STRESS TESTS IN THE INSURANCE FIELD – CONCEPTUAL OR IMPLEMENTING DIFFICULTIES

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Abstract:
The insurance business is based on uncertainty. Therefore, the insurer must take a lot of possible results in consideration, results that could affect its current and forthcoming financial situation. Stress tests are a necessary tool for the insurer when it comes to managing risks. At the same time, an insurer must maintain the financial resources at an adequate level to handle the risks.
The main objective of this presentation is: to debate the role that stress tests should play when managing the risks an insurer faces, but also the way these tests could help the insurer maintain a certain level of solvability and capital adequacy; to emphasize the importance stress tests have in assisting the supervising authorities in evaluating the risks insurers have to deal with and to give an overview of the different factors that need to be taken in consideration when projecting and implementing stress tests, including a discussion on the modeling techniques that could be used.
The research methodology used for this paper is mixed, combining qualitative research – **aiming to** *gather an in-depth understanding of insurance particularities - and quantitative research – to develop and employ mathematical models, theories and/or hypotheses pertaining to stress tests.*

Key words: sensitivity test, scenario test, VaR/TVaR, static/dynamic modeling

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1. Introduction

There are numerous definitions to what a stress test means. Stress tests are statistics-based methods carried out by insurance companies in order to provide a better understanding of the liabilities they face in extraordinary situations. These are based on the analysis of the impact of the adverse scenarios with a decreased but not impossible probability of occurrence. Throughout a stress test there are various techniques which can be carried out in order to measure the effects of the extraordinary or extreme effects. These include deterministic modeling and stochastic modeling, as well as the Monte-Carlo simulation technique.

The "stress test" denomination includes not only the *sensitivity test* but the *scenario testing* as well. These stress tests can be financial, operational, legal, connected to cash or connected to any other risk which could have a significant economic impact on the insurance company.

Basically, a *sensitivity test* estimates the impact of one or several changes of one or several risk factors closely related to each other, concerning the forthcoming financial affairs of the insurance company.

As compared to the *sensitivity test*, *a scenario test* is a more complicated type of test, which renders simultaneous changes in a series of risk factors and is usually influenced by what happens in different areas of the world. *The scenario test* provides an insight of the impact of catastrophic events on the financial situation of the insurance company in a certain part of the world, or simultaneous shifts of different risk categories

which influence all the transactions or course of business events of the insurance company, such as the volume shift of written policies, the fluctuations of prices of capital investments, the change in the interest rate.

There are two types of scenarios: *historical and hypothetical. The historical scenarios* rely on the changes of the risk factors in the past, and *the hypothetical scenarios* rely on a shock structure, which have been brought into discussion due to their likelihood of occurrence in theory, but not in actual practice.

Specialized literature and practice established *two functionalities* of the stress test from the insurer`s point of view. *The first one* of the two observes the *macrofinancial (systemic) analysis,* that is the study of the reliability of the financial system in case of extreme shocks and the quantifying of the systemic risk. The purpose of the stress test from the systemic point of view is to identify the latent exposure which might engender contamination effects financially. Stress test models can particularly provide an independent assessment of potential vulnerability sources and a broader comprehension of the links between the financial system and the macroeconomic environment. *The second* function is connected to *the institutional analysis,* due to the fact that the stress test can convey the vulnerable insurance companies. These can be used by the surveillance authority alongside with traditional instruments of off-site surveillance (rating models anticipation warning systems and other quality based information) in order to identify the insurance companies which need to be under closer observation.

2. Purpose and objectives concerning stress tests

The main function of stress tests is also brought about by the fact that these can raise the efficiency of the insurance companies endurance and that of the whole financial system in times of recession. This is why the periodical infliction of stress test scenarios must stand for an important risk management tool for an insurance company, through which it can be warned about the unexpected outcomes pertaining to the occurrence of various types of risks and which can enable an evaluation of the capital requirements which need to be met to overcome the losses that arise in this context. Consequently, stress tests mainly fulfill the following parts: they provide potential evaluation of risk exposure, which go beyond the limitations of existing patterns and historical database and which support the capital planning processes and the definition of alternative plans of cash.

