AN ALTERNATE APPROACH TO IPO RISK ASSESSMENT

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1.0. INTRODUCTION

Mobilization of capital is an important and a necessary function of corporate business bodies. Companies can raise capital through equity, debt, promoters themselves raise capital through their relatives and venture capitalists. Often companies may not be in a position to meet all their financial needs in this way. The common option is that the owners offer to the public a portion of their stock or ownership in the form of equity shares for a price. In securities or capital markets the offering to the public for the first time is called an Initial Public Offering. The returns from IPOs vary considerably over time and are not predictable as evidenced by studies (Narasimhan and Ramana 1995; Koh et al., 1993; CMIE 1993). There is always some risk associated with investment in IPOs. In the short run, IPOs may be underpriced and investors may view them as an attractive investment proposition. However, in the long run negative returns may accrue to the investors. Therefore, a fair assessment of risk involved in IPOs is an important element in investment decisions.
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Abstract

Assessment of IPO risk involves analysis of a large number of quantitative and qualitative factors. The sources of risk can be categorized into four subdomains. They are Promoter, Fundamental, Industry & Market and Government & Environment. There are a number of quantitative models available to assess the risk of IPO. However these models can not process qualitative data associated with the subdomains. This paper discusses the limitations posed by quantitative methods in analyzing IPO risk. A better approach comprising a blend of Knowledge Based System (KBS) for processing qualitative data and Quantitative methods for numerical data has been proposed to supplement the deficiencies associated with KBS and quantitative methods. It proposes CLIPS software as implementing media.

Keywords: IPO risk; Knowledge Based System; Risk Assessment; Expert System Architecture; CLIPS-IPO risk assessment.

1.0 INTRODUCTION

Mobilization of capital is an important and a necessary function of corporate business bodies. Companies mobilize their finance in several ways which include equity, debt. Promoters themselves raise capital through their friends, relatives and venture capitalists. Often companies may not be in a position to meet all their financial needs in this way. The common option is that the owners offer to the public a portion of their stock or ownership in the form of equity shares for a price. In securities or capital market parlance, the stock of a company that is issued to the public for the first time is known as the Initial Public Offering (IPO).

The returns from IPOs vary considerably over time and are not predictable as evidenced by studies (Narasimhan and Ramana 1995; Koh et al., 1995; CMIE 1995). There is always some risk associated with investment in IPOs. In the short run, IPOs may be underpriced and investors may view them as an attractive investment proposition. However, in the long run negative returns may accrue to the investors. Therefore, a fair assessment of risk involved in IPOs is an important element in investment decisions.
The decision-making process in risk assessment are often too complex to be treated by conventional methods (Pinson and Lamsade 1992). The decision-making process involves judgment, which is non-deterministic and heuristic in nature. Assessment of risk involves judgment based on subjective, partial, and grass-root level data. Often this necessitates breaking down the problem space into components or subdomains. Final assessment of risk involves aggregation of partial assessments from subdomains. In addition to the non-deterministic nature of factors affecting risk assessment, the relative importance given to these factors varies from analyst to analyst. This characteristic makes the decision-making process with regard to the analysis of IPOs a complex and time-consuming process.

This paper is a part of series of articles on different aspect of the application of knowledge Based Systems for the assessment of IPO risk.

2.0 RISK ANALYSIS DOMAINS

Risk is defined as "the potential for return to deviate from an expected value" (Marshall and Bansal 1992). Risk analysis of IPOs involves consideration of several subdomains that are the sources of risk. The subdomains recognized by the author are the promoter, the fundamental, the industry and market, and the government and environment. Each of these subdomains have a large number of qualitative factors in addition to quantitative data. The synthesis of these data varies across industry segments and the analyst. The following sections discuses the possible list of factors for different subdomains.

