CHAPTER 2

OVERVIEW OF CONCEPTS OF FINANCIAL MARKETS AND FINANCIAL ENGINEERING

2.1 Introduction

Financial system has provided different firms with two alternatives to access external sources of fund including financial markets (i.e. direct financing) and financial institutions (i.e. indirect financing). The decision making regarding the sources and the mix of financial instruments is determined by firm’s financial policies. The risks and uncertainties associated with any financial operations have been intensified due to the recent trends towards globalization in financial systems bringing about increased competition and higher volatilities and more complex risks. With increased globalization, integration and linkages have become more critical to success of any financial system in general and financial markets in particular. All these factors together, have been attracting much research efforts for the development of sophisticated models and customized answers for each type of problems and clients. Financial engineering as a newly created discipline among practitioners and academics is tackling this requirement. It is a term coined with the help of modern information technologies and its field has integrated a wide range of quantitative analysis disciplines, such as mathematics, statistics, time series, stochastic process, data mining, and artificial intelligence. Using as building blocks the tools of risk management, derivatives, cash market instruments, statistics, computer science, and financial institutions, financial engineering intends to develop a framework for designing and implementing tailor made instruments and solutions through existing creative and innovative processes.

In order to clarify the main motives behind the financial engineering, in this chapter, first, we have a brief review of financial system and markets, their trends, their structure and operations, major associated risks and costs, and finally the efficiency concept in markets. Then there is the review of literature
regarding financial engineering concept, origin, and its different tools, the scope of activities, the main factors behind its remarkable growth, and major fields of application, which are discussed in detail, and in the last part of the chapter there is a brief review of different controls over engineered products and their trade.

2.2 Financial market

Financial markets are centers or arrangements providing facilities for buying and selling of financial claims and services.

2.2.1 Role of Financial Market

Financial markets serve six basic functions. These functions are briefly as follow:

- Borrowing and Lending
- Price Determination
- Information Aggregation and Coordination
- Risk Sharing
- Liquidity
- Efficiency (1).

Schwartz and Francioni classify different objectives of financial markets in five fields of macroeconomic, microstructure, legal, operational, and social objectives providing the economy with capital allocation, price discovery, protection, reliability, and equal treatment respectively (2, pp.16-21).

2.2.2 Classification of Financial Market

Financial markets can be distinguished along two major dimensions:

2.2.2.1 Primary Markets versus Secondary Markets

Primary markets are markets in which users of funds (e.g., corporations) raise funds through new issue of financial instruments, such as stocks and bonds, to support their needs when they do not have sufficient internally generated funds. Once financial instruments are issued in primary
markets, they are traded in secondary markets. Secondary markets provide a centralized market place where economic agents know they can transact quickly and efficiently (3, pp.4-7).

**2.2.2.2 Money Markets versus Capital Markets**

Money markets are markets in which debt securities with maturities less than one year are traded. In this market, different participants such as; government, government agencies, corporations, and municipal governments borrow money on a short term basis, and investors with funds invest for a short term. Capital markets are markets that trade financial assets with maturities of more than one year. Capital markets allow borrowers, whose credit worthiness is more easily assessable, to obtain funds directly, without the involvement of an intermediary. At their most basic, capital markets consist mainly of markets for debt and equity but, as sophistication grows, they expand to provide deep and liquid secondary markets, and to encompass other financial products such as derivatives. Capital market is broadly divided into two major parts as:

- Market for government and semi-government securities
- Market for corporate securities or Industrial securities market

Historically, the earliest securities markets were markets for governments’ securities. In the most countries even today, the market for government securities remains the largest securities market. Markets for government securities are important not only because of their size. Government securities play a special role in the economy. Indeed, financial markets served the need of governments long before they started to finance corporations in the late nineteenth century. In all major economies, corporate investment is financed predominantly out of internal funds and in all of them, external financing is mostly in the form of debt rather than equity. In most of them, most debt is indirect (loans from financial intermediaries) rather than direct (issues of debt securities).

Given the limited role of this market in financing corporate investment, does not mean these markets are unimportant. External financing in general and financial markets in particular, are the marginal sources of funds for
investment. While external financing is small on average, it can be very important for new firms and industries that are expanding rapidly or investing heavily in new technology.

The rather modest role of equity market as a source of external financing belies its true importance. It is above all a market for ownership. It makes possible the restructuring of the economy through mergers and acquisitions and privatization. It helps to impose market discipline on managers. Therefore these markets have a much greater effects on the quality of investment than its quantity. In fact financial markets ensure that investible funds flow to the best uses, and make an economy more adaptable by facilitating the growth of new industries and the closing down of declining industries. Jeffrey Wurgler presents empirical evidence that financial markets improve the quality of investment. He shows in particular that countries with more developed financial markets see more investments in growing industries and less in declining industries (4).

2.2.3 Difficulties of External Financing

All firms need, at varying times, to obtain capital and to do so, they must either borrow the money (debt financing), sell a portion of the firm (equity financing), or both. How a firm raises capital depends a great deal on the size of the firm, its life cycle stage, and its growth prospects (5, pp.513).

The understanding of difficulties in the way of external financing enables us to see why financial markets are organized the way they are. The nature and degree of problem depends on the form of financing. Any direct lending through the financial markets face three main problem of reliance on promises, incentive problems, and liquidity.

From the point of providers of fund, with debt financing, the borrower may default on his obligations. Once default becomes a real possibility, the incentives of the borrower become distorted and will have little to lose. This means lender needs to know if there is substantial increase in the probability of default, and for this, it is necessary to monitor the borrower to prevent misbehavior in this way. Default is a real possibility with risky debt; therefore,
the arrangements to deal with it are very important and will affect lenders' willingness to provide financing.

In equity financing there is no question about default, but the big problem for the provider is to ensure that the recipient does not abuse his discretion over the size and timing of payments to the provider. As a protection, equity financing gives the provider a right of control over the management of the enterprise. However, exercise of this right of control is fraught with problems, and involves considerable effort and cost. In addition, equity is even harder to price than risky debt due to two unknown factors of risk and future payments.

From the point of view of recipients of funds, the priority of different forms of financing depends on the costs of dealing with any problems associated with the financing which have to be born by the recipient. Safe debt is a cheap source of financing for the recipient. Enterprises having excellent credit or can find ways to make their debt safe will be able to find external financing at relatively low cost. Risky debt and equity are more expensive sources of external financing for the recipient. In addition to the higher yield to compensate the provider, there is some degree of control over the enterprise from the providers to protect their interests which is potentially costly (6, pp.312-315).

Given the main problems, financial markets address these problems. Primary markets address all the standard problems of financing needs to acquire and process information, to draw up a contract between counterparties, to monitor the compliance, and so on. Secondary markets provide liquidity, price discovery, more active primary market, etc.

2.2.4 Capital Market Organization and Function

From the organizational and functional point of view, financial markets may be discussed in two distinct parts of primary market and secondary market.

2.2.4.1 Primary Market / New Issue Market

I. Legal Environment

Many rules and regulations surround the process of securities issuance. These regulations certainly increase the cost of issuing, but they also provide
protection for investors which enhance the value of securities. In common, the rules require registration of all public offerings by firms. The companies file a registration statement with authorized entity containing; general information about firm and detailed financial data, description of the security being issued, the agreement between the investment bank acting as the underwriter and the issuing firm, the composition of underwriting syndicate in case of existence. Once the registration statement is approved, the underwriter is free to start selling the security in primary offering (7, pp. 8-9).

II. Alternative issue methods

Companies may issue new securities in form of public or private issue. Public and private placements differ in terms of the regulatory requirements that must be satisfied by issuer. In private placement, the issue is sold directly to the limited number of large investors usually in the form of institutional investors, such as investment companies, insurance companies, and pension funds.

There are two kinds of public issues:

General cash offer is such that the issue of securities is offered for sale to the general public on a cash basis. In case of equities, the general cash offer is referred as initial public offering (IPO) or unseasoned new issue and is done when companies are going to public.

Follow on offering or seasoned equity offering is a new issue for a company with securities that have been previously issued and can be made by using cash offering or rights offer. In right offering corporate gives shareholders preemptive right to the new shares of stocks. With compared to the new share issues this mechanism not only leads to low-cost distribution but also has lower dilution*.

In case of long term debt the general procedures are same as those for stocks, but registration statement for public issue of bonds is different from the one for equity and it must indicate an indenture. Another important difference is

* - For more detail regarding mechanics, valuation, effects… see reference no. 3, pp.534-542.
that more than fifty percent of all debt is issued privately, while for stock the
dominant form is public offering.

III. Underwriting

When the public issue of securities is a cash offer even in some of
private placements, underwriters are usually involved. Investment banking
performs the underwriting role in this process. They traditionally provide
services such as:

- Formulating the method used to issue the securities, the term and timing
  of offering
- Pricing the new securities
- Distributing of new securities

Three basic types of underwriting are involved in public placement of issues:

In the Firm commitment underwriting the underwriter guarantees the
corporation a price for newly issued security by buying all the issues at a fixed
price. The spread will be the underwriter compensation for the expenses and
risks involved by them with the issue and vary for different types of offering (8).

Best effort underwriting, where, underwriter does not guarantee a price
to the issuer and acts more as a distribution agent for a fee and only agrees to
use its expertise to sell the securities. In most cases the investment bank brings
in a number of other investment banks to help sell and distribute a new issue
called a syndicate. Syndicates of investment banks lead to spread of risks
associated with the sale of the securities among several investment banks and
results in larger pool of potential outside investors, which increase the
probability of successful sale (3, pp.262-264).

Duch auction underwriting in which underwriter does not set a fixed
price for the securities and offer price is set based on competitive bidding by
investors. This approach is more common in bond markets.

To reduce the risk of liabilities associated with underwriting, before the
registration statement becomes effective, the underwriter holds a due diligence
meeting besides attending several other matters such as final determination of
the size and price of offering. With the size and price set, the signing of the
underwriting agreement, as well as the filling of the final amendment to the registration, ensues (9, pp. 82).

Risks and rewards of underwriting: Underwriting is a very risky business. An underwriter mispricing an issue stands to make loss. Determining the correct offering price is the most difficult thing an underwriter must do specially for an initial public offering. The issuing firm faces a potential cost if the offering price is set too high or too low. Under-pricing is fairly common and there are evidences showing that it can be quite dramatic. The year to year summary of under-pricing for the period of 1975-2005 including 7597 companies in the USA, shows average under-pricing of 17.3 percent overall for the thirty one years. Securities overpriced on average in only one year. There is no general agreement regarding the under-pricing explanations. But much of the apparent under-pricing is related to the smaller, more highly speculative issues. These firms tend to be young and such young firms can be very risky investment, trying to attract investors through the under-priced issues. On the other hand, under-pricing can be a kind of insurance for the investment banks. And finally under-pricing can be a way to reward institutional investors- as their major investors giving opinion regarding suitable prices and level of interest in the stock- for revealing their estimation of share price and number of shares that they would like to buy. In general, countries with developed capital markets have more moderate under-pricing than in emerging markets (5, pp.523-529).

With an IPO, the underwriter often stabilizes the price of issue in the secondary market until it is sold off (according to the legal period after a new issue). This can sometimes leave the underwriter with large amounts of unsold shares. Even if underwriter prices the issue correctly, there is a risk that market interest rate will rise between the time the underwriter buys the issue and the time it can be resold. As a compensation for the risks they take and for the services they provide, they earn a spread and often also an explicit fee. While the risks of underwriting have increased in recent years due to increased volatility in interest rates, their spread and fees have shrunk because of intensified competition.
2.2.4.2 Secondary Market

Already issued financial assets are traded in secondary market. In this market the issuer of the asset is not involved and existing issue changes hands in this market from seller to buyer with the help of a securities broker or a firm acting as an intermediary between them.

I. Roles of Secondary Market

Secondary market plays two important roles including price discovery and liquidity provision.

As securities represent promises of future payment, their value depend on amounts expected to receive and the risks involved. Expectation and evaluation are based on available information and the people using the information. An ideal market is the market where all traders are carried on at fair prices. Price discovery is the process of arriving at fair prices and this process vary in different markets.

Secondary market provides liquidity provision through which trades in securities can be done quickly and without loss. In this sense, the function of market is like as an intermediary.

II. Organization of Secondary Market

There are two alternative ways to conduct trading; the dealer market and auction market. In dealer market, the responsibility of setting the prices rests with dealers. They absorb the liquidity imbalances through their own inventories. In an ideal market dealers change the prices they quote as new information becomes available. In practice, the information availability is not same for all dealers and while some of them have better information and some are better at interpreting it. The threat from information traders gives dealers a strong incentive to set prices accurately and to hoard information. Therefore, prices tend to respond to new information quickly in a dealer market. Dealers have special information about the trading prices itself and often guard it and make it available to the public with a delay, giving them a temporary advantage over the information traders.
The best defense against the consequent losses to information traders is thin bid-asked spread. In general, the greater the uncertainty about the fair price, and the greater the threat from information traders, the greater will be the bid-asked spread. Whatever the bid-asked spread, dealers will occasionally take losses from trading with information traders but wider spread provides larger dealers profit from liquidity traders. Besides dealer market there is inter-dealer market which primarily is used to adjust dealers’ inventories. This market serves pivotal informational function. New information typically affects this market first, and this is where price discovery takes place for market as a whole.

In auction market, buy and sell orders are brought together and price is set to clean the market. There is no differentiation between information and liquidity trading. The price of security rises or falls equally in response to new information or to liquidity imbalances. The prices generally change more slowly in response to new information. This market is far from hoarding trading information, and usually market makes information available as quickly as possible. The better the information, the easier it is for information traders to come in and smooth out liquidity imbalances (6; pp.318-323, 10).

