

# Financial Services Authority



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Dear Chief Executive

## **STRESS TESTING THEMATIC REVIEW**

In this letter, we report on a thematic review of stress testing practices at ten large firms in the banking, building society and investment banking sectors. We have included several examples of what we observed to be good practice. We set out key findings relevant to senior management in the body of the main letter and give full conclusions in the Appendix. We are not proposing any new rules or guidance in this letter.

Stress testing and scenario analysis are essential tools for firms' planning and risk management processes. By using stress testing and scenario analysis, senior management can assess and adjust their view of the risks that face their firm, plan mitigating action and identify risk concentrations. From our perspective, it allows us to see how firms will manage their financial resources through adverse circumstances. As we explained in a Discussion Paper last year (DP05/2<sup>1</sup>), we believe that the wider use of stress testing by major firms has the potential to reduce risks to the UK financial system. We recognise that there is no simple formula for an effective stress testing programme: firms need to decide for themselves what is effective, taking into account their own business, structure, etc.

Broadly speaking, we found that most firms in our sample had practices that went some way to meeting the characteristics of the 'Comprehensive Approach' (we summarise the background to the Comprehensive Approach below). A small number of firms had practices

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<sup>1</sup> FSA Discussion Paper 05/2, 'Stress Testing', May 2005

that ranked strongly against all of the characteristics. Moreover, most firms were developing and improving their practices. A small number were weak in all respects. We accept that this is our judgmental assessment against an industry benchmark. But it lends support to our view that many firms still need to make further progress to attain the standards as reflected in the Comprehensive Approach. This letter is designed to help firms in their progress.

The full conclusions of our review, including an assessment of how advanced firms are in embedding the characteristics of the Comprehensive Approach into their risk management frameworks, are set out in the Appendix to this letter. Even though the results are based on a relatively small sample of firms, we believe that the examples gathered are reasonably representative of the range of firm-wide stress testing practice within the group of firms reviewed. So the results are of wider relevance to larger firms and not only to those in the banking, building society and investment firm sectors.

We described the Comprehensive Approach to stress testing in DP05/2. The approach was developed in co-operation with the industry, and represents a view of good practice rather than FSA guidance. We have set out the six characteristics of the Comprehensive Approach in the Appendix. Reiterating what we said in the Feedback Statement to DP05/2<sup>2</sup>, we shall expect to see all firms, particularly the larger and more complex institutions, move towards incorporating the principles of the Comprehensive Approach within their risk management frameworks. We would, of course, expect each firm to do so in ways that are proportionate to the risks inherent in, and the scale of, the firm's business.

These are the key conclusions from our findings.

- **Close engagement by senior management resulted in the most effective stress testing practices.** There was a range of practice in the extent of senior management engagement. Good practice was most in evidence in firms where senior management took a direct interest in their firm's stress testing programme, resulting in scenario selection and management reporting that addressed the concerns of management. In some firms, chief executives were involved personally at the review and challenge stages. In other firms, a high-ranking officer, such as a chief risk officer, took personal charge of the stress testing programme, ensuring that it functioned effectively within their organisation, and briefing senior management. A few firms did both.
- **Good practice was observed where firms conducted firm-wide stress tests of scenarios which were plausible, yet under which profitability was seriously challenged, key business planning assumptions were flexed or scope for mitigating action was constrained.** We were struck by how mild the firm-wide stress events were at some of the firms we visited. On the evidence of our review, few firms were seeking out scenarios such as those that might require a dividend cut, generate an annual loss, or result in shortfalls against capital requirements while still remaining plausible. The current high level of profitability and capitalisation in many firms may provide part of the explanation. But additional reasons could be that firms

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<sup>2</sup> FSA Feedback Statement 05/2 'Stress Testing: Feedback on DP05/2', December 2005

might underestimate the likelihood of severe events or, where mitigating action is envisaged, they might overestimate their ability to take action that is both effective and timely. As a result, senior management may not be presented with scenarios that force consideration of more challenging issues.