Stress tests must be an essential part of risk and management policy of insurance companies and top management must be actively involved in the settlement of objectives and scenarios, as well as in the analysis of the results and mandatory decision-making for the improvement of risk-management activities, capital and cash planning, etc.

In order to provide a risk overview complementary to other tools of risk management, such as Value at Risk (VaR) and economic capital, stress tests must provide an independent risk perspective.

Therefore, stress tests are complementary to ordinary risk management models, they have underlying complex methods, which concern quantity, the analysis of historical data and of a foreseeable evolution by using statistics-based methods. Furthermore, they can be used for the acknowledgement of the results of statistic models at a high level of reliability used for the calculation of the Value at Risk (VaR).

The stress test is also an important risk management tool, during economic boom in which financial innovations lead to the implementation of new products, for which there is no sufficient database for the evaluation of the exposure to risks according to similar methodologies applied in existing products.

Of high importance is the fact that the capital planning of an insurance company should include thorough stress tests (carried out throughout a period of 1-3 years), which rely on the likelihood of the market`s conditions changing or that of extraordinary events occurring. These are to be used in the internal evaluation process of capital adequacy (ICAAP), to identify the needs and forthcoming income sources in unfavourable conditions. Throughout this process one must bear in mind that due to the recession even the best founded insurance companies can encounter major difficulties in income/fund absorbtion at a reasonable price.

Moreover,we find it mandatory that insurance companies detain methods which would evaluate the effect of reputational risk upon other categories of risk through stress tests (credit, cash, market and others),to which the insurance company is exposed so as to maintain a steady market reliability.

3. Modeling techniques for stress tests

Stress test methodology can reach a high level of complexity, the most advanced being those methods simulating the impact of the drastic change of macroeconomic conditions upon the incomes and capital of the insurance company. They can aim at different risk types, which are assessed individually or as an aggregate impact, such as credit, market, cash, operational and other risks. Ordinary models are based on static or dynamic modeling, on deterministic or stochastic approaches.

Typical of the *static modeling* is that all financial data throughout a fixed period of time is taken into consideration, while the *dynamic modeling* accounts for the evolution of the financial situation in future periods.

The deterministic approach relies on a „what if" analysis,which implies the selection of a set of economic and insurance variables, which are used to create other scenarios.This approach measures the impact of these variables upon cash flow in an insurance company depending on the different scenarios which are put into practice. As opposed to the stochastic approach, which supports that all scenarios which occur are realistic, the deterministic approach selects the scenarios by accounting for the results of the most trustworthy simulations for economic and insurance variables.

Based on simple mathematical procedures, this approach has the benefit of being significant to both the insurers as well as to surveillance authorities. The impact of more scenarios upon the cash flows of an insurance company is analysed so as to obtain some data concerning the endurance of this company to the gravity of the economic and insurance conditions. On the one hand, this enables the company to redefine the business or the investment strategies that can be carried out, and, on the other hand it allows the surveillance authority to apply the appropriate methods for the vouching solvability.

The underlying hypotheses of scenarios in deterministic models can easily be altered if unforeseeable changes in the adopted variables occur and, the model can therefore be updated according to the economic conditions evolution. Consequently, the deterministic approach has some advantages, such as the reliability of results and the liability of scenarios.There are, however, some drawbacks, as follows:

a) the use of professional reasoning in the scenario design– one can overestimate/underestimate a more optimistic/pessimistic outcome. As a consequence, the designer must design realistic scenarios so as to obtain objective results through simulation.

b) the misinterpretation of the correlations between exogenous variables – the lack of knowledge connected to the relations which occur between scenario implemented variables. The designer must bear in mind that the assumption of a hypothesis in a given scenario and other correlations with other variables can occur. These are to be acknowledged and adequately estimated.

Bearing in mind the differences mentioned above, by including deterministic elements in a stochastic approach, and by including the stochastic ones in a deterministic approach allows the combining of both with the purpose of creating a more accurate model in accordance with real life.

The stochastic approach is mainly based on the variables which are randomly selected out of a specific probability distribution function; these probability variables stand for the most important factors which have an effect on insurance. This approach is based on studies about the theory of risk and theory of probabilities, by using the distribution of probability in the estimation of bonuses, losses and incomes from investments, having as purpose the value allotment to the main cash flows and the actual application of simulation analysis.

