

## MECHANISMS OF FINANCIAL ENGINEERING AS NEW ALTERNATIVES

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### ABSTRACT

The purpose of this study is to investigate the effects of different mechanisms that used to solve the problems of financial, the problems of Financial and new financial market developments give rise to use new tools in risk management, asset management, mortgage finance, derivatives pricing and hedging, as well as the need to provide better tools to help financial decision making<sup>1</sup>. Financial institutions need the specialists with an understanding of problems financial strategies, with an expertise and practical know-how, at the same time need to focus on the significance of financial operations in the bigger picture. So I try show the importance and impact of financial engineering.

**Keywords:** Financial Innovations, Venture Capital (VC), Corporate Finance Division (CFD), Capital Market Authority (CMA), World Federation of Exchanges (WFE), Note Issuance Facilities (NIFs), Collateralized Mortgage Obligation Bonds (CMOB).

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<sup>1</sup> <http://econ.upm.edu.my/ijem/vol2no2/bab08.pdf>

## INTRODUCTION:

Finance is one of the most important fundamentals of investment for any economy the world. The development of finance tools in order to the financial globalization requirements and the capital transfer among states has recently become the main concern of financial and banking experts, so financial engineering is the emergence of a new funding pattern differs from the traditional funding in vision of the risk levels in investments need funding<sup>2</sup>. That type of funding becomes important when the accumulative capital decreases<sup>3</sup>.

The different mechanisms used to provide tools new investment, development in traditional securities, update methods financial restructuring of banks, tools financial, operations, which contribute to improved performance, increased profitability, check the speed and efficiency with cost savings. Any economy need new finance tools can improve growth and productivity. It meets the needs of corporations at the different funding stages. The activity of venture capital has begun in the United States of America and these institutions spread later in other countries with the aim of meeting the needs of investment funding and overcoming the inadequacy of supplied capital with suitable conditions of the existing financial institutions and providing funding for new or high risk projects which do not have growth potentials or high rate<sup>4</sup>. This paper try to focus on the different mechanisms used through the design, the development, and the implementation of innovative financial instruments and processes, and the formulation of creative's solution to problem in finance<sup>5</sup>.

The outline of the paper is organized as follow: - In section 1, introduction, present the aim of this research, question of research and literature review on the modeling of credit migrations risks. Section 2 then provides the overview about financial engineering, advantage and factors contributing to the growth of financial engineering. Section 3, empirical studies of financial engineering and conclusions.

## OBJECTIVE OF THIS RESEARCH:

The objective of this paper is to discuss the concept, forms, importance, and objectives of financing engineering with an indication of the advantages of this new funding type in light of the review of some experiences applied , the most important rules and policies necessary to support the success of this type of financing in the developing countries especially in Egypt. Provide insights about basic differences in the form of market failure in measuring credit risks. Provide insights about different financial engineering instruments. Provide insights about benefits of using financial engineering instruments as tools of public policy to promote regional development. Aid the government at increasing the role of the private sector in financial services provision, with strengthening role risk management in financial institutions.

## QUESTIONS RESEARCH:

1. What are different financial engineering instruments?
2. What are the specific market conditions – or traditions -used and which are used?
3. Are there any impact of financial engineering on financial system?
4. What are evidence exist on the benefits of using financial engineering instruments as tools of public policy to promote regional development?

## HYPOTHESES:

Financial engineering have impact widespread on financial policy, and develops investment, product and reduces the chances of unintended negative outcomes. The following hypotheses are proposed:

H0: There are negative relation between dependent variable, (alternative mechanisms) or (financial engineering) and independent variables changes in activities, asset allocation, pricing methods to measure the economic – timing skills - transactions costs - option replication.

H1: There are impact positive of financial engineering on instruments as tools of public policy to promote regional development

## THE MOST IMPORTANT FACTORS THAT CONTRIBUTED TO THE BUILDING OF MECHANISMS FOR FINANCIAL ENGINEERING:

<sup>2</sup> The Economic Importance of Venture Capital as New Funding Alternative with Reference to the Egyptian Experience Dr. Ezzat Molouk Kenawy; Dr. Mohamed Fathy Abd-el Ghany, [http://www.textroad.com/pdf/JBASR/J.%20Basic.%20Appl.%20Sci.%20Res.,%202%20\(4\)3598-3606,%202012.pdf](http://www.textroad.com/pdf/JBASR/J.%20Basic.%20Appl.%20Sci.%20Res.,%202%20(4)3598-3606,%202012.pdf)

<sup>3</sup>bid

<sup>4</sup> <http://archive.org/details/americanalmanac29unkngoog>

<sup>5</sup> <http://www.slideshare.net/itsvineeth209/financial-engineering-1>

Global capital markets have witnessed since the beginning of the sixties of the twentieth century revolution in the areas of financial innovations can be summarized in the following four phenomena:

- A. Financial innovations, which formed the first step to crystallize the concept of financial engineering, which will focus on inventing new tools and risk management tools that will ensure the companies planning for their future and service objectives - this one hand - and on the other ensure yield positive economics Islamic whole through the development of capital markets, and provide them with the various tools and financing mechanisms that meet the objectives of all dealers.
- B. Multiplicity and diversity of investment instruments available in the financial markets, and this has led to increased market liquidity, and to provide more funding by attracting new investors and provide new opportunities for those seeking funding.
- C. Development of risk management tools, which enabled the redistribution of financial risks, according to the preferences of investors for risk. In short, the business organizations exposed to four kinds of financial risks: the risk of interest rate, exchange rate risk, risk volatility in stock prices (property rights), and commodity price risk, and the problem with risk is not in size, but in the fact that occur without expecting, nor graduated risk management tools for the following three solutions: either to work to reduce the disposal of the source of danger to sell, or diversification, or risk insurance.
- D. Development Tools arbitrage between markets, which made it possible to improve the costs and increase the return and openness on the financial markets.
- E. Multiplicity and diversity of investment strategies as a result of the multiplicity and diversity of the renewed investment instruments (especially derivatives).

## LITERATURE REVIEW:

There are descriptive literature which discusses recent financial engineering and that advances various hypotheses about them has arisen (Van Horne 1985; Miller 1986, 1992; Mayer 1986; Cooper 1986; Faulhaber and Baumol 1988; Campbell 1988, ch.16; Siegel 1990; Finnerty 1992; Merton 1992; Kopcke 1995; Lea 1996)<sup>6</sup>. Sharpe (1987) Arnott and Fabozzi (1992), and Bodie, Kane and Markus (1999) focus on asset allocation vast and addresses a board set of issues. Most Studies that consider derivatives in the context of asset allocation use option – pricing methods to gauge the economic value of the market – timing skills, Merton ( 1981 ), Henriksson and Merton ( 1981 ), and Evnine and Henriksson (1987). Carr, Jin and Maden (2000) solve the assets allocation problem in an economy where derivatives are required to complete the market. Carr and Maden (2000) consider a single – period model where agents are permitted to trade the stock, bond and European options with a continuum of strikes. Because of the inability to trade dynamically, options constitute a new asset class and impact of beliefs and preferences on the agent's positions in the three asset classes is studied. In a general equilibrium framework, they derive conditions for mutual – fund separation where some of the separating funds are composed of derivative securities. None of these papers explores the possibility of substituting a simple buy – and – hold portfolio for a dynamic investment policy.

The other literature are relevant to our paper: :-Merton's (1995) functional approach to understanding the dynamic of financial innovation Bodie and Merton (1995) and Merton (1997) , the literature on dynamic portfolio choice with transactions costs, and the literature on option replication. There are many examples contained in Merton (1995) illustrating the importance of function in determining institutional structure is the example of the German government's issuance in 1990 of ten – year Schuldschein bonds with put – option provision . Merton (1995) observes that the put provisions have the same effect as an interest – rate stabilization policy in which the government repurchases bonds when bond prices fall and sells bonds when bond prices rise. More importantly, Merton (1995) writes that “ the put bonds function as the equivalent of a dynamic, open market, trading operation without any need for actual transactions”.

