What is *Dynamic Financial Analysis* (DFA)?

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The imminent introduction of Solvency II will drive the application of internal evaluation and risk management models. Dynamic Financial Analysis (DFA) is becoming an ideal technique for the development of internal models. This is the name used to embrace the stochastic simulation models in insurance business that enables the evaluation of the impact of strategic decisions on the solvency and profitability of the company.

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Traditionally, risk control and solvency analysis have constituted one of the principal concerns of insurance companies. The use of internal models to carry out this work has stimulated interest in the Dynamic Financial Analysis (DFA) models. Although DFA can be used to determine the capital needs for solvency purposes, its scope of application, amongst others, extends to risk analysis, investment strategy evaluation, product appraisal and the analysis of results. The main advantages of the internal models are that they are more flexible than standard models and can

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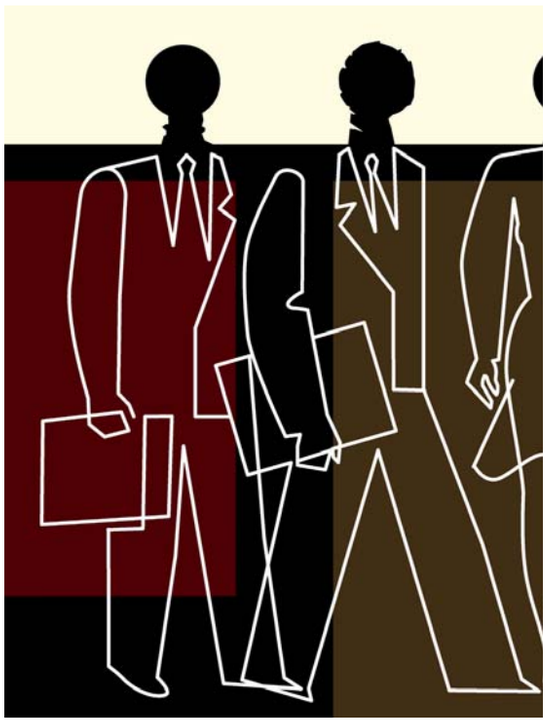


provide a more reliable reflection of a company´s business which enables better management.

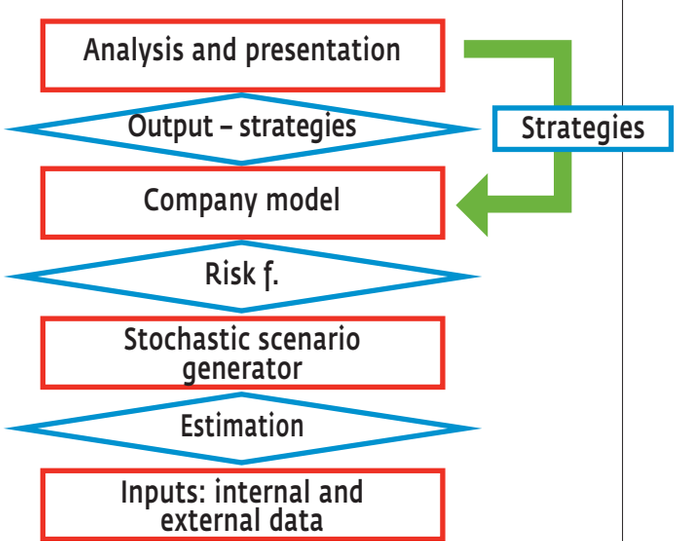
Dynamic Financial Analysis (DFA)

In classic actuarial analysis, technical and financial decisions were analyzed independently. As opposed to this method, DFA undertakes an integrated analysis of both activities. The importance of integrated models resides in the fact that both decisions are interrelated from the point of view of the organization. Therefore, decisions that might be taken in the context of a business unit, when evaluated in isolation, might not be the most appropriate for the company as a whole.

There are many definitions that have been attributed to DFA since, as Kaufmann *et al.* (2001) affirms, it is impossible to define or to describe only one DFA methodology. D'Arcy *et al.* (1998) indicates that DFA is a process that examines the financial situation of an insurer over the course of time, taking into account the interrelations between the different parts and the stochastic nature of the factors that can influence the results. We consider that DFA is the simulation process of insurance activity in an integrated way by means of stochastic modelling of determined variables in the evolution of assets and liabilities of the company with differing purposes. In this way, a DFA model[1] uses the Monte Carlo simulation techniques to predict the company´s results in the light of a group of future scenarios and shows how those results can be affected by changes in the internal and/or external conditions of the company.