Stochastic approaches are quite complex but provide more accurate results. One of the advantages of stochastic modeling is that it conveys an image of the array and likelihood of occurance of different financial outcomes. This fact is useful in reaching a certain degree of realiability in the solvability level. Stochastic models are useful, and sometimes essential, when insurance contracts contain not only options but financial warranties as well. In these circumstances, stochastic modeling is likely to be necessary not only for the anticipation of financial situations but for the elaboration of stress tests.

Other advantages of the model pertain to the fact that it represents an alternative to the traditional modeling, therefore a tool of some alternative(or new) models in situations in which convenient results cannot be obtained or in which the work methodology is extremely time-consuming, the Monte Carlo method can be used in simulations , more scenarios based on the definying of a parameter scenario can be made,scenario in which the function of the distribution probability is introduced.One can also randomly generate a set of premises, each of them being able to be taken as singular. The use of Monte Carlo methods, with a high number of simulations allows the introduction of certain measures of fluctuation in the model when future losses and new business are evaluated.

However, this approach is not flawless, especially when interest rates are uncertain and share prices are submitted to constant change, such as:

a) the lack of reason conjuration for which a company is deemed as surviving or one doomed to failure – indeed,the model provides the insolvency rates in each scenario , but fails to acknowledge why a certain company is surviving or not.

 b) the parametrization of the model – refers to the selection of one specific distribution function of probability for the main cash flows from one particular company. This implies the validation of the form and parameters of the function of distribution, used to maintain a as-accurate-as-possible representation of the underlying process of the involved variables evolution.

c) the redundancy of the model – refers to the "renewal" of the model when some initial assumptions change due to a reparametrization. This occurance involves a change in the result of the failure probability, which does not convey information about their nature and one cannot determine whether this change occurs due to the revised hypotheses or just due to pure chance.

An example of stochastic technique of risk measurement is the value at risk (VaR) and the trail of value at risk (TVaR). TailVar (also known as Policyholders' Expected Shortfall) is more frequently used for the remodeling of catastrophical events.

VaR is a statistics-based estimation which measures, for a certain reliability interval (usually between 90 and 99%, but usually 95%) the value of a sum (for example 5 million), in a certain currency (for example the Euro) which a portfolio or organization can lose within a given period of time (for example 10 days) due to a change in the market price for target assets. The amount of time for this can be of one day for most of the transactions or of a month or more for portfolio investments.

The main advantages of VaR are:

● it can quantify in a single numerical value the value of market risk for the entire asset portfolio of the insurance company , a fact which simplifies the workload of risk management, and enhances the decision-making and control capacity;

● it is used for the comparison of the market risk for all types of activities of an insurance company.

● the indicator can be extended to other risk categories, such as the credit risk or the operational risk;

● it can measure the risk typical of an instrument (for example: the including of the individual risk of a share or rating differences between interest rate bearing instruments (titles, bonds) among risk factors);

● it can be calculated separately on each portfolio of instruments and , bearing all the assets in mind,it can be calculated by simple sums without considering the correlations which occur between risk factors of instruments.

All things considered, statistic-based models such as VaR have their flaws:

- They do not account for the cash flow of the markets that the financial instruments are transactioned.

- They only measure the market risk on short term, when the market has a steady evolution, without any extreme shifts.

- The costs which the implementation of an integrated calculus system of Value-at-Risk are quite high.

- In some situations, the values offered by VaR lack accuracy because the model depends on many parameters the evolution which are difficult to anticipate.

- The VaR indicator measures the market risk on a short-term basis (usually for a day or a month) ,reason for which it cannot be used in the anticipating of the capital needed by an insurance company to cover the market risk in the long run.

Despite these advantages and flaws, VaR is used at a large scale in the financial industry and should merely be perceived as an additional method of market risk assessment.

4. The complexity of scenarios

The complexity of stress tests should be chosen according to the situation of each and every insurer. Simple tests, with hypotheses which would cover major risks can be more useful than a complex modeling, which is difficult to grasp and hard to validate.A careful insurer, a good manager however should examine the quality and the content of these tests on a regular basis and to look for means of improving the methodology in time.