Magill and Constantinides (1976) were among the first to point out that in the presence of transactions costs, trading occurs only at discrete points in time. More recent studies by Davis and Norman (1990), Aiyagari and Gertler (1991), Heaton and Lucas (1992, 1969), and He and Modest (1995) have contributed to the growing consensus that trading costs have a significant impact on investment performance and, therefore investor behavior. Despite the recent popularity of internet- based day-trading, it is now widely accepted that buy-and – hold strategies such as indexation are difficult to beat- transactions costs and management fees can quickly dissipate the value-added of many dynamic asset- allocation strategies.

<sup>6</sup> W. Scott Frame, " *Empirical Studies of Financial Innovation: Lots of Talk, Little Action?*", Research Department, Federal Reserve, Bank of Atlanta , (<http://www.philadelphiafed.org/econ/conf/innovations/files/framewhite.pdf>)26/02/2006.

There are more several studies have considered the option-replication problem directly, in some case using mean-squared error as the objective function to be minimized such as Duffie and Jackson (1990), Schweizer (1992, 1995, 1996), Schal (1994), Delbaen and Schacher Meyer (1996), and Bertsimas, Kogan, and Lo (2000a), and in other case with transaction costs such as Leland (1985), Hodges and Neuberger (1989), Bensidm ,et al.(1992), Boyle and Vorst (1992), Davis, Panas, and Zariphopoulou (1993), Edirisinghe, Naik, and Uppal (1993), Henrotte (1993),Avellaneda and Paras (1994), Whalley and Wilmott (1994), Grannan and Swindle (1996), ,and Toft (1996).

Illustrates Merton's (1995) automatic stabilization policy the possibility of substituting a static buy-and-hold portfolio for specific dynamic trading strategy, an interested-rate stabilization policy. The modern technology for replacing options is clearly well established, and natural generation of that technology is to construct portfolios of options that replicate more general dynamic trading strategy.

## THE CONCEPT OF FINANCIAL ENGINEERING:

"Financial engineering" concept is as old as financial transactions, but it seems relatively recent in terms of terminology and specialization. Most definitions of financial engineering are derived from the views of researchers who develop theories, or financial product designers in financial institutions, for this, we find different definitions of the term, according to the angle that could be considered too.

From the point of view of financial markets, the term "financial engineering"<sup>7</sup> used to describe the analysis of data collected from the financial market in a scientific way, and allows the use of tools and techniques of financial engineering for financial engineers, and thus a better understanding of the party dealers in the market. This is very important for traders because the accuracy and speed of information essential in making decisions.<sup>8</sup> Financial engineering is the use of financial such as forwards, futures, swaps, options and related products to restructure or rearrange cash flows in order to achieve particular financial goals particularly the management of financial risk<sup>9</sup>.

Financial engineering is not only limited to corporate and institutional applications, many of the most creative financial innovation have been directed at the consumer level (like adjustable rate mortgages, cash management accounts, and various new forms of life insurance)<sup>10</sup>.

Financial engineering has thus become the life blood of these activities<sup>11</sup>. According to Thone Finnerty<sup>12</sup> financial engineering involves the design, the development, and the formation of creative tailor made solutions to problems in finance.

## REASONS FOR THE EMERGENCE OF FINANCIAL ENGINEERING<sup>13</sup>:

- 1- There are a number of theories about the reasons for the existence and development of financial innovation, which is the basis of financial engineering but can be summed up in as a response to certain restrictions hinder achievement of economic goals such as : liquidity, profit and reduce risk<sup>14</sup>. This may be legal restrictions, such as preventing or contracts legally certain transactions, or technical restrictions such as the difficulty of transporting certain products, or convert one material to another or social restrictions, such as preference for a particular type of product to another.
- 2- Information Technology and the concept of the broad market the emergence of networks in particular helped to transform multiple global markets and separate to the financial market with a large, no temporal and spatial barriers and range up to the arrival of the information transmitted. Because there different needs in different parts of the world interconnected by these networks has become easier to design requirements and interviewed based on a broad base and wide of the participants in this market Big World, and of course, the greater the number of participants in these markets, the more able creators and designers securities and financial instruments work economically acceptable, that is, they find ample space for movement and whenever designed or invented a new tool and found it requested and accepted.

<sup>7</sup> [http://www.suomenpankki.fi/en/julkaisut/bulletin/financial\\_stability/Documents/B\\_2\\_12.pdf](http://www.suomenpankki.fi/en/julkaisut/bulletin/financial_stability/Documents/B_2_12.pdf)

<sup>8</sup> Liew Soon Bin, " Hierarchical Volume Visualization for Financial Data", School of Computer Engineering, Singapore [www.cs.usyd.edu.au/~vip2000/poster/bin\\_vis.doc](http://www.cs.usyd.edu.au/~vip2000/poster/bin_vis.doc) -16-02-2006.

<sup>9</sup> [http://my.safaribooksonline.com/book/finance/9780470407356/part-three-financial-management/chapter\\_12\\_financial\\_engineeri](http://my.safaribooksonline.com/book/finance/9780470407356/part-three-financial-management/chapter_12_financial_engineeri)

<sup>10</sup> Ibid

<sup>11</sup> Neeraj Nautiyal, Role of Financial Innovation in Reengineering Business: An Overview

<sup>12</sup> Ibid

<sup>13</sup> Zvi Bodie, « What Is Financial Engineering? », Op-Cit. p1

<sup>14</sup> Silber.W.L, "The process of financial innovation", American Economic Review, Vol.3 ,pp89-95.

- 3- Efficiency and effectiveness were taking on greater importance in the case of the expansion base of participants, and markets generally directed towards high degrees of improving service delivery to customers. Therefore, we find in this type tools or financial means (such as interest rate swaps) replace relatively old methods of financing such as refinancing loans.
- 4- Other factors:
  - Increase the number of markets the new organization:  
Increasing the number of new regulated markets for the future and shares innovations in communications and computer technology in recent years to reduce the cost of trade and financial instruments stereotype is very large, and then increase the use of financial engineering areas are widely used. As a result, it became possible to produce customized financial contracts and at a reasonable cost, includes a wide variety of investment needs and the need to manage the risks faced by businesses, governments and even the families sector<sup>15</sup>.
  - Increasing risk and the need to manage:  
Fluctuations in prices (commodity prices and interest rates and exchange rates and stock prices and bond), especially after the global trend to floating exchange rates, as well as raising barriers to capital flows across geographical boundaries, political and rapid development in communication and transition and economic transformation of focus for labor economics knowledge-intensive, all this led to large swings and unexpected in the ocean of global economic whole, which form a major threat to businesses as threatened its existence and the consequent extension need to produce new financial products and the development of high capacity to control the financial risks and. This led to the trading of these products and new financial instruments in the current markets of banknotes in the capital markets, as well as new markets<sup>16</sup>.
  - Take advantage of the financial system<sup>17</sup>:  
The effectiveness of the financial system on its ability to mobilize savings and ensure the best allocation of resources.<sup>18</sup> Distinguish functional analysis (Merton 1992)<sup>19</sup> six functions entrusted to the financial systems: mobilization of financial resources, distribution, risk management, information extraction to support decision-making, control moral hazard and problems asymmetry of information and finally facilitate the purchase and sale of goods and services through the payment systems<sup>20</sup>.

#### **TYPES OF FINANCIAL ENGINEERING ACTIVITIES INCLUDE THREE TYPES OF ACTIVITIES:**

S. Sweilem (2000), defines financial engineering as the design, development and implementation of tools and innovative financial mechanisms, and drafting for creative solutions to the problems of funding, "and thus indicates that the financial engineering includes three types of financial engineering activities<sup>21</sup>:

A -Design innovative financial instruments, such as credit cards, and new types of bonds and stocks, and the design of innovative hedging contracts;

B- The development of financial instruments, which meet these innovative tools to the needs of the new financing, or radical change in the existing contracts to increase the efficiency with respect to risk and term to maturity and yield;

C -The implementation of innovative financial instruments, any innovation innovative operational procedures that will be low-cost, flexible and practical;

The financial engineering that is an approach to contemporary finance systems designed to achieve efficiency in the contemporary financial products developed in the shadow of the financial needs and which is characterized as a renewed and varied. The importance of financial engineering - especially in the contemporary world - as you balance between several objectives and then design innovative tools to accommodate all of these goals together, and this task is not easy as you need for concerted efforts on the organizational form of the legitimate organs and economists, bankers and accountants .