- **Communicating results clearly and accessibly was important for many firms.** Good practice that we observed included presentation of stress testing or scenario analysis results to senior management that: (a) showed the effects of the stress test over a multi-year time horizon; (b) showed the effects of the stress test across a selection of metrics (for example, its effect on capital, the balance sheet, or P&L); and (c) separately presented the effects of possible management action on these same metrics in the stress scenarios.
- **Good practice entailed using group-wide stress testing and scenario analysis to challenge business planning assumptions.** A small number of firms chose not to operate a group-wide programme of stress testing. Apart from questions of compliance with proposed Handbook requirements, it seemed to us that senior management might not assess the risks facing their firm as effectively as others in our sample by failing to seek evidence that might confirm or challenge their own opinions about those risks.

As we have said, we think that it is important for firms to perform effective stress testing. We ask firms to do this so that management takes severe but plausible scenarios into account when making strategic or risk management decisions. If such scenarios are likely to result in outcomes that are outside the firm's risk appetite, then management may want to take mitigating action.

Accordingly, you should expect your supervisors to discuss with your firm the nature and quality of your stress testing activity as evidence of sound planning and risk management. Supervisors may also suggest that considering the results of your stress testing programme may help us understand the risks facing your firm and understand your mitigation plans. Where firms are particularly weak in their stress testing practices, we will seek improvements as part of our ARROW Risk Mitigation Programmes.

Although we have assessed actual performance against the benchmark of the six characteristics of the Comprehensive Approach, which are not themselves part of the FSA Handbook, our general emphasis on stress testing will be supported by Handbook requirements. The need for stress testing derives from our Principles for Businesses 3 and 4: 'a firm must take reasonable care to organise and control its affairs responsibly and effectively, with adequate risk management systems' and 'a firm must maintain adequate financial resources'. When they come into force, our proposed requirements in GENPRU<sup>3</sup> will require a firm to carry out stress tests and scenario analyses that are appropriate to the nature of its major sources of risk (GENPRU 1.2.42 R). We give guidance on these requirements in GENPRU 1.2.63 G to 1.2.78 G. These derive from the stress testing

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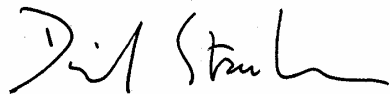
<sup>3</sup> Our proposed GENPRU requirements are set out in Appendix: Volume 1 of CP 06/3 'Strengthening Capital Standards 2', January 2006.

requirements built into the various internal model approaches for Pillar 1 minimum capital requirements. They also reflect more generally the over-arching requirements under Pillar 2 for firms to stress test their overall risks for a severe economic downturn projected over a capital planning horizon of a three to five year period.

Our future work on stress testing is likely to focus on implementation by individual firms, particularly in the context of GENPRU requirements and Pillar 2 stress testing. In addition, we may undertake further thematic or cross-firm work and hold industry seminars.

If you or others in your firm wish to discuss the matters raised in this letter, please consult your FSA Relationship Manager. We are sending this letter to the chief executives of large banks, building societies and investment firms that are authorised by us. We plan to publish this letter on our website on Monday, 16 October 2006.

Yours sincerely

A handwritten signature in black ink, appearing to read 'David Strachan', with a stylized flourish at the end.

David Strachan  
Director  
Major Retail Groups Division  
Financial Services Authority

## **APPENDIX**

### **STRESS TESTING THEMATIC REVIEW: OUR APPROACH AND CONCLUSIONS**

1. This Appendix discusses the good practice we observed in our stress testing thematic review. We focused on 'good' practice as opposed to 'best'. We recognise that, in a few instances, observed practice qualified for the term 'best'; where we felt that this was the case, we have indicated that the illustrated practice lies beyond the merely 'good'. Moreover, in some cases our good practice points are stylised examples combining observations from more than one firm.
2. Deciding what is good practice and whether it works well is a matter of judgement and needs to be viewed in the light of a firm's individual circumstances. We recognise that opinions within the industry may reasonably differ in some areas; and processes will develop over time so that what is considered good practice will change. For this reason, our views on good practice are not standards, minimum requirements, rules or guidance. But we do believe that the results of our review will be valuable both to firms and to us.
3. The results of our review are structured around the six characteristics of the Comprehensive Approach:
  - i) Senior management will be able to identify and articulate a firm's risk appetite and understand the implications of stress events within this context.
  - ii) Senior management will take an active part in identifying potential stress scenarios.
  - iii) Outputs from stress testing will be communicated to senior management in comprehensible format.
  - iv) Senior management will have an overview of firm-wide risks and stresses and a concept of total risk even where precise aggregation is not possible.
  - v) Senior management will consider formally the implications of stress testing for a firm's strategy or business profile.
  - vi) IT systems, resources and procedures will allow senior management to identify, quantify and manage efficiently the stresses that affect a group.