Risks are rarely completely independent or completely connected to other factors. The insurer should examine the correlations between the various risks in order to evaluate the effects they can have on stress test models and on the hypotheses used. It is important that the presumed degree of correlation which is to be implemented in the future is not undervalued. There are proofs according to which in unfavourable situations the correlation levels, which were previously low, increased.The determination of the interdependence among risks require professional reasoning, because a certain occurrence of events can influence new social and economic conditions significantly.

Correlation analyses are necessary to guarantee the taking into account of the interdependency between risks.For example,if an insurer was affected by a major catastrophe ,the other parts that it depends on may be affected in their turn ,such as reinsurers, insurance negociators, other service providers , which can be unable of meeting their contractual deadlines or of providing services etc.

The determination of the dregree of dependency which exists among risks may be a complex procedure. This issue occurs especially when the tail dependencies degree is determined. An example of tail dependencies would be in the case in which two uncorrelated risks exist and the production of the first risk leads to higher losses for the second risk should any extreme event occur, as compared to average loss,should the event had not taken place. For example,a major catastrophe can coincide with a stock exchange collapse. The aftermath of the latter can be higher than expected due to the tension among investors.The terrorist attack from 11th September 2001 is an example in this sense because a airline catastrophe does not usually accelerate a downfall of the stock exchange.

5. The designing of the scenario

Because the designing of the scenario is essential in both approaches,the manner in which a scenario is being designed and what types of variables should be taken into consideration should be noted.

In practice,a scenario is a set of hypotheses on external variables which can affect the business stategy of an insurance company. This set of hypotheses represent the environment in which this company will probably operate in the future.

There are three main stages in the designing of a scenario, as follows:
a) selection;
b) effects;
c) calibration.

The selection of a scenario needs the designing of a hypothesis concerning the trends that both the economic environment and the insurance one would have. The economic environment could affect an insurance company through recession or overvalue, falls in the stock market, big fluctuations in inflation rate and interest rate. The insurance environment can influence an insurance company in a negative way through a postponed cycle of subscription bigger competition pressure, restrictive reglementation of natural calamities.

The effects of the scenario are focused on the interpretation of the different hypotheses pertaining to the economic and insurance environment generally speaking, which the company should submit to . This translation should bear a thorough account of the main relations between the economic and the insurance environment because they are not independent. For example,unpredicted changes in interest rates affect the output of the investments and, at the same time the subscription cicle of a company which includes bonuses, incidentals and losses. In addition, the inflation and interest rate are interdependent and, consequently the inflation rate is associated with changes of the interest rate. Therefore,there are some influences not only on the investment output and the subscription cycle but on the booking method endorsed by the company.

The calibration of the scenario implies the choice of the most accurate method for the determination of the severity of each and every scenario. As far as this aspect is concerned, there are several methods that can be implemented, such as the use of previous experience or management expectations for forthcoming years.The degree of severity of each scenario is usually included in the model through the definition of a standard scenario which is a result of the most reasonable expectations for the foreseeable future and one or more alternative scenarios which would render more optimistic or pessimistic outcomes of the future.

6. Conclusions

Conceptually speaking the denomination of stress test is basic, what is more complex is the putting into practice of this technique. Some of these techniques reside in:
- the determination of stress factors,
- the pinpointing of the way in which they are stressful ,
- the pinpointing of the value range which should be used ,
-the pinpointing of the timespan which these stress tests should take into account,
- excellent decision-making.

Another factor which insurers should consider is the fact that stress tests usually require a reliable database and a compatibility among insurance companies for the appropriate analysis of the interdependencies between risks.

Internal communication flows between branches of an insurer are also important, especially when there is no designated department which would carry on stress tests.

The extent to which the parameters and the variables are trustworthy should mirror the interpretations of the results and the recommendations made.Critical analysis should be carried out on a regular basis in order to ensure that they remain relevant for the changing of the risk profile of the insurer and for the external market contions.

As a consequence, we feel that the regular stress test scenarios should be an essential part of risk and management knowledge of an insurance company because it provides potential evaluations of risk exposure and endorses the capital planning processes and of defining of cash alternative plans.

These can raise the endurance of insurance companies in financial crises especially in the periods of stability/economic boom in which, due to the lack of extraordinary risks, the insurance companies may not be fully aware of the scale of a recession period and its effect on their financial stability and can easily accept a higher exposure to risk at a lower price.

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