CHAPTER III

CONCEPTS RELATING TO FINANCIAL FORECASTING MODELS

Measures of Financial Performance

A business entity is assumed to be primarily concerned with earning of adequate net returns and maintaining a satisfactory liquidity position. Following this view the textile mill is a decision unit on both the production and the financial sides. For the purpose of achieving the objectives, a textile mill is assumed to

1. Establish expectations of the future conditions.
2. Formulate a plan of action for the future which is consistent with expectations.
3. Implement the plan.

The meaning of financial performance is as varied as the number of research investigations. Hence there is no widely accepted measure of financial performance especially in public sector undertakings in India. However, for the purpose of this study, financial performance is measured on the basis of the following four variables:

1. Earnings before taxes.
2. Net current assets.
3. Reserves and surplus.
The choice of these four variables as measures of financial performance may be justified for the following reasons:

Economic performance is the first and foremost purpose of a business enterprise. It is indeed the reason for its very existence. As such the use of earnings before taxes allows one to recognise the fact that performance is the source of reward required to compensate investors and lenders for the risk they are taking. The relationship between net income and capital invested in the generation of that income is one of the most valid and most widely recognised measures of enterprise performance (1, p.546).

Secondly, the popularity of working capital as a measure of liquidity and of short-term financial health is so widespread that it hardly needs documentation (1, p.447).

Thirdly, reserves and surplus is a measure of long-term growth. Reserves and surplus is a component of net worth. Since the model is used to evaluate the product mix policies, and the share capital is the same for all the policies, changes in reserves and surplus alone are considered significant.
Lastly, cash balance is a measure of immediate liquidity and the capacity to generate cash surplus of an enterprise.

Since the forecasting model developed in this study is used to compare and select a product-mix policy, the above four measures of financial performance are considered significant.

The Meaning of "Dynamics"

The term "dynamics" as applied to business and economic analysis has different meanings for different researchers. Hicks (2, p.115) has expressed the distinction between static and dynamic models in the following way:

"I call Economic Statics those parts of economic theory where we do not trouble about dating; Economic Dynamics those parts where every quantity must be dated."

Baumol (3, p.4) defines economic dynamics as "the study of economic phenomena in relation to preceding and succeeding events." A dynamic mathematical model allows the changes of system attributes to be studied as a function of time. In line with Baumol's notion Harrod (4, p.8) says "dynamics will specifically be concerned
with the effects of continuing changes and with rates of changes in the values that have to be determined."

Samuelson (5, pp. 352-387) states that "it is the essence of dynamics that economic variables at different points of time are functionally related ... It is important to note that such a dynamic system generates its own behavior over time... This feature of self-generating development over time is the crux of every dynamic process."

From the review of the concept of economic and business dynamics it is evident that one pertinent feature of dynamic analysis is the dating of variables which introduces a consideration of time into the picture. All business and economic decisions are related with time. It is the time element which makes the concept of dynamics meaningful in business and economics. In a study of dynamic phenomena such as multi-period financial forecasting, consideration of variables related to performance measures as periodic functions of time is relevant.

The dynamic nature of financial performance

The constancy of change is as pervasive in business as it is in any other sphere. Financial performance of a firm does not take place in a static environment. In the
actual financial performance process the firm's plans, actions and decisions, at any given period of time, obviously are interrelated closely both with the past and the future. It is, therefore, essential that a study on financial forecasting of a firm somehow accounts for its dynamic nature.

Since textile mills can never be certain about the future, expectations play an important role in corporate planning. The fact that expectations, and hence planning, may be in error emphasizes the importance of process of learning and obtaining information which greatly influence the formulation of expectations and plans. The process of learning and obtaining information implies that expectations stretch over time.

While textile mills may stick to the same expectations over a certain period of time, it is, in general, most likely that new expectations arise as time goes by. Accompanying new experience, expectations are changing and hence are different at every successive point of time which implies a continuous process. As time goes by, evidence changes continuously as more facts become known and hence, the prospect may be changing over time accordingly.
Since expectations in one period relating to economic and environmental conditions in the future period might be held with great uncertainty, the production and investment plans which are based on expectations must be adjusted or revised with time continuously. Adjustment of production and investment plans toward desired or optimal levels should continue as knowledge is gained over time.

