in barrier options are very risky for the writer because they knock in when

they are in-the-money. Many writers have suffered by writing deep in-the-money reverse knock in barrier options.

Regular knock out barrier options are not very risky for the buyer. When they knock out, the market price is better than the strike and can be locked into in the spot or forward market, or through another option.

Some issues in whether the barrier has been hit are worth noting:

(i) It is useful to specify the time of the barrier option trade along with the date. In that case, an American style barrier would need to be hit after the time of trade and before its expiry.

(ii) It is also necessary to be clear about when a barrier event can occur, for example, can it occur on a week-end? The standard practice is to prescribe its occurrence between 5 a.m. Sydney time on Monday to 5 p.m. New York time on a Friday.

(iii) Should the barrier event be deemed to have occurred only when a transaction, as distinct from quotation, hits the barrier? If a transaction, the minimum size usually considered is $ 3 mn or equivalent. Should the transaction be such as to be observable by the dealer?

(iv) Another problem comes up where the currency pair is illiquid (say INR: CHF, and the rate has to be determined by crossing two exchange rates (INR: USD and USD:CHF). Can such crossed rate be sufficient evidence of the barrier having been hit, when there is no transaction or quotation in INR: CHF?

Given the various technical issues involved, it is best to use standard ISDA documentation for confirmation of trades, and be clear about the implications and specifications.

10.4.2 Binary Options and Range Accruals

A binary option pays a predetermined, constant amount if on expiry it is in-the-money; nothing otherwise. Binary options are also referred to as all-or-nothing, digital, or lottery. Binary options are also structured in the form of the pay off being a specified asset (a share for example) than a specified sum of money.

One example:

USDJPY One Touch American Digital

Binary Level	:	112.00 JPY / USD
Expiry	:	31st January 2009, 3pm Tokyo time
Payout	:	USD 100,000
Premium	:	25 % of the USD amount (i.e. USD 25,000)

A range accrual is an option structure where the pay off depends on the **number of days in a period when a variable is above (or below) a specified**

level. In fact, the pay off under a range accrual is the same as under a series of binary options, one maturing every day of the period.

Consider the following example

Range Accrual Level (RAL)	:	112.00 JPY / USD
Expiry	:	31st December 2009 at 3pm Tokyo time
Payout	:	USD 1,000 for each day that the spot rate is below the RAL
Premium	:	USD 50,000

10.4.3 Forward Start Options

Such options have two maturities: the maturity of the forward period when the fee is paid (and the option becomes operative), and the obviously longer maturity of the option itself. The fee and the notional amount are determined at the inception of the transaction: so is the strike, not in absolute terms, but in relation to the spot rate on expiry of the forward period. For instance it could be the

- the spot rate on maturity of the forward period;
- the forward rate for maturity of the option ruling when the forward period matures, etc.

10.4.4 Compound or Split Fee Options

Simply stated, this is an option (say option A) to enter into an option B whose parameters – strike, notional, maturity, etc. – are determined in advance. The fee for buying option A is less than the fee for buying option B at inception. On the other hand, if you choose to exercise option A and buy option B, you would need to pay an extra fee. The fees for options A and B taken together are more than the fee of buying option B at inception.

End-users looking to hedge contingent exposures may find such options useful. The maturity of option A would be so chosen as to allow the contingent exposure to become a contractual one—or at least for most of the uncertainties to be eliminated. The structure reduces the upfront costs of hedging contingent exposures—but the total cost is more if you decide to exercise option A and buy option B.

10.4.5 Other Exotics

(a) Average rate option: The cost is lower than a straight option, but the contract uses the average rate over a set period, as the strike price. This is also known as the Asian option.

(b) "Contingent" option: A call on the pound at USD 1.50, but exercisable only if pound LIBOR is more than (say) 7%.

(c) Look Back Options: These give the buyer of the option the right to buy/sell at the best price during the life of the option, or over a set period.

(d) Quanto Option :The strike price and the underlying are denominated in one currency, but, on exercise, the intrinsic value is converted to the domestic currency for settlement purposes **at a fixed, predetermined exchange rate**.

(e) Shout options: A European option where the buyer has the right to "shout" at any one time before expiry. The pay off is the greater of
- The normal pay off on expiry; and
- The pay off at the time of the "shout" i.e. based on the spot price then ruling

10.4.6 General Comment

The above list of exotic structures is by no means exhaustive. In fact, new, and more complex, structures get devised in the market every day.

10.5 Interest Rate Options

Interest rate options are useful for hedging the interest fluctuation risk on LIBOR-linked floating rate loans, and often take the form of a "cap" on the LIBOR. If actual LIBOR during the currency of the contract exceeds the agreed "cap" on any interest re-fixation date, the writer of the cap compensates the buyer for the difference. In effect, a cap is the purchase of a series of options on the LIBOR, with the agreed cap as the exercise price, and the number of options purchased is the number of times LIBOR is due to be reset over the validity of the cap contract. These are all European-style options with expiry dates corresponding to the dates of LIBOR resettings. The price or fee to be paid by the buyer depends on the difference between the cap and the forward interest rates implied by the LIBOR term structure, the period for which the contract is to run, interest rate volatility, etc. The higher the cap, the lower the fee; contrarily, the longer the period of the contract, the higher will be the fee payable.

The cost can be reduced if the borrower simultaneously agrees to sell a floor for the LIBOR. Conceptually, this is very similar to the tunnel option or range forward discussed above. In that case, if the actual LIBOR is less than the floor, the difference will have to be paid by the borrower to the counterparty. When a contract specifies both the cap and the floor it is referred to as a "band", or a "collar". The two strike prices—namely, the cap and the floor—can be so chosen that the cost of the collar is zero.

The following table gives indicative quotations prevailing some time back.

Table 10.5 Interest Rates Options on Three-Month Libor Maturity: 5 Years

CAPS (offer)	USD	
Strike	1.50	1.63
Price as percentage of principal amount	0.54	0.47

FLOORS (bid)	USD	
Strike	1.25	1.38
Price as percentage of principal amount	0.38	0.47

From the table, it will be seen that in the given rate structure, a cost-free five-year collar is a cap of 1.63% and a floor of 1.38%. Note how the prices of the floor goes up with the strike rate, even as the price of the cap falls.

