Dynamic Financial Analysis: An Untrodden Path of Catrisk and Solvency II

Chitro Majumdar[1]

Extended Abstract

DFA – Dynamic Financial Analysis grew in late 1990s out of practical need rather than academic research with Casualty Actuarial Society (CAS) being the pioneer of this genesis with specific needs of insurance sector in mind. In the last few years, non life insurance corporations in western world have experienced, among other things, pricing cycles accompanied by volatile insurance profits and increasing catastrophe losses contrasted by well performing capital markets.

Here are the DFA solutions of several challenges in (re)insurance/ capital market world:

1. DFA (Dynamic Financial Analysis): DFA offering enables the creation of a comprehensive framework to manage Enterprise Risk. DFA in the capital budgeting decision process of a company is launching a new invention and predicting the impact of the strategic decision on the balance sheet in a horizon of few years. The P&C Insurance Risk for the Purpose of Solvency Economic Capital Requirement will be solved by a multi-line risk factor model where we generate scenarios and apply risk measures to quantifying inter-dependencies among risks. DFA gives strategy for Enterprise Risk Management in order to avoid undesirable outcomes which could be disastrous. Hence, we focus on the downside and on the tail of the profit and loss of distribution is a critical part of ERM. However, higher returns may require taking more risk. I am limiting the use of DFA and ERM analytics to scrutinizing the distribution's tail leads to effectively ignoring valuable information embedded in other parts of the distribution with more comprehensive type of dependence structure on results by comparing linear and nonlinear dependencies & copulas. This helps organization to improve their risk control.

2. This has severely affected shareholder value as well as solvency position of many non-life companies amidst rigid regulatory constraints, hyper competition and changing risk landscape. The net result capital drains into more profitable market segments.

3. In comparison to the earlier static environment of the insurance market where there was no particular need for sophisticated analytics: actuarial analysis was carried out on the
underwriting side – without linkage to the investment side of the company, which was analyzed separately. Quantitative analysis amounted to modelling a group of isolated silos, without taking a holistic view. This completely ignored the interplay & interrelation amongst

[1] ***CHITRO MAJUMDAR***: Oracle Financial Services, Level 25, 40 Bank Street, Canary Wharf, London 14 5NR, UK; Email: chitromajumdar@gmail.com.

the various risk factors in evaluating a strategic decision and hence in the process ignored the major economic factors driving shareholder value. DFA overcomes this drawback by joint
stochastic simulation of risk factors affecting a company. Risk factors typically include economic risks (e.g. inflation), underwriting risks, asset risks (e.g. stock market return) and
business risks (e.g. underwriting cycles). We see the DFA to be a more generic tool that extends the conventional boundaries of the insurance industry. The outcome of a DFA analysis depends on the stakeholders and objectives of the analysis.

4. DFA tries to facilitate and help justify or explain strategic management decisions with respect to Strategic asset allocation, Capital allocation & budgeting, performance measurement, market strategies, business mix, pricing decisions to even pro-forma analysis. The key success factor in designing an efficient DFA system is not only in the choice of proper econometric models but to identify the key random variables affecting asset and liability cash flows and their interrelationship.

5. The factors are then modularized depending on the business and simulated stochastically under different scenarios before simulating their combined effect on the company's bottom line.

6. A properly designed DFA tool hence in that can be used for management decision support for different strategic alternatives and also as a benchmark for performance. The strategic assumptions made during the strategic planning process can also be simulated or changed easily in due course of time for strategic adjustments and control.

7. Commercially available DFA products are usually tailored for specific industry sectors and hardly have any flexibility, which makes it an analogous tool to Scenario testing.

→ We see DFA as a tool for management decision support, which culminates in predicted financial statements and the distribution of important financial indicators on the strategic horizon.

→ As a concrete example of our vision we site the use of DFA in the capital budgeting decision process of a company launching a new product and predicting the impact of the strategic decision on the balance sheet in a horizon of 2-3 years.

→ To identify the few factors that will affect the asset liability cash flow are demand uncertainty, sales volatility, credit risk, volatility in the price of raw materials cost of capital to name a few.

→ Each of these random variables can be stochastically simulated either based on the distribution of retrospective data or under strategic assumptions. When simulated in a combined way the future cash flows can be predicted which in return would dictate the capital requirements in the future.

→ Depending on the capital structure of the company and simulated interest rate in the capital market the final earnings volatility of the company can be predicted to identify the return and associated risks.

→ We first decompose the historical vintage performance data into a maturation function of months-on-books, a quality function of vintage origination date, and an exogenous function of calendar date. In a second step, the exogenous function is modeled with macroeconomic data or factors representing portfolio management impacts.

→ Stress tests are performed by extrapolating the exogenous function using externally provided scenarios for extreme macroeconomic events.

→ Given concerns about exposure data quality and about model inaccuracy, it is unclear if the insurers are properly measuring the uncertainty associated with extreme outcomes. Consideration of that uncertainty leads directly to the determination of the capital required to support operations. The combination of sophisticated mathematical measurement of extreme outcomes and dynamic financial analysis (DFA) could lead to a stronger and more transparent industry.

→ The present market is very interested in catastrophe measurement and management and is planning to begin the collection of relevant data from the regulated insurers. The expectation is that analysis of the data will lead to a regulatory process involving modern mathematical techniques and DFA; in particular it is worthwhile to consider the integration of certain copula modeling techniques in a DFA framework and to conduct numerical validation tests within a simulation study.

→ Possible approaches could include the catastrophic events via Markov Jump Diffusion Models. For catastrophic events, the assumption that catastrophe claims occur in terms of the Poisson process is inadequate as these processes rely on the assumption of constant intensity. Markov Modulated Poisson process can be used to model more realistically the arrival process for catastrophic events.

→ Under the process, the underlying state is governed by a homogenous Markov chain, in which Markov jump diffusion models can be used to derive pricing formulas and hedging formulas for catastrophe insurance products, e.g. futures, options, & catastrophe bonds.

→ The methodology could then show how catastrophe insurance product prices are related to the jump rate of catastrophe events, standard deviation of jump size, and mean of jump size. Such techniques can also be modified to apply to financial catastrophes and other extreme events.

→ We will find built-in support for most DFA modelling needs: Portfolio risk management and modelling, Economic capital estimation and allocation, Evaluation of ceded reinsurance and other management strategies, Cash flow analysis, financial statement modelling and projections.

→ The approach is demonstrated in an analysis of the US Mortgage markets.

→ “Product”- following should be the terms:

A. Liability Curves, Changes there in due to- a. new cadent / deal, b. New instruments, c. New Events;

B. Asset Distributions- a. Current Market Senaior

C. Ratings / Solvancy II- a. Cash Flow, b. Simulations: Asset / Liability Balance

Keywords include: Dual-time Dynamics, Nonlinear Dynamics, Time Series Analysis, Portfolio Forecasting, Scenario-based Forecasting, Retail Lending, Stress Testing, Macroeconomic Scenarios

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