2.1 Promoters subdomain

This domain is mainly concerned with various factors related to promoters role in the project. One need to check whether the promoters belong to first generation of entrepreneurs or those who belong to the existing business houses. Some business houses are normally known for protecting the interest of the investors. If the promoters have already an established businesses, one could assess the present issue based on their past performance in earlier business (Menon 1995). The response of earlier issues of promoters in other business are also worth investigating. Besides one must also consider the pattern of stakes in equity over a period of time and also before the issue and after the issue for previous issues of the company. If the promoters stakes are in the decline, then one need to be careful about selection. This fact reveals the commitment of promoters in the project.

The scripts belonging to a business group that is entering the capital market for the first time needs critical examination. One must also critically examine factors such as the technical and managerial abilities of promoter with respect to the type of industry to which the project is associated.
Another factor that needs consideration is the share holding pattern with respect to the members being relatives or belonging to one community or region. As these factors indicate certain value system such as aggressiveness, societal commitment. High promoter's and institutional investor's stakes are indication of the confidence reposed on the project. Such projects are worth consideration for investment provided factors in other subdomains are favourable. The presence of lead managers, merchant bankers and underwriters gives some indication of the project reliability. Some merchant bankers have built up reputations for post-issue appreciation. Any issues whose lead managers, merchant bankers or underwriters belong to such category, the investors can have faith on those issues.

If the promoter is involved in the litigations or scandal even when all the factors are favourable, it may bring down the ratings to a very low level. The government stake in the equity is also an important factor in determining the efficient working of company.

2.2 Fundamental subdomain

This subdomain looks at the fundamental aspects of the project proposal based on the accounting and financial data. Companies whose net worth and gross sales are less than two and ten crores respectively, should be avoided. This may be due to low liquidity of scripts once the company is listed in the stock exchange. The current ratio (CR) for a company with a constant demand for its products, should be greater than or equal to two. However, from shareholders point of view a high CR means low returns because money is unnecessarily blocked in working capital. Even though the CR is within the specified range, it is essential to compare the values with industry average.

Another factor that needs attention is the net sales per share (NSPS). This ratio helps to establish the position of the company in the industry, its ability to survive in bad periods, and its future profit growth. A company with high NSPS scripts are normally associated with blue-chip companies (Ganesh 1995a). The companies in capital intensive industry should have high financial leverage. If the market is booming then the investors can expect higher profits. The return on capital employed (ROCE) is yet another barometer to determine how efficiently the funds are being utilized. While using ROCE, the time of incorporation of companies should be considered (Ganesh 1995) because of difference in the valuation of assets. If the ROCE is high and showing a rising trend over the period, then the company is a good candidate for investment.

The purpose of the issue determines whether the capital raised is for expansion programme or towards infrastructure. Funding infrastructure has a long gestation period. Such scripts are attractive for investors interested in long term investment horizon.
In the case of expansion programmes, the resources could be towards working capital to utilize the existing capacity or expansion into new line of business or products. The clarity of the purpose statement is important in assessing the genuineness of the issue. It is important to know the share of present issue in the total project cost. This information blended with the purpose of issue could reveal the chances of a company going to the public for the remaining funds once again.

If the issue has a premium tag, then it has to be appropriately discounted keeping in mind the company's future activities. It is important to assess the proper utilization of the raised capital. This could be determined by separating the profits from sources other than line of business and also the company's share of profits in the overall profit of the group. This data can be used to calculate the earnings per share for comparison purposes.

2.3 Industry-market subdomain

This subdomain refers to factors having industry-wide influence. For example, the industry having a strong trade union force may have difficulty in introducing innovations, which in turn may lead to poor performance. A good example for this is the banking industry. The market for the company plays an important role in determining its operations. The extent of collaborator's stake is an indication of the assured market. Higher the stake better is the market for the company product as collaborators have reposed confidence in the market.

The export oriented units have promising returns in the present context of liberalization. However, the region to which the produce are marketed needs investigations. For example, the market behavior of gulf countries is totally different from European or the American market. The government controls in terms of price and product also play an important role in determining the market and hence investment. Gestation period is yet another factor in determining the investment opportunity. The industry segment such as power, roads with long gestation period are not attractive to the short term investors.