III. Types of Secondary Market

Secondary market for securities can be organized either as an exchange where buyers and sellers come together to buy and sell securities or as an over-the-counter (OTC) market allowing buyers and sellers to transact without meeting at one physical place. OTC market has less stringent minimums such as certain listing requirement and size of firms prevailing in exchanges, and majority of public firms not listed in exchanges trade over-the-counter through a network of dealers. There are also two alternatives to the traditional exchange-based and OTC-based market in the U.S., known as third market and fourth market, including elements of both OTC and exchange market. Generally trades are done through an electronic communication network (ECN). In spite of difficulties in obtaining data on transaction costs in alternative markets, costs of trading in off-exchange market are lower (6, pp.536-539).
IV. Market Mechanics

In exchanges all transactions occur on trading post. Once a firm has applied for and been accepted to list on exchange, it is assigned a specialist that is like a monopolist with the power to arrange the market for that particular security. They are obligated to establish the fair market price of securities and even occasionally stabilize the securities prices by intervention.

Transactions occur at the given post:

- Brokers on behalf of customers at the market price
- Orders are left with specialists to be executed
- Specialists transactions for their own account

Any investment in secondary market is done through brokers who then send the order to its representative at exchange (commission broker) or to a floor broker who working for themselves, to conduct the trade with the appropriate specialist or market maker in the security.

V. Types of Orders

Two major types of order are market orders and limit orders. The vast majority of orders sent to floor or commission brokers are of these two types. Market order is an order for broker and market specialist to transact at the best price available when the order reaches the post. Limit order is an order in which investor to avoid the danger of unexpected price changes can place. In this type of order a specific price and time to the order execution is determined (3, pp.269-271). Besides these two basic form of orders there are different types of conditional orders such as; stop order, stop limit order, make-if-touched order, time specific order, fill-or-kill order, size-related order and so on. Nowadays, orders are increasingly coming from the public using Online (internet) Trading, bypassing the commission brokers and going directly to the floor brokers.

VI. Short Selling

This is an important mechanism in financial markets. In this practice, various institutional arrangements allow investors to borrow securities so that the borrowed security can be delivered to satisfy the sale. In fact, securities are
not owned at the time of sale, but, security is purchased subsequently by investor and returned to them who lent it. This practice prevents security prices to be biased towards the view of more optimistic investors, causing a market to depart from the standards of a perfect price-setting situation.

VII. Margin Transaction

In this mechanism, investors can borrow money to buy securities and use the securities themselves as collateral. By this mechanism investors create financial leverage. The funds borrowed, will be provided by brokers against the call money rate plus service charge.

VIII. Margin Requirement

Brokers are not free to lend as much as they wish to investors to buy securities. There are some limitations. The initial margin requirement is the proportion of total market value of securities that investors must pay in cash according to the prevailing rules in each market. There is also maintenance requirement that is the amount of security needed in investor’s margin account as compared to total market value and if it falls below minimum maintenance level, the investor is required to put up additional cash after margin call by broker (11, pp.110-114).

2.2.5 Financial risks

One of the most important factors strengthening of business of financial engineering has been the concept of expected and contingent cash flows. Risk, can be defined and classified in many ways. In most basic form, it can be defined as the uncertainty regarding future outcome. In finance, on this basic definition, financial risk is the uncertainty of future state of a financial market; and this uncertainty may lead to a profit or a loss. Financial risk can be decomposed to various other classes including:

2.2.5.1 Market risk

Market risk is the risk of loss arising from the adverse movement of markets or market references. The market parameters including exchange
rates, interest rates, commodity and stock prices, and volatility are the main risk factors. Within the broad class of market risk we may consider other subdivisions as follow:

- **Directional risk**: The risk of loss arising from an adverse movement in the direction of a market/reference, such as an equity, bond, index, currency, or commodity.
- **Curve risk**: The risk of loss arising from an adverse movement in the shape of a yield curve, such as a steepening, flattening, or inversion of the curve.
- **Volatility risk**: The risk of loss resulting from an adverse upward/downward movement in the absolute or relative volatility of a market/reference.
- **Basis risk**: The risk of loss resulting from an adverse movement in the differential between two asset references, or a futures contract and its underlying deliverable.
- **Spread risk**: The risk of loss arising from an adverse movement in the differential between a risk-free benchmark and its associated risky counterpart, such as corporate bond quoted as a spread to a risk-free government bond.
- **Correlation risk**: The risk of loss arising from a change in the correlation between two or more assets that define a contract or exposure.

### 2.2.5.2 Credit risk

Credit risk is the risk of loss resulting from the failure of counterparty to perform on its contractual obligations.

- **Default risk**: The risk of loss arising from the failure of counterparty to perform on its liabilities and contractual obligations. Default risk exposures may be divided into trading risk exposures (from derivative/traded contracts), direct credit exposures (from unsecured loans), settlement risk exposures (from currency/securities settlements), and contingent risk exposures (from future commitments and contingencies that may create credit exposures).
• Sovereign risk: The risk of loss arising from the action of government authority on local/non-local assets in its financial system, including capital/exchange controls, currency devaluation, asset expropriation, and so on.

2.2.5.3 Liquidity risk

Liquidity risk is the risk of loss arising from an inability to obtain funding or liquidate asset in order to cover cash flow needs. Liquidity risk is often included as a subset of market risk, but for purposes of clarity, the exposure is considered on a standalone basis. Liquidity risk can be segregated into:

• Asset liquidity risk: The risk of loss arising from an inability to sell or pledge assets at, or near, carrying value in order to generate cash to meet liabilities/payments coming due.

• Funding liquidity risk: The risk of loss arising from an inability to obtain rollover financing or incremental unsecured funding to meet other liabilities/payments coming due.

• Joint asset/funding liquidity risk: The risk of loss arising from a cash spiral, where an inability to obtain funding leads to forced asset sales/pledges at below-market prices, leading to further funding shortfalls, and so on.

2.2.5.4 Operational risk

Operational risk is the risk of loss due to the failure of operating procedures, technologies, or processes. There is wide variety of operational risks. Some of the most common subclasses are:

• Payment/settlement risk: The risk of loss arising from the failure by a firm to deliver cash or securities in fulfillment of a trade/contract for any reason excluding default.

• Interruption/technology risk: The risk of loss arising from an inability to conduct the business in a standard operating environment as a result of infrastructure/technology malfunctions, interruptions, or destruction.
• Legal/documentation risk: The risk of loss arising from an improperly constructed legal position/defense or flawed legal documentation that does not protect (12, pp. 9-11).

Besides different types of financial risks, end users and intermediaries are facing with a range of non-financial risks. The complexity of today’s financial instruments and markets and the accelerated pace of technological progress have led to a dramatic increase in the field of trade and treasury. An incorrect use of financial instruments can lead to spectacular losses. Not only financial instruments but also the markets themselves face increasing risks. All market parameters are subject to daily fluctuations. With considering all volatilities and complexities, a sound understanding of the instruments traded and efficient methods and techniques to manage risk are the basic prerequisites for lasting economic success.

2.2.6 Costs Incurred in Securities Market

2.2.6.1 Flotation cost

Flotation cost is the cost incurred by companies offering their securities to the public. This cost can be categorized as: Gross spread (i.e. the expenses to compensate underwrite. It is the difference between the price the issuer receives and the offer price.), Direct expenses (consisting of filling fees, legal fees, taxes, and all reported on prospectus.), Indirect expenses (i.e. the costs not reported on the prospectus including the costs of management time spent working on the new issue.), Abnormal return is seen in case of stock cash offering (i.e. the drop in the value of existing stock following the announcement of the new issue.), Under-pricing in IPOs (I.e. selling below the true value.), Green shoe option (i.e. a contract giving the underwriter option to purchase additional share from issuer at the offering price and essentially all IPOs and SEOs include this provision) (13).
2.2.6.2 Transaction costs

Transaction costs are all the costs associated with management of investment including time involved in making investment decision. Transaction costs decomposed into direct or explicit costs and indirect or implicit costs.

2.2.6.3 Direct/explicit costs

Direct or explicit costs are itemized separately, and investors pay for these like any other expenses. They are set administratively or negotiated. The main items in this class are commissions and fees, information costs, and taxes.

2.2.6.4 Indirect/implicit costs or execution costs

Indirect or implicit costs are the cost of actually buying and selling. Execution costs include: Bid-ask spread (the cost involved in providing immediacy), Market-impact cost (the cost resulting from any changes in market prices due to execution of an order), and Market-timing costs (incurred when the security prices move in response to factors unrelated to the particular transactions).

2.2.6.5 Opportunity cost

Opportunity cost is the loss in profit from trades that are missed or not executed due to the changes in market conditions before execution can be completed. Rushing a trade to reduce market-timing costs may only result in higher market-impact costs. Market-timing costs are cost of executing a trade and if the traders fail to execute desired trade, an opportunity cost is incurred (14, pp.69-82).

Transaction costs can greatly affect investment performance. If the costs are high, the amount of trading may be significantly reduced, damaging the liquidity of market. In the presence of other alternative market centers, the harm may be reduced if investors direct their trades. Wayne and banks introduce four factors increasing transaction costs including; speed, size, momentum, and liquidity. According to them, faster trades and big sizes of trades overwhelm the market ability to accommodate the transactions. They also show that
transaction costs in a crowd of buyers, thin and dull markets are higher than in crowd of sellers, robust and vibrant markets (15).

Direct costs are less than implicit costs, but nevertheless account for an important part of cost of trading. For example, Aitken and Swan (1997) analyze the effect of tax reduction on securities trade, reflecting average rises of 21 percent in trade resulting from the reducing level of tax on securities transaction from 0.3 percent to 0.15 (16).

Implicit costs typically amount to several times of direct costs. Their relative importance has implications for strategies to minimize them. Different researches have been carried out to qualify this cost and analyze their effects. Barclay, Kendal, Marx (1998) examined the effect of changing bid-ask spread on prices and trading volume and found out that higher spread significantly reduced volume of trade without affecting of price level (17).

2.2.7 Efficiency and role of information

Market efficiency is a term that is used in many contexts with different meanings. Sometimes it describes the operating characteristics of market. West has made distinction between an operationally efficient market and a pricing efficient market. Market is operationally efficient when transaction services are available as cheaply as possible. In efficient pricing market, prices at all times fully reflect all available information that is relevant to the valuation of securities prices. In other words, all relevant information is quickly integrated into the price of securities (18).

Information is the input that drives investment decisions and therefore trading. Security prices are results or output of the process. In efficient markets, information should be reflected in prices with an accuracy that leaves no investor an incentive to search for additional information or to trade. If information is perfectly reflected in prices and if trading is frictionless (seamless and costless) process, then security prices will follow a random walk. However, when the realities of actual markets are taken into account, it is clear that trading is not frictionless and that share prices do not follow random walks. Understanding this is crucial to appreciating the importance of instituting
efficient market architecture. Schwartz and Francioni describe five different dimensions of informational efficiency as; efficiency with regard to existing information, efficiency with regard to information-gathering activities, the informational accuracy of equilibrium prices, and finally the dynamic efficiency of information dissemination (2, pp.412-422).

In identifying the relevant information set that prices should reflect, Fama classified the pricing efficiency of a market into three forms including: weak, semi-strong, and strong. Their distinction lies in the relevant information that is hypothesized within the price of security. In weak efficiency price of security reflects the past price and trading history of security while in semi-strong form security price fully reflects all public information. Strong market efficiency exists when the security price reflects all information, whether or not it is publicly available (19).

Fama (1991) reclassified three categories of market efficiency as; return predictability, event studies, and private information. Return predictability explores whether future return or price can be predicted based on the current information and in efficient market the future return will not be predictable. Event studies refer to a particular methodology of testing whether the prices reflect efficiently the released information and in efficient form, asset prices will quickly reflect the newly released information. Private information consider whether investors with access to inside information beat the market and in efficient market, trading based on private information will not yield abnormal profits (20).

Based on different empirical evidences, we can say that markets are efficient in the weak and semi-strong forms but are not efficient in the strong form. Similarly, research on earnings predictability suggests that over a long horizon, expected return explained by time variation is consistent with the notion of market efficiency (21). Event study literature suggests that securities market reacts quickly and efficiently to the public release of new information and prove market efficiency as it relates to publicly available information. In case of private information what is found through the results of insider trading and other related research, suggests that trading based on private information indeed provides abnormal returns (22).
What makes markets efficient is that investors must perceive that a market is inefficient and it is possible to beat. Investments strategies intended to take advantages are the fuel keeping the market efficient. In real world, markets cannot be absolutely efficient or wholly inefficient, it is a mixture of both, wherein daily decisions and events cannot be always reflected immediately into a market. In the age of information technology, markets all over the world are gaining greater efficiency. However, while the pace at which we receive information and market transactions quickens, it also restricts the time it take to verify the information to the information used to make a trade (23).