10.6 Swaptions

This is an option to enter into a swap. Two variations are common:

- A payer swaption gives the buyer the right to pay an agreed fixed rate and receive a floating rate as per the agreed benchmark (typically, LIBOR).
- A receiver swaption gives the buyer the right to receive an agreed fixed rate and pay a floating rate.

The payer swaption could be used by borrowers with floating rate debt to hedge the interest rate risk. (Needless to say, there will be an upfront fee, or premium, to buy the swaption.) In general, in a positive yield curve environment, the floating rate will be lower than the fixed rate at which it can be swapped. The payer swaption gives the flexibility to the buyer/borrower of continuing to pay the floating rate, or exercise the swaption, at the previously agreed fixed rate.

10.7 Cancelling Options

A straight option purchased can be cancelled, or sold, at its current price. This could be higher or lower than the fee paid for its purchase depending upon the changes in the spot rate, interest rates, volatility, etc., since the purchase. On range forwards or ratio range forwards, however, one point is worth noting. The package would be zero cost at inception, but cancellation could result in a cost or gain depending on how the prices of the two options have moved in the interim. The movement is unlikely to be identical as changes in the spot rate would make one costlier and the other cheaper.

American style option contracts should not be exercised before maturity as you are better off selling them. This is because, on exercise, you will receive only the intrinsic value of the option. By selling it, you will capture the full value—intrinsic and time—which will be more than the intrinsic value.

There is one exception to the general rule. If on the premature exercise of an American option, the interest on the inflow is more than the foregone time value, then obviously it makes sense to exercise the option rather than sell it. In practice, such circumstances will be rare.

10.8 Options and Forwards: A Comparison

A question that often arises is whether, or in what conditions, options should be preferred to forwards for hedging purposes. The question becomes all the more important, as options carry an upfront fee, while forwards are perceived as being "cost-free". While there is no general and definitive answer to the question, a few points are worth noting:

- Forwards are not "cost-free". While there is no upfront fee, banks sometimes insist on margins against the counterparty risks inherent in forward contracts. The interest on margin money is a cost. More importantly, an "opportunity cost" is inherent to forwards: one cannot take advantage of a favourable movement in exchange rates. Options have an upfront fee, but no opportunity cost.
- For a strike price equal to the forward rate, an option will be more expensive than a forward contract, **unless the spot rate moves in the option buyer's favour by more than the fee paid**. Let

  a = The option fee per unit on a European style call option
  F = The forward rate as also the strike price
  X = Spot rate on maturity

  (Both F and X are expressed in units of base currency per unit of currency being hedged.)

Table 10.6 Effective Exchange Rate under Forward and Option Contracts

Spot rate	Effective exchange rate	
	Forward contract	Option contract
$X \leq F$	F	$a + X$[1]
$X > F$	F	$a + F$[2]

[1]Option cheaper only if $(F - X) > a$,
[2]Option always costlier.

It follows from the previous point that forwards should be preferred, if an adverse movement is expected. Options should be considered if a favourable movement is expected, but one wishes to buy protection against the possibility of the view going wrong. In that case, the author recommends use of out-of-the-money options to limit the upfront cost.

In short, options as a hedging tool are like insurance policies: the best outcome is that no claim arises, i.e., options are not exercised!

Chapter 11

Pricing and Hedging Options: Basic Principles

11.1 A Simple Example

11.1.1 Pricing and Hedging a European Style Call on the Dollar

One way of hedging a European style call option on the dollar would be to

- Buy dollars spot, when spot crosses the strike rate and
- Sell the purchased dollars, whenever the rate falls below the strike rate

There are two implications to such a strategy:

- The funds cost and
- The transaction costs.

Since one can never be sure how many such transactions will be needed, let alone the total cost, there would be no way of ensuring, with a given degree of probability, that the hedging cost would be less than the fee earned by writing the option.

Let us look at a little more sophisticated mechanism, based on the following assumptions:

- You are writing/selling on option to sell USD (i.e., call on USD) at Rs 43 per USD (the strike rate) six months hence (maturity). This is also the spot rate.
- The 6 months forward rate is Rs 44 per USD
- You are of the view that the spot rate six months hence will be somewhere between Rs 41 and Rs 45. (We come back to this point later.)

In the above scenario, can we determine the price and hedge of the option? (Note that the following discussion is intended to explain to the reader the major determinants of option prices.)

Being committed to selling USD, the obvious hedge is to be long in that currency. Let us assume that you decide to buy 1 USD forward at Rs 44, which is today's six-month forward rate. The option sold by you will not be exercised, if the spot rate on maturity of the contract is at or below Rs 43. Our assumed cheapest rate for the USD is Rs 41. If the option is not exercised, in the worst case, we may have to sell the USD bought forward for Rs 44, at Rs 41. If the difference of Rs 3 is charged by way of a fee, no loss would be incurred, even if the option is not exercised, and you have to unwind the hedge at the worst end of your expectations. (If spot is Rs 42 or indeed anywhere between Rs 41 to Rs 43, the option will not be exercised. The cancellation of the hedge will cost less than the fee collected and you will end up with a profit.) Again, as this amount of Rs 3 is needed only six months hence, it is sufficient to charge a fee, recoverable while writing the option, which together with the six-month interest thereon, will amount to Rs 3. The present value of Rs 3 is thus the price of the option.

Let us now consider what happens, if the ruling rate is more than the exercise price of Rs 43—Rs 45 in the extreme case—and the buyer exercises the option. He will pay Rs 43, which together with the fee of Rs 3, is more than sufficient to pay the Rs 44 at which you had bought the USD in the forward market. In fact, you make a profit of Rs 2, if the option is exercised at the worst assumed spot rate.

For quoting a competitive fee for writing the option, let us try to so structure the transaction as to break even at the two extremes of our range of expectations – and end up with a profit, if the rate is anywhere in between. We, therefore, need to see whether, with a hedge of USD 1 in the forward market and the present value of Rs 3 as the price, we can write more than one call option on the dollar. We have already so structured the fee as not to incur a loss, if the option(s) is (are) not exercised, and the hedge has to be cancelled. We now see how many options we can write ***with the hedge and fee unchanged***, and the assumption that the spot will be at the worst end of our expectations, viz, Rs 45.

