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CEBS Guidelines on Stress Testing (GL32)

Table of contents

Section 1 - Introduction and background

1. Stress testing is a key risk management tool within financial institutions. The Capital Requirement Directive (CRD), and, in particular, supervisory review under Pillar 2 requires institutions to take a forward-looking view in their risk management, strategic planning and capital planning[1]. One of the tools institutions can use to facilitate this forward-looking perspective in risk management is stress testing. CEBS has addressed stress testing in its Guidelines on technical aspects of stress testing under the supervisory review process that were published on 14 December 2006[2] and which are being replaced by the current revision.

2. Since that time there have been a number of developments in stress testing with regard to its methodologies and usage. In particular, the financial crisis of 2008-2009 highlighted significant lessons in relation to stress testing practices. In many instances supervisors observed that stress testing did not appear to be sufficiently integrated into institutions' risk management frameworks or senior management decision-making. In general, where it was used, scenarios were not sufficiently severe nor was there appropriate consideration given to the potential crystallisation of confluences of events. In other instances, supervisors observed that risk concentrations and feedback effects were not considered in a meaningful fashion.

3. Supervisory expectations of institutions' stress testing practices have developed in the light of recent experience both within the EU and beyond, as evidenced in the comprehensive revision of the Basel Committee on Banking Supervision's (BCBS) revision of its Principles for sound stress testing practices and supervision[3].

4. These guidelines will assist institutions in understanding supervisory expectations of appropriate stress testing governance and infrastructure, and also cover the use of stress testing as a risk management tool. These guidelines are designed to be as practical as possible and identify the relevant building blocks required for an effective stress testing programme from simple sensitivity analysis on single portfolios to complex macroeconomic scenario stress testing on a firm-wide basis.

5. Figure 1 depicts the "building block" approach which guides the structure of these guidelines. That structure focuses on the overarching principles of governance including:

[1] Please refer to ICAAP 8 of the CEBS Guidelines on the Application of the Supervisory Review Process under Pillar 2 (GL03) published on 25 January 2006. (see: http://www.c-ebs.org/getdoc/5b3ff026-4232-4644-b593-d652fa6ed1ec/GL10.aspx)
[2] Please see http://www.c-ebs.org/getdoc/e68d361e-eb02-4e28-baf8-0e77efe5728e/GL03stresstesting.aspx
[3] Please refer to BCBS Principles for sound stress testing practices and supervision, May 2009 (see http://www.bis.org/publ/bcbs155.pdf)

- stress testing governance structures and their use including the application of CEBS's High level principles for risk management[4] to stress testing - outlined in Section 2;

- possible methodologies including the importance of undertaking both simple sensitivity analyses and more complex scenario stress testing – dealt with in Section 3, (Qualitative and quantitative approaches to reverse stress testing are also addressed here);

- a multi-layered approach to stress testing programmes, from simple portfolio-level to comprehensive firm-wide scenario analyses – introduced in Section 4;

- outputs of stress testing programmes including the interaction between the outcomes of stress tests and management intervention/mitigating actions – discussed in Section 5;

- use of stress tests to assess the viability of the institution's capital plan in adverse circumstances in the context of ICAAP – discussed in Section 6; and

- supervisory review and assessment giving practical guidelines to supervisors on particular topics ranging from challenge to scenario selection to stress testing outcomes and capital planning – addressed in Section 7.

6. The range of stress tests that institutions should undertake as part of their stress testing programmes should be complementary. For example, stress testing of a credit portfolio is likely to inform a broader credit risk stress test and, similarly, firm-wide scenario stress testing is likely to draw on experience from individual risk stress tests, whilst taking into account that simple aggregation is unlikely to be sufficient.

7. The guidelines describe both quantitative and qualitative aspects of stress testing while noting the principle of proportionality; that small and simple institutions may focus more on the qualitative aspects whilst larger more complex institutions will require more sophisticated stress testing techniques. However, in all cases, it is expected that there will be a key qualitative narrative running through the stress testing programme that will clearly identify the links between an institution's risk appetite, its business strategy and the potential impact of external and internal events on its business model. The management body will take a particular interest in ensuring this narrative is coherent and in keeping with its stated risk appetite.