2.2.8 Trends in capital markets

In the raising of capital much of the aspects like the sources of external financing, the process of issuing securities, parts of regulatory environment have remained the same for decades and, in some cases, as long as century. In many cases, however financial markets in general and capital markets in particular have changed dramatically over 20 to 30 years and should continue to change in futures. These changes can be classified into the following interrelated categories:

- Globalization
- Deregulation
- Technology
- Growing importance of institutional investors
- Innovation and asset securitization

Globalization is the first major sources of changes in financial markets, the increasing integration of financial markets across national borders. It has brought the securities firm of different countries into competition with one another. Global competition forces governments to deregulate or liberalize various aspects of their financial markets. Deregulation has spurred competition among financial institutions and markets in each country. The growing importance of institutional investors has stimulated competition. The greater bargaining power of institutional investors has enabled them to
demand cheaper and better services, and this has been an important driving force behind deregulation. **Advances in telecommunication, computer technology, and computing power** allow the real time information, monitoring, and rapid execution of orders [6, pp.328-330]. Competition among financial institutions brings forth and fosters the development of new products and markets. Existing regulations that impede the free flow of capital and competition motivate the development of financial products and trading strategies to get around these restrictions. Through technological advances and the reduction in trade and capital barriers resulting from globally internationalized financial markets, surplus funds in one country can be shifted more easily to another country. As a result, a need arises for **innovative financial products and trading strategies** to more efficiently protect against the adverse movement of foreign currencies (11, pp.27). Since 1960s, there has been surge in significant financial innovations. Observers of financial markets categorized these innovations in different ways. Professor Stephan Ross suggests two classes of financial innovation:

- New financial products (financial assets and derivative instruments) better suited to the circumstances of the time (e.g., to inflation) and to the markets in which they trade.
- Strategies that primarily use these financial products.

Another classification system of financial innovations based on more specific functions has been suggested by the Bank for International Settlements:

- Price risk- transferring innovations
- Credit risk-transferring instruments
- Liquidity-generating innovations
- Credit-generating instruments

Price risk-transferring innovations provide market participants with more efficient means for dealing with price or exchange rate risk. Reallocation of the risk of default is the function of credit risk - transferring instruments. Liquidity-generating innovations do three things:

I. They increase the liquidity of the market.
II. They allow borrower to draw upon new sources of funds.
III. They allow market participants to circumvent capital constraints imposed by regulations.

The function of credit-generating and equity-generating innovations, is to increase the amount of debt funds available to borrowers and to increase the capital base of financial and nonfinancial institutions respectively* (24).

**Financial engineering** is, in essence, the phenomenon of product and/or process innovation in the financial industries.

**Asset securitization** has been another major trend in capital markets. It is one of the key financial innovations in part of products that dramatically have influenced the role of financial intermediaries since 1980s. Asset securitization is a structured finance technique that allows for credit to be provided directly to market processes rather than through financial intermediaries. In principal, securitization serves as a refinancing mechanism to diversify external sources of asset funding and to transfer specific risk exposures (25).

Securitization involves taking an illiquid, cash flow producing asset, packaging into a pool of like assets, and then issuing securities backed by the asset pool (i.e. marketable financial claims). Originally asset securitization was confined to residential mortgages but in the mid-to late-80s it spread to auto loans, credit receivables, commercial mortgages, and lease contracts. The main reason for this spread has been the lower total transaction costs with securitization (26, pp.549).

Issuing of asset-backed securities in the process of securitization improves overall market efficiency, by offering marketable financial claims on securitized asset exposures at merchantable quality (27).

The key motivations behind securitization are as follows:

- Active balance sheet restructuring for certain accounting objectives and balance sheet patterns
- To reduce economic cost of capital as a proportion of asset exposure associated with asset funding (efficient asset funding)

* For more detail see Tufano, P. (2002). Financial Innovation, Working Paper, Harward Business School, ptufano@hbs.edu
• To ease regulatory capital requirement to manage risk more efficiently (by lower bad debt provision)
• To efficiently access capital market in lieu of intermediated debt finance at a cost of capital, which would not be possible on account of the issuer’s own credit rating (credit enhancement)
• To overcome agency cost of asymmetric information in external finance

The economic reasoning of securitization depends on the ability of issuers as profitable enterprises to maximize shareholder value as the principal goal of economic activity. Hence, from a capital market perspective, it is imperative to assess how these aspects of securitization affect the (shareholder) value of the issuer and whether the tradeoff between envisaged benefits and attendant drawbacks yields positive payoffs to both issuers and investors (25).

2.3 Financial Engineering / Concepts and Definitions

Many of the most innovative new products trading in the capital markets and derivative instrument markets today originated as the financial engineering solution to fit a specific client needs and situation. Financial engineering is perhaps the latest terminological addition to the world of finance and this is a new example of invasion of social thinking by technology.

The term “Financial Engineering” came into use after the discovery of the Black-Scholes Option Pricing Model in the 1973. Their scientific discovery led to a new methodology to solve practical financial problems. Regardless of how today’s environment came about, two things are certain. First, the volatility of market rates has created ever increasing demand for clever financial products to manage financial risks. Second, current technology has made it possible for financial institutions to create, price, and hedge products specifically designed to neutralize these financial risks. From these foundations, financial engineering was born (28, pp.3-4).

Financial engineering is not a new phenomenon. For centuries the solving of financial problems and explanation of opportunities for making profits or reducing tax liabilities has occupied the mind of entrepreneurs and others.
However, recent years have witnessed a growth in the field of financial engineering on a scale which has not been seen before. The process of financial engineering can be described in a number of ways:

- It can be regarded as the creation ab initio of a financial product to deliver a defined financial payoff to an end-user at a fixed point in time or a set of periodic payoffs over time.
- It can also be viewed as the ‘fine-tuning’ of an existing financial product to improve its return or risk characteristics in light of changing market conditions.
- It can be considered as a process which allows existing financial products to be overhauled and restructured to take advantages of a changed taxation, legal or general economic climate (29, pp.1).
- Definition of financial engineering:
  - Financial engineering is the design of new types of security to fill needs not satisfied by existing securities (6, pp.329).
  - Galitz explain financial engineering as the use of financial instruments to restructure an existing financial profile into having more desirable properties (28, pp.5).
  - John Finnerty has defined financial engineering as the design, the development, and the implementation of innovative financial instruments and processes, and the formulation of creative solutions to problems in finance (30, pp.3).
  - Financial engineering is the application of financial economics, mathematics, computer technology, and the scientific method to the optimal sourcing, utilization, and protection of financial assets (31).

2.3.1 Factors Contributing to the Growth of Financial Engineering

The explosive growth in financial engineering over the last decades is the consequence of a number of factors. Each of these factors has stimulated one or more aspects of financial engineering, made some form of financial engineering possible, or, when combined with other factors, formed an environment conducive to financial engineering.
Finnerty describes ten forces that stimulate financial engineering. These include risk management, tax advantages, agency and issuance cost reduction, regulation compliance or evasion, interest and exchange rate changes, technological advances, accounting gimmicks, and academic research (32). In general, the factors can be divided into two groups. The first consists of those factors that characterize the environment in which the modern corporation operates. The environmental factors may be regarded as external to the firm and over which the firm has no direct control, but they impact the firm’s performance and so are great concern to the firm. The second group consists of those factors that are internal to the firm and over which the firm has at least some control. These factors are considered as intrafirm factors.

2.3.1.1 The environmental factors

These factors include such things as increased price volatility, globalization of industry and financial markets, tax asymmetries, technological development, advances in financial theories, regulatory change, and intensified competition, etc.

Price volatility has three dimensions including the speed of price change, the frequency of price change, and the magnitude of price change. Most markets have experienced increases in the speed, frequency and magnitude of price changes since the mid-1970s. Commodities and financial market have become more volatile because of following factors:

- Inflationary forces which disrupted the markets during the 1970s
- Breakdown of traditional institutions and international agreements
- Globalization of the markets
- Rapid industrialization of many underdeveloped countries
- Greater speed in acquiring, processing, and acting upon information

All these together have exposed investors, especially equity holders to more price risk. To a considerable degree, price risk can be decreased by diversification, but diversification alone is not sufficient. In recent years, volatility has been increased by a more rapid flow of information and those who are threatened by must manage the risks it poses.
Globalization has the size of markets and greatly increased competition exposing the modern corporations to significant risks and, in many cases, cutting profit margins. Increased size of markets has led to more use of debt in capital structures and increasing reliance on leverage to enhance returns. Multinationals were born after corporations learnt to tap the capital markets of host countries. Multinationals have considerable exposure to exchange rate risk and interest rate risk and managing of these risks are essential to their successfully operations. The efforts at foreign financing was aided by development of Eurodollar market in the 1970s and the integration of the world capital markets brought about the introducing of new financial instruments capable of bridging the markets.

Tax asymmetries exist if two firms are subject to different tax rates, and these are often exploitable by financial engineers. Much financial engineering is inspired by tax asymmetries. Tax asymmetries exist for number of reasons:

- Granting special tax exemption to some industries.
- Existence of different tax burdens in different countries and even different tax law for domestic and foreign firms doing business within a country.
- Nature of past performances has left some firms with sizable tax credits and write offs which effectively eliminate any tax obligations for some years to come.

Financial engineering does not assist firms in the evasion of taxes. Rather, financial engineers that arbitrage tax asymmetries help firms to avoid taxes.

Technological advances have motivated a great deal of financial engineering. Many of technological breakthroughs involve the computer, high speed processors, powerful desk-top units, network systems, and enhanced methods of data entry, and so on. Closely related to advances in computer technology are advances in telecommunications which are critical to certain forms of financial engineering. Improvements in communications allow for instantaneous worldwide conferencing and data transmission. There have been tremendous advances in software programs at the same time. Advent of spreadsheet programs has allowed modeling of complex financial deals.
Technological developments have contributed to the growth of financial engineering in other important ways. Technological advances have brought about more volatility due to facilitating of information transmission. In fact, better flow of information is manifested in more rapid and larger absolute changes in prices in short-run. Therein lies a role for financial engineering. It can be used to help firms manage the price risks inherent in market economy. To the extent that technological developments increase volatility, the risk management role of financial engineering is much more important.

Finance, as a formal discipline, is concerned with value and risk and financial engineering can not be used effectively without a solid foundation in financial theory. From the finance theory prospective there have been a number of landmarks. Perhaps most notable of these are evidenced by the works of Markowitz (1952) who laid the basis for modern portfolio theory (33), Sharpe (1964) whose Capital Asset Pricing model provided a deeper insight into risk (34), Black and Scholes (1973) whose seminal work on option pricing revolutionized the way in which contingent claims could be valued (35), and some adopted models to multi-period interest rate and exchange rate options, introduced in the late 1980s.

Much of financial engineering activity has been fostered by an atmosphere of deregulation of industry and encouragement of entrepreneurial experimentation. Deregulation fed competition and forced once protected industries to become more efficient or to close down, and thus release their resources to more productive ends. The increased competition pressures coupled with the 1980s atmosphere of deregulation led to efforts to end much of the regulation heaped on industry and circumvent existing regulations. For example, prohibitions against interstate banking in the US, broke down, commercial banking became increasingly involved in investment banking activities, and so on. Transactional nature of investment banking increased due to competition among investment banks. At the same time, the cost of information, on which many transactions depend and the cost of transaction itself declined significantly during the 1980s- continuing a trend which was already well established by the close of 1970s. These trends
were largely an outgrowth of enormous technological developments that be highlighted earlier. Many of financial engineering activities, particularly those involving arbitrage and multi-instrument structured deals are dependent on minimizing transaction costs and information costs.

2.3.1.2 Intra-firm factors

Intra-firm factors include such things as liquidity needs, risk aversion among managers and owners, agency costs, greater levels of quantitative sophistication among investment managers, and more formal training of senior level personnel.

Liquidity has many faces and meaning in finance. It is often used to refer to the ease with which an asset can be converted to cash or ability to raise cash in hurry, or the degree to which a security’s value will deviate from par as economic conditions change, the degree to which a market can absorb purchases and sales of securities without imposing excessive transaction costs. Both individuals and corporations have liquidity needs and many of financial innovations over the last decades have targeted these needs and concerns.

Risk aversion is considered a fundamental tenet of financial theory that rational individuals have an aversion to financial risk, means individuals are only willing to bear risk if they are adequately compensated for doing so. Nowadays, there are wide varieties of innovative instruments capable to limit the risk (e.g. adjustable rate debt, adjustable preferred stock, collateralized mortgage obligation bonds, etc.). These products expose their holders to considerably less risks. Besides all these instruments there has been introduction of very efficient risk management instruments like interest rate futures, interest rate options, stock index futures, and so many other instruments. Among the risk management strategies developed or improved over the last decades we can refer to asset/liability management techniques, better risk assessment and measurement techniques, and development and improvement of hedging strategies.

Agency cost is another motivating force behind much financial engineering. This asserts the fact that structure of modern corporate ownership
and control is in such a way that corporate managers simply do not always have the best interest of the firm’s owners. The cost to the firm from the separation of ownership and control are not generally apparent and is difficult to measure, but market for the firm’s stock will often tell the tale. Many of financial innovations during 1980s were due, at least in part, to their ability to reduce agency costs. LBOs are a clear example. Securing the capital to make LBOs possible required new forms of financing, inspiring still other innovations, for example, junk bond market (30, pp.19-62).

2.3.2 Scope and End Users of Financial Engineering

Financial Engineering activities are generally concentrated in the financial services industry. Increasingly, however, a demand for competent Financial Engineers is also found in treasury departments of non-financial corporations and in public institutions.

On the capital markets side, financial engineers are responsible for structuring and marketing complex financial products, developing sophisticated trading and risk management strategies, and engineering solutions for a wide variety of complex financial problems faced by corporations, state and local governments, international agencies, and sovereign governments.

In many respects financial engineering and financial risk management are different sides of the same coin. Whereas risk management seeks to identify market or individual instrument risk exposure and uses exchange-based or over-the-counter instruments to hedge that risk when market conditions indicate the process to be necessary and sensible, financial engineering creates products and strategies with designed payoff profiles which are, at least up to a point, independent of the impact of volatile markets. Also it is possible to structure some straightforwardly engineered products using exchange-based derivatives, which possess special features (29, pp.10).

On the financial technology side, financial engineers interface between the capital market personnel, the operations personnel, and the technologists responsible for supplying the full range of technological support that is vital to the proper functioning of a modern financial marketplace. The effective
management of these interfaces as a strategic partner is essential to maintain competitiveness in global markets (30, pp.7).