#### **FACTORS CONTRIBUTING TO THE GROWTH OF FINANCIAL ENGINEERING:**

<sup>15</sup> Ibid

<sup>16</sup> N. Fred , "The stock exchanges and financial engineering," Youth University Foundation, Alexandria, Egypt, 1999, p 224.

<sup>17</sup> <http://www.caclubindia.com/forum/-financial-engineering--57249.asp>

<sup>18</sup> Ibid

<sup>19</sup> Peter Tufano, "Financial engineering", *The Handbook of the Economics of Finance*, 2002 p p 9-10.  
[www.people.hbs.edu/ptufano/fininnov\\_tufano\\_june2002.pdf](http://www.people.hbs.edu/ptufano/fininnov_tufano_june2002.pdf)15-01-2006

<sup>20</sup> Ibid

<sup>21</sup> S. Swailem, "Financial engineering industry: Looks at the Islamic approach," Research Center, Al-Rajhi Banking and Investment Corporation, December. p 5, 2000, [http://shodhganga.inflibnet.ac.in/bitstream/10603/3225/8/08\\_chapter%201.pdf](http://shodhganga.inflibnet.ac.in/bitstream/10603/3225/8/08_chapter%201.pdf)



## REASONS FOR RAPID GROWTH IN FINANCIAL ENGINEERING:

Since the 1950s and 1960s, and particularly in the last decade, the global and financial environment has changed rapidly. In particular, the breakdown of the Bretton Woods agreement in 1972 which ultimately led to floating exchange rates, has led to major increases in volatility and competition Smith (1990:33)<sup>22</sup>. Technology has improved dramatically in this period.<sup>23</sup> Government debt has also increased in most countries. Marshall (1992:20)<sup>24</sup> has classified the causes of increasing risk into two: environmental and intra-firm. We use this classification here to analyse the reasons why the increase in risk and major developments in finance, taken together, created the right environment for rapid growth in financial engineering<sup>25</sup>.

## ENVIRONMENTAL FACTORS:

It may be regarded as the factors external to the firm and over which the firm has no direct control but which are nevertheless of great concern to the because they impact the firms performance<sup>26</sup>. It includes:-

- i. **Increase in price volatility:** The term "price" here includes the price of money, foreign exchange, stocks, and commodities. The currency floats have meant that the stability of exchange rates is a thing of the past. Interest rates have been very volatile too, e.g., in June 1982, AA bonds were yielding 15.3 percent. In May 1986 the same bonds yielded 8.9 percent and in April, 1989, 10.2 percent (Brigham, 1990:604)<sup>27</sup>. Oil prices are the best example of dramatic commodity price volatility, and the October, 1987 stock crash illustrates the volatility in stock prices. There was also a major volatility in overall prices, i.e., inflation, over the past three decades. This all-round increase in volatility has led to tremendous increases in the risks which companies face, and enhanced the need for hedging the risks<sup>28</sup>.
- ii. **Globalisation of the world economy and competition:** Commerce has grown very rapidly in the past two decades. This has increased the size of markets and greatly enhanced competition (Marshall, 1992:658)<sup>29</sup>.
- iii. **Deregulation and increase in competition**<sup>30</sup>: Initially, investment banks were the only ones which could offer various services regarding risk management. Deregulation of the financial markets has brought in new entrants into the financial markets, particularly NBFIs, who have aggressively competed with the traditional banking sector, by introducing new products and services. In return, banks were forced to come out with innovative ways to compete with NBFIs by taking recourse to off-balance sheet transactions.
- iv. **Advances in technology and communication**<sup>31</sup>: Funds can be transferred from ATMs and telephones now. Computers have entered the field of finance in a big way.
- v. **Development of new markets and market linkages:** There has been an explosive growth of futures and options exchanges worldwide. 24-hour trading has become possible on futures and options exchanges across the globe. The Chicago Exchange has developed a computer system on which trade can now be carried out at any time, replacing human activity on the floor (Marshall, 1992:665).
- vii. **Advances in financial theory**<sup>32</sup>: Developments in finance theory have contributed immensely to the development of new hedging techniques. The OPM is a case in point.
- viii. **Tax asymmetries:** Taxes differ across industries and countries, over time. Also, some firms have sufficient tax credits/ write-offs which give them an advantage over other firms. For example, zero coupon yen bonds were treated liberally in Japan. In the USA<sup>33</sup>, the abolition, in 1984, of the withholdings tax on interest payments to overseas investors in the domestic securities of the USA influenced the growth of interest rate swaps (Das, 1989:170)<sup>34</sup>.

<sup>22</sup> Smith, Clifford W., Jr., Smithson, Charles W. and Wilford, D.S. (1990). "Managing Financial Risk" in *The Handbook of Financial Engineering*. Harper Business Books, New York

<sup>23</sup> K. Ezzat Molouk; G. Mohamed Fathy, The Economic Importance of Venture Capital as New Funding Alternative with Reference to the Egyptian Experience,

[http://www.textroad.com/pdf/JBASR/J.%20Basic.%20Appl.%20Sci.%20Res.,%202%20\(4\)3598-606,%202012.pdf](http://www.textroad.com/pdf/JBASR/J.%20Basic.%20Appl.%20Sci.%20Res.,%202%20(4)3598-606,%202012.pdf)

<sup>24</sup> Marshall, John F., and Bansal, Vipul K. (1992). *Financial Engineering: A Complete Guide to Financial Innovation*. New York Institute of Finance, New York.

<sup>25</sup> <http://sanjeev.sabhlokcity.com/almaak/Termmap/fin-ASSIGN3.DOC>

<sup>26</sup> <http://www.slideshare.net/RanjiniKNair/financial-engineering-12874616>

<sup>27</sup> Brigham, E.F., and Gapenski, L.C. (1990). *Intermediate Financial Management*. 3rd ed. The Dryden Press, Chicago.

<sup>28</sup> Ibid

<sup>29</sup> Ibid

<sup>30</sup> Ibid

<sup>31</sup> <http://www.scribd.com/doc/130095611/financial-engineering-Final-Word-docx>

<sup>32</sup> Ibid

<sup>33</sup> Ibid

<sup>34</sup> Das, Satyajit (1989). *Swap Financing*. The Law Book Company Ltd., Melbourne.

- xi. **Standardisation**<sup>35</sup>: There has been an increasing standardisation of financial instruments, e.g., in futures, options and swaps. This has expanded the market.
- xii. **Low documentation costs**: Many of the new financial instruments require little documentation, and no prospectus, etc. This has made them attractive to companies.

### FINANCIAL ENGINEERING TEAM:

Financial engineers often work as a part of a larger team. The elements of the team will very depending on the nature of the engineering involved.

### TEAM MEMBERS<sup>36</sup>:

Accountant, tax specialist, underwriters, compliance officers, traders, financial analysis, programmers, information service personnel.

The important point to remember is that financial engineer does not usually work alone. All the members of the team are carefully selected work together efficiently and with the speed required by the solution communication is the key.

### FORMS OF FINANCIAL ENGINEERING<sup>37</sup>:

Funding varies according to the phase where the financing-required company exists. There are four financing stages, namely the phase of capital establishment, capital development, capital of ownership transfer, and capital of the correction.

In the first phase, emerging and innovative high-risk institutions- which have great hope of growth and development- are funded. Capital is allocated to cover the expenses of research and experiments and the development of the new laboratory and commercial items. It also covers market commodity testing until the start-up phase and the beginning of production. It is a difficult financing due to the seriousness of the institution probable failure of the institution, which has no legal entity at this phase (Merton, R, 1973).

