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Financial Engineering: an assessment of the Opportunities in the Indian Financial Market

KEYWORDS: Financial Engineering, Risk Management, Portfolio Management, Product Development, Derivative Securities

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ABSTRACT *Financial engineering uses multi-pronged tools and inter-disciplinary knowledge from the fields of conventional finance, computer science, statistics, economics and applied mathematics to address current financial situations as well as to devise new and innovative financial products, in view of the specific investment goals. Financial engineering is sometimes referred to as quantitative analysis and is used, among others, by commercial banks, investment banks, insurance agencies and hedge funds.Although there are many overlaps and synergies in their activities; nevertheless most financial engineering positions have a specific focus within the firm viz. to make money by trading the firm's own capital; to support the frontline traders with timely strategies; to create new, hybrid and innovative financial products; to measure, manage and control risk; and to maintain investment portfolios thatmeet certain given objectives. Many complex problems are associated with each area of practice, which are yet to be solved. These represent opportunities for continuous research in a variety of fields, by both academic researchers and industry professionals.*

Introduction

Financial Engineering involves the use of mathematical techniques to solve financial problems through innovative engineering and re-engineering of financial instruments or products. Financial engineering uses multi-pronged tools and inter-disciplinary knowledge from the fields of conventional finance, computer science, statistics, economics and applied mathematics to address current financial situations as well as to devise new and innovative financial products, in view of the specific investment goals. Financial engineering is sometimes referred to as quantitative analysis and is used, among others, by commercial banks, investment banks, insurance agencies and hedge funds.

Financial engineers have their jobs cut out – in designing, creating and implementing new financial instruments, models and processes to solve problems in finance and take advantage of new financial opportunities. Considerable research is put into these models and theories and they rely on in-depth data analysis, stochastic analysis, simulations, and risk analysis. Financial engineers apply their inter-disciplinary knowledge of several academic fields, including corporate finance, economics and statistics for creative problem solving in finance. Financial engineers work in the security analysis, mutual funds and portfolio management, banking, financial management and consulting industries.

Financial engineering is also concerned with the strategies companies use to maximize profits or other important performance metrics. Examples include creating derivative instruments which can address the issue of unusual risks faced by a party to a transaction, structuring the cash flows from a purchase or sale in a way that better addresses the interests of the buyer and the seller, and using new methods of risk-return analysis to compute the fair market value of new or existing financial instruments.

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Proprietary Trading andAlternative Investment Strategies

Proprietary trading is trading done for the directbenefit of the owners of a firm. This is distinctly different from agency trading which istrading done for the benefit of its customers. Traditional financial institutionsoften engage in proprietary trading as an important side-line. It is also the primary business activity of the Hedge funds.

There are various types of'alternative investment strategies' such as convertible arbitrage,merger arbitrage, fixed income arbitrage, various forms of leveraged long-short equity, emerging market trades, distresseddebt, managed futuresand private equity. Further, there are many sub-categories within each category.For example, convertible arbitrage can be sub-divided into capital structurearbitrage, mandatory converts, synthetic puts, volatility arbitrage, and creditarbitrage. Likewise, long-short equity can be sub-divided into general long-short equity,dedicated short bias and equity market neutral.

Trading Support

Pricing complex instruments and transactions quicklyand accurately, whilemanaging risk at the same time(in a manner consistent withfirm's objectives) are critical capabilities for a trading professional.It becomes critically important to build and maintain the Decision Support Systems (DSS) for facilitating and augmenting these capabilities. Financial Engineering provides themathematical and quantitative talent required to build and maintain these decision supportsystems. Both proprietary implementations built in-house and commercialsystems sold as customised and turnkey solutions are used for this purpose. The trading activities themselvesmay either be proprietary or customer related.

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The exact manner in which financial engineers are integrated into the trading desksmay vary from case to case. If a desk is executing trade outputs from an automatedsystem, then the goal is often not 'what to trade' but 'how to execute', with minimal impact on the market. In contrast, a market maker must matchincoming buys and sells and he has to often commit own capital of the firm to maintain a systematic andorderly market. In today's markets, volumes are so high and trades are executedso quickly that this cannot be accomplished without analytic support. In othercases, traders operate in areas without well-organized exchanges, such asmortgage backed securities, and must demonstrate the ability to run complex models to pricethese instruments as they negotiate with counterparties.

