

Stress testing in practice: a survey of 43 major financial institutions

Over the last couple of years large, internationally active financial institutions have engaged in increasingly complex and diverse activities. This tendency towards greater complexity, together with the experience of recent financial market crises, has reinforced an already large and growing interest in how these institutions measure and monitor their risk exposures. A specific set of risk management techniques, called “stress testing”, has attracted particular attention among both practitioners and regulators.²⁶ Stress tests are tools used by financial firms to gauge their potential vulnerability to exceptional but plausible events. Typically, a stress test estimates how the value of the firm’s portfolio would change if a particular market event were to occur. In recent years, stress testing has grown in importance, being used as a supplement to frameworks based on value-at-risk (VaR) and other risk measurement tools.

Stress tests gauge exposures to exceptional events

A census of stress test scenarios

Against this background, in March 2000, the Committee on the Global Financial System (CGFS)²⁷ decided, as a follow-up to previous work in the area of risk measurement and management, to organise a global census of stress tests in use at major financial institutions. To that end, the Committee established a Task Force of G10 central bank staff, which was asked to investigate the role of stress testing in risk management, identify which exceptional events market participants considered to be significant risks, and develop information on the heterogeneity of risk-taking at any given point in time.

CGFS undertakes a survey ...

²⁶ The interest of the regulatory community, for example, is apparent from the 1996 *Amendment to the Capital Accord to incorporate market risks* of the Basel Committee on Banking Supervision. It explicitly recommends testing the firm’s portfolio against a number of historical events, including the two ERM crises of 1992 and 1993 and the 1987 stock market crash.

²⁷ The CGFS is a central bank committee established by the Governors of the G10 central banks. It monitors and examines broad issues relating to financial markets and systems. In carrying out its tasks, the Committee places particular emphasis on assisting the Governors in recognising, analysing and responding to threats to the stability of financial markets and the global financial system. The Committee is chaired by Yutaka Yamaguchi, Deputy Governor of the Bank of Japan.

... and 43 major institutions take part ...

Forty-three major commercial and investment banks from 10 countries participated in the census and were asked to report their firm-wide stress tests that captured material risks as of 31 May 2000. Based on a set of survey forms, these banks and securities firms submitted a total of 293 *stress test scenarios* (based on a possible market event, such as a stock market crash) and 131 *sensitivity stress tests* (based on standardised moves in closely linked market risk factors, such as a parallel yield curve shift).

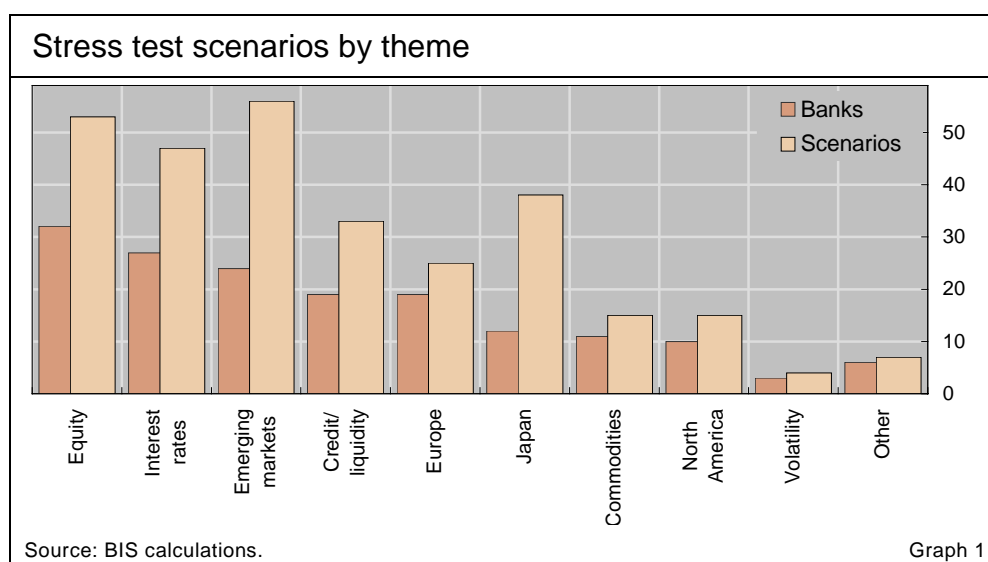
Stress test scenarios and their use in risk management