The second phase of capital development is that one at which the project has reached the productivity stage of revenue generation. However, it faces financial pressures make it to resort to external financing sources to achieve the hopes of internal growth (an increase of productive and marketing capability); the external growth (project or branches acquisition, or markets diversification) and the expansion, whose average ranges annually between 10% - 5%. It venture capital includes as well, the two phases of project's development and maturity. Risks tend clearly to decrease, and self-financing plays a clear role at this phase.

At the third phase, i.e. capital of ownership transfer, funding used funding whenever there is a change of the project owning majority into a new group of owners, or convert an already existing project into a holding financial company aims to purchase the existing projects (cases of death - accession). This phase includes also granting the company loans for new partners to ensure that there is no activity obstruction. After meeting all financial obligations, ownership is transferred to the investing partners in the subsidiary company (Hellmann, T. and M. Puri, 2000).

Finally the fourth phase which is capital correction is allocated to projects already existing, but facing special difficulties. They have the self- potentials to restore their ability and activity, but they need financial revival in order to be put in order, and anew resettle in the market and become able once again to achieve profits (Rwih Abdel Samie, and Hijazi Ismail,( 2006).

### FINANCIAL ENGINEERING PREPARED FOR CAREERS:

### FINANCIAL ENGINEERING HAS BEEN INTEGRAL TO THE GROWTH AND SUCCESS OF MORTGAGE FINANCE<sup>38</sup>:

### PRIVATE MORTGAGE INSURANCE BASICS<sup>39</sup>:

### PRIVATE MI CONTRACTS

- Private MI is an insurance contract that protects mortgage investors from credit losses by paying a claim when a loan goes bad.

<sup>35</sup> Ibid

<sup>36</sup> Ibid

<sup>37</sup> Ibid

<sup>38</sup> *The Mortgage Crisis and the Role of Financial Engineering: Confessions of a Financial Engineer Wannabe*

<sup>39</sup> Ibid

- Typical coverage is 25% \$100,000 loan with 25% coverage would get a base claim payment of \$25,000 plus interest and expenses.
- Risk is backed by private capital.
- Industry traditionally insures low down payment mortgages – but in some countries like Canada private MI covers 100% of the risk of loss.
- MI is essentially a first loss residual on a low down payment mortgage compensated by an IO strip – this makes it a risk management and financial engineering business at it's heart.
- Industry Basics
- Competitive industry with 8 active players in 2008
- 2008 Thesis - industry capital base would be dramatically eroded, creating opening for new entrant.
- 2010 Reality - industry will pay an estimated \$35-50 billion in claims from private capital without a TARP bailout (a “man bites dog story” in the mortgage crisis). One incumbent closed shop, the others have been hurt but still standing.
- High risk/high reward opportunity due to very high barriers to entry, including:
  - Capital
  - State licensing (can take years)
  - Platform
  - Approval by Fannie Mae and Freddie Mac
  - Ratings
  - Lender acceptance

#### **CAPITAL MARKETS IN EGYPT:**

The development of capital markets in Egypt remains below, especially in terms of primary markets, although noteworthy strides have been made. Egyptian firms access to long-term capital has been hampered mainly by an inadequate legal framework, especially regarding new securities issuance; lack of active domestic financial investors; and a weak regulatory and supervisory framework. While the secondary capital markets are active, new capital market issuance—both bond and equity—have been very limited. The primary markets are much smaller than those of high-performing emerging markets. Little external financing has been made available for firms from both equity or bond markets, and what is provided mostly goes to the largest firms. As elsewhere, stock exchanges mainly target large, blue-chip companies; because of their size, low creditworthiness, and limited transparency, SMEs have more difficulties in accessing capital markets.

Egypt well functioning primary securities market. The Egypt government obligations remains strong, the securities industry is becoming more active, and foreign investors' interest remains high. However, capital-market reforms in Egypt to date have mainly focused on secondary markets and have not extended to easing firms access to securities markets through new issuance. Direct firm finance in the capital markets should be recognized as a priority in Egypt's overall financial sector reforms. The government should place a higher priority on primary market development, which would help raise long-term funds for the productive sectors.

Reform measures would involve reducing issuance costs, deepening investor base and creating an issuer-friendly policy and regulatory environment. On lowering issuance costs, various legal reforms are needed, including improving legal procedures for securities issuance, completing the recently begun shift from a merit-based to a disclosure based system, increasing managerial efficiency of regulators and streamlining any increased disclosure requirements and procedures, as well as, increase government bond liquidity. Deepening the investor base could be attained by enhancing collective investment schemes regulations, developing retail programs for privatization initial public offering (IPO), and expediting the consolidation among brokers and promoting competition.

Creating a more issuer-friendly regulatory framework could be achieved through various measures, including reinforcing the new Corporate Finance Division (CFD) at the Capital Market Authority (CMA) with competent staff to champion direct corporate financing through securities issuance; improving CMA statistical system to conform to the World Federation of Exchanges (WFE) standards; strengthening its capacity in data and information dissemination; and improving information disclosure at CMA and the Cairo and Alexandria Stock Exchange (CASE) to enable investors obtain more information regarding corporate governance structure and important corporate actions.

It is very important implemented actions should be within the context of a well-designed overall strategy. Should be established a National Capital Market Development Strategy in coordination with the government debt market and privatization policies, within the framework of the existing Financial Sector Reform Program.



There are four main pillars for this strategy should include: promoting the external financing of Egyptian firms; fostering more direct and indirect securities holdings by households; enhancing the competitiveness of the capital market industry; and accelerating the integration of the Egyptian capital market in the MENA region and the world at large.

### WHAT IS THE ROLE OF FINANCIAL ENGINEERING IN “RISK MANAGEMENT”?

#### SOME POSSIBLE ANSWERS<sup>40</sup>:

- 1) Part of business unit, helping business unit leaders manage risk – if so, we know what happened. Business unit priorities such as profits, volume, client satisfaction, market share and growth took precedence in many organizations.
- 2) Co-equals with the business unit leaders – if so, who broke the ties and made the final risk decisions? What were the motivations and priorities of the people that decided?
- 3) Final and absolute deciders on risk matters – if so, does that make the Head of Risk the CEO? If the Head of Risk disagrees in a major way with the CEO, how long does he/she stay in the job?
- 4) Independent oversight – if so, for whom? The CEO? The Board? Do they understand the risks? Do they have time to absorb the details and engage? Will they favor risk, or other priorities and objectives?

Financial engineer<sup>41</sup> demand structural solutions to corporate risk exposure. Individual are unwilling to bear risk because they are not adequately compensated for doing so. Some of the innovation of the concerned subject deals with liquidity and also have risk limiting capability for example collateralized mortgage obligation bond, provide a vehicle by which, direct investment in mortgage or mortgage pass through certificates or instrument like adjustable rate debt are not very price sensitive in the general level of interest rates as equivalent maturity fixed coupon instruments thus only expose their holder to less risk.

During the last two decade financial innovation has been directed to design some sophisticated risk management strategies. Among the instrument introduced are interest rate future and interest rate options, stock index future and stock-index options. Currency future and currency options, over-the-counter contracts such as forward rate agreements and forward exchange agreements and a whole array of swap products including interest rate swaps, currency swaps, commodity swaps and equity swaps. Among the risk management strategies developed or improved over the last two decades are assets/liability management techniques including various forms of duration and immunization strategies better risk assessment and measurement techniques including both the quantification of price risks via volatility measure and graphic representations via risk profiles and the development and improvement of hedging strategies including duration based regression based and dollar value based techniques.

#### LIFE-CYCLE INVESTING AND FINANCIAL ENGINEERING<sup>42</sup>:

Financial engineering is the practical application to the inter temporal allocation of resources and the management of risk<sup>43</sup>. Its principal analytic tools are continuous-time stochastic optimization models and arbitrage-based models of contingent-claims pricing. In this section of the paper, I try summarize the development of financial engineering and its application to the investment-management business.