The dynamic nature of financial performance may be recognised from the fact that decisions concerning production and investment are closely interdependent over time as the firm grows. It is quite obvious that the rate of performance depends heavily upon the firm's capacity of production which may be expanded through the acquisition of additional resources. The ability of acquiring resources at any period of time is largely dependent upon the availability of funds, which may be obtained from both internal and external sources, namely, disposable income and funds borrowed from lending agencies. Borrowing from external agencies depends on the past and expected future financial performance. Internal generation of funds also depends upon the net returns. This is possible only through efficient production and investment policies. Forecasting financial performance under alternative production and investment policies is essential to select suitable policies.
Risk and Uncertainty

The state of the information available to the decision makers of the firm may take on any one of the three forms—certainty, risk, and uncertainty. Cohen and Cyert (6, pp. 307-308) differentiate certainty, risk and uncertainty in the following way:

"In a certainty model it is assumed that the economic agent possesses complete information which relates a unique outcome to an alternative course of action. In the absence of certainty, multiple outcomes may result from at least some actions the decision makers can take. If the agent is able on an objective basis to compute the probability that a particular outcome will result if any given action is taken, then the decision model is an objective risk model. When the economic agent has no objective basis for determining these probabilities but nevertheless feels that he knows them, then the decision model is a subjective risk model. Finally if the economic agent is unwilling or unable to formulate, either on objective or subjective grounds, the probabilities that specific outcomes will correspond to particular actions, but instead is able only to indicate the range of outcomes which might follow from any action, then the decision model is an uncertainty model."
If only normal conditions had prevailed everything would have been much better. But in a competitive economy normal conditions hardly ever prevail for any length of time. Results are obtained by exploiting opportunities, not by solving problems. All one can hope to get by solving a problem is to restore normalcy. The indeterminacy of future events lies at the crux of the planning problem. Commitments based on assumptions concerning tomorrow must be made today. It is a fact that the textile industry faces a highly variable environment resulting from fluctuations in yarn and cloth prices, government policies and changes in technology. A substantial amount of returns may be sacrificed when environmental changes are not anticipated and acted upon correctly. The time involved in production and investment decisions in textile operations precludes perfect knowledge of the future.

Therefore, a textile mill's decision making must take place in an environment of imperfect knowledge. The necessity that the time element is included in the financial forecasting model poses another problem in pursuit of an empirical investigation. Accordingly, if the forecasting of financial performance is to have any impact, uncertainty should be taken into consideration and handled appropriately.
Types of uncertainty

Price uncertainty

In a competitive market situation, textile mills have no control over the prices of inputs and finished products. Price variability and uncertainty for textile industry can be considered to be exogenous to individual textile mills.

Technological uncertainty

Technological uncertainty faced by textile mills mainly come about as a result of invention and/or improvement in technology of spinning, weaving and textile finishing both at national and international levels.

Institutional and sociological uncertainty

This uncertainty may be caused by changes in public thinking, governmental and political ideologies and international agreements. Little is known about the institutional and the sociological uncertainties whose quantification are difficult.
Hence, this study centers around price uncertainties in relation to cotton and yarn prices only, because they are major sources of indication in achieving desired performance levels.

Dynamic planning behavior of a textile mill

Organizational survival demands a continual adaptation of goals and processes to the changing opportunities and constraints. A growing organization should not limit its outlook merely to the next operating year. It should think ahead of that period and plan for exploiting the emerging opportunities.

The dynamic nature of a textile firm's financial performance and the significance of the time element in financial performance process render the traditional static theory of the firm unrealistic.

Economic models of the firm may either be described as static or dynamic. "Static models are those that do not explicitly take the variable time into account, while models which deal with time-varying interactions are said to be dynamic models" (7, p.14). Wagner (8, p.41) states that "Common to all dynamic models is that current decisions
have their effects both in the present and subsequent periods." Cohen and Cyert (6, p. 3C7) state

"If the alternative courses of action among which the economic agent must choose and the possible future states of affairs which might result all pertain to a single time period, and if the pay-off function which defines the agent's preference ordering on the set of outcomes depends only upon events of this same time period, then the decision model is static. In contrast, if both the alternative courses of action and the possible resulting outcomes involve considerations pertaining to more than one time period, then the decision model is dynamic."

Similar to Cohen and Cyert, Hicks (2, p. 194) says "Just as the static problem of the enterprise is the selection of a certain set of quantities of factors and products, so the dynamic problem is the selection of a certain production plan from among the alternatives that are open... In statics we are content to think of entrepreneur maximizing his surplus of receipts over costs; ... But when the problem is looked at dynamically, it becomes clear that the entrepreneur can expect, not a single surplus, but a stream of surpluses, going on from week to week."
Viewing from these angles the financial forecasting model built in this study is a dynamic one in the sense that the model is used to evaluate and select a product-mix policy from among the alternatives over a period of several years into the future. The model is also stochastic because it considers the price of cotton and yarn as stochastic variables affecting financial performance.