... submitting 293 firm-wide scenarios

Graph 1 sets out information on the 293 firm-wide stress test scenarios reported in the census, the main part of the Task Force's analysis.²⁸ Stress test scenarios were classified into themes based on their dominant asset class or geographical region. The graph shows the number of banks running a stress test in a particular area, regardless of how many similar stress tests that bank runs, and the total number of scenarios reported in the census for a particular theme. The four most common areas stress-tested were equity prices, interest rates, emerging markets and credit/liquidity spreads, followed by those focused on stress events in particular regions (including stress to foreign exchange rates). Only a few stress tests focused on commodities and related risk factors or on stress in options markets.

Scenarios focus on asymmetry in risks ...

Based on a detailed examination of these firm-wide stress test scenarios, as discussed in the Task Force's report, a number of observations can be made. First, there is a perceived asymmetry in risks. Crashes were much more likely to be stress-tested than booms for equity prices and emerging markets. Increases in interest rates and credit/liquidity spreads were more commonly stress-tested than decreases. Exchange rate related stress tests were more



²⁸ The Task Force's report, entitled *A survey of stress tests and current practice at major financial institutions*, was published in April 2001 and is available at www.bis.org. The Task Force was chaired by Alain Duchateau of the Banque de France/Commission Bancaire.

balanced, though “weak dollar” scenarios outnumbered “strong dollar” ones. In the follow-up interviews conducted by the Task Force members, risk managers attributed this asymmetry to asymmetric exposures (eg banks are exposed to the risk of rising interest rates, declining equity prices and widening credit spreads), asymmetric probabilities (eg higher risk of a stock market crash because of historically high equity market valuations), and managers’ personal experience of stressful events, which, in turn, is perceived to be asymmetric.

Second, it seems that banks rely on stress tests particularly for those markets or products whose risks may be inadequately captured by statistical risk measures like VaR. Interviewed risk managers suggested several reasons why VaR may inadequately measure risk for some markets or products, which would lead them to rely on the use of stress tests. Among those were: a lack of good historical price data, a tendency for markets to gap, illiquidity, or difficulties in estimating the highly non-linear exposures from options dealing. Risk managers cited emerging markets as a leading example of the above conclusion that some markets are particularly well suited for stress testing. This is particularly apparent from the prominence of stress tests involving emerging market exposures.