#### PORTFOLIO OPTIMIZATION<sup>44</sup>:

The application theory to investment management began in 1952 with the Markowitz (1952) mean-variance theory. This theory provided a tractable model for quantifying the risk-return trade-off to be derived from a set of risky assets by identifying the standard deviation of a portfolio's rate of return as its risk and the mean as its reward. The inputs to the Markowitz portfolio-selection process consist of a set of risky assets characterized in terms of their means, standard deviations, and correlations with each other. The outputs are in the form of a menu of risk-return choices arrayed along an “efficient portfolio frontier<sup>45</sup>.”

Tobin (1958) added a risk-free asset to the list of inputs and showed how this expanded the efficient frontier and

<sup>40</sup> Ibid

<sup>41</sup> Neeraj Nautiyal, Role of Financial Innovation in Reengineering Business: An Overview, <http://www.icmis.net/informs/icoqm10/ICOQM10CD/pdf/P431-Final.pdf>

<sup>42</sup> Chapter in NBER book *Risk Aspects of Investment-Based Social Security Reform* (2001), John Y. Campbell and Martin Feldstein, editors (p. 291 - 320)

<sup>43</sup> <http://www.nber.org/chapters/c10597.pdf>

<sup>44</sup> Ibid

<sup>45</sup> Ibid

simplified the process of finding the optimal mix. Building on the work of Markowitz and Tobin, Sharpe (1964) and Lintner (1965) investigated the equilibrium structure of asset prices, and their capital asset pricing model (CAPM) became the basis for measuring the risk-adjusted performance of professional portfolio managers. Today, the mean-variance model is at the core of quantitative models for asset allocation and can even be implemented on a personal computer<sup>46</sup>.

In the late 1960s and early 1970s, models of optimal portfolio selection being developed in the academic world became considerably more sophisticated. Merton (1969, 1971, 1975) introduced continuous-time stochastic models into portfolio theory, thereby extending and enriching the static, single-period mean-variance model. He showed that hedging can be as important as diversifying in the demand for assets. The desire to hedge against a risk gives rise to a demand for securities that are highly correlated with that risk. For example, a desire to hedge against adverse changes in short-term interest rates induces a demand for long-term bonds. Merton (1973b) also developed the multifactor inter temporal capital asset pricing model (ICAPM) and proved that, in equilibrium, a security's risk premium will reflect not only its beta on the market portfolio but also its betas on commonly shared hedging portfolios.

### **THE EFFECTS OF FINANCIAL ENGINEERING :**

#### **THE EFFECTS OF FINANCIAL ENGINEERING ON FINANCIAL INSTITUTIONS:**

The basis of nature of the work of financial institutions is financial intermediation, has resulted in the use of financial engineering in the innovation and development of new financial instruments, especially with the technical development to the decreased need for banking business<sup>47</sup>. On the one hand became with surpluses can communicate directly with people with disability, through the stock market and securitization mechanism, and then receded role of financial institutions and private banks in the mediation between the parties, and is what led to the so-called "contraction and mediation". In the other hand, contributed to the technical development and the possibility of financial balance between the maturities of assets and liabilities of individuals and institutions, so that reduced the role of banks even in this aspect.

The factual examples that illustrate the catastrophic effects caused by the financial engineering on the private enterprise sector on too many financial institutions, to the extent that some researchers named tampering launched as an alternative to financial engineering used by these financial institutions, following months these examples:

#### **EMPIRICAL STUDIES OF FINANCIAL ENGINEERING:**

In this section, we review empirical literature about financial engineering.

##### **A. The environmental conditions that encourage innovation:**

We could find only two studies that focus primarily on the environmental conditions that encourage financial engineering. Ben-Horim and Silber (1977) test the proposition that regulatory constraints induce innovation. They construct a linear programming model to estimate the opportunity costs (shadow prices) of deposits, debentures, and capital (net worth) for large banks from 1952-1972. They find that the rising shadow prices of these items, as they approached regulatory constraints (such as Regulation Q), were associated with some of the major innovations of the 1960s, such as the negotiable CD<sup>48</sup>.

Lerner (2002) examines financial patents covering the years 1971-2000. He examines (among other things) the patenting activity of investment banks and finds that patenting was positively related to the size of the investment banks and to the extent of their indirect academic ties. He also finds, however, that the direct involvement of academic institutions or of academics themselves in financial patenting was not related to finance-related research productivity of the institutions or the individuals<sup>49</sup>.

##### **B. The customers for and users of financial engineering:**

There are many of studies that focused on the characteristics of customers for and users of financial engineering.

<sup>46</sup> Ibid

<sup>47</sup> <http://www.fsa.gov.uk/pubs/cp/cp144.pdf>

<sup>48</sup> W. Scott Frame and Lawrence J. White, "Empirical Studies of Financial Innovation: Lots of Talk, Little Action?" Research Department, Federal Reserve, Bank of Atlanta, Working Paper 2002-12.

<sup>49</sup> Lerner, Josh, 2002. "Where Does State Street Lead? A First Look at Finance Patents, 1971-2000," Journal of Finance, 57, 901-930.

There have been two studies of commercial banks that have focused on their decisions to adopt Internet banking. Furst, et al. (2000)<sup>50</sup> analyzes survey data on Internet banking, as of the third quarter of 1999. Using logit models, they find that a bank's choice of adopting Internet banking is related to holding company affiliation, location in an urban area, higher fixed expenses, and higher non-interest income. Among banks that offer Internet-related services, a greater number of service offerings were positively related to bank size and the length of time offering Internet banking. Sullivan (2000)<sup>51</sup> compares banks in the 10<sup>th</sup> Federal Reserve District<sup>52</sup> that had transactional Internet web-sites as of the first quarter of 2000 to those that did not have such web-sites. He finds the former to be significantly larger and located in areas with a more educated population and a higher population fraction in the 18 to 64 age group. Banks offering transactional Internet web-sites are also found to have higher non-interest expenses and higher non-interest income<sup>53</sup>.

Laderman (1990)<sup>54</sup> examines the use of automatic teller machines (ATMs). She finds that the number of ATM cards in use per state, as of 1987, was positively related to population and per capita income and negatively related to the number of branches, to the presence of unit banking restrictions, to limits on ATM placement in states with large numbers of banks, and to mandatory sharing requirements in states with large numbers of banks.

Next, there have been two studies of consumer use of electronic bill payment (Mantel 2000)<sup>55</sup> and of debit cards (Mantel and McHugh 2001)<sup>56</sup>. They find that the expected demographic characteristics – especially income and education (or proxies for them) – provide significant explanatory power.

Frame, et al. (2001a)<sup>57</sup> find that the probability of adopting small business credit scoring (SBCS) by large banks in the mid-1990s was negatively related to the number of subsidiary banks, but positively related to the number of bank branches.

The last study in this group, Gowrisankaran and Stavins (2001)<sup>58</sup>, finds that a bank's adoption of an automated clearinghouse (ACH) retail payments system is positively related to the use of ACH by other local banks and also to market concentration; both results are consistent with the presence of network externalities.

### C. Expansion:

We are aware of five studies of the expansion of financial engineering. Three of them involve the deployment of automatic teller machines (ATMs) by banks.

First, Hannan and McDowell (1984)<sup>59</sup>, using a failure time estimation procedure, find that larger banks and those operating in more concentrated local banking markets registered a higher conditional probability of ATM adoption. Second, Hannan and McDowell (1987) find that the conditional probability of ATM adoption is positively related to a rival's adoption and that firms in less concentrated markets react more strongly to rival precedence than do their counterparts in concentrated markets. Finally, Saloner and Shepherd (1995) find that the expected time to adoption of ATMs declines in both the number of users and locations, indicating the presence of network externalities.

Kopcke, Richard W and Jagtiani et al. (1995)<sup>60</sup> examine the diffusion of off-balance sheet (OBS) activities of U.S. commercial banks for 1983-1991, across the entire banking industry and for individual banks. They find that capital requirements had no consistent effect on the speed of diffusion of OBS activities and that individual bank characteristics were generally not important in explaining the speed of diffusion of the banks.