If the number of USD is n, the buyer of the contract will pay Rs $43n$, while exercising the options. Besides, we have Rs 3 as the fee. Together, these inflows will have to be adequate to buy one USD at Rs 44 (under the forward contract) and $(n - 1)$ USD at the spot rate of Rs 45. The equation, therefore, becomes

$$43n + 3 = 44 + 45(n - 1)$$

Solving it, $n = 2$.

To summarise, for writing an option contract to sell 2 dollars at Rs 43 six months hence, you will have to charge the present value of Rs 3 as the fee and buy 1.00 USD forward at Rs 44 by way of a hedge. If the actual rate is between Rs 41 and Rs 45 you will make a profit; you break even at Rs 41 and at Rs 45, which is the assumed range.

More generally, **the fee per dollar** is (the present value of) Rs 1.50 and **the hedge ratio** 50%.

11.1.2 A Wider Range

Let us see the impact on pricing, if the expected range is Rs 40 to Rs 46, the other variables, i.e., spot, forward and strike rates, being unchanged.

By a process of reasoning similar to the one followed in paragraph 11.1.1, it can be shown that the fee per dollar is (the present value of) Rs 2 and the hedge ratio 50%. This teaches us the first lesson about option pricing: the wider the range, i.e. the greater the volatility of a price, the higher will be the fee. **Volatility is a major determinant of option prices** and in standard models designated by the variable "σ" (pronounced "sigma), and expressed on a % p.a. basis.

11.1.3 A More Favourable Strike Price

Let us now see the impact of a strike price more favourable to the buyer, say, Rs 42.50, the other assumptions being as in paragraph 11.1.2. Re-doing the calculations, it is easy to see that the fee per dollar is (the present value of) Rs 1.875 and the hedge ratio is 62.5%. This is the second lesson: if the strike price is more favourable and, therefore, there is a greater likelihood of the option being exercised, the fee and the hedge ratio go up. **The strike price** is also a major determinant of option prices.

11.1.4 Interest Rates

In the cited example in paragraph 11.1.1, the fee is the present value of Rs. 1.50. So another determinant of the option price or fee is the (risk free) domestic interest rates for the period of the option. Domestic and foreign currency interest rates also come into play in the determination of the forward rate (see Chapter 3—to be sure, this is not always applicable in the USD : INR market).

Note that in the above discussion, every variable which affects the price of an option contract is known—except of course the (future) volatility of the exchange rate!

11.2 Pricing Models

The basic principle of calculating the option price is that it is the present value of the probability weighted pay offs from the option on its maturity. The two standard models are binomial and Black Scholes. (Both give more or less identical results when the branches of the binomial tree exceed say 25 or 30.) Complex options are also valued using the "Monte Carlo" system. We discuss here only the Black Scholes model. But before that it will be useful to consider some theoretical upper and lower limits for option pricing.

11.2.1 Theoretical Limits for Option Prices

A. Definitions:

$P(x, X, t)$ = price of a call option on currency $C2$, in units of $C1$ per unit of $C2$, where

x = spot rate in units of $C1$ per unit of $C2$

X = Strike rate in units of $C1$ per unit of $C2$

t = maturity of the option, expressed in years

B. Price limits on call options

(i) $P(x, X, t) \geq 0$, never negative—this is self-evident and no explanation is necessary.

(ii) $P(x, X', t) > P(x, X'', t)$ where $X'' > X'$—the former has a higher actual, or potential, intrinsic value than the latter, i.e. greater probability of exercise, and hence the higher price.

(iii) $P(x, X, t1) > P(x, X, t2)$ where $t1 > t2$—the longer the expiry, the higher the price.

(iv) $P(x, X, t) \leq x$ (if not, it will be better to buy the asset; it will have at least some value on expiry—the option may have zero value.)

(v) For an American option, $P(x, X, t) > x - X$ (intrinsic value or the profit on immediate exercise)

(vi) For European options, consider the following table of option and forward contract values, x' being the spot rate on maturity.

Table 11.1 Values of Option and Forward Transactions

	Value of transaction when		
Transaction	$x' < X$	$x' = X$	$x' > X$
Buy call option	0	0	$x' - X$
Sell put option	$-(X - x')$	0	0
Both together	$x' - X$	$x' - X$	$x' - X$
Sell forward at $F = \frac{x \times (1 + (I1 \times t))}{(1 + (I2 \times t))^1}$			
by interest parity	$F - x'$	$F - x'$	$F - x'$
All three together	$F - X$	$F - X$	$F - X$

[1] I1 and I2 are, respectively, the base currency and foreign currency interest rates expressed as fractions.

The combination buy call, sell put (at the same strike price), and forward sale is equal to ($F - X$), irrespective of spot rate on maturity. This mathematical certainty can now be used to establish the relationship between call and put prices. In an efficient

market, the present value of the three transactions taken together equals $(F - X)/(1 + (l1 * t))$: else, arbitrage opportunities will open up and correct the price relationship.

For the three transactions taken together, cash flows today are as follows:

Buy call	:	outflow call price
Sell put	:	inflow put price
Forward sale	:	0

Therefore, the difference between the call and put price **with the same strike and maturity, i.e. the net funds flow,** has to be equal to the present value of $(F - X)$ or $(F - X)/(1 + (l1 * t))$. Therefore, for European call options:

$$P(x, X, t) \geq \frac{(F - X)}{(1 + (l1 \times t))}, \text{ since the price of the put option is} \geq 0$$

(vii) Also, for given x, X, t, an American option will be priced ≥ a European option, as the former provides greater flexibility for the buyer.

C. Take another look at B (vi) above and consider what happens when $F = X$, i.e., the strike rate is equal to the forward rate. **In that case, $F - X = 0$ and the prices of the call and put options should be equal.**

11.2.2 Black Scholes: Historical and Conceptual Background

The most accepted option pricing model is the Black-Scholes Model. Initially introduced for valuing stock options, the model has been adopted for currency options as well. The modified Black Scholes model used for currency options is known as the "Garman-Kolhagen" model. Just as the normal distribution is the limiting form of the binomial distribution, the Black Scholes Model can in many ways be regarded as the limiting form of the Binomial Model as the number of time periods tends to infinity.