### **OUR APPROACH**

4. In our review, we examined the practice of firm-wide stress testing at larger and more complex firms. We visited ten firms during the second and third quarters of 2006. We visited large banks, building societies and investment banks, but did not visit any asset managers as initially indicated in paragraph 4.4 of the Feedback Statement on

DP 05/2. Of the ten firms visited, nine had participated in the conference on stress testing held at our offices in September 2005. All firms have applied for, or are considering applying for, permission to use one or more of the advanced approaches under the Capital Requirements Directive (CRD).

5. Building on the characteristics of the Comprehensive Approach, we structured our visits around the following topics:
  - governance;
  - risk appetite;
  - use of stress testing by senior management;
  - capital planning;
  - role of business managers and risk and financial management;
  - design and execution of stress testing;
  - technical considerations; and
  - reporting the results of stress testing.
6. At each firm, we observed stress testing practice at an aggregate firm-wide level where issues of senior management involvement, risk appetite and capital planning were to the fore. We also met with management of selected significant business units to observe more granular issues of underlying stress testing and scenario analysis applying to specific portfolios. Ahead of the visit we were supplied with existing policies, procedures and examples of senior management reports. We also reviewed firms' descriptions of their stress testing practices in the risk management sections of their most recent annual reports.

## CONCLUSIONS

7. As we explained in the main body of the letter, we found that most firms in our sample went some way to meeting the characteristics of the Comprehensive Approach. A small number of firms had practices that ranked strongly against all of the characteristics. Moreover, we observed that most firms were developing and improving their practices. A small number were weak in all respects. If firms wish to achieve good practice against all the characteristics of the Comprehensive Approach, then further progress remains to be made.
8. We have organised the conclusions of our review under the six characteristics of the Comprehensive Approach, repeating the characteristics in italics.

## **Risk appetite**

*Senior management will be able to identify and articulate a firm's risk appetite and understand the implications of stress events within this context.*

9. In DP05/2, we reported on our discussions with the industry and we relayed the view that good practice entailed having a framework for ensuring that firm-wide risk was identified and captured.
10. In our review, we observed that good practice in this area included a risk appetite statement from the Board that communicates effectively the Board's risk tolerance to the organisation and to stakeholders. The hallmarks of a risk appetite statement included being clear and accessible throughout the organisation.
11. The methods used to indicate risk appetite varied from firm to firm. Examples included statements of preferred risk asset ratios, target agency ratings, risk and return statements, economic capital measures, acceptable stress losses and mandate statements indicating activities in which stakeholders expected the firm to be active. Firms chose the techniques that were suited to their own circumstances.
12. Some firms chose to adopt risk appetite statements that were purely qualitative. Such firms tended to back up their statement with measures that would allow business units to judge whether new business fell within risk appetite.
13. Good practice would be to formulate risk appetite through an iterative process, subject to periodic review and adjustment in the light of experience.
14. Good practice would also be to examine stress scenarios to see whether, if the scenarios were to materialise, the outcome would result in risk-taking that exceeded the stated risk appetite.
15. Here in more detail are a couple of examples that we observed.
  - At one firm, we observed the setting of stress loss limits at various confidence intervals corresponding to their view of both a mild and a severe stress event, against which actual stress loss estimates by the business units were controlled. Alongside this approach, we observed the setting of mandates describing at a detailed level what type of business the group would undertake. These were complemented by more traditional quantitative limits and portfolio caps, such as credit limits by group, industry, sector, country and region. We judge that this approach lies more towards best practice at this time.
  - Another firm chose to describe risk appetite in terms of operating profit at business unit level, after deduction of expected loss and the standard deviation of expected loss that would cover the target dividend payout ratio. If the dividend ratio could not be covered, then the firm would consider using surplus capital that was otherwise earmarked as distributable to shareholders.