[4] CEBS High level principles for risk management published on 16 February 2010 (see http://www.c-ebs.org/documents/Publications/Standards---Guidelines/2010/Risk-management/HighLevelprinciplesonriskmanagement.aspx)

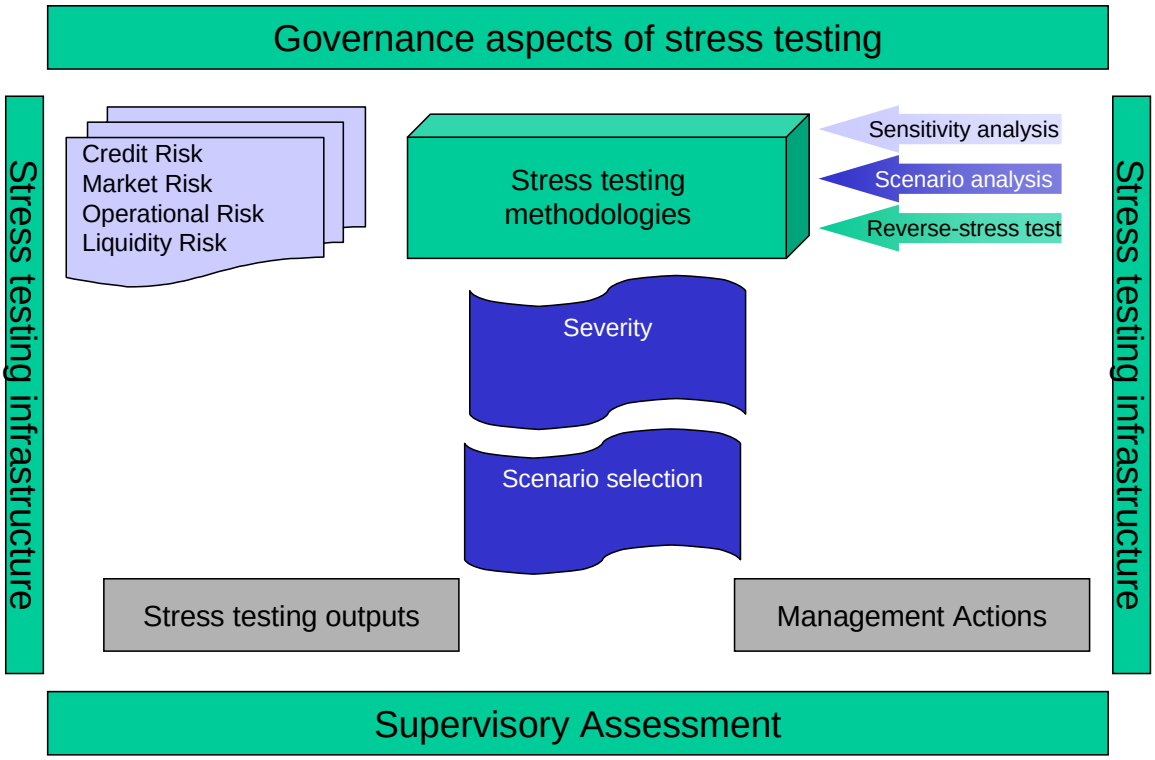

Figure 1. The "building block" approach to the guidelines

8. The guidelines are supplemented by a range of annexes that provide examples of stress testing specific risks (market risk (Annex 1), securitisation (Annex 2), credit risk (Annex 3), operational risk (Annex 4), liquidity risk[5] (Annex 5), interest rate risk in banking book (Annex 6), and concentration risk (Annex 7)). The annexes illustrate some practices in relation to stress testing these risk types, but are not exhaustive lists of practices. Some of the practices discussed in the annexes are applicable to all institutions, whereas others are related specifically to the institutions using advanced approaches for calculation of regulatory capital requirement (internal market risk models, IRBA and AMA).

9. The guidelines form part of the suite of CEBS guidelines and complement the Guidelines on the Application of the Supervisory Review Process under Pillar 2 (GL03)[6] and focus on the enhancement of the risk management practices of institutions. These guidelines do not introduce new Pillar 1 or Pillar 2

[5] In the implementation of principles contained in this Annex, national supervisory authorities and institutions should be aware about ongoing discussions regarding the proposals for changes to the liquidity regime to be introduced in the CRD IV. CEBS is closely monitoring the regulatory developments, has participated in the public consultation of the proposals for the CRD IV, and will amend, if necessary, the principles put forward here, once the legislative proposals are finalised.