The model was developed by Fisher Black, Myron Scholes and Merton Miller in the early 1970s. Black, who died in August 95, was a mathematician, and is considered by many as the first "rocket scientist" to make an impact in financial markets. (These days, of course, Ph.D.s in physics and mathematics are a standard part of derivatives trading teams in major commercial and investment banks, busy pricing and hedging ever more complex and risky mechanisms.) Interestingly, the breakthrough in developing the model came, when Black/Scholes/Miller noticed that the equation they were trying to solve was similar to a formula in physics, which describes the process of

heat diffusion: the solution then became obvious. Curiously enough, the Black Scholes option pricing formula, which has by now become a landmark in the history of finance, had a very lukewarm response from the academic world initially. Several journals refused to publish the paper describing the model. Ultimately, it was published in the May 1973 issue of the *Journal of Political Economy*. The timing was fortuitous, as the world's first option exchange had just opened in Chicago. Sellers, who were pricing options on little more than gut feeling, took to the model enthusiastically and almost everybody was using it within a year. It remains standard even today to calculate both the price and hedge ratio of a call option.

The model was developed by considering a portfolio consisting of a long position in call options and a short sale of the underlying asset—stock, currency, etc. The objective was to develop a model for the value of the option, such that small changes in the spot price of the underlying asset would have a neutral effect on the value of the portfolio. In other words, the change in the value of the option compensates for change in the value of the short position. (To achieve this, there needed to be a proportionality between the amount—notional principal—of the long call, and the amount of the short sale.) In that case, the return on the portfolio should be the riskless rate of return. While this is the conceptual framework, the theoretical derivation is quite complicated.

Another foundation of the model is the assumption that the periodic, say daily, relative price change of an asset—share, currency, etc.—is normally distributed. Students of statistics are familiar with the concept of the so-called normal distribution, the bell-shaped curve. If a variable is normally distributed, it is possible to predict the range over which a given percentage of values will lie, by using the mean and standard deviation. Thus, 95% of the values lie within +/– 2 SD's of the mean. This can then be used to estimate, with the desired degree of confidence, the range within which the future exchange rate is likely to lie – and for pricing and hedging options.

11.2.3 The Model

The formula uses "natural" logarithms (ln), i.e., to the base "*e*", and powers of "*e*", where

$$e = 1 + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \ldots \text{ to infinity}$$

$$= 2.718282, \text{ using the first 50 terms, and rounding off.}$$

It can be shown that

$$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots \text{ to infinity}$$

According to the Black Scholes Model, the value of a European call option, with the full premium paid in advance, in units of *C*1 is

$$P(x, X, t) = (e^{(-i1 \times t)}) ((F \times N(d1) - X \times N(d2)).$$

where

$P(x, X, t)$ = price of a call option on currency $C2$, in units of $C1$ per unit of $C2$, where

$C1$ is the base currency; and

$C2$ the currency on which the option is written (the underlying currency).

x = spot rate in units of $C1$ per unit of $C2$,

X = strike rate in units of $C1$ per unit of $C2$,

t = maturity of the option, expressed in years,

$i1$ = risk free interest rate on $C1$ expressed on a continuously compounding basis. If I1 is the periodically compounding rate expressed as a fraction, it can be shown that $1 + l1 = e^{i1}$ or $i1 = \ln(1 + l1)$.

(An interest rate of 10% p.a. applied annually is the same as 9.76% p.a. compounded half-yearly, or 9.6% p.a. compounded monthly. The process carried on further leads to the concept of continuous compounding — the periodicity of compounding tending to zero time interval, but not quite reaching it, a concept familiar to mathematicians for summing up infinite series with a finite sum. The function "ln", natural logarithm, i.e., to the base e, is available on most modern spread sheets).

F = Forward exchange rate of C_2 in units of $C1$

$$= \frac{x \times (1 + (l1 \times t))}{(1 + (l2 \times t))}, \text{ or } = xe^{((i1 - i2) \times t)}$$

$N()$ = cumulative normal density function (i.e., the probability that the final outcome will be less than ( ) standard deviations above the mean.

$$d1 = \frac{(\ln(F/X) + ((SD^2) \times t/2))}{(SD \times (t^{0.5}))}$$

$$d2 = d1 - (SD \times (t^{0.5}))$$

SD = A measure of annual volatility of the price of the underlying asset – see 11.2.4 below.

Conceptually, the price of an option is the present value of the expected (i.e. probability weighted) payoff under the option on its maturity. Again, $N(d2)$ is the probability of exercise of the option. The Black-Scholes model also gives the hedge ratio in the spot market as $N(d1)/(1 + (l2 \times t))$: this is, incidentally, the first partial differential of the price with reference to the spot rate, x.

This ratio is referred to as the **option delta**, and is the ratio of the amount of the hedge and the quantity of the underlying on which the option has been

written. A corollary for hedged option writers is that they need to keep adjusting the hedge as the spot price of the underlying asset moves. **When the spot rate changes by a small amount, the resulting change in the price of the option is reliably compensated by the change in the value of the option delta**. For larger movements, delta itself will change. **Gamma** is the rate of change of delta, or the second partial differential of the price with reference to the spot rate. **Vega (or kappa)** is the term used to define the change in price as a result of change in volatility—the first differential with reference to SD. Volatility, as already noted, is a major determinant of the price. The other terms in common use are **Theta** (measure of option price change with passage of time) and **Rho** and **Phi** (change in price as a result of change in domestic and foreign currency interest rates). Standard software is available (e.g. Derivagem) to price an option by inputting the variables. One other point is worth noting: from the model, it is obvious that the price/value of an option and its hedge ratio keep changing with every change in any of the variables: in particular, the forward rate and volatility. The former in turn depends on the spot rate and interest rates in the two currencies. Therefore, for writers of hedged options, the delta needs do be rebalanced continuously, at least once a day.

11.2.4 Volatility

As we have seen earlier, the major unknown in pricing options is the measure of volatility ("σ") to be used. Note that what is needed is a measure of future volatility.