In modern markets, there are many market participants who turn to financially engineered products for their fund raising, investment or risk hedging needs. The end users of financial engineering are: financial institutions trying to manage their risks or asset-liabilities, corporate treasurers wishing to achieve a reasonable band for interest and currency rates to enable them to plan and project cash flows from investment projects, equity fund managers, bond fund managers seeking to reach high level of performance growth with limited risk; and also individuals looking for high returns on their savings with limited loss potential (29, pp.5).

2.3.3 Tools of Financial Engineering

Financial Engineering is as an important profession within the financial services industry. Financial Engineering is built on analytical foundations, and the discipline also draws heavily upon the theoretical foundations of modern finance. Financial Engineers require a broad but specific knowledge of financial instruments and markets, accounting and tax rules, and information technology. Financial engineering use a vide variety of instruments, theories and ideas, and processes in its operation to custom design solutions to incredible array of problems in finance. All these knowledge, instruments, processes and rules together are considered as tools of financial engineering. These tools can be divided into two broad categories including:

- conceptual tools
- physical tools and process

2.3.3.1 Conceptual tools

The conceptual tools involve the ideas and concepts which underlie finance as a formal discipline. These are essential knowledge base for people who are working in this field. Examples of conceptual tools are valuation theory and its application, portfolio theory, risk and return measurement, hedging theory, accounting relationships, and tax treatment under different forms of
business organization, understanding interest rates and exchange rates, speculation, arbitrage, and market efficiency etc.

2.3.3.2 physical tools and process

The physical tools of financial engineering include the instruments and the processes which can be pieced together to accomplish some specific purposes. The processes include different trading mechanisms and techniques, such things as electronic securities trading, public offering, private placements of securities, self registration, and electronic fund transfer and any other innovative methods or different requirements to reduce the cost of transaction or risks or any other problems existing in the trade processes. At a very broad level, the basic instruments are cash market instruments and derivatives (30, pp.7-8).

I. Cash market instruments including debt market instruments like fixed income securities, and equity and equity related securities. Cash market characterized by delivering of traded asset, either immediately or shortly thereafter. Payment usually is made immediately, although credit arrangements are sometimes used.

II. Derivatives are financial contracts whose values depend on the value of some underlying assets or references. They serve valuable purposes in providing a mean of risk management, speculation, arbitrage, and efficient portfolio adjustment. In contrast with cash market/spot market, derivative markets are for contractual instruments whose performance is determined by how another assets, indices, or price references perform. Derivatives can be in different forms varying from plain vanilla to exotics. The four most basic types of derivatives stand out: forward contracts, futures contracts, swaps, and options. Typical forward, futures, and swap contracts are self financing or zero cost instruments.

Forward contract represents the obligation on both parties of transaction to buy/sell an asset at pre-specified price, at predetermined future date. Forwards are traded in OTC market and all the terms regarding the transaction are subject to mutual agreement between two parties.
**Futures** contract is standardized form of forward contract traded in futures exchanges. The transactions are carried out through clearing association along with different requirements to minimize the possibility of default risk associated with forward contracts. The key distinguishing feature of forward and futures contracts is that future positions call for daily settlement of cash (i.e. making to market), rather than single settlement of cash flow at maturity.

**Swaps** are forward transaction involving an exchange of promises, two parties agree on a swap rate on a notional principal and series of maturity dated. A swap is really just a portfolio of forward contracts. In fact two counterparties exchange cash flows in future based on a predetermined formula.

**Option** is a contract between two parties-a buyer and a seller- that gives the buyer the right, but not obligation, to purchase or sell something at later date at a agreed price. Option buyer pays the seller a sum of money called premium. Options enable their holders to lever their resources while at the same time limiting their risk. Options are traded in both OTC and option exchanges markets.

Derivatives are subject to default risk and resulted replacement risk, especially in case of forwards, futures and swaps whichever way the prices or references change one of parties has an incentive to default, but in contracts traded through exchanges it is minimized through exchange mechanism (36, pp.3-20).

Derivatives markets have expanded dramatically in recent years. The main gain from derivatives is to permit individuals and firms to that they would not be able to achieve without derivatives or could only achieve at much greater cost (hedging). When individuals and firms can manage risk better, risks are born by those who are in the best position to bear them and firms and individuals can take on riskier but more profitable projects by hedging those risks that can be hedged. As a result, the economy is more productive and welfare is higher.
A second important benefit from derivatives is that they can make underlying markets more efficient. First, derivatives markets produce information. Second, derivatives enable investors to trade on information that otherwise might be prohibitively expensive to trade on. The lower costs of transaction and higher liquidity of markets resulted from derivatives has led to operational advantages and market efficiency (37).

The users of derivatives: The users of derivatives are individuals, nonfinancial firms, and financial institutions. Firms use derivatives for hedging as well as other purposes such as smoothing earning and reducing the present value of their tax liabilities (Graham and Rogers, 2002), and speculation (38). Use of derivatives to hedge, lowers return volatility of firms and the stock return exposure to market risks. Guay (1999) shows that when firms start using derivatives, their stock return volatility falls by 5 percent, their interest rate exposure falls by 22 percent, and their foreign exchange exposure falls by 11 percent (39). Clearly firms do use derivatives for hedging, although if firms hedged systematically, they would use derivatives much more (Guay and Kothari, 2003) (40).

The accounting treatment of derivatives is sufficiently complex so that derivatives can be easily used to decrease or increase reported earnings to hide the earning profits with the aim of smoothening the earning or taking advantages of lower taxes.

Financial firms/institutions such as banks and investment banks make markets in derivatives, but they also take positions in derivatives, more likely for risk management with the aim of reducing the probability of financial distress.

In case of individuals, little is known about derivatives use by them. Shiller (2003) makes an important point concerning the use of derivatives by individuals, which is that the opportunities for individuals to hedge risks that matter to them with derivatives are extremely limited (41).

Risks associated with derivatives: Though derivatives can make underlying markets more efficient, and provide better opportunities for managing risk observers have long been concerned that they can also disrupt markets because they make it easier to build speculative positions. They have been
criticized for having been the source of large losses. There is no doubt that derivatives are powerful instruments, but typically they contain a high degree of leverage resulting to a large gains or losses for a small price changes. The temptation to speculate when one should be hedging is a risk that even the knowledgeable often take. Excessive confidence on the ability to forecast prices and interest rates and acting based on them by using derivatives can be extremely risky (36, pp.16-20).

Derivative trading does not require much cash investment. As a result, their trade can look very profitable when its revenue is compared to the required cash investment. Derivatives may look profitable using traditional accounting, but when the cost associated with the increase in risk is properly taken into account, they may not be. Proper evaluation of the profitability of derivatives requires taking into account the capital required to support the risks of derivatives. The ignorance the cost associated with the increase in risk brought about by derivatives trading, leads to overstate of profitability.

Since 1994, regular users of derivatives have made considerable progress in measuring the risks of derivatives portfolios. The two most popular approaches are a risk measure called value-at-risk (VaR) and stress tests. With these tools, firms that use derivatives regularly know their risks reasonably well. But these measurement tools do not always work well.

It should be noted that derivatives are typically evaluated and priced assuming there are no frictions in financial markets and often some other more technical assumptions. However in reality there are market imperfections affecting performance of these instruments.

**Pricing of Derivatives:** With the assumption of no market frictions (and, often, some other more technical assumptions), one can find a portfolio strategy that does not use the derivative and only requires an initial investment such that the portfolio pays the same as the derivative at maturity. The portfolio is called a replicating portfolio or tracking portfolio. The derivative must be worth the same as the replicating portfolio if financial markets are frictionless, since otherwise there is an opportunity to make a risk-free profit (the term of art is an arbitrage opportunity).
Fischer Black and Myron Scholes, in their path-breaking work provide a mathematical solution for the option price, the Black-Scholes (1973) formula, and for the number of shares held in the replicating portfolio at any time during the life of the option under some assumptions (35). This formula led to the development of the formula is now part of valuation models which are more sophisticated than the Black-Scholes model, and known as derivative valuation models based on principle of no arbitrage.

In real world there are considerable departures from the assumptions in pricing models and there is no general agreement regarding the better model of pricing. Even relatively simple derivatives contracts can be misvalued substantially. Valuation issues are much more complex when trading is illiquid and available prices, if any, do not offer a good measure of the price at which a derivative can be traded. This is the case in more customized product with complex structure.

2.3.4 Application of Financial Engineering

As it was mentioned before financial engineering can be in wide varieties of financial operations and strategies, for instance, asset/liability management, tax driven deals, risk management, arbitrage and speculation, leverage buyout and restructuring, structured finance, portfolio management, and so many other cases. But in general may classify financial engineering application in three major categories including:

- Hedging and risk management;
- Arbitrage and speculation;
- Structured finance.

2.3.4.1 Hedging and Risk Management

In the face of risk, financial engineering can offer two extreme alternatives: First, risk can be replaced with certainty in which adverse and beneficial part are both removed. Second, replacing adverse risk and leaving the beneficial part alone. In many cases, the eradication of risks is just what is wanted, but it is easy to imagine the desire to eliminate only the adverse risk
and leaving the beneficial one in place. The second alternative illustrates a perfect hedge which is impossible in practice. Between this two extreme, financial engineering is that it offers an almost unlimited range of possibilities, allowing deals and hedges to be tailored precisely to match individual requirement.

**Hedging:** Hedging may be defined as a position taken as a temporary substitute for a later cash position. That is the taking a derivative position opposite to the existing exposure. A hedge is a financial instrument whose sensitivity to a particular financial price offsets the sensitivity of the firm’s core business to that price. In the financial markets in recent years, derivatives are playing an important role in the process of decision making of investors, corporations, and investment funds. Derivatives can be considered not only as tools for hedging, but also as means of controlling risk that means reduce risk when one wants to reduce, and increase when one wants to increase it. The specific feature of derivatives such as low transaction cost and ease of use of derivatives have given flexibility to the firms to make adjustments to the risk of a firm or portfolio.

**Risk management:** The critical importance of using derivatives properly has created a new activity called risk management. Risk management can be considered as the practice of defining the desired level of risk, identifying the firm’s current level of risk, and using derivatives or other financial instruments to adjust the actual level of risk to the desired level of risk. Risk management has also started entirely new industry of financial institutions that offer to take positions in derivatives opposite the end users, which are corporations or investment funds.

The finance literature describes risk management as being concerned with identifying a firm’s exposure to financial risk where financial risk is defined as the variability in cash flows and market values caused by unpredictable changes in commodity prices, interest rates and exchange rates. Nowadays, risk management process has improved the practice of hedging from a simply taking a position in derivatives to reduce risks to a strategy to get desired level of risk, and controlling that according to their objectives.
Impetus toward greater attention towards risk management is the result of number of factors, most notably, the increased volatility of interest rates, exchange rates, commodity and equity prices, and increased importance of multinational corporations, and several other factors. Along with these factors the explosion in information technology made it possible to do numerous and complex calculations necessary to price derivatives quickly and at lower cost and to keep track of positions taken.

**Motives for Hedging and Risk Management:** In the Modigliani-Miller world where there is no imperfection such as transaction costs, information costs, taxes, they argue that shareholders can do financial transactions as well as firms. Even hedging and risk management which can be considered as financial decision can be practiced by shareholders by adjusting their personal portfolios; and so there is no need for firm to practice hedging or risk management. However this ignores several important points. In a world with imperfections, most firms can practice hedging and risk management more effectively at lower cost with compare to individual investors or shareholders. This is the result of their size and investment in information, giving them advantage over their shareholders and individual investors. The reasons behind hedging are same to those for risk management. In general, the theoretical justification for hedging and risk management is that their implementation must create value for shareholders and give them what they cannot get by themselves (7, pp.740-742).

Hedging or risk management benefits are related to the market frictions such as bankruptcy costs, taxes, and so on. The benefits of risk management can be as follow:

- Risk management/hedging can reduce firms’ expected tax payments
- Risk management/hedging can reduce cost of financial distress
- It allows firms to better plan for future capital needs and reduces their need to gain access to outside capital markets.
- It can be used to improve the design of management compensation contracts and also allow firms to evaluate their top executives more accurately.
• It improves the quality of investment and operating decision.

Taxes play an important role in most financial decisions. Through hedging firms reduce their expected tax liabilities. The tax gains accrued often are the result of asymmetry between tax treatment of gains and losses. This is done by reducing the volatility in firm’s earning. The empirical relevance of tax incentives to hedge have been established by Graham and Smith (1999). They show for the average U.S. firm that a 5% reduction in earning volatility reduces the tax burden by 3% of taxable income, in some cases even by 8% (42).

Distress costs include costs arising from conflicts between debt-holders and shareholders, and the costs arising from reluctance of major stockholders to do business with a firm having financial difficulties. Risk management or hedging firms’ risks may increase its value by reducing the probability of distress in future. In fact, some adversity associated with high leveraged companies can improve the problem through hedging (43). All these can lead to higher rating for firm and as hedging opportunities improves, firms can choose more highly leveraged capital structures and take more tax advantages through increased tax shield and also the advantages relating to debt financing.

Internal funds are viewed as cheaper sources of financing and that is due to better information, tax reduction, and lower transaction costs. Because of differences between the costs of external and internal capital, firms’ investments closely correspond to their cash flows which is usually very volatile. Firms have tendency to over-invest or under-invest depending on the availability of internally generated cash flow. To the extent that hedging reduces the variability in cash flow, it can increase the value of firm. In other words, when it is costly to firm to delay or alter the investment plans with limited access to the financial markets, hedging benefits them (44).