## Senior Management Engagement

*Senior management will take an active part in identifying potential stress scenarios.*

16. In DP05/2, we reported the view that the key aspect of this approach was that senior management took responsibility for the choice of stresses to be examined as part of their responsibility for managing firm-wide risk.
17. In our review, it was clear that stress testing activity took place at several levels of the organisation. Firms typically operated a programme that included, in most cases, some stress testing at the firm-wide or group-wide level, in addition to stress testing activity within business units throughout the organisation. All firms recognised that the extent of engagement by the most senior management needed to be governed by the scope and purpose of the stress testing activity in question. For that reason, we observed that good practice was for senior management to engage in the firm-wide, top-level macro stress testing process but limit their involvement in more granular stress testing such as that performed for specific portfolios.
18. What appeared to work well for a number of firms was for the firm's senior management, perhaps in the form of one individual such as a chief risk officer or equivalent, to take personal responsibility for the firm-wide stress testing programme. Having a single individual take responsibility appeared to result in a focused programme, aimed at addressing questions that were of interest to the firm, and in harnessing resource for the programme. This individual would be able to use the results of the stress testing exercises, in combination with other data, in the course of normal contact with the CEO and with the firm's executives. This appeared to have the benefit of making the results immediate, as the individual can select and communicate often complex information to the CEO and other senior managers so that those not involved in stress testing could focus quickly on the results of most importance. Clearly in the course of our review, we were only able to hear anecdotal accounts of how this worked in practice, but we did judge this to be an example of good practice.
19. In many cases, firms devoted extensive time and resource to developing the stress scenarios. This process was characterised by broad consultation within the firm, involving management, business unit staff, risk management staff and economists about the types of scenario that needed to be run. This process of internal consultation appeared to be good practice and to add value in itself. To run macroeconomic scenarios, firms need to specify key inputs such as interest rates, equity prices, inflation, unemployment, property prices and economy-wide default rates; this usually required expert input in the form of economists and econometric modelling. Some firms used a proprietary economic model for this purpose. Consideration of stress testing design by a Committee with an appropriate remit might also be good practice.
20. What we saw at many firms was that some components of the stress testing programme, usually at the top-most level of aggregation, were undertaken in conjunction with the planning and budgetary cycle. The Board were presented with,

and considered, a range of alternatives to the central planning assumption. This use of stress testing stands in contrast to that performed for day-to-day risk management purposes. We observed that it was good practice to perform stress testing in relation to the more strategic business planning and budgetary cycle as well as for day-to-day risk management purposes. The frequency of this type of stress testing tended to be annual, perhaps complemented by interim updates. We observed many of the firms in our sample flexing a central planning scenario in both upward and downward directions. The advantage of flexing upwards was that the impact of higher than expected balance sheet growth could affect the capital position of the firm, particularly where capital-raising opportunities were constrained or where a repayment of excess capital to shareholders was being planned.

### **Communication of results**

*Outputs from stress testing will be communicated to senior management in comprehensible format.*

21. In DP05/2, we summarised the process for producing the stress testing results and communicating them to senior management.
22. In the course of our review, we examined many instances of stress test reports. We observed a variety of ways of communicating results. In some cases, firms produced a fairly comprehensive stand-alone stress testing pack, covering many different scenarios. In other cases, as already explained, firms chose to present stress testing results as variants to a central planning scenario: the central scenario itself was either an expected outcome or alternatively it embodied comparatively conservative assumptions about future developments. Where the latter approach was used it might be said to represent a mild stress scenario. These approaches all appeared reasonable within the specific processes of particular firms.
23. It is inherent in stress testing that a range of possible future states of the world is applied to often complex businesses. As a consequence, stress testing and scenario analysis practices tend to be complex and involved processes. This places a significant communications burden on those who are compiling the outputs of stress tests as part of management information packs. They need to communicate the outcome of these stress tests in a form that senior management can use to set strategy and guide major decisions. This means that management information on stress testing should be presented in a way that is aligned to the firm's broader business needs. It also means that stress testing results need to be articulated in a clear and concise fashion to allow senior management to keep sight of the bigger picture when digesting potentially complex scenarios.
24. Accordingly, good practice was observed where firms spelled out clearly and concisely the impact of scenarios on key metrics, whether the scenario analysis is being used for strategic planning purposes or day-to-day management of, for example, market risk.

25. An example of good practice in presenting the results of stress testing or scenario analysis would be to show:
- a) the effect of the stress test over a multi-year time horizon;
  - b) the effect of the stress test across many types of metrics (for example, its effect on capital, the balance sheet, or P&L); and
  - c) the effect of possible management action on these same metrics in the stress scenarios, separated from the effects in (b).