The infrastructure support for an industry is also a factor to be considered. The industries such as aluminum are energy intensive. If the company has not made separate arrangement either with the government or on its own may have difficulty in operating the plant. The order-book position of the company is also an indicator of secured market for its product. Investors may avoid companies marketing those products for which the country has excess installed capacity.

The operating efficiency levels of a company determines its stability in the industry. Some other factors are quality of after sales service, and product competition from organized and unorganized sectors. These factors are determined by market segments and the extent of raw material import. The market segment could be government or private income group. If the company is producing consumer durable
product, then one need to assess its marketing and distribution arrangements such as tie ups with MNCs or existing players, and association with well-known brand names. Yet other factors include sales turnover, product market share, and tie up with end user for produce.

2.4 Government-environment subdomain

This subdomain considers factors related to administrative controls by government authorities that impact projects. These factors influence the investment avenues at macro level. They include clearance from state pollution control board and settlement of claims by income tax department, excise department and sales tax authorities. The profitability of a company is also determined by various state and central government incentives such as tax holiday, low electricity tariffs.

Projects related to industries such as power, refineries, and paper need not only the state approval but also the acceptance from environmental groups and local citizens. If the company is wood based, clearance from forest authority is essential. At national level the entry of MNCs through tie up shall be determined by the government's trade policies such as large scale import duty reductions. The environment subdomain also include the policies governing capital market operations.

3.0 METHODS OF MEASURING RISK

The assessment of IPOs require usage of appropriate methods to process various factors highlighted in the preceding sections. Following subsections deals with different methods of risk assessment with its limitations.

3.1 Quantitative and statistical methods

Quantitative methods are essentially evaluation models based on mathematical and statistical concepts. For example, Dividend-Discount and Earnings-Forecasts are two of the models being used in the evaluation process. Statistical models measure the potential returns to deviate from expected values with the aid of variances and standard deviation. The application of these models requires past data. However the assessment of IPO risk involves besides, quantitative data, the analyst need to consider qualitative data which are judgmental, non-deterministic, heuristics in nature. Therefore, the application of these models to the assessment of risk associated with IPOs is questionable.

3.2 Commercial Databases

These are primarily the capital market databases such as the Capitaline, CIMM, and PRIME. These databases provide extensive query options, spreadsheet support for computational tasks, and graphic user interface. Though they have better features
than quantitative and statistical methods, they do not provide support for the evaluation of IPOs when only partial and uncertain data are available. These systems do not have inferential knowledge bases to interpret the data or information. This is a serious limitation of such databases. At the best, they are data bases that can provide on-line data support.

4.0 LIMITATIONS

Given the informational requirements, the cited models are the easiest to compute the risk. However these models are dependent on various quantitative measures based on past data. The studies (Verma 1988; Obaidullah 1994) have shown that the past values of such measures provide no indication of future values (risk). Hence the risk assessment methods should incorporate factors which are non-financial and extraneous, which can not be included in the cited valuation models adopted to assess the risk of IPOs (Prat 1993). These include nature of business and the history of enterprise from its inception, promoters track record, economic outlook in general and outlook of specific industry in particular, market, government policy. The details are given in section 2.0.

A proper assessment of the influence of these factors can be judged based on one's expertise. There has been a flurry of research work on expertise. One such study has found that experts spend a great deal of time analyzing a problem qualitatively (Glaser and Chi 1988). These expertise cannot be incorporated directly into the cited valuation methods. This view of limitations of mathematical models have been highlighted in several studies (Dietrich and Kaplan 1982; Duda et al., 1987). Besides, these models face difficulty incorporating subjective, non quantifiable features in financial risk assessment applications. Some of the features which makes the mathematical models difficult to assess the risk are

(a) a mixture of qualitative and quantitative reasoning,
(b) a combination of unlimited data and limited time,
(c) judgmental input, and
(d) multi attribute assessment.

The deficiencies of quantitative and statistical methods and commercial databases have led to the use of an alternate approach to process the factors in an organized manner in the form of Knowledge Based System (KBS) along with quantitative models. The KBS is also termed as Expert Systems and is based on Artificial Intelligence.