Consulting and Customer Support
Investment banks and other financial institutions provideresearch reports and other forms of analytical support to their customers. These supports may often be provided free of cost as a means of maintaining client relationshipsor stimulating the demand for a firm's services. Such kind of consultancy and customer support is widely prevalent these days and a visit to any number ofbrokerage web sites will give you an indication as to how pervasive this is in today's scenario.

In other cases, these services may be paid for by the investing organizationitself. Companies, universities and other organizations maintain significantportfolios of financial assets in the form of pension funds, endowments andsinking funds (amounts set aside to fund an activity or purchase in the future).Smaller firms hire outside consultants to advise them in the management of these assets. Although the larger organizations maintain their own staff of professionals, from time to time they still engage consultants to provide an independent,and hopefully superior, review.

Product Development
In contemporary times exotic options, hybrid securities and collateralizedobligations forms an increasing share of the business undertaken by investment banks. These products are used to augment return or to insure againstlegal, fiscal, regulatory or liquidity risks. Some of these risks are company specificand may require customized solutions, using specific assessment and strategies.

The development of collateralized obligations has been an example in this area. Themost common of these are mortgage-backed securities (MBSs), which breakdown a payment obligation stream into sub-deals or tranches, e.g., separating the principaland interest streams, Principal Obligations (POs) and Interest Obligations (IOs), respectively. Derivatives of thesetranches can, in turn, be created, e.g., in which the yield from a fixed rate interest obligation is swappedwith a floating rate.

Other examples include hybrid securities that overlay various fixedincome or equity investments with derivatives to enhance yield or create amore tax efficient income stream. For example, a debtor can combine a fixedrate bond with a receiver 'swaption' to give an issuer the benefits of both afixed and floating rate bond. This structure allows the issuer to retain fixedrate payments if rates rise but switch to floating rate payments if rates fall,albeit with an "insurance" cost.

These products involve complex provisions and their correct pricing poses great difficulty. Theyoften demand the assessment of events and probabilities for which there is nomarket or at best only an illiquid "market". However, within this difficultylies an opportunity.Financial institutions are in a better position to track and exploit these opportunities because they use financial engineering. They are able to model these instruments, tradethem at an attractive spread, and, as counterparties to many such deals, buildinternal portfolios whose component risks offset one another.

Risk Management and Risk Control
Laws and regulatory guidelines pertaining to risk-monitoring and control, alongside the laws and regulations dealing with credit and capital requirements havebeen around for a long time. However, the catastrophic high profile failures of hedge funds and investment banks in recent times haveled to a call for a more consistent, verifiable, quantitative, firm-wide approachto risk monitoring and control. These days firms recognize that, with the increasingcomplexity of financial products and markets, the capability of being able to define and enforce coherent risk managementpolicies will determine the organization's survival.

It is an onerous task to define, develop, implement, operate and maintain thenecessary infrastructure to accomplish these goals. It requires adeep understanding of a wide spectrum of financial instruments, as also howthe exposure to them has been financed. There are also significant technical challengesin real-time processing of high performance databases and visualization of strategic future choices.

Portfolio Management
Portfolio management deals with the identification of financial objectivesand their translation into a portfolio of assets that is diversified so as to manage risk and optimize return. The portfolio so created then has to be managed over timein the face of uncertain investment performance and consumption demands.This is a very complex and demanding task: Portfolio management requires creating and using an elaborate mathematical framework which would be consistent with:

- Thousands of potential investments related to one another in complex ways
- an enormous number of parameters which must be estimated in a statistically meaningful manner, and
- a large number operational, business and legal goalsand requirements,of inter-connected and even conflicting nature, which must be accommodated in the investment model

Once this foundation has been set down, the even more formidable challenges, associated withmaking the choice of assets in a portfolio, are to be encountered. Even with the knowledge of existing theory, there are many real world issues that complicatethe decision making process and best solutions remain elusive. We have to deal with underlying parameters that are non-stationary and poorly understood. Add to it the fact that the transactions costs are involved and they are highlynon-linear and uncertain. Such complications, in turn, mean that standardsingle period approaches may rarely represent the actualproblem.

Individuals in this area may work either as in-house portfolio managersor as outside/freelancing consultants. Large portfolios such as mutual funds, pension funds, corporatesinking funds, government or university endowmentsetc typically employ both in-houseand consulting talent. How-

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ever, all investors require these services at some point of time or the other. This has created huge opportunities for financial engineering and its practitioners.

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