### **Overview of firm-wide risks**

*Senior management will have an overview of firm-wide risks and stresses and a concept of total risk even where precise aggregation is not possible.*

26. In DP05/2, we reported the view that aggregation of risks was technically difficult and, for some types of risk, such as reputational and legal risk, all but impossible. Stressing some risk factors in combination such as market and credit risk factors was embryonic. Good practice, nevertheless, was for management to be presented with a holistic view of risks, with an informal or impressionistic assessment of all firm-wide risks being seen as useful.
27. In our review, we found that senior management did, by and large, have a clear opinion about the main risks affecting the firm as a whole. What was harder to discern was whether or not that opinion represented a fair view of those risks. In some cases, it appeared that management held an accepted and perhaps inflexible view of the nature and likely impact of what those risks were. In other cases, management sought to use their stress testing programme to challenge their own assumptions about the risks and vulnerabilities facing the firm.
28. Most firms attempted some form of macroeconomic scenario analysis which might embody both market, credit and perhaps other financial risks as they might evolve over the medium term, up to three, four or five years ahead. In that sense, market and credit risks did tend to be aggregated. However, the consequences of market stress, such as interest rate movements, might be limited mainly to first round effects.
29. Firms with significant trading activities naturally needed to undertake a rich programme of market risk stress testing. We saw many examples of this. As well as assessing the impact of sharp movement in market rates, prices and implied volatilities, good practice also entailed examining: the effects of market liquidity drying up; the impact of market events on business volumes; and the effect of market movements on counterparty exposures. As we observed in our most recent Financial Risk Outlook<sup>4</sup>, it is in this field that stress testing is most developed.

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<sup>4</sup> FSA 'Financial Risk Outlook 2006', January 2006

30. Many firms found it useful to consider the non-financial impact of scenarios or to consider scenarios that were themselves non-financial in character. In this vein, we discussed scenarios based on pandemics and also, but to a lesser extent, terrorism; a small number of firms also mentioned legal risk. For example, one firm considered a scenario in which two of its processing hubs were affected by a pandemic disease, working through the effect not only on financial variables, but also on the availability of management, systems, people and property. As such the stress test combined aspects of business continuity planning. Abstracting from this and other examples discussed with us, good practice would entail firms considering scenarios that contain unusual or hypothetical elements that could impact severely on the business, including those that could simultaneously affect the firm through both financial and non-financial channels.

### **Consideration of implications of stress testing**

*Senior management will consider formally the implications of stress testing for a firm's strategy or business profile.*

31. In DP05/2, we reported the view that stress testing was not an end in itself, but that it called for consideration of possible management response.
32. We ask firms to stress test so that management takes extreme but plausible scenarios into account when making strategic or risk management decisions. If these scenarios are likely to result in outcomes that are outside the firm's risk tolerance, then management may want to respond. This response could take a number of forms: altering the balance of its portfolio, changing its strategy, or shifting its geographical business concentrations.
33. Because firms' articulation of risk appetite was less specific than we expected, particularly as it applied to individual business lines, we did not see examples where the chain of events described above played out. We did see some less severe scenarios incorporated in the annual business plan, usually supplemented with quarterly updates. However, mildly stressful scenarios were unlikely to demand significant changes to management strategy, though they would sometimes confirm management's decision to adopt less conservative strategies.
34. When examining the severity of stress tests being performed, we were struck by how mild many of them were. The firm-wide stress tests being performed frequently resulted in an impact that would be comfortably absorbed by annual profits. We did not see much evidence that firms were seeking out more severe scenarios that would necessitate a dividend cut, or an annual loss or shortfalls in capital requirements. We can only speculate about the reasons: they are partly conjunctural in that, under current economic conditions, firms may feel that they are able to absorb a wide range of stress events. But firms may possibly underestimate the likelihood of severe events and may also be over-optimistic about their own ability to select appropriate mitigating actions and do so at the right time. Moreover, most firm-wide scenarios were purely macroeconomic in character; we saw few attempts to incorporate within these scenarios elements that might affect their specific firm, such as deterioration in

reputation, an adverse change in their competitive position within their industry or the failure of a market counterparty. We consider that good practice would involve firms including among their suite of stress tests, a few scenarios under which profitability was seriously challenged and under which some key business planning or environmental assumptions were flexed. In this vein, under our rules for the internal ratings based (IRB) approach to credit risk, we require firms to apply stress tests for a downturn in the economic cycle which represent an event such as might occur once in 25 years; and we will look for a similar degree of severity to be applied to the overarching stress tests for the capital plan under Pillar 2 in order to assess whether firms can maintain their Capital Resources Requirement (i.e. the Pillar 1 minimum) over a three-to-five horizon.