In general, the DFA models tend to be processes of a generic structure that integrate the following activities (see, for example Blum and Dacorogna, 2004) (Illustration 1).

[1] The DFA models are generally classified as stochastic and deterministic models.



The generic structure of a DFA model.

The company must identify the main risks that affect the future financial situation of the company. Once identified, it is necessary to incorporate the model inputs, which is the set of company internal data and the environment in which it operates. These inputs are necessary for the estimation or calibration of the parameters of the stochastic models used to carry out the projections. The values of the parameters must allow building consistent and realistic scenarios, for which it is normally necessary to establish hypothesis about the future behaviour of the variables. Once the parameters of the model have been specified, they must be validated. One method frequently used for this task is back testing.

An essential aspect of the DFA scenarios generator is that the projected paths must not be generated in an isolated way, but they must reflect the relationship between the different variables used in the model. The company model takes into account the composition of the portfolio of assets and liabilities and enables the evaluation of the behaviour of the insurer in the context of the simulated scenarios.

The output of the model will depend on the objective for which it is used, but when the objective is the analysis of the risk, the economic surplus needs to be determined. The results obtained by the model must be analyzed, for which it is common to put them together into different measurements of profitability and risk. As a result of this process, the company can analyze the risks, evaluate strategies or determine the capital necessary in these simulated scenarios. If the results for any scenario are not acceptable, the causes or risk factors that have motivated them must be identified. A positive consequence of this process is that it is useful to establish which are the risk factors or scenarios that provoke a larger number of unacceptable situations.

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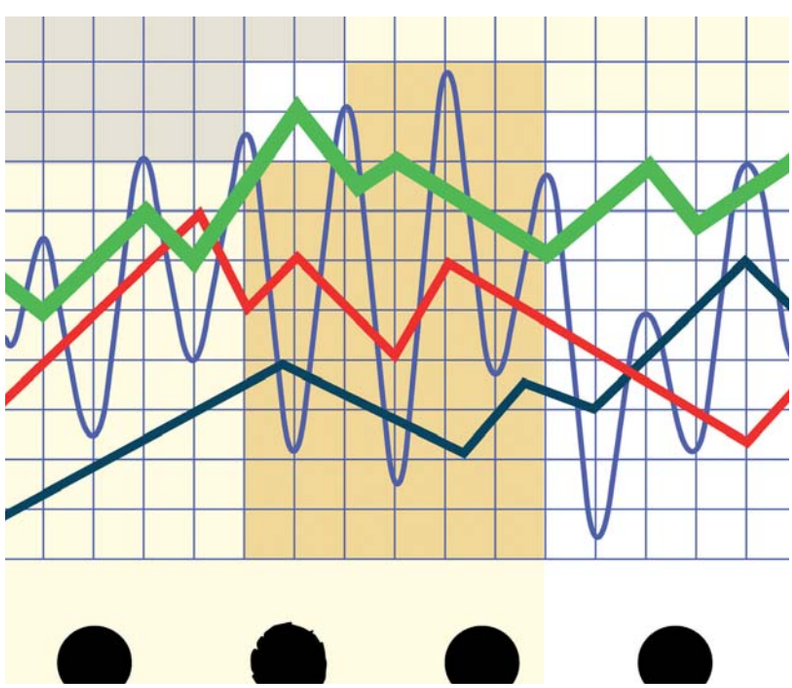
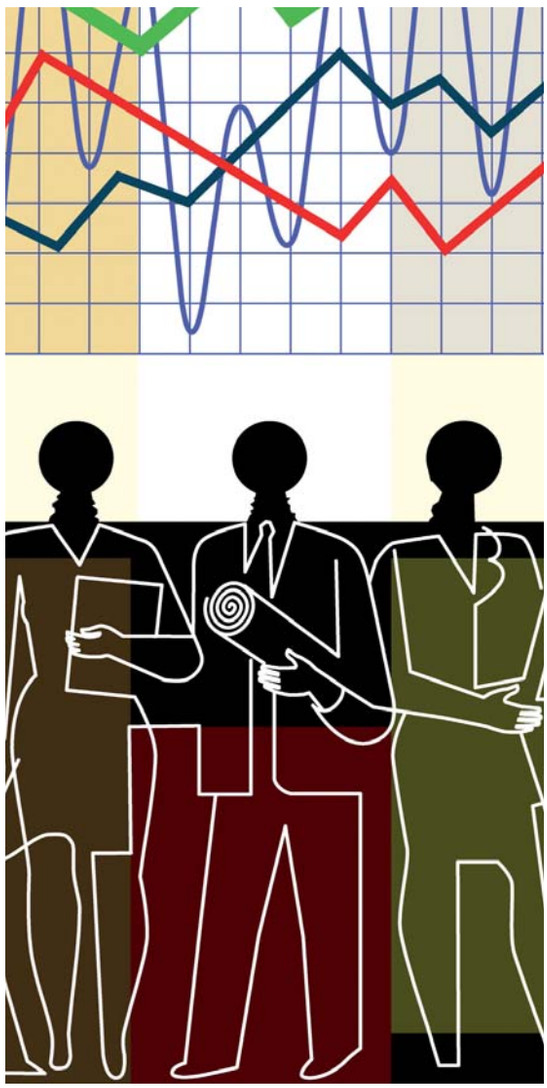