[6] CEBS Guidelines on the Application of the Supervisory Review Process under Pillar 2 (GL03) published on 25 January 2006 (see http://www.c-ebs.org/getdoc/00ec6db3-bb41-467c-acb9-8e271f617675/GL03.aspx)

regulatory requirements and do not address issues such as supervisory stress testing.

10. These guidelines should be implemented proportionately, taking account of the nature, scale, and complexity of the activities of the institution concerned as well as their risk profiles. The principle of proportionality applies to all aspects of these guidelines, including the methodology, as well as the frequency and the degree of detail of the stress tests. CEBS acknowledges that smaller and/or less complex institutions may not be able to perform complex firm-wide macro-economic scenario based stress tests. However, they should still address stress testing at least in a qualitative manner while quantitatively limiting themselves to more simple sensitivity analyses of the specific risk types to which they are most exposed. This will allow smaller and/or less complex institutions to identify, assess and test their resilience to shocks relating to the material risks they face. However, in developing their stress testing programmes all institutions should consider to the extent possible interactions between risks, for example intra- or inter-risk concentrations[7], rather than simply focus on the analysis of single risk factors in isolation. To this end, the qualitative approach to reverse stress testing discussed in these guidelines may be beneficial.

11. Large and complex institutions are expected to have an appropriate infrastructure in place to undertake a variety of the stress testing approaches that are covered in these guidelines from simple portfolio based sensitivity analyses to complex macro scenario driven firm-wide exercises. Moreover, large and complex institutions are expected to include in their stress testing programmes rigorous firm-wide stress tests covering all material risks and entities, as well as the interactions between different risk types (see Section 4.2).

12. Cross-border institutions are expected to implement these guidelines and set up stress testing programmes covering the consolidated level and, where applicable, material entities and/or business lines subject to the principle of proportionality and relevance.

13. Where the Pillar 1 minimum capital requirements of the Basel II framework are determined by supervisory approved internal models (for example, the internal model-based approach to determine market risk capital or the internal ratings-based (IRB) approaches for credit risk) institutions should conduct stress tests to assess the robustness of the outputs of their internal models used under Pillar 1 and their capital cushions above the regulatory minimum.

14. There is a clear difference between the establishment of minimum regulatory capital under Pillar 1, which is identified as capital against unexpected loss and the assessment of risk in a stress test. Pillar 1 sets capital against

[7] Stress testing is deemed to be one of the methods for identifying interactions between risk factors and identification of inter-risk concentration as discussed in the CEBS revised Guidelines on concentration risk management under supervisory review process (GL31).

unexpected tail events to a specific confidence level[8], which might be interpreted as a measure of regulatory solvency. Stress testing, particularly in reference to stress testing under Pillar 2 is about understanding, inter alia, what happens to an institution's ability to meet its internal capital requirements when external conditions change for the worse over a period of time.

15. Of course, CEBS recognises that stress testing is more than a simple capital assessment and is one of the risk management tools, which allow for better understanding of an institution's risk profile and its resilience to internal and external shocks. Given the natural limitations of the methodologies, parameters and data used, as well as overall uncertainty about forward looking assessment and the actual occurrence of assumed scenarios, stress testing cannot provide for absolute safety. Therefore, stress testing should be used by institutions in combination with other risk management and control tools to make informed business decisions. Supervisors should not rely solely on the results of stress tests to make a decision regarding risk profile and capital adequacy of an institution, but should use it in combination with other supervisory tools, including within the framework of colleges of supervisors, where applicable.

Implementation of the guidelines

16. CEBS will expect its members to apply the present guidelines by 31 December 2010, meaning that by this date the guidelines should be transposed into national supervisory guidelines and reflected in the national supervisory manuals/handbooks, where applicable, and implemented in supervisory practices.

17. CEBS also expects institutions to make progress in implementing the guidelines following the transposition and recommendations/requirements of national supervisory authorities, and to put in place implementation programmes aimed at ensuring timely/ compliance with the new guidelines (e.g. gap analysis, implementation plans, etc.).

18. To ensure harmonisation of practices across Member States, CEBS will conduct an implementation study one year after the implementation date. The implementation study will be focused on the transposition of the guidelines into national regulations and on their implementation in supervisory practices, as well as on the progress made by institutions.

[8] For example, Internal Ratings Based models under Pillar 1 for credit risk, nominally assess risk to a 99.9% confidence interval for a one in a thousand event.