The conflicts of managers and shareholders are costly. In order to minimize this conflict costs, the executive compensation should be designed to expose managers to the risks associated with factors can be controlled by them, while minimizing exposures to the other risks over which the executive has no control. Firms may be better able to obtain their objectives with a simple performance-based contract if they allow their managers to hedge the
appropriate risks and compensate them in a way giving them incentive to hedge. In addition, firm will be able to evaluate its executive more accurately. In this condition, earning will be a more accurate indicator of managerial performance when extraneous noises in earning are removed or at least limited.

Hedging and risk management can reduce the variability in company’s core business. This provide management at the firm with better information necessary for decision making, thus improve management decision making (45).

Sometimes what company practice is not just hedging but rather it is practicing risk management, for example; when a firm goes into a particular business despite of its risks. In this case, they may hedge risks which may be completely different from that business risk accepted by firm to allow them to concentrate on their main business. In fact, through risk management they set the current level of risk to the desired level of risk.

Some firms use risk management as an excuse to speculate in areas where they have less expertise than they think. They practice risk management because they believe that they can forecast movements in the underlying sources of risk. When the sources of risk is unrelated to the firm’s basic line of business, the consequences of bad forecasting combined with highly leveraged derivatives can be terrified. Even it is possible that firms manage risk because they believe that there are arbitrage opportunities.

As it mentioned before, reducing risk is not by itself a sufficient reason for hedging or managing risks. To the extent that risk management reduces the costly process of bankruptcy, saves taxes, and makes it easier for firms to take advantages of profitable investments, value is clearly created (36,687-688).

Objectives and Efficiency of Hedging and Risk Management: Before any decision regarding hedging strategy or managing risk, firms must determine what they concern about. In fact they have to clarify their main objectives of hedging, which are the major incentive for risk management, and their risk tolerance determining the acceptable risk level. The objective may be to achieve a target financial results with various characteristics, or maybe to maintain the present status or at least to limit their risk arising from volatility.
Some of the best-articulated hedging programs in the corporate world will choose the reduction in the variability of corporate income as an appropriate target. This is consistent with the notion that an investor purchases the stock of the company to take advantage of their core business. Other companies just believe that engaging in a forward outright transaction to hedge each of their cross-border cash flows in foreign exchange is sufficient to deem themselves hedged. Yet, they are exposing their companies to untold potential opportunity losses. It is important to set proper objectives based on firms' exposure and the main incentives behind hedging. Therefore, firm exposure must be determined and quantified through sophisticated techniques. There are different techniques used for this purpose such as; regression method based on historical data, simulation methods as a forward-looking method, pre-specification of factor betas using theoretical knowledge, or volatility. Nowadays, perhaps the most popular way to measure risk exposure is Value at Risk (VAR) defined as the worst loss possible under the normal market conditions for a given time horizon. It is determined by the time interval under consideration and by what manager considers as normal condition. VAR is a standard methodology used for measuring risks to value a portfolio of derivatives or other securities (7, pp.774-778). When exposure is quantified, hedge instruments must be determined to fit the preferences and the view of the senior management and the board of directors. Not every structure will work well in every environment. Therefore the hedge effectiveness can be defined as the degree to which a hedge adequately matches the movements in the position to be hedged. It is the degree of correlation between two prices representing the price closeness with which their movements track one another. The effectiveness of hedge is often specific to the situation and depends on the strength of relation between the position to be hedged and the hedge instruments, which can vary greatly by market. Moreover, the goals of managing risk are typically unique to each situation. The other important concept regarding hedging is the costs associated with hedging. Although hedging is not costless, not all hedges will be equally costly. Efficiency of hedge is determined by two factors, namely hedge effectiveness and cost of
hedge. Efficient hedge provides maximum reduction per unit of cost (46, pp.172-176).

2.3.4.2 Speculation and Arbitrage

The efficient market hypothesis (Fama1965) maintains that market pressures brought about by intense competition among speculators and arbitragers to exploit information and price discrepancies will ensure that competitive markets are informationally efficient at all times. This means it is not possible to earn return in excessive of a fair return associated with the risks involved. In early 1980s, Grossman and Stiglitz argued that it is inconsistent to believe that market efficiency can be product of speculation and arbitrage as a privately costly function, and also believe that they will not rewarded. If there were no reward or profit in their application, then these activities would stop and in that case, how could markets continue to be efficient? Therefore, it should be accepted that there is an equilibrium degree of inefficiency. In fact, there is enough inefficiency, at least on occasion, to provide a return to speculation and arbitrage, but no so much that the return is excessive (47).

The question of market efficiency, or lack of that in market is critically important to financial engineers. Much of financial engineering over the last decades has sought to develop new and innovative instruments and strategies to exploit price discrepancies opportunities.

Speculation: Speculation involves contemplation of the future, formulation of expectation, and taking of position in order to profit. Speculators are basically forecasters acting upon their forecasts in where prices are determined by the transaction of supply and demand. Thus, it is largely a matter of forecasting the evolution of demand and supply. Successful speculation depends on the acquisition of superior information and or the ability to interpret information and its implications better than others.

Role of speculation: There are many arguments in favor of speculation activities. The cumulative effects of speculators function have a very significant effect. They operate in response to their information acquisition and analyses, and any changes that subsequently result should represent movements toward
market clearing, so they bring information to the market. They help market in evaluation of information by gathering and analyzing them for getting proper position to profit, providing faster prices reaction to the changes in market conditions. Other beneficial operation of speculators is their help in the allocation of resources across time, particularly for those goods that are harvested (in commodity market) during short period of time, but the stocks of which must last for much longer periods of time. Other characteristic speculation is the risk-bearing nature of it. At any given time, when there is large number of hedger on one side of the market and lack of hedger taking the opposite position, the bearing of hedger’s risk is done by speculators for profit or in better word reward (46, pp.224-228).

**Application of Financial Engineering in Speculation:** Speculation is where someone wishing to take advantage of a particular view of the market can speculate on anticipated changes, thus creating an exposure where none existed before. It often takes the straightforward form of buying something whose price expected to rise or selling one whose price is expected to fall. It must be noted that, it is not always necessary to use derivatives to speculate, but tools and techniques of financial engineering can prove very advantageous for number of reasons.

- **Gearing.** Most instruments particularly derivatives offered by financial engineering for this purpose, are highly leveraged. They allow speculators to adopt positions with minimum capital outlay.

- **Ability to provide complex strategies.** Using building block approach, through financial engineering, it is possible to create highly tailored exposures and strategies that would be difficult to achieve any other way. For example, a speculator could bet on a narrowing in interest differential between two currency, or could position himself to take advantage of market moving within a specific range of prices.

- **Ability to create exposures impossible otherwise.** Some views are simply impossible to take advantage of specially without using derivatives. For example for the speculator believing that market volatility will decline have little choice but to use option (28, pp. 312).
**Arbitrage:** Arbitrage is an activity with a long history and involves two or more simultaneous transactions in different markets in order to take advantage of price discrepancies between them. Unlike speculation, arbitrage profit is from discrepancy in price relationship. In the academic word, it is often described as a profitable business actively involving no investment and no risk (academic or pure arbitrage) by simultaneous activities in multiple markets. But in the reality, arbitrage generally can not be effectively conducted without some, at least temporary, investment and it is rarely completely risk free.

**Types and Role of Arbitrage:** There are many different forms of arbitrage. The most obvious form is spatial or geographical arbitrage in which arbitrageurs seek to profit from the price discrepancy among markets. In order for spatial arbitrage to be profitable, the price discrepancy between two markets must be sufficiently large to cover the transaction and transportation costs, and also conversion cost, if arbitrage is between two different currencies. Another type of arbitrage is temporal arbitrage through which arbitragers try to exploit profit from the differences between spot and forward prices and it will be profitable if spot and forward prices differ by enough to cover cost of carry.

In addition to these two types of arbitrage, creation of various forms of financial instruments besides many of trading strategies appeared recently on the financial landscape has given profitable opportunity to arbitrageur operations, called arbitrage across instruments or conversion arbitrage. Any creation of new instrument through existing instruments or decomposition of financial instrument to achieve new one with different features (creation of synthetic instruments, zero coupon bonds from conventional bonds, creation of collateralized mortgage obligations from whole mortgages, creation of swaps from forwards, etc ), providing any deviation in pricing equilibrium can be exploited by arbitrageurs. There are also other forms of arbitrage including; arbitrage across risk and tax arbitrage. In the arbitrage across the risk one party sells its own low-risk debt to raise funds to purchase high-risk assets. Insurance is an example of arbitrage across risk. Insurers take on many individually large risks and, through the pooling of these risks, dramatically reduce them. This is also the kid of risk reduction common in other forms of diversification where
through the proper structuring and diversification of portfolio, very risky positions can be held with very little overall risk. The preferred stock issued by low-tax corporations and held by high-tax corporations is an example of tax arbitrage.

The action of arbitrageurs is actually beneficial on the whole because, in driving up under-priced instruments and driving down over-priced ones it rapidly restores market prices to their natural equilibrium. In fact the arbitrageurs operation helps to ensure that prices of similar instruments are comparable (28; pp.313, 46; pp.230-236).

Application of Financial Engineering in Arbitrage: Financial engineers have been very active in all aspects of arbitrage and critical to their activities are the relationship between the prices of assets having different maturities, different risks, different temporal, different special features, and different tax characteristics. There is a great amount of inter-related financial products, and in many cases, it is possible to synthesis one product from a combination of others (for example, interest rate swaps are similar to a strip of FRAs). Synthetic securities are cash flow streams created from a combination or decomposition of the cash flows associated with a set of instruments that exactly replicate the cash flow streams associated with a real instruments. By appropriate combination of instruments and derivatives, it is possible to synthesize the cash flow of virtually any security. The question of, if it is better to hold a real security or the synthetic one depends on the users of this instruments. For an arbitrageur, the issue will be which instrument or strategy provides greater spread over its implied rate. There is a close relationship linking the prices of comparable instruments and under normal circumstances, the actual prices of related products will follow this relationship almost exactly though, the prices may deviate for a short period in turbulent markets or in a large physical separation among markets. This can be an opportunity for arbitrageur to intervene. For practical purposes, it can be assumed that market prices of inter-related instruments are in line with one another. Thus, for the users of widely quoted financial engineering tools such as, swaps, caps, and so on, more effective method will be looking for most appropriate strategies giving
them opportunities for profitable operation rather than looking around for mispriced instruments that rarely exist.

There is no question that speculation and arbitrage make prices more efficient, and there is also no doubt that financial engineering with its stress on innovative new ways to exploit inefficiencies have themselves contribution to make the market more efficient. As markets become more efficient, fewer exploitable opportunities remain and finding them up require even more effort. Financial engineering detest efficient markets, yet their activities facilitate new forms of speculation and arbitrage which are the driving forces behind the market efficiency. The financial engineers’ struggle is to continuously search for new opportunities, new ways to trade, and even larger scale on which to trade in order to exploit ever shrinking margins.

2.3.4.3 Structured finance / Development factors and Major Motives

Financial activities have been a part of global economics framework for centuries. Lending, borrowing, speculating, investing and hedging, have been employed for years in order to provide specific goals. As forces of deregulation, technology and capital mobility have taken firmer root in the landscape of the late 20th and early 21st centuries, the financial market place has evolved, becoming increasingly useful, efficient and sophisticated. Now, it is common for institutions relying on basic capital raising instruments, to turn to a range of highly customized instruments to achieve their goals.

Structured finance relates to a group of complex financial instruments and mechanisms that defers a simple universal definition, but broadly defined it could be described as referring to the repackaging of cash flows that can transform the risk, return and liquidity characteristics of financial portfolios (48). A more straightforward interpretation is provided in BIS (2005), where structured finance is defined as a form of financial intermediation which is based on securitization technology: Structured finance “… involves the pooling of assets and the subsequent sale to investors of claims on the cash flows backed by these pools. Typically, several classes (or tranches) of securities are issued, each with distinct risk-return profiles” (49). This definition clearly involves the
elements of (i) pooling of assets (either cash-based or synthetically created by using credit default swaps) and (ii) the tranching of liabilities that are backed by the asset pool. In addition, (iii) the credit risk of the collateral asset pool is separated from the credit risk of the originator, through the involvement of a Special Purpose Vehicle (SPV) or Special Purpose Entity (SPE) (50). Structured finance is strongly interrelated with securitization. And while it is a very broad concept but according to Fabozzi and Kothari (2007), in a narrow sense, it may be used almost interchangeably with securitization (51) see also: Blundell-Wignall (2007a and 2007b), Citigroup (2007) (52), and Criado and Ritel (2008) (53).

Structured finance denotes the art and science of designing financial products to satisfy the different needs of investors and borrowers as closely as possible. In this sense, it represents a specific technique and operation of financial intermediation business. Nowadays, the structured finance term has been provided with more specialized meaning, i.e. that of a set of products involving the presence of derivatives. The very reason of existence of structured finance market rests on the same arguments as the old-fashioned banking business. That was motivated as the only way for investors to provide funds to borrowers, just in the same way as any sophisticated structured finance product is nowadays constructed to enable someone to do something that could not be done in any other way or in a cheaper way under the regulation. In this sense, massive use of derivatives and financial engineering appears as the natural development of old intermediation business (54, pp.1-2).

Structured finance encompasses all advanced private and public financial arrangements that serve to efficiently refinance and hedge any profitable economic activity beyond the scope of conventional forms of on-balance sheet securities (debt, bonds, equity) at lower capital cost and agency costs from market impediments and liquidity constraints (55). In particular, most structured investments are in two broad forms:

- **Structured assets:** This class of assets includes instruments that are created, decomposed or restructured in some patterns to redirect or alter cash flows. Traditional asset classes are combined with contingent
claims, such as risk transfer derivatives and/or derivative claims on commodities, currencies or receivables from other reference assets.