... and on markets with risks not captured by other measures

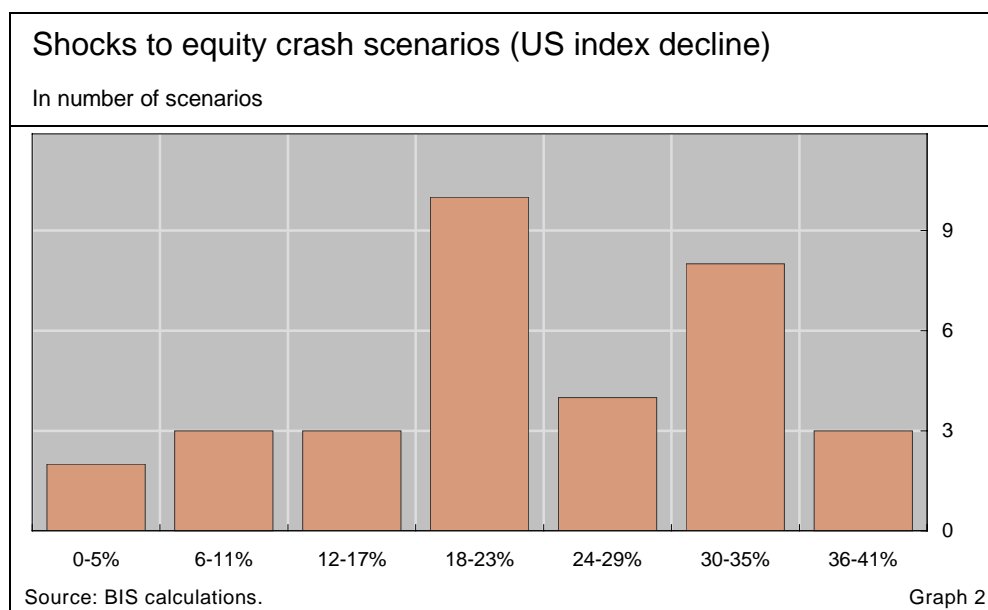
Another striking result of the census is the substantial heterogeneity across scenarios that, on the surface, look rather similar. This is reflected, for example, in the fact that the assumed magnitude of shocks varies substantially even among those scenarios portraying essentially identical events. While differences in shock sizes are not surprising in the case of hypothetical scenarios, differences are apparent even for historical scenarios that are based on an actual episode whose shocks are a matter of common knowledge. A potential source of these differences is that banks, when devising their stress tests, use different time horizons to measure historical shocks. One bank may use a one-day shock, another may use a two-week shock and a third may use the peak-to-trough shock.

Shock sizes vary even among historical scenarios ...

Graph 2 illustrates the point. It displays the frequency distribution of the magnitude of shocks to stock market indices in the United States as applied in 20 “Black Monday 1987” and 13 “hypothetical stock market crash” scenarios reported in the census. It is obvious that banks use quite differently sized shocks to capture an equity crash. A second example for this sort of heterogeneity is apparent from the cross-market effects assumed for the equity crash scenarios (not indicated in the graph). In 16 of these scenarios interest rates are shocked in addition to equity price indices. Of these 16 scenarios, nine assume that interest rates will decline, while five assume they will rise. The two remaining scenarios assume a mixture of rising and falling rates across countries.

... and cross-market effects can be very different

Finally, banks were asked a number of supplementary questions about how they implemented stress testing. According to their responses, stress testing has become a standard risk management technique for the reporting banks. All the



banks use stress tests to understand the firm's risk profile and to communicate the results to senior management. Just over half of the banks use stress tests to set limits, while one fifth use them for capital allocation. Two thirds of banks claimed that the results of stress tests had, at least once, directly led them to hedge or unwind a position. However, such a response, as indicated in the follow-up interviews, is by no means automatic as decisions tend to be made on a case by case basis. Most banks run at least some of their stress tests at a high frequency (daily/weekly). In contrast, some bank representatives said in interviews that the more complicated scenarios were costly to run, implying a lower frequency (monthly/quarterly). One quarter of banks run stress tests that allow for some, albeit limited, interaction of market and counterparty (default) credit risk. However, none of the interviewed risk managers claimed complete integration of market and counterparty credit risk, an area that received considerable attention in the wake of the 1997-98 crisis. Banks suggested that, at least at present, such interaction was limited to business lines or specific products that are assumed to have a material impact on exposure.

Implications of the census

The following implications of the census can be highlighted. First, it appears that stress testing, at least at those institutions reporting in the census, has become an integral part of banks' risk management. In devising their stress tests, risk managers seem to recognise the character of firms' exposures as well as the relative merits of scenario analysis and other techniques, such as VaR and sensitivity analysis, in dealing with specific exposures and different markets.

Second, in interpreting the results, firms seem to take into account their position in the market and the strategic aspects of risk management. Thus,

Stress tests an integral part of risk management ...

... but response not mechanical

there is no unique response by the reporting banks to the information gained through stress testing. In particular, there is no indication that banks reporting in the census apply strict, mechanistic policies to unwind positions if the corresponding stress test limits are being breached. Decisions are thus being taken on a case by case basis. In this regard, interviewed risk managers suggested that the appropriate reaction to a stress test will depend on the relationship between their bank's positions, other banks' positions, and the size of the market they operate in.