(a) Knowledge Base,
(b) Inference Engine and
(c) User Interface.
5.0 ARTIFICIAL INTELLIGENCE SYSTEMS

The focus of Artificial Intelligence (AI) field today is to make computer mimic the way humans think and act (Rich and Kelvin 1991). These systems were originally designed for solving problems in relatively structured areas. With the advancement in the AI field, these techniques have begun to interest the business sector in the recent years, particularly the financial and banking sectors (Martin and Zickefoose 1992).

Expert Systems (ES), which is a highly successful branch of AI, has been widely used in manufacturing (Padmanabhan and Sounder 1994), and marketing (Burke et al., 1990; Anand et al., 1993; Stafford and Haan 1994; Liberatore and Stylianon 1994; Mentzer and Gandhi 1992). A number of studies (Bohanec et al., 1995; Ram and Ram 1990; Carter and Catlet 1987; Duchessi et al., 1988; Valentine 1988; Shaw and Gentry 1990) have been undertaken to apply ES concepts in the finance discipline. Amongst all the disciplines finance has the highest number of applications in AI and ES (Hayes-Roth and Jacobstein 1994).

6.0 KNOWLEDGE BASED SYSTEM

Knowledge based system is a computer system that uses the experience of one or more experts in some problem domain and applies their problem solving expertise to make useful inferences for the user of the system (Waterman and Hayes-Roth 1982). They are knowledge based in nature and hence, are also referred to as knowledge-based systems (Fikes and Kehler 1985). They are capable of accommodating human thought processes and the interpretations of factors affecting the assessment of risk. The knowledge bases of ES consist of If...Then... rules which encapsulate the judgmental procedures of individual thought process. Though ES are meant for qualitative inputs, many ES support quantitative evaluations. This feature of ES enables both objective and subjective assessment of risk. ES are flexible enough to consider different subdomains of the analysis simultaneously or in isolation. These features of ES overcome the deficiencies of conventional tools and methods used in the assessment of risk associated with IPOs.

7.0 EXPERT SYSTEM ARCHITECTURE

Most expert system (ES) architecture originates from the generic structure (Holsapple and Whinston 1988) as shown in the figure 1. The basic framework of ES has following three components.

(a) Knowledge Base,
(b) Inference Engine and
(c) User Interface.
1. Knowledge Base

The knowledge base of an ES consists of facts and heuristics that are necessary to understand, formulate and solve the problem. The facts constitute a body of information relating to a situation or problem area that is agreed upon by experts in the field. The heuristics are rules of thumb that are used by experts to make judgments on the basis of incomplete or partial information.

There are five different strategies for representing knowledge: propositional rules, frames, semantic networks, object-oriented models, and production rules. The representation strategy selected will depend on the characteristics of the problem at hand. Amongst them, rules are the most common method of representing the knowledge (Machlup 1998). Rules can represent the knowledge in the form of regular logical sentences.

A rule has the general form of: IF $p_1$ AND $p_2$ AND ... AND $p_n$ THEN $q$ where $p$'s are the premises and $q$ is the conclusion.

$$\text{Rule: } \frac{p_1 \wedge p_2 \wedge \ldots \wedge p_n}{q}$$

The above representation of knowledge is a useful way to capture of qualitative and subjective data which are unique to a capital market analysis.

7.2. Inference Engine

The Inference engine (IE) uses facts and rules contained in the knowledge base and processes them to reach a decision. The IE is essentially a computer program that provides a methodology for making inferences by deciding which rules are satisfied by facts, to decide where to start making inferences, and also to resolve conflicts.

**FIGURE 1**

Expert systems generic structures
The following sections discuss the various components of ES framework.

7.1 knowledge base

The knowledge base of an ES consists of facts and heuristics that are necessary to understand, formulate and solve the problem. The facts constitute a body of information relating to situation or problem area that is agreed upon by experts in the field. The heuristics are rules of thumb that are used by experts to make judgments on the basis of their own beliefs and experience to solve a problem in a particular domain.