<sup>50</sup> Furst, Karen, William Lang, and Daniel Nolle, 2000. "Internet Banking: Developments and Prospects," Office of the Comptroller of the Currency Working Paper Number 2000-9.

<sup>51</sup> Sullivan, Richard J., 2000. "How Has the Adoption of Internet Banking Affected Performance and Risk in Banks?" Financial Industry Perspectives, Federal Reserve Bank of Kansas City, 1-16.

<sup>52</sup> The 10<sup>th</sup> Federal Reserve District encompasses Colorado, Kansas, Missouri, Nebraska, New Mexico, Oklahoma, and Wyoming.

<sup>53</sup> Ibid

<sup>54</sup> Laderman, Elizabeth S., 1990. "The Public Policy Implications of State Laws Pertaining to Automated Teller Machines," Economic Review, Federal Reserve Bank of San Francisco, Winter, 43-58.

<sup>55</sup> Mantel, Brian, 2000. "Why Do Consumers Pay Bills Electronically? An Empirical Analysis." Economic Perspectives, Federal Reserve Bank of Chicago, (Fourth Quarter), 32-47.

<sup>56</sup> Mantel, Robert and Timothy McHugh, 2001 "Competition and Innovation in the Consumer e Payments Market? Considering Demand, Supply, and Public Policy Issues," Federal Reserve Bank of Chicago, Emerging Payments Occasional Working Paper Series (EPS-2001-4).

<sup>57</sup> Frame, W. Scott, Aruna Srinivasan, and Lynn Woolsey, 2001a. "The Effect of Credit Scoring on Small Business Lending," Journal of Money, Credit, and Banking, 33 (August), 813-825.

<sup>58</sup> Gowrisankaran, Gautam and Joanna Stavins, 1999. "Network Externalities and Technology Adoption: Lessons from Electronic Payments," Federal Reserve Bank of Boston Working Paper 1999-5

<sup>59</sup> Hannan, Timothy and John McDowell, 1984. "The Determinants of Technology Adoption: The Case of the Banking Firm," Rand Journal of Economics, 15(Autumn), 328-335.

<sup>60</sup> Kopcke, Richard W. and Jagtiani, 1995. "Financial Innovation and Standards for the Capital of Life Insurance Companies," New England Economic Review, Federal Reserve Bank of Boston, January/February, 29-57.

Molyneux and Shamroukh (1996)<sup>61</sup> examine the diffusion of the underwriting of junk bonds and of note issuance facilities (NIFs) during the 1978-1988 period and first 11 months of 1996, respectively. Molyneux and Shamroukh argue that banks (commercial and investment) are more likely to respond to competitive and institutional bandwagon pressures by adopting an innovation when it threatens an existing business, rather than when it represents new business opportunities. However, for both underwriting innovations, the authors find that adoption by one bank makes it more desirable for other banks to follow suit – and this effect increases in the number of adopters.

More recently, Akhavein, et al. (2001)<sup>62</sup> examine the diffusion of small business credit scoring (SBCS) by large banking organizations in the mid-1990s. Estimates from a hazard model indicate that larger banking organizations and those located in the New York Federal Reserve district adopted this technology sooner. At obit model confirms these results and also finds that organizations with fewer separately chartered banks, but more branches, introduced innovation earlier, which is consistent with theories stressing the importance of bank organizational form on lending style.

#### D. Profitability and social welfare:

This is the category that has attracted the largest number of empirical studies of financial innovation. Tufano (1989)<sup>63</sup> examines a cross-section of new securities to examine whether financial product innovators enjoy first mover advantages. Specifically, he uses a sample of 58 innovations (representing 1,944 public offerings) to test whether investment banks that create new securities benefit by charging higher prices (underwriting spreads) than imitators or by capturing larger quantities. He finds that, over the 1974-1986 period, investment banks that created new products did not charge higher prices in the period before imitative products appear and in the long-run charge lower prices than rivals. However, these innovators underwrote more public offerings of products that they innovated, than did imitating rivals. Overall, Tufano's results are not consistent with monopoly pricing of new securities issues by innovators, but rather with the presence of cost advantages that allow these institutions to capture market share.

Two papers examined the welfare effects of specific security innovations. First, Varma and Chambers (1990)<sup>64</sup> study the wealth effects associated with the issuance announcement of original issue deep discount (OID) bonds. They find that OID issues announced between March 1981 and June 1982 were associated with positive stock-price responses, while subsequent issues that were not tax-advantaged had no wealth effects. This result contrasts with the negative effect often found for debt-financing announcements<sup>65</sup>.

Second, Grinblatt and Longstaff (2000) find that investors use Treasury STRIPS to make markets more complete and to take advantage of tax and accounting asymmetries<sup>66</sup>. The authors estimate a joint model of stripping and reconstitution activity using data for 1990-1994 and find that such activities are positively correlated. They also find that stripping and reconstitution are not driven by valuation differences between Treasury STRIPS and comparable bonds, but rather to the presence of long-dated issues. Tax and accounting rationales, as proxied by bond coupon rates and prices, are also important to explaining these activities. In short, Grinblatt and Longstaff conclude that STRIPS<sup>67</sup> are used for fundamental economic reasons, and not as attempts to exploit arbitrage profit opportunities.

The sole financial organizational innovation that has been empirically studied has been bank holding companies' (BHCs) formation of Section 20 subsidiaries to underwrite securities in the late 1980s and the 1990s. Bhargava and Fraser (1998)<sup>68</sup>, using event studies, find that BHCs experienced abnormal positive returns from the initial Federal Reserve decisions to permit banks to form and expand these subsidiaries, but negative abnormal returns from subsequent decisions to permit BHCs to expand their corporate underwriting. Fields and Fraser (1999)<sup>69</sup> find that the

<sup>61</sup> Molyneux, Phil and Nidal Shamroukh, 1996. "Diffusion of Financial Innovations: The Case of Junk Bonds and Note Issuance Facilities," *Journal of Money, Credit, and Banking*, 28 (August), 502-522.

<sup>62</sup> Akhavein, Jalal, W. Scott Frame, and Lawrence J. White, 2001. "The Diffusion of Financial Innovation: An Examination of the Adoption of Small Business Credit Scoring by Large Banking Organizations." Federal Reserve Bank of Atlanta Working Paper 2001-9.

<sup>63</sup> Tufano, Peter, 1989. "Financial Innovation and First Mover Advantages," *Journal of Financial Economics*, 25, 213-240.

<sup>64</sup> Varma, Raj and Donald R. Chambers, 1990. "The Role of Financial Innovation in Raising Capital: Evidence from Deep Discount Debt Offers," *Journal of Financial Economics*, 26 (October), 289-298.

<sup>65</sup> Ibid

<sup>66</sup> Allen, Franklin and Douglas Gale, 1988. "Optimal Security Design," *Review of Financial Studies*, 3, 229-263.

<sup>67</sup> STRIPS refer to the Separate Trading of Registered Interest and Principal of Securities. This program allows investors to strip Treasury notes and bonds and create separate discount bonds and reconstitute previously stripped notes and bonds.

<sup>68</sup> Bhargava, Rahul and Donald R. Fraser, 1998. "On the Wealth and Risk Effects of Commercial Bank Expansion into Securities Underwriting: An Analysis of Section 20 Subsidiaries," *Journal of Banking and Finance*, 22 (May), 447-465.

<sup>69</sup> Fields, L. Paige and Donald R. Fraser, 1999. "On the Compensation Implications of Commercial Bank Entry into Investment Banking," *Journal of Banking and Finance*, 23 (August), 1261-1276.

pay performance sensitivity of the CEOs of BHCs that enter securities underwriting increases during their transition into underwriting but remains substantially less than the sensitivity found in investment banks. Gande, et al. (1999)<sup>70</sup> find that BHC entry into underwriting tended to decrease underwriting market concentration and, consistent with the consequent increased competition, decreased underwriter spreads and ex ante yields. Finally, Cornett et al. (2002)<sup>71</sup> find that the pretax cash flow of BHCs that established Section 20 subsidiaries tended to increase, as compared to BHCs that did not establish subsidiaries and to investment banks. The change does appear to be due to their entry into the new line of business. The authors also find that the riskiness of the banks did not change subsequent to their entry.