- **Synthetic assets**: It is defined to include instruments that are created exclusively out of one or more derivatives. The traditional asset class is replicated by synthetization or new financial instruments. In this case, the resulted synthetic asset generates cash flows corresponding to the end user requirements.

While in some instances, both classes of assets can be used to achieve the same results, in others, one may be more advantageous than other

**Key factors for development of structured finance**: Some of the most elemental and popular instruments of financial markets are structured assets dating back to the 19th century, such as convertible bond or the first commodity-linked bond in the same era. While these type of assets have been in existence for several decades, but they have gained increasing attention and use since 1990s. The greatest amount of financial innovation and growth has occurred in more recent years. The key factors to this growth have been; improvement in derivative valuation methods, technology, legal structuring, market liquidity, international capital flows, and financial creativity which together has led to the development of customized and sophisticated structures.

Introduction of option pricing method by Black, Scholes, and Merton in early 1970 was a revolutionary for pricing derivatives and also synthetics, as options are a core constituent of many of instruments. Improvement of computing capacity, and simulation-based pricing, has resulted in creation of more complex structures. Progress in networking and communications with providing electronic trading platforms, electronic communication networks, have facilitated on-line OTC product trading including structured and synthetic product. Clarification of the legal environment along with use of standardized legal documentation has made it easier for transaction parties. Market liquidity has been an important factor in development of various instruments, because without a liquid market for instruments benefited from active two way flow, it would be difficult to create another asset. The financial creativity of intermediaries has been a catalyst in structured and synthetic assets
development. They provide products in response to the request of their clients. The intermediaries’ ability in applying financial engineering techniques to create entirely new products has helped market development. Leading intermediaries are able to use their knowledge of markets, clients’ requirements, and valuation techniques to develop useful and customized assets.

**Motives behind structured finance:** Financial and non-financial institutions in both banking system and capital markets may use structured finance if either; established forms of external finance are unavailable, or depleted for a particular financing need, or traditional sources of funds are too expensive for issuers to mobilize sufficient funds for what would otherwise be an unattractive investment based on the issuer's desired cost of capital. In capital market, the main goal of financial management which can be facilitated by structured finance can be categorized as:

- **Funding:** The attempt in external financing through capital market is to do so in optimal form, meaning lowest cost of funding while maintaining a balanced portfolio of liabilities across markets and maturities. Synthetic and structured liabilities are used to both lower funding costs and provide new investors and market access.

- **Hedging:** To protect against different exposures faced by institutions and minimize chance of loss, the appropriate hedges are essential. Synthetic and structured contracts can be used to create the best possible hedge for the exposure.

- **Investing:** In any investment the attempt is to achieve the investment goal in a rational and cost-effective manner by optimizing risk/return profile, and synthetic or structured assets, are often effective mechanism for increasing return while preserving desired risk profile.

- **Speculating:** An institution responsible for asset returns by taking a greater amount of risk, will implement its speculation program to achieve its investment goals, and structured finance permit the establishment of maximum speculative position regarding complex and volatile risks and leverage.
Certain other forces supplement the above mentioned factors, serve as additional drivers including; regulation and market access, asset creation, liquidity creation, balance sheet optimization, pooling and diversification, and tax benefits.

In brief, structured finance offers issuers enormous flexibility to create securities with distinct risk-return profiles in terms of maturity structure, security design, and asset type, providing enhanced return at a customized degree of diversification suitable to an individual investor’s desire for risk. Hence, structured finance contributes to a more complete capital market by offering any mean–variance trade-off along the efficient frontier of optimal diversification at lower transaction cost. New products are created to fulfill the specific needs in the best way, and their profit stream can be sustained when they meet client demand (12, pp.1-5).

I. Building Block Approach to products

The building block approach first was suggested by Smithson (1987), for financial engineering and products. According to this approach, the instruments are less different than first they meet the eye and complicated looking instruments, can be broken down into just a few simpler instruments, while even the simpler instruments can be broken down into small basic components (56).

The creation of any asset depends critically on the existence of various financial and legal tools. Financial instruments and contracts exist because a set of building blocks is available to structure and reshape cash flow and exposures. In fact, any complex structured or synthetic asset can be decomposed to the elementary parts which can be used in different forms providing different characteristics. The building blocks will be arranged and combined regarding the users’ attitude and needs. The essential instruments and vehicles of structured and synthetic asset world can be classified in three broad categories:

**Derivatives:** Derivative as the contracts that derive their value from other market references, have expanded and evolved rapidly during last few decades and now are an integral part of the global financial markets. Derivatives-standardized exchange traded and customized OTC traded-all are essential
building blocks of financial marketplace. Their ability in hedging or transferring market and credit risk, establishing leveraged/un-leveraged speculative position, portfolio diversification, enhancing return/yield on portfolios, creation of specified asset or investment portfolio, generating liquidity on an existing asset or liability, reshaping cash flow, lowering all-in funding cost, and so many other effects, have made them extremely popular.

**Host securities/liabilities:** Host securities are issued directly by companies, corporations, governments, either through public notes, self registrations, private placements, or transferable loans. These are another essential component of structured and synthetic asset markets, playing an integral role in conveying the economic risks and returns that intermediaries and end users seek. Even in case of synthetic instruments, while some of them are created on standalone basis, most are formed using of host debt securities. Host securities can be used along with derivatives and also they can accept embedded derivatives to provide specific need. Though transferable/tradable loans are not securities, but they have marketability features of securities. When a loan is marketable, transferring it to other bank or investor on a secondary basis, add a dimension of liquidity to the traditional loan product, making them more suitable for a range of structured asset transactions.

**Issuing/repackaging vehicles:** Cash flows can be altered by placing assets, liabilities, or other cash flows into an entity, who then issues its own liabilities to investors, particularly in case of structured assets. They can be a special purpose entities (SPEs), trusts, or investment companies and partnership. Their operations are advantageous through lowering friction costs and improvement in transaction economics (57, pp.154-187).

Financial engineering relates to creation of new products and strategies that are useful to intermediaries and end-users. It involves identifying the needs, determining how best to address the need, assembling necessary building blocks, and delivering the finished product. The foundation of any new synthetic or structured asset is that, any complex asset, liability, or off balance sheet contract can be divided ultimately into a discrete set of risk divers and associated cash flow. With knowledge regarding the associated risks and the
cash flow with an asset, it will be possible to construct, reshape, or deconstruct any type of asset around it. Financial engineering simply formalized the process (12, pp.9-42). The stylized overview of the players involved in structured finance is presented in figure 2.1.

![Structured finance: Key Market Participants](image)

**Fig. 2.1** Structured finance: Key Market Participants (58).

**II. Classification of structured and synthetic products**

New products (synthetic/structured) are created by intermediaries to address the end-users requirements. While some of them are successful and accepted in marketplace and achieve widespread uses resulted from joining other intermediaries and end users, some fail and discontinued. The new products must feature certain basic characteristics regarding the product itself, underlying market, and the regulatory environment, in order to succeed besides the recognition of the new product value by the participant in the market which is one of the major factors responsible for its success through providing more demand. Synthetic and structured assets can be classified in seven broad categories as:
Callable, Puttable, and Stripped (zero coupon) securities

These classes of structured assets are among the most established of financial markets. Their ability in transforming the maturity, interest and principal flows pattern to investors is most attractive features of this assets.

Callable/Puttable Bonds: Callable and puttable bonds are the combination of bonds and options that are issued directly by governments or companies.

Callable bond is the combination of a bond and a long issuer call option on bond prices or a long issuer put option on interest rates. In exchange for granting call option to issuers, the investors collect a premium in form of enhanced coupon. Callability of a security is primarily function of interest rates and then issuer’s credit spread (in the static rates). Decline in interest rates, provides opportunities to refinance in the lower rate environment, leading to exercise of option. In case of static interest rate, if credit spread of issuers improve in market term, it will be possible to call security and reissue debt at the tighter market spread, and so reduce the funding cost.

Puttable structures are less common than callable one and are issued several years after them. A puttable asset is the combination of a bond and a long investor put option on bond price or a long investor call option on interest rate. Issuers of puttable bonds pay lower coupon reflecting option premium. The option will be exercised if interest rate increase and strike price is breached, or if with a stat rates, the issuer’s credit spread widens beyond the strike, in which it will advantageous to put security back to issuer.

The option adjusted measure is used for valuation of callable/puttable bonds and any type of securities with uncertainty in their cash flow pattern and redemption date. Option adjusted yields are based on bond price and volatility (59). A bond is said to have fair price when the option adjusted yield for the bond with embedded option is equal to the same bond without option (60, pp. 99-109).

Advantages and Deriving Factors: Callable bonds allow issuers to take advantage of future rate decline to lower funding costs, and permit investors to earn an incremental yield in the interim. Puttable bonds permit investors to take advantage of future rate increase to boost yield, and allow issuers to lower all-in
funding costs in the interim. Both callable and puttable bonds provide arbitrage opportunities through the monetization of optionality. Investors in callable and puttable bonds include most major institutional parties, including mutual and pension funds, hedge funds, bank intermediaries, and corporations. The embedded option benefits have become a useful risk management tool for some, and effective way of increasing returns to other parties.

**Stripped Securities** represent structured cash flow interests that can be directly issued by sovereigns (e.g. governments strips), or by intermediaries trying to replicate the same economics. They are securities broken down into their constituent cash flows of interest and principal payments. In fact they are comprised of a series of interest only (IO) and principal only (PO) based on cash flows payable by the issuer of the original security, entitling the holder to an interest flow or principal flow. As these securities collateralized by government bonds in trust or custody account, investors will not bear credit risk of intermediaries. This market gained popularity over the years as the underlying securities that are manufactured permit to establishment of very explicit cash flows at set horizons, creating more cash flow stability than standard coupon bonds. The strip market can be a useful conduit for institutions seeking to match their asset and liabilities or immunize their portfolio.

**Advantages and Deriving Factors:** Striped securities permit investors to acquire specific cash flow from a given bond with minimum risk of default. They create opportunities to match duration and convexity requirements precisely, allowing for more effective risk and investment management. Since stripped securities are traded on discount basis, require smaller initial capital investment, this can be significant for those trading at a deep discount (e.g. long-dated PO strips). These securities give investors a certain and fixed redemption value if securities hold to maturity. They also generate tax advantage for investors who can place the securities in tax deferred account. Since a sufficient supply of bonds is essential in allowing strip market to develop, strip programs are suitable for national system with large amount of government debt eligible for stripping. Investors in strip securities are usually sophisticated institutional investors using the products to create specific portfolio risk management
profiles. The additional convexity and duration obtained from some securities are attractive choices for running diversified or complex portfolios.

**Mortgage- and Asset-Backed Securities**

This class of assets represent one of the most significant, innovative, and liquid elements of capital markets. They are complex fixed income securities backed by diversified pools of mortgage and other assets. They have transformed portions of illiquid real estate mortgage, and receivable/loan markets into liquid and tradable securities, freeing balance sheet of sponsor/originator from the capital or regulatory constraints in the process.

**Mortgage-backed securities (MBS):** The basic MBS is the mortgage pass-through security from which other MBSs are created such as collateralized mortgage obligations and stripped MBSs. They are created when an intermediary pools together a group of mortgages, and issues securities or participation certificates. The securities are conveyed to, and issued from, a bankruptcy-remote SPE or trust, the capital obtained from investors by the issuance of the securities is used to fund the portfolio of mortgages acquired from originator. In fact, it is a mechanism designed to collect and pass through all interest and principal flow from an underlying pool of mortgages to the investors holding securities. There are different types of mortgage pass-through securities such as agency pass-through, private label pass-through.

The most important risk associated with this group of assets relates to cash flow uncertainty resulting from prepayment of borrowed principal. This risk is the fundamental input in valuation of these assets. Other common characteristics of MBSs is the price compression or negative convexity implying lower price appreciation and higher price depreciation than on a standard positive fixed income security resulting from the prepayment option the MBS investor grants the mortgage borrower.

Collateralized Mortgage Obligations (CMOs) were developed to address the special risk requirements of investors through comprising of other structured assets such as pools of pass-through securities, whole loans and even mortgage strips. CMO bundle together pools of MBS and then rebranch them
into individual securities with different prepayment characteristics. In this mechanism, the cash flow of pass-through securities is redirected to different bond classes creating securities with different risk/return profiles, allowing investors to select a security with preferred risk/return profile. Designing these structures creates more liquidity and cash flow stability over a range of prepayment spread for investors seeking low-risk securities, rather than negative convexity characteristic of MBOs and allows more accurate asset-liability management and also allows originators to earn profit between collateral and the financing costs.

Stripped mortgage securities are comprised of two different securities receiving all principal flows, or all interest flows from the MBS pool. This two can be combined to create the underlying MBS, and arbitrage forces assure this condition. In case of any discrepancy, reconstitution activities accelerate till the arbitrage spread is eliminated. Strips are mostly issued via specialized trusts existing explicitly to issue the two classes of securities and manage the attendant cash flow some are issued as structures IOs and POs through the CMO tranching mechanism. The PO tranche is deep discount security redeemable at par. If rates fall and prepayments accelerate, the effective yield on PO will rise while increase in rates, prepayments will slow, the principal on mortgages remain outstanding for long period so effective yield over a long period will be very small. The IO is purchased without a specified par value, and the investor is entitled only to the interest coupon. IO is unique among fixed income securities in reaction to the rate movements, therefore can be used to hedge certain positions against adverse interest rates movements (12; pp.83-89, 60; pp.197-225).