35. Assessing the severity or mildness of a scenario is clearly a judgmental exercise. 'Mild' stress tests included tests that firms characterised as 'once in five years' or 'once in ten years'. Some firms tried to attach a probability to their stress tests: firms seemed content to use tests that they viewed as having a 10% or 20% probability of materialising. Some firms did a series of tests of increasing severity. In one case a firm had three scenarios of escalating degrees of economic weakness. Under the weakest scenario, GDP followed a growth path whose minimum value was 1.0%, rebounding to 2.9% in the fifth year of the scenario. When this weakest scenario was combined with a sharp increase in commercial property write-offs, it gave rise to a modest loss in just one of the forecast years; moreover this loss became a modest profit after the effect of mitigating action was factored in. We have spelt out this scenario in some detail in order to illustrate what might be viewed as a borderline 'mild' scenario.
36. Some firms in our sample did run scenarios that were severe in their assumptions and in their impact. For example, one firm used several scenarios which were designed to assess risk within a particular business sector. Some of the most severe scenarios were assigned probabilities of occurring of 1 in 10,000 or 1 in 100,000: the management of these firms considered that the likelihood of these scenarios occurring was negligible. However, one scenario based on three successive years of GDP contraction, was given probability of 1 in 350 of occurring; this scenario might be characterised as being both severe and low in probability, but not completely implausible. In terms of impact, the cumulative effect on the business line in question was pronounced; we were not shown the effect of the same scenario on the firm's whole portfolio.
37. Good practice would be to use scenario analysis to test whether potential changes to strategy could result in outcomes that are outside the firm's risk tolerance if some downside scenarios were to crystallise.
38. Good practice would also be to use scenario analysis as a part of contingency planning to see how significant downside scenarios could require significant changes of strategy.

## **IT systems, resources and procedures**

*IT systems, resources and procedures will allow senior management to identify, quantify and manage efficiently the stresses that affect a group.*

39. In DP 05/2, we explained that developing adequate human and IT resources to manage the stress testing process would be likely to help firms identify, quantify and manage stresses. We also explained that it is important that a firm's IT systems are adequately resourced to be able to stress test all of a firm's businesses for all major risks that affect it on an aggregate basis.
40. We found that all firms reviewed had some forms of IT systems and procedures in place to support their stress testing practices. Some firms had a more structured procedure around stress testing than others.
41. While some firms based their scenario selection and development on their in-house data, resources and IT systems, others rely on external systems or models to carry out part of their stress testing. The application of external models tends to be more common for assessing the impact of changes in macroeconomic conditions where the stress events are derived from the external environment.
42. Good practice would be to have IT systems, resources and procedures that could produce stress testing outputs for communication to senior management in a comprehensible format. These systems would also be able to support the volume and complexity of data arising from a firm's business. Systems that could support the aggregation of stress test on a firm-wide basis were perhaps best practice at this point in time.
43. When a firm has multiple IT systems in place for their stress testing process, good practice would be to have good interface between those systems. Firms that have undertaken a major acquisition may be particularly challenged in this area.
44. Good practice would also entail a continual search for improvements in systems and procedures to accommodate business needs.

## **Business unit level stress testing**

### General

45. Most of the findings of our review are relevant to firm- or group-wide stress testing undertaken in respect of senior management concerns. We also examined stress testing practices at one or more individual business units on our visits, which allowed us to examine practices at various levels within the firm's organisation and also examine stress testing as used in the day-to-day risk management. We were selective about the business units chosen, aiming to include at least two examples for each type of business unit.
46. What we saw was that, for a given business line, there were relatively few important factors affecting the behaviour of the portfolio. A stress test for the given business

line therefore might stress only those drivers. As such, stress testing is within the capability even of firms with simpler business models than those observed in our sample. To assist in that process, we record below our view of good practice at a technical level in respect of individual business lines.