The use of computer simulation models in planning

Commerce, industry and government have now become more complex. Due to diversification and rapid growth, businesses have tremendously complex organisational and control problems. Business firms are living in a world of rapid changes and extensive interactions. Although modern business is faced with a more complex world than were its predecessors, it has even less time in which to make decisions and therefore can less afford the luxury of time and manpower consuming decision aids.

Computer simulation is a formal decision support system that is adaptable to the complexities and changes of modern business and can be developed and communicated efficiently. It is frequently impossible to perform controlled experiments with business and economic systems.
Computer simulation is an alternative for this. It is essentially a problem-solving technique the adoption of which is made possible by the emergence of high speed electronic computers and the availability of planning-oriented software packages.

"In recent years computer simulation has become increasingly popular among economists and management scientists as a tool for analyzing the behavior of complex economic systems. The range of application of computer simulation now extends from specific activities of business firms, for example, inventory control and production scheduling, to simulation of entire corporations and the economy of United States (as well as other countries)" (9, p.2). Ensherff and Sisson (10, p. 272) argue that "Any manager who wants to run his activity so that he controls its changes, rather than reacting to changes, cannot avoid investigating simulation."

Since it was hoped that this study could suggest some hypothesis about the impact of alternative product-mix policies under uncertain costs and prices the possibility of discovering results through computer simulation seemed attractive. Computer simulation was selected as the research methodology of this study for one other reason. It was felt
that by utilizing a computer simulation approach, this study would produce as a by-product a model of industry performance that other researchers could build on in an effort to formulate a richer simulation model to analyse any situation. "As several organisational theorists and economists have recognized, computer simulation models of firms and industries can be considerably more useful for certain purposes than many of the abstract analytical models traditionally found in the microeconomic literature" (11, p. 11).

However, most of the simulation models are not truly integrated models to evaluate the type of problems envisaged, especially in the textile industry. Therefore the model that has been built in this study attempts to fill this gap.

The experiments that were performed with the computer simulation model which was built for this study were conducted primarily to test the comparative effects of changing the product-mix policies. Several measures of performance such as earnings before taxes, net current assets and the like which were monitored during each run of the model gave an indication of how performance was influenced by making changes in the product-mix.

There are many problems faced by management which cannot be solved by standard operations research techniques.
Utilizing the power of a digital computer one can build and study a simulation model containing arbitrarily high order complexities and a large number of interdependencies, as well as uncertainties. Many mathematical programming models are found unsuitable for solving problems under uncertainty in a multi-product and multi-period context. Simulation is an appropriate and flexible technique in situations where formal analytical models are incompatible with the system being studied.

Simulation— an explanation

Naylor (9 p. 2) defines simulation as a "numerical technique for conducting experiments with certain types of mathematical models which describe the behavior of a complex system on a digital computer over extended periods of time." Mao (12, p. 285) defines simulation as "the technique of evaluating the merits of alternative courses of action through experimentation performed on a mathematical model representing the actual decision-making situation." Gordon (13, p. 39) defines system simulation "as the technique of solving problems by the observation of the performance, over time, of a dynamic model of the system."

A review of the above definitions implies that a pre-requisite for simulation is a model of the system to
be simulated and parameters of the model. The principal difference between a simulation experiment and a real world experiment is that, with simulation, the experiment is conducted with the model of a real system instead of with the actual system itself.

Since computer simulation is an experiment, experimental design techniques are applicable. Experiments can be conducted with a model at a particular point in time or over extended periods of time. While the former leads to a static or cross-section simulation the latter leads to a dynamic or time series simulation. A dynamic simulation results when we simply extend the length of a given simulation run over time without changing any of the conditions under which the simulation is being run. Mihram (14, p. 9) states that "A model is either dynamic or static, depending upon whether or not any of its features or symbols alter over time."

Another important feature of most simulation experiments with economic and business systems is that they are stochastic as opposed to a purely deterministic simulations. "Models of business and economic systems frequently include random variables over which decision makers can exercise little or no control. By including
these random or stochastic variables in the model, a simulation experiment can be used to make inferences about the overall behavior of the system of interest that is based on probability distributions of these random variables" (9, p.6).

