

STRESS TESTING: A FUNDAMENTAL TOOL FOR FINANCIAL RISK MEASUREMENT

Stress testing is a risk management tool used to gauge the potential impact on a portfolio of hypothetical events and/or movements in a set of financial variables. There has been a tendency in the past to see stress testing as a secondary risk management tool compared to other methods of risk measurement such as value at risk (VaR). However, stress testing has become very common and sophisticated and it is being applied regularly by financial institutions to measure the likely impact of market shocks, as well as credit and liquidity events. This box explains what stress testing is, its benefits and drawbacks, and its relationship with other more established risk measures.

There are a wide variety of stress-testing categories based on the type of risks involved (market, liquidity, credit risks or any combination of these), the risk factors analysed (e.g. yield curve risks, foreign exchange risk, default risks, etc.), the stress-testing methodology (e.g. scenario analysis, what-if and risk factor analysis), the portfolio type (e.g. trading book, banking book or off-balance sheet), the geographical dimension (e.g. Europe, Japan, the United States), the level of the test (desk level, unit level, enterprise level) or the complexity of the portfolio (e.g. plain vanilla instruments, exotic structures). This variety shows that, although the principles of stress testing are simple, its application can be very complex.

Stress testing is well suited to assessing the degree of vulnerability of a portfolio in situations of crisis where normal market correlations break down and more mainstream measures of risk such as VaR fail to provide a fair picture of potential losses. In crises, markets can suddenly become very illiquid, rendering risk management strategies based on hedging useless and leading to much bigger losses than anticipated. Large and extreme swings of risk factors underlying the valuation of non-linear positions can also produce losses much larger than suggested by VaR estimates based on normal market conditions. Stress testing is also good at revealing and quantifying concentration risks through the analysis of correlation assumptions that may break down in situations of stress and could leave the portfolio with much larger exposures than first realised. Finally, stress tests, if applied well, are good at providing risk managers with information not only on the vulnerabilities but also on the possible flaws or weaknesses in the risk management framework.

Stress testing has also its limitations; in particular it is dependent on the scenarios and the subjectivity that surrounds the process of selecting the scenarios. This ultimately depends on the judgement and experience of the people applying it. The consistent application of stress testing is also difficult as it is necessary to follow through the scenarios and all possible ramifications which can be very complex. This complexity can lead to computational problems which also put some practical limitations on the frequency of stress-testing exercises.

Stress tests do not provide information on the likelihood of the outcome of the stress test happening. If the type of event considered could occur with a significant probability and the outcome yields a bad state, then the result of the stress test should be taken seriously. The lack of probability information makes stress testing a natural complement to probability-based risk measures such as VaR or expected shortfall (ES). VaR gives the maximum likely loss at a certain probability, but it does not provide any information on the loss that can be experienced if the loss exceeds VaR. Expected shortfall is a better measure because it provides the expected average value of tail losses. However, it does not really say much about possible large losses that can be

incurred beyond that level. Stress testing is good at providing information on bad states at the tails of the loss distributions, which is precisely where VaR and ES fail. VaR and ES are good at providing probabilistic measures of losses, but not so good at providing answers to “what if” questions, whereas stress tests are good at “what if” questions, but very poor at providing the associated probability of stress-testing outcomes.

The attention given to stress testing by financial institutions and regulators has increased dramatically in the last decade. This reflects a recognition that good stress testing could have helped institutions to weather various recent financial storms. Stress testing is in its own right a respectable risk measurement tool, on an equal footing with other more established risk measures such as VaR, and has a sound intellectual basis in the theory of comprehensive risk measures.¹ Risk managers are well-advised to keep deepening the scope and reach of stress-testing exercises so as to reduce the impact of future episodes of financial turmoil.

¹ See Box 13 in ECB (2007), *Financial Stability Review*, June.