Section 2 - Governance aspects of stress testing and use

19. It should be noted that general risk management principles, as stipulated in the CEBS High-level principles for risk management,[9] apply fully to the governance and oversight of stress testing programmes. In this section CEBS elaborates on these high-level principles with respect to their application to stress testing.

Guideline 1. The management body[10] has ultimate responsibility for the overall stress testing programme of the institution. Its engagement is essential for the effective operation of stress testing. The management body should be able to understand the impact of stress events on the overall risk profile of the institution.

20. The management body has ultimate responsibility for the overall stress testing programme. This is essential in order to ensure the authority of the stress testing programme at all levels of the institution and to ensure that the management body fully understands the impact of stress events on the overall risk profile of the institution. Their engagement will also help to maximise effective use of the programme, especially with respect to firm-wide stress testing and capital planning, in terms of the outputs of the stress tests and the limitations of the stress tests (e.g. probability of the event occurring or judgmental bias in a stress test's specification).

21. Practical aspects of stress testing, such as identification of risk drivers, implementation, management, etc., may be delegated to senior management. However, the management body (or relevant designated committee) should actively engage in the discussion, and where necessary challenge, the key modelling assumptions and scenario selection and is expected to question assumptions underlying the stress tests from a common/business sense perspective, e.g. whether assumptions about correlations in a stressed environment are reasonable. The management body should take responsibility for agreeing on and where necessary challenging the credibility of management intervention and mitigating actions based on stress test results (as one of a range of risk management tools).

22. As an example, the management body may also consider engaging in stress testing committees where thorough discussions with risk managers about the design, assumptions, results, limitations and implications of the stress testing programme are conducted.

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[9] CEBS High level principles for risk management published on 16 February 2010 (see http://www.c-ebs.org/documents/Publications/Standards---Guidelines/2010/Risk-management/HighLevelprinciplesonriskmanagement.aspx)

[10] The term 'Management body' as defined in Article 11 of the CRD should be understood to embrace different structures, such as unitary and dual board structures and not any particular board structure. The management body represents the top management level of an institution, and senior management (which is not defined in the CRD) should be understood to represent the level of management below the management body (see also CEBS Guidelines on the Application of the Supervisory Review Process under Pillar 2 (GL03).

Guideline 2. The stress testing programme should be an integral part of an institution's risk management framework and be supported by an effective infrastructure.

23. Stress testing should be integrated into an institution's risk management processes. For example, the stress test programme should:

    a. analyse the aggregate of an institution's businesses and risk types as well as the separate components of portfolios, risk types and business lines;

    b. factor in the relationships between risk types;

    c. support bottom-up and top-down stress testing, including reverse stress-testing[11];

    d. have a flexible platform that enables modelling of a wide variety of stress tests across business lines and risk types as and when the senior management require;

    e. draw data from across the organisation, as needed; and

    f. enable intervention to adjust assumptions in a straight forward manner.

24. As one component of demonstrating that the stress testing programme is embedded in risk management, supervisors expect to see stress testing as an integral part of the Internal Capital Adequacy Assessment Process (ICAAP). The ICAAP should be forward-looking and take into account the impact of a severe scenario that could impact the institution. The ICAAP should demonstrate that stress testing reports provide the management body and senior management with a thorough understanding of the material risks to which the institution may be exposed[12].

25. In order for stress testing to be a meaningful part of the risk management framework, stress tests should be undertaken with appropriate frequency. In some risk areas, stress testing is necessarily done frequently while overarching firm-wide stress testing may be done with lower frequency. For large complex institutions they will have a number of risk areas requiring frequent stress testing e.g. market risk, which will inform the broader stress testing framework. Smaller, simpler institutions may not have the same range of requirements. The frequency of stress tests should be proportionate to risk areas and the need for overall firm-wide stress testing. The stress testing programme should also allow for ad hoc stress tests.

26. The stress testing programme should be supported by an appropriate infrastructure and/or data framework allowing for both flexibility and appropriate levels of quality and control. Infrastructure and/or data

[11] Bottom-up stress test generally means stress testing specific exposures and risk factors and then the results are aggregated. Top-down stress testing means stress testing exposures at an aggregated level and then allocating the results to relevant entities/business lines. For reverse stress testing see Section 3.4.