THE DYNAMIC DFA MODELS INCORPORATE CONDITIONAL DECISION RULES, PROVIDING THEM WITH ARTIFICIAL INTELLIGENCE



Also, there are several statistical methods that help to determine the effect of different individual variables on a target variable, facilitating the identification of the explanatory factors of the results of the model.

In order to analyze the output of a DFA model correctly, it is also necessary to carry out an analysis or sensibility test. The objective is to examine how the original results react to changes in the initial hypotheses or parameters. This way, one can check that the results obtained in the simulation are robust and not just the results of the hypotheses and parameters used. The sensibility tests are normally completed with the analysis of stress scenarios (stress testing), where the resistance of the company can be verified in the light of extreme changes to certain variables.

Once the outputs have been analyzed, a report can be prepared for the company´s management or governing body. A summary of the information produced by the model should be contained in the report so that the most suitable strategies can be identified, enabling actions that will achieve results in line with the company objectives.

Incorporation of the strategy in dynamic form

The dynamic DFA models incorporate conditional decision rules, providing them with artificial intelligence. The reason for this inclusion is the theory that management can react to its environment by reviewing strategies when necessary and not implement its business plan in a passive way during the model´s projection period. Formally, the rules of decision are implemented via algorithms that do calculations for some model variables according to the values obtained in previous periods or the values predicted in the future. In this way it attempts to simulate the future reaction of the company (evolution of the strategies) to the specific conditions simulated during the projection period. D'Arcy *et al.* (1998) indicate the advisability of incorporating certain strategic decisions into the models but they do not recommend incorporating all the decision making processes into the model so that the effect of different scenarios can be analysed.

Uses and users of DFA

In this section we describe the multiple uses attributable to the DFA technique. The Casualty Actuarial Society (1999) provides a list of potential uses when it states that DFA provides management with useful information for making decisions in the following areas:

1. Evaluation of the business plan. DFA models can be used to study in depth the causes for which the company´s financial objectives have not been met.

2. Marketing strategy (product and market development). DFA can provide a base for policy rating and/or explore the possible financial effects that new markets and products will have on the financial results of the existing products and markets.

DFA CAN BE USED TO IMPROVE THE COMPANY'S UNDERSTANDING OF COSTS, ADVANTAGES AND RISKS ASSOCIATED WITH CHANGES IN THE CLAIMS MANAGEMENT PHILOSOPHY FOR THE INSUREDS

3. Claims management. DFA can be used to improve the company´s understanding of costs, advantages and risks associated with changes in the claims management philosophy for the insureds.

4. Determining the capital necessary for the company. Capital sufficiency normally refers to the company´s ability to pay all its potential obligations. Historically, companies have fixed their capital by means of simple formulae based on premium ratios or reserve ratios and do not take into account risks faced by the companies. DFA is able to quantify better the level of capital necessary to support the risks of the business.

5. Allocation of capital over lines of the business. DFA permits an evaluation of the risks and profitability of the different

THE RISK AGENCIES RECOGNIZE THE IMPORTANCE OF RISK MANAGEMENT TECHNIQUES SUCH AS DFA. A COMPANY THAT ANALIZES ITS ECONOMIC DECISIONS BY MEANS OF DFA TECHNIQUES MAY OBTAIN A MORE FAVOURABLE RATING

operative divisions of a company and, consequently, allocation of capital can be made according to the value assigned to the risk borne by the company.