There are five different strategies to encode the facts, rules and their relationships that constitute knowledge (Hermon and King 1985). They are semantic networks, object-attribute-value triplets, rules, frames, and logical expressions. Amongst them, rules are the most common method of representing the knowledge (Mockler 1989). Rules use if...then... clause for representation of knowledge. These rules contain premises or conditions in the if clauses and conclusions in the then clauses. The example below shows a typical representation of knowledge used in the evaluation of IPO risk assessment.

\[
\text{Rule-1 if } \text{industry-type declining} \\
\text{company-overall-strength strong} \\
\text{company-market-position good} \\
\text{company-management good} \\
\text{then } \text{ipo-risk low}
\]

The above representation of knowledge enables the capture of qualitative and subjective data which are unique to a capital market analyst.

7.2 Inference Engine

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7.3 User Interface

The User-Interface (UI) component of ES enables the interaction between a user and the inference engine during consultation session. Common interfacing techniques include commands, forms, icons, menus, and their combinations. Dual communication is provided by the UI; users ask the inference engine for advice and users are asked for specific data by the inference engine during consultations. In addition, users can ask for the inference engine's line of reasoning after the deduced advice is presented.

8.0 ES FRAMEWORK FOR IPO RISK ASSESSMENT

The generic ES framework shown in the figure 1 needs to be modified to meet the requirements IPO risk assessment. The common users of such framework are sophisticated users who have sufficient knowledge of finance, capital markets, economic and political conditions, which are time variant in nature. The typical sophisticated users of ES are primarily the experts such as equity researchers, merchant bankers, fund managers, stock brokers, funding agencies.

Observations (survey of 22 capital market professionals) have shown that the analyst evaluate the scripts not in an identical manner. These professionals also interpret the same data differently for different industries and differently at different point of time. This characteristic feature of capital market professionals demands that the ES must be flexible such that the user can fine tune or modify the knowledge base.

In view of the above the naive users find it very difficult to understand the line of reasoning of ES advice. Hence the ES should be directed towards sophisticated users to serve as a memory aid to experts, who can easily overlook facts during their hectic day-to-day schedule.

At the time of knowledge acquisition, the developer (knowledge Engineer) may involve several experts to elicit heuristics. Since there were more than one expert involved in the knowledge acquisition process, there is a need to achieve some type of consensus on the factors. A crude method to solve this problem would be to consider the knowledge elements (factors) which show a majority agreement. Hence the initial knowledge of the system may have these common rules or heuristics. At the time of implementation new rules could be added to the knowledge base for fine tuning exercise.

9.0 IMPLEMENTATION OF EXPERT SYSTEM

The ES can be implemented using a suitable software media that are either ES languages or tools or shells. There are several ES languages and tools available in commercial and academic environment. An expert system language is a translator of
commands that conform to a specific syntax and it has an inference engine to execute the statements of the language (Giarrantano and Riley 1994). The well-known ES languages are LISP and PROLOG. There has been a growing trend toward using the C language in artificial intelligence application.

An ES tool contains a language and associated utility programs, which are intended to ease the development, debugging and delivery of application programs. The utility programs may include text editors, graphic displays, code generators, etc. On the contrary, an ES shell is a special purpose language that enables the users to supply only the knowledge. The market for ES products has undergone remarkable changes over time. These changes are characterised by factors such as the number of tools available, cost, operating system environment, and host languages (Mettrey 1987).

AI languages, such as the LISP and PROLOG, call for greater degree of skill as compared to ES shells to produce application software. Naive users will find it difficult to master the syntax of these languages and to develop application software from scratch. Further, utility programs are not available. These aspects makes the developer to choose an ES shell for developing ES.

The complexity in terms of number of facts and rules needed for the assessment of risk associated with IPOs makes the developer to consider the following factors. They are

(a) ease of knowledge representation,
(b) inference efficiency,
(c) flexibility to incorporate new features,
(d) portability, and
(e) cost.