Garbade and Silber (1978)<sup>72</sup> examine the effects of a major input innovation for finance: the establishment of the telegraph in the nineteenth century. They find that the telegraph quickly narrowed inter-market price differentials for securities and for foreign exchange across U.S., markets in the 1840s and for bonds between New York and London in 1866. They also find that the establishment of the consolidated tape for New York Stock Exchange (NYSE) securities in 1975 did not cause price differentials to narrow between the NYSE and the Midwest Stock Exchange; they conclude that, for this latter case, the pre-existing telecommunications links were already so good that the consolidated tape added little<sup>73</sup>.

The characteristics of Internet-only start-up (de novo) banks in the late 1990s have received attention from De Young (2001a, 2001b)<sup>74</sup>. He finds that, as compared with conventional de novo banks, the Internet are less profitable, due to low business volumes and high non-interest expenditures; he also finds, however, that the Internet profitability ratios and noninterest expense ratios improve more quickly over time than do those of conventional, offering some hope that the Internet-only format may eventually be viable.

F. A summing up<sup>75</sup>.

We have surveyed the 27 empirical studies of financial engineering that we were able to uncover, using quite broad criteria. It is worth noting, however, that only 17 separate phenomena are covered, since some financial innovations are examined by more than one study.

Some summary characteristics are in order:

- Only five studies precede the 1990s.

- Only two studies address the environmental conditions that encourage financial innovations.

Thus, the hypotheses advanced by the broad descriptive literature on innovation remain largely untested. Seven studies address the characteristics of the customers for and users of financial innovations. Six studies address the diffuse on of financial innovations. The remaining studies examine consequences and (explicitly or implicitly) welfare effects.

- Only one study covers financial patenting; five cover innovations that pertain to securities or securities underwriting; the remaining twenty-one studies apply to banking.

- Only one financial organizational innovation (the establishment of Section 20 subsidiaries by BHCs) is covered (by four studies). Some studies cover financial product/service innovations (e.g., debit cards); some studies cover financial process innovations (e.g., small business credit scoring); and some studies covered innovations that could be described as a process or as a product/service depending on the perspective taken (e.g., the offering of Internet banking).

It seems clear that considerably more empirical work is possible, especially for testing the hypotheses concerning the conditions that encourage innovation. Further, some of the results that have been established in one area (e.g., banking) could be expanded to others.

## THE APPLICATION STUDIES OF FINANCIAL ENGINEERING:

There are three major methods of actually working on the building block approach: (i) to look at the risk and payoff profiles, (ii) to look at time-line cash flow diagrams and (iii) lastly, there is the arithmetic approach

<sup>70</sup> Gande, Amar, Manju Puri, and Anthony Saunders, 1999. "Bank Entry, Competition, and the Market for Corporate Securities Underwriting," *Journal of Financial Economics*, 54 (October), 165-195.

<sup>71</sup> Cornett, Marcia M., Everen Ors, and Hassan Tehranian, 2002. "Bank Performance around the Introduction of a Section 20 Subsidiary," *Journal of Finance*, 57 (February), 501-521.

<sup>72</sup> Garbade, Kenneth and William Silber, 1978. "Technology, Communication, and the Performance of Financial Markets," *Journal of Finance*, 33 (June), 819-832.

<sup>73</sup> Ibid

<sup>74</sup> DeYoung, Robert, 2001a. "The Financial Performance of Pure Play Internet Banks," *Economic Perspectives*, Federal Reserve Bank of Chicago, 25 (First Quarter), 60-75.

<sup>75</sup> Ibid



recently introduced by Donald J. Smith<sup>76</sup>. The boxed cash flow diagrams approach is also sometimes used (Marshall, 1992: 535)<sup>77</sup>.

In each of these approaches, the process is essentially the same. First of all a graphical or mathematical view of the current risk exposure is projected. This picture is overpaid with the cash flows associated with the hedging instruments under consideration. Then the residual or net cash flows are examined. Ultimately, by varying the delivery months and the strike prices, etc., the risk exposure is manipulated in the desired manner. To facilitate the calculations and analysis, spreadsheets and special software packages are put to use (Marshall, 1992:540)<sup>78</sup>. It is usually possible to achieve the objective using different combinations of hedging instruments. The combination or strategy which is least costly is then accepted (Marshall, 1992: 535)<sup>79</sup>. The securities resulting from this process are often given special names, or simply called synthetic securities<sup>80</sup>.

We look below at some examples of synthetic securities. This list is only illustrative; the actual range of products, as can well be imagined, is almost infinite. The figures referred to in the following discussion are given in Annexure I to this paper. The detailed method of building or synthesising the listed securities is not provided, for want of space<sup>81</sup>.

### PAYOFF PROFILES METHOD:

In this method, the risk and payoff profiles of the instrument are drawn, and the combinations of some of the simpler instruments can be seen in this way<sup>82</sup>.

- i. Synthetic future: A forward/future can be synthesised by "snapping together" a European call and a European with the same time to maturity and exercise price. (Copeland 1988:323)<sup>83</sup>.
- ii. Swaps with option like characteristics: Swaps can be constructed to have option-like provisions which limit the range of outcomes. These include the floating floor-ceiling and the fixed floor-ceiling swaps. (Smith, 1986:254)<sup>84</sup>.

### TIME-LINE CASH FLOW METHOD:

The time-line cash flow diagrams are very intuitive and easy to grasp. Usually, the direction of the arrows represents the direction of the cash flows; the long arrow denotes the principal, and short arrows the exchange of other cash flows. A denotes fixed interest rate and ~ denotes floating interest rate. The following examples illustrate this approach.

- i. Reverse floater: In a reverse or inverse floater, the coupon payment on an inverse floater decreases as LIBOR increases. It can be synthesised in many ways, (Smith, 1990:64)<sup>85</sup>.
- ii. Synthesis of a deep-discount dollar bond: (Smith, 1986:257)<sup>86</sup>.
- iii. Synthetic dual currency bond: (Marshall, 1992:592).
- iv. A forward swap: This instrument is also called a delayed start swap, and combines forwards with a swap, or two swaps (Smith, 1990:57)<sup>87</sup>.
- v. Foreign-pay zero (Marshall,1992:594).

### ARITHMETIC APPROACH:

The notation of the arithmetic approach is illustrated by:  $A = B + C$ , where A, B, and C represent expected cash flows from these securities. The "=" sign represents identical cash flows in terms of amount, currency and timing. A "+" indicates a long position and a "-" indicates a short position (Smith, D.J.)<sup>88</sup>. The following

<sup>76</sup> Smith, Clifford W., Jr., Smithson, Charles W. and Wilford, D.S. (1990). "Managing Financial Risk" in The Handbook of Financial Engineering. Harper Business Books, New York.

<sup>77</sup> Marshall, John F., and Bansal, Vipul K. (1992). Financial Engineering: A Complete Guide to Financial Innovation. New York Institute of Finance, New York.

<sup>78</sup> Marshall, John F. and Bansal, Vipul K. (1992). *Financial Engineering: A Complete Guide to Financial Innovation*. New York Institute of Finance, New York.

<sup>79</sup> Ibid

<sup>80</sup> <http://sanjeev.sabhlokcity.com/almaak/Termmap/fin-ASSIGN3.DOC>

<sup>81</sup> Ibid

<sup>82</sup> Ibid

<sup>83</sup> Copeland, T.E., and Weston, J.F. (1988). *Financial Theory and Corporate Policy*. 3rd ed. Addison-Wesley Publishing Co.

<sup>84</sup> Smith, Clifford W., Jr., Smithson, Charles W. and Wakeman, Lee Macdonald (1986). "The Evolving Market for Swaps" in The Midland Corporate Financial Journal. Winter 1986.

<sup>85</sup> Ibid

<sup>86</sup> Ibid

<sup>87</sup> Smith, Roy C., and Walter, Ingo (1990). *Global Financial Services*. Harper Business, New York.