Two approaches are possible:

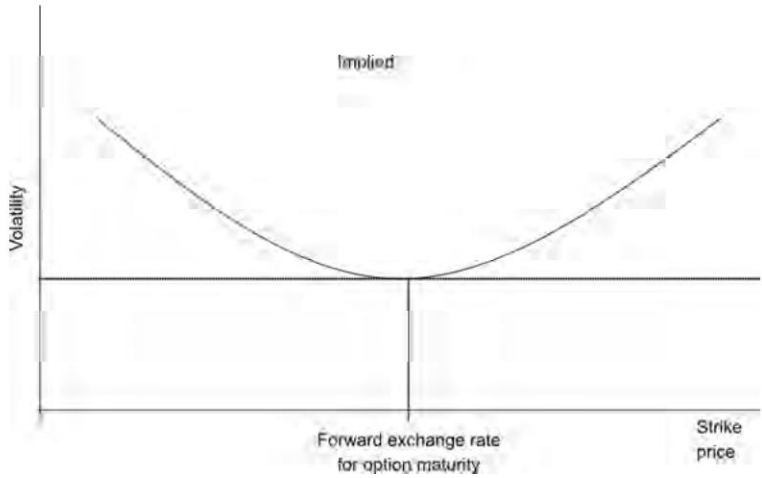
- Use historical volatility (i.e. past volatility) as a measure of the future volatility;
- Use the volatility implied by the prices of traded options which is the market's estimate of future volatility. Implied volatility can be calculated through reverse working of the Black Scholes model.

One difference between implied and historical volatilities should be noted. In principle, volatility is a measure of the magnitude of changes in market price of the underlying asset, and should therefore be independent of the strike price or maturity of an option. This is clearly so as regards historical volatility, (calculated using a standard model) as the strike price of an option does not enter the calculation.

On the other hand, in practice, volatilities implied by market prices of options are not identical across the range of strike prices or across maturities. (But implied volatilities are/should be equal for call and put options with identical strike and maturity). Under normal market conditions, implied volatilities are lowest for at-the-money options and increase as the strike price moves more and more in-the-money and out-of-the-money ranges (see Graph 11.1).

(The actual graph is not as symmetrical.) Given the shape of the resulting curve, this phenomenon is often referred to as the volatility smile.

Graph 11.1 Volatility Smile



Market players ascribe the higher volatilities implied by the prices of deep in-the-money and out-of-the-money options to the fact that, in practice, extreme prices occur with greater frequency than predicted by the normal distribution.

Volatilities implied by market prices of options not only vary with the strike rate but also with the maturities of options. Again, prices—and hence implied volatilities—of options also depend on the demand for calls or puts. If market sentiment is towards a currency strengthening by a given maturity, demand for, and hence price (and implied volatility) of, calls on that currency are likely to rise—the reverse would be the case for puts on the currency.

11.2.5 USD:INR Options: Volatility Data on FEDAI Site

In the Indian market, option prices are not being quoted as such: banks are however quoting the volatilities of ATM options on Reuters/Bloomberg screens. This apart, the Foreign Exchange Dealers Association of India (FEDAI) publishes volatility data on its website (www.fedai.org.in), by conducting a poll of market participants at 4.00 PM every day. To quote from its circular,

"FEDAI will be polling volatility estimates at 4.00 p.m. (which will be announced immediately thereafter) as under:

(a) At the Money (ATM) Options
(b) 25 Delta Risk Reversal
(c) 25 Delta Strangles
(d) For Maturities: 1 week, 1 month, 3 months, 6 months and 1 year.

Part B

The meaning and purpose of terminology used are given below:

1. **FEDAI Volatility Fixings**

   FEDAI conducts a poll of volatilities from banks at 4.00 p.m. every day. The volatilities polled are for At the Money (ATM) Options, 25 Delta Risk Reversals and 25 Delta Strangles. The maturities for which these volatilities are polled are 1wk, 1m, 3m, 6m and 1yr. The volatilities that are supplied on this page are 'mid' rates and are rounded off to the nearest basis point (or 0.01%). Options quoted have an expiry time of 11.30 a.m. IST on the expiry date.

2. **ATM Volatilities**

   This is the implied volatility of an option whose strike price is the same as the currently quoted forward exchange rate in the market. Implied volatility is a measure of the degree of uncertainty that the market attaches to the return on a particular currency over the life of the option. This is the volatility when input into the Black (1976) or Garman Kohlhagen (1983) Option pricing models, will produce the correct market price for the option. The same volatility can be used for both ATM call & put.

3. **25 Delta Risk Reversal**

   A 25 Delta Risk reversal is a combination of a long 25 Delta Call and a Short 25 Delta Put (same tenor). For quoting purposes, it is expressed in volatility terms as the difference between the volatilities of a 25 Delta Call and a 25 Delta Put. This number, unlike the ATM volatility, can be either positive or negative. A risk reversal quote can be interpreted as the market expectation of the appreciation/depreciation of a particular currency over the life of the option. If a currency pair is typically quoted as CCY1/CCY2 (e.g. USD/INR), then a positive (negative) Risk Reversal quote implies that the market expects CCY1 to appreciate (depreciate) relative to CCY2 over the life of the option.

4. **25 Delta Strangle**

   A 25 Delta Strangle is a combination of a long 25 Delta Call and Delta Put (same tenor). For quoting purposes, it is expressed as the average of these two implied volatilities minus the ATM volatility for that tenor. This number can be positive or negative (although negative numbers are hardly seen). This number can be interpreted as the curvature of the volatility smile (plot between option delta and volatility). The closer (farther) the strangle quote is to zero, the flatter (more pronounced) is the volatility smile.

5. **Odd Maturities**

   In case of maturities other than those indicated under item No.6.d. of Part A above, the method of interpolation is to be used on a linear basis as in the case of outstanding forward contracts."

The volatility data available on the FEDAI site can be used for calculating the implied volatilities for different strikes as explained below.

Market Data (% p.a.) on 31st March 2008

	ATM	25 Delta risk reversal	25 Delta strangle
12-months	5.34	−0.31	0.29

The closing spot and 12-month forward rates that day were Rs 39.97 and Rs 40.69 respectively.

Notation

σATM : volatility of an at-the-money (forward) option.
σc25 : volatility of a call option with delta of 0.25 and
σp25 : volatility of a put option with delta of 0.25
D25RR : 25 delta risk reversal
D25S : 25 delta strangle.