[12] CEBS Guidelines on the Application of the Supervisory Review Process under Pillar 2 (see http://www.c-ebs.org/getdoc/00ec6db3-bb41-467c-acb9-8e271f617675/GL03.aspx)

frameworks should be proportionate to the size, complexity, risk and business profile of an institution, and allow for the performance of stress tests covering all material risks an institution is exposed to. An institution should ensure that it devotes sufficient resources to developing and maintaining such infrastructures and/or data frameworks including appropriate resources and IT systems, where applicable, that facilitate effective data delivery and processing in a quantitative and qualitative manner.

27. The stress testing infrastructure and/or data framework of a cross-border group, should allow stress tests to be conducted at various levels of the organisation, including at the consolidating level, but also at the level of material entities. Alternatively, in cases where the institution applies a centralised approach to risk management, and stress tests are being conducted predominantly at the consolidated level, the design of the stress testing programme should allow for articulation of the impact/results of the group (consolidated) level stress tests to material entities and/or business lines.

Guideline 3. Stress testing programmes should be actionable and inform decision making at all appropriate management levels of an institution.

28. The stress testing programme, as part of a range of risk management tools, supports different business decisions and processes including strategic decisions. Such decisions should take into consideration the shortfalls of stress testing and the limitations of the assumptions used.

29. The management body and senior management have responsibility for evaluating relevant output from the stress testing programme and for taking appropriate management actions. These measures or actions may vary depending on the circumstances and other available information (see also Guideline 15 for specific management intervention and mitigating actions to address outcomes of stress tests), examples of such actions, although not exhaustive are:

    a. reviewing the set of limits, especially in cases where legislative requirements indicate that the results of the stress tests should be reflected in the limits set by institutions (i.e. requirements relative to market risks and to credit risk mitigation techniques);

    b. use of risk mitigation techniques;

    c. reducing exposures or business in specific sectors, countries, regions or portfolios;

    d. reconsidering the funding policy;

    e. reviewing capital and liquidity adequacy;

    f. reviewing strategy;

    g. reviewing the risk appetite; and

h. review of the contingency of the framework or development of a framework where one does not exist.

30. The results of stress tests should also be used as input to the process of establishing an institution's risk appetite and fixing exposure limits as well as a planning tool to determine the effectiveness of new and existing business strategies and their impact on capital utilisation. Stress testing results could mean that an institution is comfortable with the risk-return consequences or it could decide to de-risk its portfolio. Stress tests are also a suitable tool to identify tail risk, for which explicit risk appetite levels may be set.

Guideline 4. An institution should have clear responsibilities, allocated resources and written policies and procedures in place to facilitate the implementation of the stress testing programme.

31. The stress testing programme should be governed by internal policies and procedures and clear responsibilities should be assigned for the overall stress testing programme in the institution.

32. The following aspects should be detailed in policies and procedures governing the stress testing programme:

a. the types of stress testing and the main purpose of each component of the programme;

b. frequency of stress testing exercises, which is likely to vary depending on type and purpose;

c. the methodological details of each component, including the definition of relevant scenarios and the role of expert judgement; and

d. the range of business assumptions and remedial actions envisaged, based on the purpose, type and result of the stress testing, including an assessment of the feasibility of corrective actions in stress situations and a changing business environment.

33. An institution should ensure that it devotes sufficient resources and develops explicit procedures to undertake rigorous, forward-looking stress testing. An institution should document the assumptions and fundamental elements for each stress testing exercise. These include the reasoning and judgements underlying the chosen scenarios and the sensitivity of stress testing results to the range and severity of the scenarios, and to the range of business assumptions and planned remedial actions.

Guideline 5. The institution should regularly review its stress testing programme and assess its effectiveness and fitness for purpose.

34. The effectiveness and robustness of stress tests should be assessed regularly, qualitatively as well as quantitatively, in light of changing external conditions to ensure that they are up-to-date. The frequency of assessment of different parts of the stress testing programme should be set appropriately. An independent control function should play a key role in the process.

35. The following areas of assessment of the stress testing programme should be considered:

    a. the effectiveness of the programme in meeting its intended purposes;

    b. the need for development work;

    c. systems implementation;

    d. management oversight;

    e. business and/or managerial assumptions used;

    f. any other assumptions used;

    g. data quality; and

    h. documentation.