<sup>88</sup> Smith, Donald J. "The Arithmetic of Financial Engineering." (Distributed in class).

examples are based on this approach.

- i. Synthetic fixed rate debt: This is given by the following combination (Smith,D.J.:405)<sup>89</sup>. Here FRN stands for fixed rate note.

$$\begin{array}{rcl} \text{Typical} & \text{Interest} & \\ - \text{FRN} & = - & \text{FRN} + \text{Rate Swap} + \text{Floor} \\ \text{Swap fixed} & \text{LIBOR} + 0.25\% & \text{pay fixed, 4.75\%} \\ \text{rate} + 0.25\% & \text{min. 5\%} & \text{rec. LIBOR} \end{array}$$

- ii. *Asset Swaps*: In asset swaps, the cash flow characteristics of the underlying asset are changed. If the usual FRN is taken as the asset, then an asset swap could look like this (Smith, D.J.:406)<sup>90</sup>:

$$\begin{array}{rcl} \text{Typical} & \text{Interest} & \\ + \text{FRN} = + \text{FRN} & - & \text{Rate Swap} - \text{Floor} \\ \text{Swap fixed} & \text{LIBOR} + 0.25\% & \text{rec. fixed, 4.75\%} \\ \text{rate} + 0.25\% & \text{min. 5\%} & \text{pay LIBOR} \end{array}$$

- iii. *Mini-max or "collared" floater*: This is basically a typical FRN with the addition of a maximum coupon rate, and is synthesised as follows (Smith,D.J.:407):

$$\begin{array}{rcl} \text{Mini-Max} & \text{Unrestricted} & \\ + \text{FRN} = + \text{FRN} & + \text{Annuity} - \text{Cap} + \text{Floor} & \\ \text{LIBOR} & \text{LIBOR} & 0.5\% \quad 8.5\% \quad 4.5\% \\ + 0.5\% & & \\ \text{min. 5\%} & & \\ \text{max. 9\%} & & \end{array}$$

- iv. *Inverse floater*: Discussed earlier as a reverse floater, this can be synthesised in many ways, one of which is illustrated below (Smith,D.J.:408):

$$\begin{array}{rcl} - \text{Inverse} = - & \text{Two} + \text{Unrestricted} & - \text{Cap} \\ \text{floater} & \text{FRNs} & \text{FRN} \\ 16\% - \text{LIBOR} & 8\% & \text{LIBOR} \quad 16\% \end{array}$$

- v. *Participation agreement*: The outcome of a participation agreement is that the buyer "has the benefit of a ceiling on LIBOR but makes settlement payments at a constant fraction of the rate differential when LIBOR is below the ceiling" (Smith,D.J.:409). It is synthesised as follows (where NP is the notional principal, NP\* is the given amount of interest rate protection, and PR, or the participation rate, is 62.5%):

$$\begin{array}{rcl} \text{Participation} & & \\ + \text{Agreement} & = & + \text{Cap} - \text{Floor} \\ 10\% \text{ ceiling} & & 10\% \quad 10\% \\ \text{NP} = \text{NP}^* & & \text{NP} = \text{NP}^* \quad \text{NP} = .375 \text{ NP}^* \end{array}$$

## OTHERS EXAMPLES OF FINANCIAL ENGINEERING<sup>91</sup>:

The primary objective of financial engineering (FE) is to meet the needs of risk management. FE takes a building block approach to the building of new instruments. This approach was first demonstrated by Black and Scholes (1973) in considering a call option as "a continuously adjusting portfolio of two securities<sup>92</sup>: (1) forward contracts on the underlying asset and (2) riskless securities" (Smith, 1990:50). Most of the hedges can be constructed from futures, forwards, options, and swaps, which are now known as the building blocks of financial engineering<sup>93</sup>. By combining forwards, options, futures and swaps, with the underlying cash position, a firm's risk exposure can be manipulated in a practically infinite variety of ways. Other common examples of the building block approach to financial engineering.

- i. Synthetic options: Black and Scholes (1973) showed that a call option can be synthesised from forward contracts and riskless securities.
- ii. Bonds with embedded options: Bonds with warrants/ convertible bonds/ callable bonds have options embedded in them. In a convertible bond, the bondholder has the right (but not the obligation) to convert

<sup>89</sup> Smith, Donald J. "The Arithmetic of Financial Engineering." (distributed in class).

<sup>90</sup> Smith, Donald J. "The Arithmetic of Financial Engineering." (distributed in class).

<sup>91</sup> Ibid

<sup>92</sup> Ibid

<sup>93</sup> Time to embrace financial engineering,

[http://www.herald.co.zw/index.php?option=com\\_content&id=47959:time-to-embrace-financial-engineering](http://www.herald.co.zw/index.php?option=com_content&id=47959:time-to-embrace-financial-engineering)

- the bond into some specified asset of the issuer<sup>94</sup>. In a callable bond the issuer has the right (but not the obligation) to call the bond for redemption prior to maturity. Varieties of other types of bonds have also been synthesised, which given the bondholder an option (Smith, 1990:65).
- iii. Synthetic futures: These can be built from forward contracts. We can also use an appropriate combination of single-period options to synthesise a futures contract (Marshall, 1992:535)<sup>95</sup>.
  - iv. Synthetic swaps: Since the payoff profile of swaps is similar to that of a forward contract, they can easily be synthesised from forwards (Smith, 1986)<sup>96</sup>. A swap can also be synthesised from an appropriate strip of futures or from a strip of futures-like option combinations (Marshall, 1992:535)<sup>97</sup>.

## CONCLUSIONS:

Financial engineering is one of the basic of our financial system, which is the life blood of efficient and responsive capital markets. Financial engineering is defined as: design, development, implementation, tools and innovative financial mechanisms, and drafting for creative solutions to the funding problems. In order to consider it successful should lead either to reduce transaction costs or to provide improved service lead in sum to fill the special needs of all participants in the financial system. So institutions must use financial engineering in the study of capital market (stock exchange, banks), and in the study of corporate financial balance. Limited financial and engineering function is to overcome the barriers and regulations imposed by the supervisory authorities.

Financial engineering provided new financing resources; thus, have provided opportunities to Companies to design instruments which could give them the freedom to address the varying needs of investors group and to lower the cost of capital. Financial engineers often helped upon to develop new instrument to secure the fund necessary for the operation of large scale businesses.

The most dramatic example of their engineering skill was perhaps, the introduction of junk bond and bridge financing and LBOs (Leverage buy out). Financial engineers are also employed in securities and derivatives product trading. They are particularly trained at developing trading strategies of an arbitrage nature. Arbitrage across instrument explains many new developments which have given rise to "synthetic" instruments and 'repacking' of cash flows. Synthetic options, zero coupon bond and collateralized mortgage obligation bonds (CMOB) are all examples of such activity. Asymmetries in market access and asymmetries in tax exposure also create opportunities. These asymmetries explain the advent of swaps and proliferation of special purpose partnerships.

Investment vehicles such as "high yield" mutual fund, money market fund, sweep system and Repo market to mention just a few have played a tremendous role in money management. Transforming high risk investment instrument in low risk investment instrument through ingenious devices as repackaging and over collateralization adds another feather on the cap.

Financial engineering has proved extremely effective in managing the increased financial risk witnessed over the past few decades, and particularly in the last decade. "It's rare that a day goes by in the financial markets without hearing of at least one new or hybrid product" (Smith, 1990:64). Using a building block approach, it appears that almost all requirements of risk management can be met by a suitable product. These instruments and their ever-expanding markets also seem to be playing a role in increasing efficiency in capital markets. Cox (1976) has suggested that "futures trading increases market information and thereby increases the efficiency of spot prices. By "efficiency" he meant that spot prices provide more accurate signals for resource allocation when the given commodity has a futures market" (Martin, 1988 :546).

The experience of venture capital in most of the developing countries is a new one and its recent results are very limited. The activity performance of venture capital companies is still weak in Egypt.

In summation, financial engineering is playing an important role as a major discipline within finance.

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