Asset-Backed Securities: These are securities backed by cash flows from specific assets including receivables and certain types of loans, and generally is defined to exclude mortgage assets and MBS domain. ABS pools certain assets with relatively short maturities and some elements of credit risk, but relatively modest prepayment risk. The credit assets are sold to an SPE(special purpose entity) or trust on a non-recourse basis, with a pledged cash flow and a perfected security interest granted to investors, this isolate the assets from
originators. An ABS issue can be structured with fixed and floating rate tranches to appeal to the wider bases of investors. The main procedure of securitization is same to that in mortgage backed securities only the difference relates the characteristics of pooled assets. The major sectors of ABS are securities backed by credit card receivables, auto loans, home equity loans, manufactured housing loans, student loans, small business administration loans, and collateralized debt obligations (CDO).

A CDO is ABS, backed by a diversified pool of one or more types of debt obligations such as high yield corporate bonds, bank loans, emerging market bonds and etc. though it relatively new addition to the world of structured assets, but it has been instrumental in transforming intermediary and investor perceptions of credit risk investment and risk management. They are arranged for specific risk and financial management reasons or to capitalize on market opportunities. They offer good value relative to similarly rated corporate bonds with less risk as a result of diversified nature of collateral portfolio, but they are less liquid. The purchasing of relevant asset is done by SPE/trust through the issuance of various tranches of securities with different risk/return features. Typical CDO may feature one or more senior tranches and subordinated and a residual or equity tranch. The structure of tranches and amount of subordination and equity depend on size of profit spread and cash flow is distributed based on seniority. A CDO can be created as cash flow CDO relying on principal and interest cash flow from securitized portfolio to service outstanding notes or it may be a market value CDO which depends on both principal and interest streams and active management to generate debt services. CDO also can be a balance sheet CDO to optimize the sponsors’ balance sheets, capital and risk exposure by transferring portion of loan portfolio to third party investors through SPE. Arbitrage CDOs have grown rapidly over past few years to address sponsors and investors seeking to capitalize on market opportunities.

Besides cash funded CDO relying on true sale, there are structured and synthetic CDOs which have developed as the logical extension of asset classes and rely on derivative replication transfer rather than true sale transfer, to achieve the goals. In structured CDO, sponsor, via a SPE, issues a credit linked
note (i.e. combination of a bond and a credit derivative) referring individual loans in the target portfolio, the note transfers risk of loan into SPE, but without physical asset transferring, and it remain in the ownership of sponsor. The notes source the flows of principal and interest from the pool of reference loans or bonds, which is paid to investors. The structured CDOs avoid the security interest and transfer issues that characterized balance sheet CDOs, and simplify the process of hedging by allowing currency and interest rate hedges to be embedded within each individual note. On the other side, since each note represents a single pool obligation, they facilitate management process (49). Synthetic CDO uses credit derivatives (for example, credit derivative swap) to achieve same results and credit risk clearly transferred through the credit derivative swaps (CDSs). The main difference of synthetics CDOs is that they do not generate funding, and they do not require full amount of securities to be placed with investors because of their leverage effects only a small proportion will be sufficient to acquire the collateral necessary to source CDS covering all credit risk portfolio (61). Since the asset portfolio may include securities and CDSs, they provide greater flexibility in portfolio management* (60, pp.227-236).

**Advantages and Deriving Factors of MBS and ABS:** The standard securitization practices have made the development of these markets possible. The successful creation of these assets, based on the existence of some essential factors including: collateral pools in sufficient size and quality; creditworthy and capable asset originators and servicers; proper structural enhancement; and adequate legal structure and protections.

They provide investors with access to unique assets in customized manner regarding risk preferences and requirements and create an efficient mechanism by which investor purchases a desired asset in form of a tranche from an entire portfolio of asset by a single transaction resulting in administrative saving. They permit companies and other originators of future cash flows to monetize their stream of forward earnings for use in current period. By these structures originators are able to transfer certain uncertainties regarding the cash flows and risk exposures to the investors at a price. They transform illiquid mortgages

* - For more details see reference no. 44, Chapter 9.
and receivables into more marketable forms providing more liquidity of financial sectors, this ultimately results in lowering issuers’ funding costs and create more attractive and secure opportunities for investors in very wide range (12, pp.60-61).

**Structured Notes and Loans**

Structured notes and loans are comprised of a host security, mostly a bond, and one or more derivative contracts and in a very broad term encompass a range of asset classes including interest rates, currencies, commodities, equities, and credits. The common initial incentive in this class is a lowering of funding costs of issuers by combining market structure and a view on implied future rates or prices. In design of structured notes, factors such as; desired participation level of investors in future market movements, degree of principal protection, payment of interests or dividends, maturity, and optimal derivative use play an important role. The host issuers allow intermediaries to issue structured liabilities on their behalf, in exchange for a fee or reduced funding cost. Therefore, investors buying such securities will face little default risk associated with the host issuer. The structuring and issuance activities have shifted toward repackaging structure and the securities that ultimately placed by SPE or trust with investors take the form of notes or trust receipts respectively, featuring specific characteristics according to the demands of investors.

Interest-rate-linked notes are structured notes with embedded interest rate options. While a conventional floating rate note pays a coupon reflecting the prevailing short term rate, these structures are able to address different requirements when interest rate is low, yield curve is steep and interest rate volatility is on the rise, and allow investors and issuers to benefit. The key structures in this category include inverse floaters, leveraged floaters, capped and collared floaters, range floaters, step-up bonds, and bond with debt warrants. They can provide leveraged return for investors, enhance the coupon rate, and reduced funding cost for issuers, and also opportunities to capitalize the embedded option for both investors and issuers.
Currency-linked notes are structures allowing investors to capitalize on movement in currency rates and/or volatility. Two of the most popular include bonds with embedded currency options or warrants and dual currency bonds which are relatively complex series of spot currency transactions and swaps.

Commodity-linked-notes are structured based on common commodity references or broader commodity indexes. Their structures involve embedded commodity options, forwards, or swaps in fixed or floating rate notes. They can be issued by commodity producer hedging their core commodity risks, or by intermediaries and other institutions looking for monetization of market view. They primarily appear to support the commodity producer’s cost of funding through loan by selling embedded option on the product (28, pp.452-461).

Equity-linked notes are floated in various forms with embedded derivatives in forms of equity forwards, swaps, and options referencing individual equities, baskets, sectors, or indexes. The most popular derivative embedded in these notes is option, due to its unilateral contracts making its cash flow assessment more precise and existence of wide range of exotic equity option with more ability to create customized risk profiles for investors. An investor in a basic equity-linked security, purchase the security paying no coupon or a coupon below the market coupon, in exchange for appreciation (e.g. a call) or depreciation (e.g. a put) in the equity reference. The issuer benefits from a lower cost of funding resulting from premium payment. The issuer of note, similar to other notes, can sell identical/similar option to monetize value. Equity-linked structures generally feature a modest level of secondary liquidity, but are intended as “buy and hold” investment strategies* (30, pp.463-469).

Credit-linked notes (CLNs) are the combination of credit risky assets and derivatives, or risk free bonds and credit derivatives issued by highly rated host issuer or repackaging vehicle. In a broad classification they include basic CLN, repackaged or synthetic bonds, and credit portfolio securitization or collateralized debt obligations (CDO) explained under ABSs. The basic CLN is the package of low risk bond or floating rate note (FRN) and a credit derivative;

* - For more details refer to reference no. 54, Chapter 6.
it functions like a pass through providing investors with the returns of credit risky investment without need to own the underlying credit asset and as payout is dependent on the credit event. Investor usually act as credit protection seller while, like other structured notes, issuer act as pass-through, selling the credit derivatives it purchase from investors to the bank arranging transaction, to reduce its funding cost. Repackaged bonds as the second main sector of credit-linked notes in this class of notes proven popular because of their payout flexibility are securitized form of asset swap, packaging credit risky securities with derivatives into a synthetic bond. Issuance is mostly via an SPE rather than a corporate, creating more flexibility and cost savings, because no third party issuer compensation is required. Bank provide required credit risky asset from the marketplace, transfer it to the SPE entering into one or more derivative contract with bank reshape the cash flows to the profiles required by investors, creating relative value for investors. All structured notes can be leveraged to serve investors with opportunities of increasing return.

**General benefits of structured notes and loans:** This class of asset has proven to be an important element of investment, funding, and risk management strategies. They give investors access to asset exposure in unique forms, with asset references, maturities, currencies, leverage, and coupon/principal customized to address individual requirements. They allow investors not permitted to trade in derivatives directly to replicate their risk/return profile through securitized structures. They reduce administrative burdens, costs and also documentation expenses for investors, regarding separate derivatives transactions and limit their counterparty risks. They add market liquidity by transforming of illiquid assets to more marketable form, providing more attractive and managed investment opportunities. Structured notes lower the issuers’ funding costs not achievable otherwise. By transferring of derivative based exposures in funded form, they lower the counterparty risks faced by intermediaries. They make it possible to create synthetic, tradable references and allow participation in certain market by synthetically replicating existing assets that are in short supply and high demand. Structured notes
facilitate transferring of risk exposures of intermediaries and other users when they wish to hedge, diversify, or reduce (12, pp.101-102).

Structured Insurance Products and Contingent Capital

Insurance-linked securities (ILS) are structured to address the needs of insurance companies to increase their risk capacity and reducing or hedging their risks through the access to capital markets. ILSs are tradable instruments referencing insurance risk, transferring financial risk of an insurance event from insurer or re-insurer to end investors compensated by higher return on security. Insurance company issues securities through special conduit called, special purpose re-insurer (SPR), acting as the issuance vehicle and bases repayment of interest and/or principal on losses arising from defined insurance events. In fact through this elemental structure, new risk supply is created and insurer passes a defined exposure to capital market investors, lowering its risk profile. ILSs are issued in multiple tranches reflecting different features, allowing investors to select a desired level of risk and return and categorized into catastrophe bonds referencing hurricane, earthquake, windstorm, and non-catastrophe bonds referencing weather, residual value, trade credit, and so on.

Contingent capital issues provide for post-loss financing through structures arranged in advance of any loss and allow firms to raise capital during a defined commitment period if specific loss-making event occurs. Unlike ILSs containing aspects of insurance, reinsurance, and securities financing, contingent capital facilities are arranged purely as funding facilities or securities transactions with no element of insurance contracts. Since these facilities are arranged in advance of any loss, their cost does not reflect the risk premium that may become apparent after the distress making the facilities cost efficient across a range of financial scenarios.

General benefits of structured insurance products: They allow exposures transferring in an efficient and cost effective manner, and create additional risk capacity allowing insurers and reinsurers to continue their function without having to rely solely on the reinsurance markets and provide them and corporations with an additional risk management tools, and establish a formal
linkage between the insurance risk market and capital markets facilitating capital transferring, when it is necessary. The products permit investors to access a new asset class that is uncorrelated to other financial assets and offer higher returns (12, pp.143).

**Structured Equity Products**

Structured equity instruments like equity linked structured notes, provide investors with exposure to the equity markets by use of a fixed income security and simultaneously provide attractive funding opportunities for issuers. All structured equity products can result in the creation of new equities while equity linked notes only provide allocation of equity exposure from one party to another one. Key structured equity instruments are convertible bonds, bonds with equity warrant, buy/write securities, and other equity hybrids.

Convertible bonds are one of the oldest and most popular structured products, and combination of a bond and an investor owned equity call option in a single package. A conventional convertible bond is a debt/equity hybrid allowing investors to convert fixed income securities to a specified number of shares when a particular conversion price is reached. Convertible bonds present attractive funding cost and minimize the impact of share dilution. This product provide investors coupon below market level in exchange for preserving them potential upside capital appreciation. Their potential disadvantage is the uncertainty about conversion because there is no guarantee of conversion unless the conversion price is set at low level, which will increase the dilution level for a given target level of equity financing. If conversion does not occur, the issuer must arrange for refinancing for redemption at maturity so to realize the funding advantages, issuer must be relatively confident about the conversion over medium term. Due to the hybrid nature of convertibles, they expose the investors to a different range of risks depending on the state of the market and relation between values convertible and equity. The convertibles’ value increase with: increasing stock prices, volatility, tightening credit spread, declining rates, lengthening call protection and declining dividend. Convertibles can be callable or non-callable or they can be issued on puttable basis,
obligating issuers to redeem the bond on one or more put dates. Callable/puttable features of convertibles give investors the right to redeem the bond in cash terms or shares. The success of convertibles has led to development of many variations.

Bond with warrants is the package of bond with equity warrant. They like as convertibles, are capital market instruments allowing investors to generate fixed income earning while retaining an equity upside. Sale of warrants with bonds lowers the cost of funding and allows deleverage balance sheet if issuer choose to use new stock proceeds to retire the bond component. In some instances, warrants can be detached and traded separately. Bonds with warrants will be similar to convertibles, as long as the warrants remain attached to the bonds.

Buy/Write securities or covered call securities are built on the premise that equities can be decompose into two separate components, one paying dividend and the other that pays capital gain only. These securities can be issued through standard underwriting methods or via SPE, in which existing securities are sold to SPE and SPE issues the structured securities presenting individual components of income stream. Some of this products result in the issuance of new equity upon exercise and some are only for allocating of existing equity, so they are not dilutive.

There are many other equity hybrids some have been proven to be used continuously and some appear temporarily to play a role or take an advantage of specific market opportunities. Adjustable-rate preferred stock (synthetic instrument comprised of preferred stock that pays a standard fixed rate dividend and a swap changing the fixed dividend for a reference floating rate), and convertible preferred stocks (same to convertible bond except that the host security is preferred stock) are most popular.