Computer models consist of algebraic equations or algorithms (called logic) representing accounting practices and operational inter-relationships of the organisations. This logic tells the computer the calculation procedure. Simulation involves the manipulation of this symbolic logic utilising the values supplied by the data base.

Merits of simulation

Simulation has certain merits compared to analytical techniques. They are as follows:

A simulation model can be used to pre-test different policies or strategies. A model can be designed to possess the characteristics of any situation. Through experimentation a group of performance and structural variables can be monitored in each computer run to give an indication of how the performance is affected by each policy or strategy. The validity of a model and its predictions can be tested
by comparing its assumptions and output to the actual from published sources. "The true value of computer simulation is thereby demonstrated in that attention is focused on the input assumptions and structural relationships" (15, p. 26).

A computer-based financial forecasting model provides a basis for testing alternative assumptions. Specific points of disagreement are quickly identified and discussion is directed towards them. With computer simulation model computer graphics can be used to chart the performance of alternatives which is easily understood by executives in decision making.

At the analysis stage, simulation models offer a means by which the relative merits of differing courses of corporate action can be compared with little cost and investment of time. Models can also help discover problems and find solutions before they have a major impact on the business. Translating a business situation into a model allows analysis of the dynamic rather than static operations of the business.

Computer simulated data may be used to test alternative hypotheses concerning the operation of the firm during the forthcoming year. These hypotheses are usually called decision rules.
Computer models are useful in corporate planning and economic forecasting. They help in the analysis of economic and business environment in relation to a company's short and long-term plans. They aid in the financial evaluation of long-term and short-term diversification plans under corporate planning, detailed feasibility studies on various investment propositions and projects, establishment of financial control systems and analysis of financial performance.

Rationale for inclusion of stochastic error terms

The computer-based planning model will give planners and managers reliable bases for planning and operating in these times of rapid and unpredictable change. The high degree of uncertainty in the economic, political and social environment invalidates a single line forecasting based on the assumption that the future can be extrapolated from the past.

Forecasts are mostly single valued figures. Actual values may not correspond to the forecasts. In order to represent the reality of cost and price fluctuations the financial forecasting model is made stochastic by inclusion of random disturbance term in the forecasting equations.
There are several reasons for the inclusion of error terms in a forecasting model.

Johnston (16, p. 4) states that "a justification for the presence of a disturbance term in economic relations is to assume that over and above the total effect of all relevant factors, there is a basic and unpredictable element of randomness in human response which can be adequately characterized only by the inclusion of random variable term." According to Enshoff and Sisson (10, p. 56) "Often exogenous variables are represented as a value plus a normally distributed error term or disturbance."

When a model is used for policy analysis, the results are subject to some margin of error. Stochastic simulation allows one to get a better quantitative grasp of what this margin of error is and to estimate its magnitude. Stochastic simulation is similarly useful when a model is used for forecasting as it allows one to obtain confidence intervals for the forecast.

Naylor (9, pp. 129-130), argues, by citing references, the reasons for inclusion of stochastic error terms in simulation experiments. By including stochastic error terms, one can replicate the simulation experiment and
make statistical inferences and test hypothesis about the
behaviour of the system being simulated that are based on
the output data generated by the simulation experiment.
Ling (17, p. 182) quotes Conway et al., "Since stochastic
variation is a characteristic of real world, the model
builder as well as the experimenter may introduce some
stochastic elements in addition to a deterministic simulation,
as to more faithfully reproduce characteristics of the
real world." Stochastic error terms are used in a number of
simulation studies (9, pp. 209-218, 297-318 and 338-350).

Thus, the major objective behind building,
experimenting with and attempting to validate the simulation
model was to be able to make some tentative statements about
the impact of alternative product-mix policies under
stochastic cotton and yarn prices. The study is a piece of
exploratory research that was designed to generate some
interesting and counter-intuitive hypotheses about the effect
of alternate product-mix policies that could be refined and
tested in future research.

The discussion in this chapter reveals clearly that
computer simulation models are best suited for financial
forecasting of a textile mill under dynamic and stochastic
environment.
FIGURE 1
FLOW CHART FOR PLANNING SIMULATION EXPERIMENTS

1. Formulation of problem
2. Collection and processing of data
3. Formulation of mathematical model
4. Estimation of parameters
5. Evaluation of model
   - Reject model
   - Accept model
5a. Formulation of computer program
6. Validation
7. Design of experiments
8. Analysis of simulation data

References