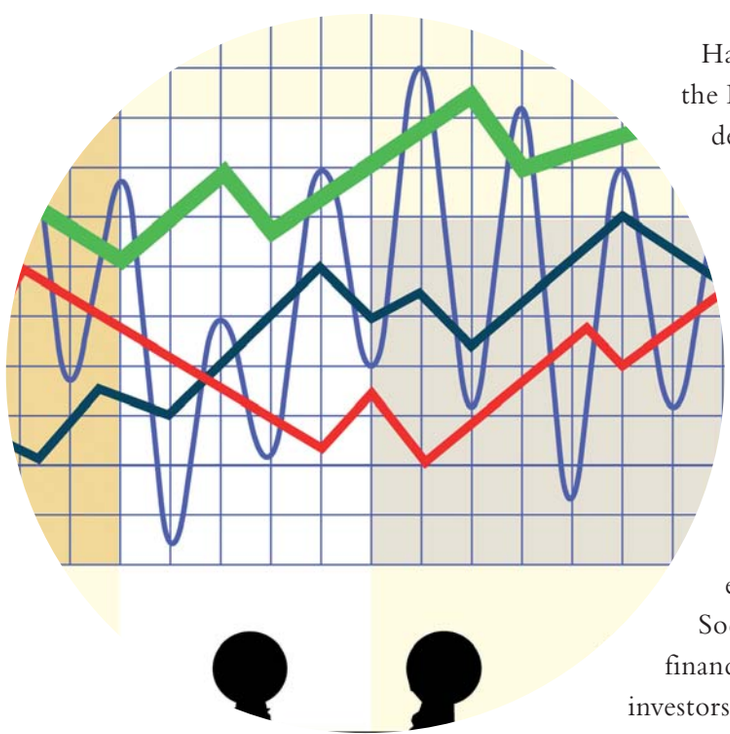
6. Liquidity analysis. A DFA model can help a company to determine the level of short-term funds that may be necessary depending on the volatility of the future cash flow.

7. Reinsurance structure or strategy. According to Bohra and Weist (2001), reinsurance analysis is based on examining the relation between profitability and the risk associated with different reinsurance structures. The key question is the risk tolerance or risk aversion of the buyer since, generally, the less reinsurance the greater the profitability, but also the risk. DFA can help to answer questions as to the type of reinsurance to be bought, the levels of retention or limits, amongst others.

8. Analysis of the investment strategy. DFA can analyze different asset strategies and observe the influence on the long-term financial results, helping companies to determine the optimum strategy appropriate for the risk profile.

9. Credit rating improvement. The rating agencies recognize the importance of risk management techniques such as DFA to the extent that they provide the necessary tools to obtain an understanding and quantification of the company´s risk exposure. A company that analyzes its economic decisions by means of DFA techniques may obtain a more favourable rating.

10. Analysis of merger and acquisition opportunities. By using DFA models, it is possible to quantify the acquisition price of a possible corporate operation as a function of the value created by the new company.



Having looked at the possible uses of the DFA technique, it is useful to determine who the potential users of these models are. Blum and Dacorogna (2004) recognize insurance and reinsurance companies as possible users, for the purpose of evaluating business plans and product development, and regulatory bodies and rating agencies, who use DFA to analyze solvency and liquidity. To the aforementioned entities, The Casualty Actuarial Society (1995) adds investment banks, financial intermediaries, institutional investors and financial analysts.

Conclusions

The need to measure the risk to which an insurance company is exposed has been promoted recently by the competitive environment in which the activity is undertaken, the technological and financial innovations, the current volatile nature of the markets and by the imminent introduction of the new regulation on capital known as Solvency II. The main advantage of DFA is that it adopts an integrated analysis of assets and liabilities that can be used for different purposes, amongst which one should highlight the fixing of capital levels adjusted to risk and the evaluation of the strategies in the light of changes in the environment. In this way, and at all times, the company is aware of the risk that it takes on and the necessary capital requirements to respond to that risk. Therefore, the company will be able to take action to situate the business within the desired risk level and to anticipate the effects of the strategies carried out.

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