**General benefits structured equity products:** This class of asset lowers the financing cost of issuers more than fixed income securities with the same maturity. The flotation of structured equity products lead to lower dilution due to de-leveraging process. They have return potential from both fixed income and equity-have ability to claim a minimum fixed income while retaining potential
equity market upside. They provide access to multiple investor bases. Among these, competitive cost of funding is the key motivating force for many issuers and indeed, convertibles can be cheaper in a short to medium term than other debt alternatives.

**Investment Funds, Hedge Funds, ETFs**

Investment funds comprise the broad class of asset portfolios that are financed by the issuance of fixed or variable amount of stocks. Since they transform capital of investor into pro rata interest in an entire portfolio of assets or financial contracts from the equity, fixed income, currency, and/or even commodity sector, they can be considered as a structured product. Most popular forms of investment funds are, open-end, closed-end funds, hedge funds, and exchange traded funds (ETFs).

Open-end funds are well established corporate vehicles to meet certain investment related objectives offering investors choices in a wide variety of funds from different asset classes, and sectors providing considerable flexibility as well as fee/cost. They can be organized as corporation trust or partnership while an independent custody such as a bank or trust must be determined to hold funds asset and monitor cash inflows/outflows. These funds react to order flow to issue more shares and Investors will be liable for taxes on dividend/interest and any capital gain, generated by fund.

Closed-end funds are professionally managed portfolios of securities listed and traded on exchanges and feature only a limited amount of leverage. They do not issue new shares on a regular basis in other aspects these funds are same as open-end funds.

Hedge funds have developed very rapidly over past two decades becoming the center of investors and regulatory interest. They mostly created to maximize return and have ability to trade across a wide range of assets and strategies and can freely comply derivatives, leverage, short selling and so on. They are flexible vehicles which attracted the attention of investors seeking larger return that may not be achieved with others. Hedge funds are often structured as private partnership and in order to access wide range of investors, set up multiple vehicles allowing capital to be directed to the appropriate
position. Shares, supply is limited and depends on the strategies the fund use to generate earning, it feature different tax characteristics (6, pp.289-298).

ETFs have several unique characteristics different from other funds. The key features include: ability for an authorized participant and the ETF trust bank to develop and liquidate interests in the fund quickly, allowing creation of new shares as well as redeeming the existing ones, and since underlying securities in the fund are traded and not sold, investors do not bear capital gains tax when they sell their shares. They provide continues trading throughout the trading day and lower cost structure allowing investors to create more economically attractive investment. All these funds backed or sponsored by major financial institutions or exchanges and are subject to meet certain exchange/regulatory requirements (12, pp.200-203).

**General benefits:** Several factors have led to strong growth in the structured investment product sector. They provide investors with exposures to a professionally managed portfolio of securities, with wide variety of risk and return characteristics to accommodate a broad range of investor styles. Portfolio management, transactional efficiency, providing continuity in an investment portfolio are other advantages of investment funds. They also allow investors direct their own asset or trade their own fund shares.

**Derivative Replication, Repackaging, and Structuring (Synthetic Assets)**

Derivative replication, repackaging and structuring refers to the processes using multiple derivatives to create entirely new synthetic assets or using derivatives to replace or restructure the assets already exist. Given the creativity of financial engineering, the number of products in this category will be very large, and even a small variation can lead to the creation structure with different investment and risk management results. In a very broad classification, the most common synthetic assets can be categorized in four classes including: synthetic long and short options and swap positions; multiple swap/option positions; and credit derivatives/synthetic credit positions, along with various sub categories within each sector.
The basic derivatives can be combined with another derivatives to create synthetic long and short positions (synthetic put or call options or synthetic swap positions). This is very powerful characteristics serves to expand investment and risk management. The creation of synthetic long and short call/put positions is very common to take advantage of yield enhancement and arbitrage opportunities. Nowadays, packaging of options in particular combinations to reflect views on market direction and volatility becomes an essential component of synthetic investment and risk management. This process can be extended to other investment/arbitrage positions.

There are situations in which multiple derivative contracts can be combined to create synthetic structures such as multiple swap/option and multi option, with specific payoff profile. The multiple swap/option positions can be used to create synthetic funding, achieve investment/portfolio goals, speculate on direction or volatility of rates, facilitate capital market access, and hedge improvement. Multi option strategies*, swaptions, and callable, puttable, and extendable swaps are the most common in this section (12, pp.220-225).

Credit default swap (CDS) has become the single most popular derivative instrument in credit market. CDSs of major credit issuers have become very liquid to the point that many end users and intermediaries prefer dealing in the derivatives rather than underlying obligations. Especially for the parties trying to establish short position in the reference credit when it is difficult to borrow and sell physical securities because of supply or regulatory issues. CDSs reshape risk or environment exposure in an efficient and cost effective manner. Therefore they are appropriate for diversification of portfolio and rebalancing efforts. The second major credit derivative is credit spread option. Both contracts are unilateral contract providing purchaser with compensatory payment based on a credit event (62).

**Key market derives of synthetic derivatives development:** Development of very specific risk and investment management goals has been one of the main forces behind the development of these instruments. Because provision of synthetic and structured derivatives is the direct function of needs of end users.

* - For details see reference no. 36, chapter 7.
Creation of synthetic asset and liabilities facilitates market access, lowering funding costs, and/or increasing returns. These instruments allow end users to participate in the markets that might otherwise be restricted and to express their desired view efficiently. They provide capital mobility and arbitrage conditions leading to monetization of funding and asset strategies. These instruments make complex hedging strategies possible in an efficient way.

2.4 Risk, Legal, and Regulatory Issues

Derivatives particularly the exotic one, structured and synthetic products besides all their benefits, are complex and risky instruments which need to be controlled properly from internal and external perspective. The main sources of complexity of these instruments relates to the specific process of their creation which adds to the layer of analytical complexities; involvement of default and non-default risks and bringing about higher possibilities of non-default risks such as liquidity risk, model risk, or those arising from third party involvement. All these together may pose unanticipated losses. The rapid evolution of structured finance and exotic derivative markets implies that new structures and asset classes are continually being introduced. As a result, unfamiliar structures create new opportunities for unanticipated behavior by holders or third parties, while the scarcity of data on the historical performance of new asset classes generates additional model risk. In other words, while these instruments can contribute to market completion and better dispersion of credit risk, they also give rise to a number of questions with potential financial stability implication.

The increasing weight of structured financial products has brought into the balance sheet of the financial intermediaries – both those involved on the buy and the sell side – greater exposure to contingent claims and derivative contracts. Most of these exposures have been new to the traditional financial intermediation business, not only for the nature of risk involved but also for the exotic nature of the payoffs involved.

There is broad consensus that structured finance played an important role in the development and propagation of the financial turmoil. For example, the IMF has concluded that “... the proliferation of new complex structured
finance products, markets, and business models exposed the financial system to a funding disruption and a breakdown in confidence” and that certain structured finance products “… likely exacerbated the depth and duration of the crisis by adding uncertainty relating to their valuation as the underlying fundamentals deteriorated” (63).

The financial turmoil revealed a number of weaknesses related to the use of structured finance which can be summarized as follows. In numerous cases, banks underestimated their exposures to structured finance products and to specific “off-balance sheet” vehicles which play an important role in this type of finance. Moreover, certain banks invested heavily in structured finance products, with retaining large exposures to specific structured finance instruments such as collateralized debt obligations, but without understanding sufficiently their impact on the banks’ capital and liquidity positions. In addition, in recent years banks in general resorted to more volatile funding sources including structured finance products. When the financial turmoil hit and structured credit markets came to a virtual standstill, the funding capability of specific banks. Furthermore, many of the globally operating banks had offered liquidity standby facilities to “off-balance sheet” vehicles engaged in structured finance, but generally underestimated the liquidity risk arising from off-balance sheet exposures. Finally, the financial turmoil has raised concerns that the process of securitization may have generated unwelcome incentive problems, in the sense that banks may not assess the credit risk of specific borrowers accurately as they put these loans off the balance sheet anyway through securitization techniques.

Therefore, policy makers, intermediaries creating and end users employing the products have an interest in attempting to understand the core challenges faced, and having sufficient knowledge to control related dimensions of different products to prevent unexpected losses. Though an end user’s processes may not be as extensive, the same rational and end goals apply, that is operating in a secure fashion with only a very small possibility of unexpected losses. Different elements of risks can affect instruments in marketplace, including market, credit, liquidity, legal, and operational risks. Control framework
applicable for each one of these risk types may be categorized as risk management, financial, audit, and legal control mechanisms.

2.4.1 Risk and Financial Controls

Institutions dealing with derivative products (synthetic/structured) on a regular basis must build and maintain a proper internal control framework allowing efficient risk management. The internal controls can take various forms, but tends to relate to credit and market risk management, independent financial and operational processing, and internal auditing. The combination of the three, working in synchronized fashion, can create a more secure dealing environment and reduce the possibilities of unexpected losses of institutions.

2.4.1.1 Market, Liquidity, and Credit Risk Management

Internal credit and market risk management is often considered as the front line of controls that enforce series of standards that are intended to keep an institution’s risk sensitive operation in balance. This is carried out by establishing limits and other controls for synthetic and structured assets as well as other risky operations which is directly linked to an institution’s risk philosophy and risk tolerance levels. The minimum risk controls that market and credit risk framework requires with reference to synthetic and structured assets may be summarized as:

- Identifying all market risks (i.e. directional risk, basis risk, spread risk, volatility risk, correlation risk, and curve risk) impacting the products, or all credit risks (i.e. counterparty credit risk, issuer default risk, and correlated risk) related to these assets;
- Qualifying all risks arising from creating and purchasing these products;
- Determining risk limits for the relevant risk exposure classes, with a direct link to the stated risk tolerance an potential return;
- Monitoring exposures on a continuous basis to ensure that exposures generated remain within an institution’s risk tolerance limits, and making necessary adjustments
• Considering new products proposed by parties and making sure that they meet the institution’s risk criteria.

This process should be reviewed on regular basis and sufficiently detailed to produce proper information on risk profile and its trends.

2.4.1.2 Internal Financial and Operational Controls

Internal financial and operational controls are necessary to track and verify transactions influencing institutions’ balance sheets, income statements, and cash flow statements. Minimum requirement related to financial and operational control should include:

• Ensuring that pricing of products comes from independent sources that cannot be manipulated,
• Establishing reserve for products with expected deficiency,
• Implementing accounting policies related to structured products,
• Provisions to avoid any breaks/fails/settlement problem of financial fraud,
• Reconciling activities and provisions to generate a link to firms’ profit and loss account and official books and records,
• Gathering independent pricing valuations of synthetic/structured assets in marketplace to ensure that valuation policy followed by institutions is equitable.
• Creating independent risk management reports reflecting activities

2.4.1.3 Internal Audit

The typical function of internal audit examines business and control units on regular cycle, testing activities against established policies to ensure proper control, and any deficiency, weakness or shortcoming or other potential problems are highlighted for resolution.

2.4.2 Legal Controls

Dealing in derivatives, synthetic and structured products require examination of legal risks and creation of procedures to ensure that proper documentation reflecting terms of trade and rights of each party is utilized. The
nature of documentation varies by products. Legal matters relating to synthetic/structured products created through one or more derivative contracts are more complex. In such instances, one or both counterparties may face more intensive legal and risk exposure especially for long term contracts with more possibility of changes in market references, market/credit exposures, or creditworthiness.

There are different forms of legal documentation employed, but majority are based on International Swaps and Derivatives Association (ISDA) framework. ISDA is global trade association presenting participants in derivative industry and has pioneered efforts to identify and reduce the sources of risk in derivatives and risk management business. The legal documentation is explained in detail in the 2002 ISDA master agreement (Multicurrency Cross Border), including key sections with reference to:

- Obligations,
- Representations,
- Agreements,
- Event of default and terminate events,
- Early termination and close-up netting,
- Transfer,
- Contractual currency,
- And finally sections 9-14 provide for rights and obligations with regard to multi branch dealings, expenses, and notices, and delineated governing law/jurisdiction and applicable definitions.

The ISDA framework is an essential legal control for institutions choosing to deal in synthetic instruments rather than those purchasing or selling derivatives-type risks via structured notes (64).

### 2.4.3 Regulatory and accounting issue

Innovation in general and in particular innovations involving derivatives, holds promises for improvements to financial and economic efficiency. However, improvements in efficiency from these products can not be effectively
realized without simultaneous changes in the supporting financial infrastructures. That is the institutional interface between intermediaries and financial markets, regulatory practices, organization of trading and clearing facilities, and management information system.

Accounting treatment of derivatives, and structured and synthetic products with embedded derivatives is based on international accounting standard 39 (IAS 39) in countries other than the US, and financial accounting standard 133 (FAS 133) in the US. These rules intend to clarify the treatment of financial derivatives and structured securities by linking them directly to the corporate financial statements. Accounting requirements set by the Financial Accounting Standard Board (FASB) and the International Accounting Standard Board (IASB), requires derivatives/structured assets users to account for their derivatives via the income statement and balance sheet rather than simply in the footnotes (65).

One of the most important motives behind innovative forms of financial assets relates to regulatory issue. Some products are driven by attempts to reduce regulatory requirements. Therefore the regulatory review of institutions dealing in derivatives, synthetics, and structured asset regarding their origination, distribution, and trading is essential. The regulatory review varies in different systems, but involves one or more regulatory entity.
References

(1) http://www.econ.iastate.edu/classes/econ308


(24) Bank for International Settlements, recent innovations in international banking (Basle: BIS, April 1986)


(32) web.mit.edu/ife/www


(64) http://www.isda.org
(65) http://www.iasb.org