In that case, from the definitions of risk reversal and strangle,

$$D25RR = \sigma c25 - \sigma p25, \text{ and}$$
$$D25S = ((\sigma c25 + \sigma p25)/2) - \sigma ATM$$

Using the two definitions and rearranging the terms,

$$\sigma c25 = 2D25S + 2\sigma ATM - \sigma p25 \quad (1)$$
$$\sigma p25 = [(2D25S + 2\,\sigma ATM - D25RR)/2] \quad (2)$$

Substituting the market data in equation (2) we can arrive at the volatility of a put option having a delta of 0.25 i.e.,

$$\sigma p25 = \frac{(2 \times 0.29 + 2 \times 5.34 - (-0.31))}{2}$$
$$\sigma p25 = 5.79\%$$

Using the value of σP25 in equation (1), we can obtain the volatility of a call option having delta of 0.25 i.e.

$$\sigma c25 = (2 \times 0.29 + 2 \times 5.34 - 5.79)$$
$$\sigma c25 = 5.47\%$$

The next step is to calculate the strikes of the call and put options whose delta is 0.25 and volatilities as calculated above. This can be done by using the Black Scholes Model, (and trial and error), to the desired degree of accuracy. In the cited example, the strikes are Rs 42.97 (25 delta call) and Rs 39.73 (25 delta put).

Since implied volatilities of call and put options with identical strikes and maturity are equal, we now have three points on the volatility curve:

Strike	Volatility
39.73	5.79%
40.69	5.34%
42.97	5.47%

We can now calculate the volatility of other strikes by interpolation. For example, the volatilities of 12 month maturity options with strikes of 40 and 41 are approximately 5.66% and 5.36% respectively. These volatilities can now be used to price and hedge the options using the Black Scholes Model,

Note that in the illustrative calculations we have used only the 12-month maturity. Similar calculations will need to be made for the other maturities for which data are available on the website. Volatilities for other strikes would need to be calculated once again by interpolation.

It will be noticed that, in the cited example, volatility is lowest for the ATM (forward) option—as it should be given the shape of the volatility smile curve. In practice, this is not always the case. For example, on 31st March 2009, the volatility data on the FEDAI site was as follows:

Market Data (% p.a.) on 31st March 2009

	ATM	25 Delta risk reversal	25 Delta strangle
12- month	12.00	3.95	0.95

The closing spot and 12-month forward rates that day were Rs 50.95 and Rs 52.23 respectively.

Doing calculations similar to those done above, the three points on the volatility curve are as follows:

Strike	Volatility
48.90	10.98%
52.23	12.00%
58.30	14.92%

11.2.6 USD:INR Options: A General Comment

Black Scholes and its variation Garman Kohlagen assume arbitrage free pricing of the forward rate, i.e. one based on the interest party principle (see Chapter 3). This is not, however, the case in the Indian forward USD:INR market. Therefore, there are issues in using the standard models for pricing USD:INR options. This is all the more so as most market participants hedge the options book in the forward, not spot, market.

11.2.7 Pricing Put Options

The basic Black Scholes Model is used for pricing European style call options. It can be adapted for pricing put options. It is also worth remembering that,

in the case of currency options, a call on one currency is a put on the other. Thus, the put option on the dollar, say, is a call on the rupee. The basic Black Scholes Model could be used to price a call on the rupee in dollar terms and converted to pricing a put on the dollar in rupee terms. Remember also that a hedge for a call on the rupee is a long position in that currency, i.e., a short position in the dollar.

Alternatively, the following formula could be used (notation same as in paragraph 11.2.3).

$$\text{Price of put} = (e^{(-i_1 \times t)}) \times (X \times N(-d_2) \times (F \times N(-d_1))$$

The hedge ratio is $(e^{(-i_1 \times t)}) \times N(-d_1)$

11.2.8 American Style Options

There is no theoretical model to price American style options. In practice, three approaches are possible:

- As we have seen, in general, it does not make sense to exercise American style options before maturity. This is because an exercise would capture only the intrinsic value, while a sale of the option would yield the full value, inclusive of the time value. Therefore, the Black Scholes Model for pricing European style options could be used for valuing American options as well **on the sound assumption that an early exercise is unlikely**.
- A modification of the above approach is to compare the price arrived at from Black Scholes with the intrinsic value and, if lower, increase it to cover the intrinsic value.
- The Binomial Model can also be used for pricing American options.

Exchange traded options are mostly American style and those traded over-the-counter generally European style. This is another reason why American options are rarely exercised before maturity as they can be easily sold on the exchange.

11.3 Interest Rate Options

11.3.1 Caps and Floors: Options on LIBOR

Options on the LIBOR, in the form of caps, can be used to hedge the interest fluctuation risk on a floating rate loan. A cap on the LIBOR is essentially a series of European style call options on the LIBOR, maturing on the dates of LIBOR refixation. Therefore, the price or value of a cap would be the total of the prices of the series of options. One point to remember is that the number of options involved in a cap would be the number of times LIBOR is due to be refixed during the validity of the cap. Thus, for example, the number of options involved in a two-year cap on the 3-month LIBOR is 7—not 8—because LIBOR for the current period has already been fixed, and there is no

uncertainty about it. Again, LIBORs are fixed at the beginning of an interest period but actual interest is paid at its end. Therefore, if a cap is in-the-money at the beginning of, say, the third interest period (i.e., when LIBOR for the third interest period is fixed), the pay off (representing the difference between the actual LIBOR and the cap) will be made only at the end of the third interest period, or, it could be paid at the beginning by discounting the amount at the ruling LIBOR.

The cost of buying a cap can be reduced by selling a floor: this can be looked upon as a series of put options on LIBOR.

The principle of call-put parity discussed earlier is also applicable in the case of interest rate options in the form of caps and floors. The point to remember is that the "forward rate" in the parity equation is the swap rate. To recapitulate the equation, the pay off from a combination of a cap (bought) and floor (sold) at the same strike rate will equal the value of a swap of the same maturity: as a corollary, if the strike is equal to the swap rate, the cap and floor will have equal values.

11.3.2 Options on Bond Prices

A few significant differences between the price behaviour of bonds on the one hand and currencies or equities on the other, should be noted:

- Bonds have a specific maturity date, and there is a certainty to the price of the bond on that date;
- Therefore, unlike in the case of a currency or equity where volatility increases with time, in the case of bonds, price volatility falls as the maturity date of the bond comes near, and is zero on bond maturity;
- The bond price is an arithmetical function of interest rates; and
- In market practice, every bond has two prices, the clean, or quoted, price; and the full, or cash, or dirty price (i.e., quoted price plus the accrued interest).
- All these factors complicate the pricing and hedging of options on bonds—although both the standard models can, and are, used. Bond option prices are also quoted in terms of yield volatilities, which are, of course, easily translatable into price volatilities.