9.1 Ease of knowledge representation

The users of ES in capital market are primarily the experts such as equity researchers, merchant bankers, fund managers, stock brokers, funding agencies. The survey of twenty two capital market professionals (Revankar 1997) reveals that majority of them are new to expert system technology. The ease with which the user can update the knowledge comprising the rules and facts, decide the acceptability of ES. Rules are the simplest form of knowledge representation as it uses if...then... format for recording knowledge.
9.2 Inference efficiency

The analysis of IPOs involves inference from four major subdomains. Each of these subdomains may consist of a large number rules. For ES to be very efficient, the inference engine must have an efficient inference algorithm.

9.3 Flexibility, portability and cost criteria

The processing environment of capital market professionals demands that the expert system framework to be flexible such that the user can fine tune or modify the knowledge base. This feature places heavy demands on the ES shell by utilities that are unique to IPO risk assessment. In most of the ES tools, the developer has to fulfill the application requirements within the scope of accompanying utilities and features. Another important feature while selecting ES media is the portability of the end product to any computer platform. ES software must be available at an affordable price to keep the product cost reasonable to invest by organizations. The ES software CLIPS stand out amongst other Es softwares available in the commercial market.

10.0 CLIPS FEATURES

CLIPS is an acronym for C Language Integrated Production System. The Johnson National Aero Space Agency, U.S.A., designed CLIPS for public use. It is a low cost software package. The latest release of CLIPS (version 6.0) costs about Rs.30,000. It uses rule as its primary form of knowledge representation. These rules have the form: if {conditions}...then {actions}. This representation is easy to understand and to document since one can use English like statements. Consider for example the following subset of data/facts being available for assessing IPO risk.

- Industry is in decline stage
- Company's overall strength is strong
- Company has strong market position
- Company management is good
- Promoters track record is good

The above facts in general English-like statements needs to be represented in a specific format to make CLIPS understands the facts. The CLIPS format is shown below.

(industry stage d)
(company overall strength s)
(company market position s)
(company management g)
(promoters track record g)
Where \( d \) indicates decline
\( s \) indicates strong
\( g \) indicates good

The experts use the above facts to arrive at heuristics based on their experience and intuition. The following is an illustration of the form of a heuristics:

**If**

Industry is in decline stage
Company's overall strength is strong
Company has strong market position
Company management is good

**Then**

IPO risk may be low

The above heuristics, which is known as *rule* in ES terminology, is presented in CLIPS format as shown below.

```clips
(defrule rule-one

  (industry stage d)
  (company overall strength s)
  (company market position s)
  (company management g)

  =>$

  (ipo risk low))
```

where

- `rule-one` : is the name of the rule
- `=>$` : is then equivalent in CLIPS
- `defrule` : is CLIPS command indicating a rule

In CLIPS, users can define new features needed for the application and later build them into CLIPS. The features such as use of framework for technical analysis, integration to commercial databases can be developed using C language and made integral part of CLIPS. Also CLIPS can be integrated with spreadsheet technology to support quantitative models (Revankar 1997). Thus the framework will enable the
blend of ability to process quantitative and qualitative data. CLIPS documentation include the 'C' language source code and no other ES tools or shells provide this facility (Mettrey 1991). Hence CLIPS scores very high over other ES tools. This feature of CLIPS makes the development environment very flexible. CLIPS has the portability advantage of its host language namely C. The benchmark tests (Leinweber 1988) have shown superior performance by CLIPS as compared to other ES tools.

11.0 CONCLUSIONS

The application of knowledge based systems to assess IPO risk will enable the capital market analyst to consider qualitative data which can not be processed by conventional models. Majority of ES tools provide facility to integrate conventional technology for using mathematical models which are quantitative in nature. The blend of these two technology enables the analyst to harness the power to process qualitative and quantitative data towards better assessment of IPO risk. In addition, at an organization level these technologies can be used to capture the analyst's long years of experience in the form of heuristics to assess IPO risk. Thus the proposed approach to blend KBS and Quantitative methods enables the organization to maintain Knowledge repository.
REFERENCES


