

Chapter 1

Introduction

1.1 Background

According to the UK magazine, *The Economist* (*Economist*, 1999), the insurance industry faces new challenges. Indeed, the insurance institutions are experiencing unprecedented change, confronting with such issues as globalization, deregulation, volatile interest rates, decreasing income yield from financial markets. Challenging times can be taken as an opportunity to develop new approaches to cope with the problems. It becomes more and more apparent that a state-of-the-art modeling of both sides of the balance sheet is an essential part of a sound management of an insurance company. That is why Dynamic Financial Analysis (DFA) has been developed.

Dynamic Financial Analysis is a process for analyzing the financial condition of an insurance institution. The Casualty Actuarial Society, being active in the formulation and development of DFA, has classified it as: “a systematic approach to financial modeling in which financial results are projected under a variety of possible scenarios, showing how outcomes might be affected by changing internal and/or external conditions.” (DFA Committee of the Casualty Actuarial Society, 1999)

Contrary to classic financial ratio or static actuarial analysis where different aspects of a company are considered in isolation, the most important characteristic of DFA is that it takes an integrated view. For an insurance institution, DFA model begins with the simulation of macro economic conditions; then the simulation results are devoted to the generation of various asset and liability values. Asset and liability values are

combined with their corresponding cash flow patterns to arrive at net cash flow patterns for the enterprise. Thus, DFA models can normally reflect the full financial structure of the modeled company and facilitate an integrated view of the risk management process at an enterprise-wide level.

DFA deals with the planning of financial resources in the face of uncertainty about economic, capital market and actuarial conditions. One way of modeling the dynamic features of the underlying decision problem is to apply the stochastic programming approach (Feldblum, 1995). Based on the stochastic simulation, DFA provides a level of insight that goes well beyond simple point estimates of critical measures; it provides an entire range of outcomes and their corresponding probabilities of occurrence. Therefore, DFA adds a new dimension to the view of the future so that management can evaluate the likelihood of many possible outcomes under a given assumption.

The application of DFA to the insurance industry began with the work of Finnish and British working groups on solvency. (Pentikainen, Pesonen, and Daykin, 1993) However, because DFA allows decision makers to understand and quantify the impact and interactions of the various risks to make better informed strategic decisions, to date, DFA has concentrated on providing management with more powerful information to support decisions.

1.2 Motivation and Objective

Despite the promise of DFA, many insurers have grown increasingly frustrated with it. As Guy Carpenter Senior Vice President, John McLean, described at the 79th Annual

Meeting of the Alliance of American Insurers, “DFA is very applicable,” but he expressed client reservations. “Our clients are concerned about the cost and the time-consuming aspects, but we have some clients that have been using it successfully.”(Lent, 2001)

The development of a realistic DFA model takes several years and a significant commitment of actuarial, programming and other staff time. Any insurer that has tried to develop its own model confronts a difficult reality: to keep pace with the effect of changing economic conditions on the entire firm, DFA model has to be revised regularly. However, DFA model could be large-scale model involving thousands, if not millions, of lines of computer code and data. The IT department faces the discouraging task of having to invest extensive time and effort to, in essence, duplicate the DFA system currently in use. Recompile of entire model in response to a single change is a nuisance in the constantly changing business environment. It leads to a vicious cycle of implementation, compilation and modification that disrupts the creative evolutionary modeling activity.

Given the importance of DFA modeling and the valuable contributions that it provides in the analysis of insurance operations, the above issue has had a negative effect on insurers who had their challenges in implementing a suitable DFA system. Over the past few years, insurers used some commercial mathematical modeling languages such as APL (Tu, 1998) or Mathematica (Ostaszewski, 1998) to construct DFA models. However, no matter what kind of modeling language is adopted, the accuracy of converting a conceptual model into an executable computer program requires a certain degree of programming skills. To overcome this obstacle, there seems to be a need for flexible and efficient model implementation approach. Our study is trying to

provide a mechanism to help the insurers building their own DFA models as easy as possible. Thus, the major obstacles for applying DFA models are quickly receding.

1.3 Scope

Although we have considered and experimented with many of the concepts discussed in this paper, we have not completed the extensive research necessary to specify all requirements that may be included in various kinds of DFA model. Currently, the scope of the research is limited into:

- We aim only to demonstrate the concept and potential of the DFA system for the Property and Casualty insurance companies.
- There are two general approaches to DFA: stochastic simulation and scenario testing. Each method has advantages and drawbacks, and each is more appropriate in certain situations. Since scenario testing is more difficult to apply to casualty insurance products (Feldblum, 1995), our system currently only supports stochastic simulation.

Despite the above limitations, we feel that by describing our conception involved in constructing the information system for DFA, we can assist others in designing other DFA systems.

1.4 Outline

The remainder of this paper is structured as follows. In Chapter 2, we survey other related work including dynamic financial analysis, modeling language, and modern decision support systems. Chapter 3 contains an overview of our system. We describe

its main components and present an example to illustrate how it works. In Chapter 4, we present the main concepts in our implementation and illustrate how an interactive application looks to the end user. Chapter 5 summarizes our results and discusses potential directions for future work.