Chapter 12

Credit and Commodity Derivatives

12.1 Introduction

While discussing commodity and credit derivatives in detail is beyond the scope of this book, this chapter will give a brief introduction to such derivatives.

12.2 Credit Derivatives

Credit risks have been an inherent part of financial markets ever since money-lending began. However, trading in and transferring of credit risks is a more recent phenomenon. In international financial markets, it took root in the 1980s when a secondary market developed in bank loans to emerging market economies unable to service them. In 1992, deals in structured instruments called credit derivatives were initiated.

As of now the term "credit derivatives" is used in relation to two somewhat different instruments or contracts:

- The first sets of derivatives do not involve a significant cash flow exchange initially. They are more like interest rate swaps or options on currencies in this respect. Some of the more popular products in this category are credit default swaps (CDS), total return swaps, etc. Globally, the notional principal of outstanding contracts of this nature was $ 41.89 trn at the end of Dec. 2008. (*BIS Quarterly Review*, December 2008)
- The second type of credit derivatives are in the nature of investment products or securities, the generic name being "structured finance". In the US alone, the aggregate notional principal of outstanding structured securities was in excess of $ 10 trillion at the end of 2007, more than the volume of outstanding treasury securities.

Both types of products manifest the common characteristic of all derivatives: their values depend on the market price of the underlying variable. In India, the Reserve Bank has postponed the introduction of credit derivatives of the first type (after the turmoil and losses in the global markets in 2008), but many structured finance issues have taken place—and continue to do so.

12.2.1 Credit Default Swap (CDS)

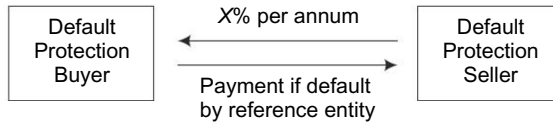
The underlying is a corporate bond – by definition, every corporate ("reference entity") bond has a default risk ("credit event"). The CDS transfers the default risk on the bond ("credit event") from the owner of the bond (the "default protection buyer") to the counterparty to the swap—the "default protection seller". The protection buyer periodically pays a fee ("spread"), on percent p.a. basis, to the protection seller, until the occurrence of the defined credit event.

The default protection seller

A. Receives the CDS spread
B. Buys the bond at face value if the credit event occurs, against
C. Delivery of bond
   OR
D. Pays the difference between the face value and the "residual value" instead of B and C.

The residual value of the bond is its market value immediately AFTER a default—actual or, often, polled if payable as per D above. The reason for the residual value provision is that the aggregate notional principal of outstanding CDS is far in excess of outstanding corporate bonds! In other words, the CDS market has become a mechanism to trade, or speculate, on the future creditworthiness of the reference entity, and/or the CDS spreads.

The cash flow exchanges under a CDS contract may be graphically illustrated as follows:



In effect, the protection seller is writing a put option on the bond with the CDS spread as the price of the option. However, there is one difference: spreads are paid periodically and not in a lump sum at inception, and cease when the credit event occurs.

In any CDS contract, the protection buyer and the protection seller agree on the reference entity; the notional value and maturity of the transaction; the premium payable by the buyer to the seller; the definition of a credit event, or event of default; and the compensation payable by the protection seller to the protection buyer when a credit event occurs.

12.2.2 Spreads

How is the spread arrived at? In a way, it is already reflected in the credit premium over risk-free bonds, implied by the coupon/yield. One way of calculating the spread would therefore be the difference between the yield on a corporate bond, and the yield on treasury/government securities of parallel maturity. An alternative is to consider the historical default rates and therefore default probabilities experienced in the bond market: this would obviously be different for different ratings. In general, the experience globally is that the actual spreads are more than the default probabilities. Lately, in a classic case of the tail wagging dog, loan spreads have sometimes been determined by the CDS spreads!

Again, default probabilities can be calculated in two ways:

- Unconditional default probability for a given rating, derived from default rates of bonds with various ratings **at inception**. An analysis of the historical defaults would give the probability of default of, say, a BBB rated bond, in years 1, 2, 3 … etc.
- Conditional default probabilities measure the probabilities of default in years $X + 1$, $X + 2$, etc., given no default in the first X years.

12.2.3 CDS as Hedge

If one is using a credit default swap as a hedge, care has to be taken to ensure that it cannot be construed as an insurance contract: the reason is that insurance contracts require full disclosure on the part of the insured. This point is also relevant even when a swap is being bought as a trading position—insurance contracts require the insured to have an insurable interest in the asset, which obviously will not be the case in a trading position.

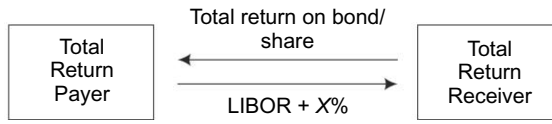
One other point is worth noting. Sometimes the borrower and the reference entity under a credit default swap may be different—the latter could be, say, the holding company of the former. In such cases, a basis risk could arise. It is also useful to study the ISDA rules on the treatment of credit default swaps in the event of re-organisation/re-structuring/de-merger of the reference entity.

12.2.4 Credit Default Swaps on Indices

The earlier discussion pertains to single name credit default swaps; CDS on bond or swap spread indices are also actively traded in the market.

12.2.5 Total Return Swap

The second most traded credit derivative is what is known as the total return swap. The cash flows under a total return swap may be illustrated as follows:



The asset could be a bond or, more often, a share. The total return includes the coupon/dividend and price changes, positive or negative. It will be evident that the cash flows are very similar to the return payer giving hundred percent finance at LIBOR plus X% to the return receiver, for financing the purchase of a bond or share. The return receiver would re-pay the principal at the end of the transaction, and periodically pay the stipulated interest. In a way, a total return swap is like a secured loan, comparable to a security re-purchase transaction, but with no recourse to the other assets or cash flows of the return receiver. The stipulated spread over LIBOR would reflect the credit rating of the return receiver, and also the price risk on the bond/share.