#### Corporate and other non-retail credit risk

47. At business unit level, most firms calculated a stressed bad debt charge. Two methodologies were observed:
  - a) a stress probability of default and loss given default (LGD) (where not a downturn LGD) to arrive at stressed expected loss which would be used as proxy for the bad debt charge; and
  - b) a rating migration analysis was undertaken to drive an increase in non-performing loans and a consequently greater bad debt charge.
48. The increased cost of carry on the stressed level of non-performing loans was not always explicitly calculated. Assessing the impact on non-interest income of stress scenarios was not necessarily a focus at business unit level, which tended to concentrate on the forecast of the bad debt charge; it appeared to be good practice and perhaps best practice to consider the impact on non-interest income at business unit level.
49. Linking economic scenarios to forecast bad debt charges for non-retail was accomplished by observing historic linkages between economic drivers and rating agency migration tables for periods of stress back to the 1980s. One firm used income gearing for the corporate sector published by the UK Office of National Statistics to forecast the level of default by comparing current gearing levels to historic gearing levels and historic losses under downturn scenarios. For commercial property some firms assumed a percentage fall and others used the rating migration approach to simulate tenant defaults.
50. A stress scenario of a banking accrual book will impact its regulatory capital and core equity (tangible equity excluding hybrid and maybe preferred) in the following ways:
  - i) performing loans will become non-performing resulting in increased bad debt charges;
  - ii) increased cost to carry of non-performing loans;
  - iii) net-interest income may be depressed and will be significantly impacted by the firm's policy for hedging its net non-interest bearing liabilities and the forecast change in the level of interest rates;
  - iv) non-interest income arising from origination of new business (typically curtailed in a downturn) and trading revenues may fall; and

- v) the migration of performing loans between rating grades will require holding more capital under the IRB approach to credit risk under the CRD; under Basel 1 and former UKGAAP such migration would have required additional general provisions.

### Retail credit risk

- 51. Unsecured lending, particularly credit card lending, poses a particular challenge for firms' stress testing because there are some indications that this sector is undergoing structural changes (including consumer attitudes to indebtedness and insolvency) that make historic relationships less valid. In the past, interest-rate increases have been the main driver of defaults; these have often been accompanied by flat or negative house price inflation that would make it more difficult to use home equity to refinance. Some firms think that the role that unemployment plays in determining unsecured lending defaults is different depending on whether that lending is unsecured personal loans or credit cards; for personal lending, one firm cited unemployment as a leading indicator, while for credit cards unemployment lagged defaults.
- 52. Residential mortgage arrears were linked to forecasts for unemployment, the base rate, and house price indices and often used the example of the early 1990s as the basis for a stressed scenario.
- 53. Both unsecured lending and residential mortgage lending highlight the need for firms to take structural breaks into account when constructing stress tests. These breaks could take the form of a policy shift (i.e. the move to give the Bank of England independence in setting interest rates) or a change in consumer or lender attitudes or behaviours.

### Market risk

- 54. Market risk stress testing was probably the most developed form of stress testing that we observed. The effect of stress events on the profit and loss on firms' trading books is immediate through mark to market accounting. The effect of a stress event would be transmitted in part through the parameters of Value at Risk models, for example by an increase in volatility. Although such parameters were not a focus of our visits, they naturally have an impact on the metrics that we were concerned with such as capital.
- 55. The market risk stress tests that we observed took the form of fairly severe shocks to rates or spreads. The use of severe shocks was necessary to evaluate product risks that might embed extreme out-of-the-money options, although some traders might view these as implausible. An alternative approach was to replicate a series of historic scenarios which had significant effects on equity, credit, interest rate, FX rate, and commodity markets but to alter the parameters of the stresses and the correlations used to make them more closely resemble current economic and financial conditions.
- 56. This regular monitoring of market shocks may be supplemented by economic capital allocations which may be allocated down to the desk level to assess return on risk and

less frequent firm-wide macroeconomic scenarios. Typically, these scenarios bear a strong resemblance to those used in the business plan. Investment firms were also able to use these same stress scenarios for measuring counterparty risk, particularly the adequacy of margins for clients such as hedge funds and commodity and metals companies.