Typically, under a total return swap, the payments are exchanged periodically, for example on expiry of the LIBOR interest period. When this is done, the notional principal on which interest is paid by the total return receiver for the next period, also changes according to the value of the underlying asset when the payments are exchanged.

In mid-2008, the US Securities Exchange Commission ruled that the recipient of a total return swap need not be considered as "beneficial ownership" for disclosure purposes: US regulations require the disclosure of "beneficiary ownership" by shareholders, when it exceeds 5%. The new ruling gave a fillip to the use of total return swaps in corporate takeover strategies.

12.2.6 Structured Finance

The topic of structured finance is beyond the scope of this book. Those interested may like to refer to the book (*Handbook of Debt Securities and Interest Rates Derivatives* by A. V. Rajwade) for understanding the basic conceptual framework. In some situations, it may be possible for Indian companies to reduce the cost of cross-border, or even domestic, finance by using the structured finance route.

12.3 Commodity Derivatives

Like their counterparts in the currency and interest rate markets, commodity derivatives exist in both the forward and option families: again, they are traded both over-the-counter and on exchanges. LME (the London Metal Exchange), NYMEX (the New York Mercantile Exchange), and CME (Chicago Mercantile Exchange) and other exchanges trade commodity derivatives like futures and options on metals, crude oil, grains, etc. In India also we have commodity exchanges like MCX and NCDEX. Their turnover is summarized in the following table.

Table 12.1

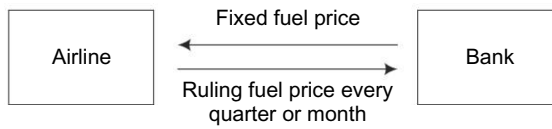
(Rs. In Crores)

Years	NCDEX	MCX
2003-04	2,313	1,483
2004-05	166,213	266,375
2005-06	951,888	1,091,714
2006-07	2,293,724	1,167,278
2007-08	3,125,959	775,591
2008-09	4,588,094	533,829
2009-10 (till October)	3,376,752	464,220

As commodity markets have become more volatile, an increasing number of businesses, whose margins are dependent on commodity prices, are becoming conscious of the price risk—and the need to hedge it. An oil refinery may be concerned with protecting its refining margins—i.e., the difference between the crude oil it buys as raw material and the petro-products it sells. Similarly a copper smelter may wish to protect the margin between the price of the oil and that of finished copper. Obviously, in such cases, the timing difference between the pricing of purchases and sales needs to be considered in developing a hedging strategy.

In the OTC market, forward contracts and swaps on commodity prices are quite common. An example will help clarify and mechanics.

Consider an airline. Its cash flows will get affected by movements in the price of jet fuel. International banks offer a commodity price swap—exchanging floating prices for a fixed price—somewhat as follows:



In effect, with this commodity price swap, the airline has entered into a series of forward contracts on the fuel price.

A more complex variation is to link jet fuel prices with the interest rate on the loan the airline may have borrowed: higher the fuel price, lower the interest rate for that period.

In effect, such a "swap" reduces the volatility of the cash flows of the airline by creating compensation for higher fuel prices through lower debt service obligations.

One note of caution about commodity derivatives: care needs to be taken to ensure that hedge effectiveness criteria under Accounting Standard 30 are met if the derivative is to be subject to hedge accounting principles.

12.3.1 Offset Hedges

Exchange regulations in India currently allow the use only of offset hedges in the global markets, and not price fixing hedges. In principle, there are two objectives for hedging the price of a commodity:

(a) To lock in the future price of a company's input cost or output.

(b) To lock into a commodity price in relation to a specific external contract.

The basic difference is that the first type of hedge is in relation to a company's continuing operations not linked to a specific existing transaction; on the other hand, the second type of hedge is transaction specific in which the hedger maintains a "balanced book" with each physical transaction being offset by a hedge. The first type of hedges are known as "price fixing hedges" while the second type of hedge is known as an "offset hedge".

The following extract from the report of the Gupta Committee appointed by the Reserve Bank in 1998, would be found useful.

"10. Successful hedging requires that two pre-conditions must be satisfied-(a) the new position assumed on the commodity exchange seeks to address a genuine/authentic underlying risk, and (b) the hedge transaction is correctly executed and monitored. In the event either or both these conditions are not met, hedging will acquire a speculative hue and in the process may increase the firm's exposure to risk. Three basic types of hedge operations which Indian corporates are likely to use would be: (A) Offset Hedge, (B) Price-Fixing Hedge, and (C) Options. In offset hedge, the physical exposure precedes or is co-terminus with the financial exposure assumed on the futures market. Price-fixing hedge arises when hedgers are not balancing their books against physical contracts but are securing (protecting) profits on anticipated business. In the process the firm tries to remove the uncertain element from its business by buying or selling goods at prices that will allow them to make profits given their own business circumstances. It has to be recognised that if physical exposure to the anticipated extent does not materalise, the firm would effectively be overhedged/underhedged. There is sometimes a thin dividing line between hedging and speculation. Companies will have to frame definite policies on the matter of overhedging or underhedging as both are a form of speculation, and clear procedures have to be laid down as to how to get out of the situation."

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Author's Profile

A. V. Rajwade is well-known to the markets as a risk management expert, author, columnist and trainer. After two decades of association with the State Bank of India in India and abroad, he became a consultant, and since 1981 has advised many corporate organizations and banks.

He has been a member of RBI's Expert Group on Foreign Exchange Markets in India (Sodhani Committee) and the Committee on Capital Account Convertibility (Tarapore Committee) and is also on the board of several public and private limited companies including Clearing Corp. of India, Thomas Cook, and Royal Sundaram Alliance Insurance Co.

Mr. Rajwade's weekly column "*World Money*" (first published in *The Economic Times* and later in *Business Standard*), now into its fourth decade, is widely read and has generated many ideas for the Indian markets over time. Mr. Rajwade has taught at premier management schools such as IIM Ahmedabad and S. P. Jain Institute of Management. He has also authored a book *Handbook of Debt Securities and Interest Rate Derivatives* (2007) published by Tata McGraw-Hill, and co-authored another one *Foreign Exchange International Finance & Risk Management* (1996) published by Academy of Business Studies.

He has authored three books including *Handbook of Debt Securities and Interest Rate Derivatives* (2007) published by Tata McGraw-Hill.

Anant Vishnu Rajwade