36. A sound and robust stress testing programme (e.g. design, scenarios, use of judgement and results) should be challenged by views from across the organisation. This requires dialogue between risk managers, economists, business managers and other relevant experts before it goes to senior management for challenge. Challenge between risk managers and business managers is likely to focus on the use and appropriateness of the stress testing programme from a business perspective. The insights of specialists within macro-economic analysis are likely to be most valuable in the process of scenario selection and in the validation of stress test results. Involvement of different experts will help ensure that the challenge of the stress test programme is both quantitative and qualitative.

Section 3 - Stress testing methodologies

37. The use of appropriate methodologies in stress testing programmes is key to fulfilling their purposes. Whilst these guidelines do not prescribe methodologies, they are designed to enhance institutions' practices in stress testing, in particular by identifying the types of methodologies that should be considered by an institution in designing its stress testing programme proportionate to its size and complexity. In a general sense, an effective stress testing programme should consist of sensitivity analyses (single and simple multi-factor analyses) and scenario analyses addressing all material risks at various levels of the institution. The combination of approaches as well as the level of detail will depend on the size and complexity of the specific institution. A smaller institution may place greater emphasis on the qualitative elements of its stress testing programme supported by quantitative outputs of the balance sheet, whereas large sophisticated institutions would be expected to run complex models which would be complemented by appropriate qualitative oversight.

3.1 Sensitivity analysis

Guideline 6. Institutions should perform sensitivity analyses for specific portfolios or risks.

38. Sensitivity analysis is the simple stressing of one risk driver to assess the sensitivity of the institution to that risk driver. For example, institutions might choose a simple interest rate shift stress or a straight forward shift in probabilities of defaults (PDs), or the default of their largest counterparties, or a decline in value of liquid assets. Such analyses provide information about key risks and enhance understanding about potential risk concentrations in one or several risk factors.

39. An institution should identify relevant risk drivers in particular: macro-economic risk drivers (e.g. interest rates), credit risk drivers (e.g. a change in bankruptcy law or a shift in PDs), financial risk drivers (e.g. increased volatility in financial instruments markets), and external events (e.g. operational risk events, market events, events affecting regional areas or industry sectors etc).

40. The institution should then stress the identified risk drivers using different degrees of severity. The severity of single factor shocks is likely to be influenced by long-term historical experience but institutions are advised to supplement this with hypothetical assumptions to test the institution's vulnerability to specific risk factors.

41. An institution can conduct sensitivity analyses at the level of individual exposures, portfolios or business units, as well as firm-wide, against specific risk areas as sensitivity analysis is likely to lend itself to risk-specific stress testing.

42. Furthermore single factor analysis can be supplemented by simple multi-factor sensitivity analyses, where a combined occurrence is assumed, without necessarily having a scenario in mind.

3.2 Scenario analysis

Guideline 7. Institutions should undertake scenario analysis as part of their suite of stress tests which should be (i) dynamic and forward-looking and (ii) incorporate the simultaneous occurrence of events across the institution.

43. Forward-looking hypothetical scenario analysis is a core part of the suite of stress tests that institutions should include in their stress testing programmes.

44. The development of a hypothetical scenario can start from historically observed realisations of risk parameters, but relying solely on historical scenarios has proved to be insufficient. Pure historical scenarios can give insights into impact but not into the confluence of events that may occur. Moreover, as historical scenarios are purely backward-looking, they tend to neglect recent developments and current vulnerabilities. Therefore, scenario

design should take into account systematic and institution-specific changes in the present and near future and thus be forward-looking.

45. A range of scenarios should be considered encompassing different events and degrees of severity. The varying degrees of severity might be captured in the analysis of different events but would ideally encompass a program of several events with several degrees of severity. Moreover, scenarios should:

    a. Address all the material risk types of an institution (e.g. credit risk, market risk, operational risk, interest rate risk and liquidity risk). No material risk type should be left unconsidered.

    b. Address the main risk factors the institution may be exposed to. In this regard the results obtained from single factor analyses (see above), which aim at providing information about the sensitivity towards single risk factors, may be used to identify scenarios that include a stress of a combined set of highly plausible risk factors. No material risk factor should be left unstressed or unconsidered.

    c. Address major institution-specific vulnerabilities. These should take the regional and sectoral characteristics of an institution into account as well as considering specific product or business line exposures and funding policies. Therefore, concentration risk, both intra- and inter–risk types, should be identified a priori.

    d. Contain a narrative scenario which should include various trigger events, such as monetary policy, financial sector developments, commodity prices, political events and natural disasters. Narrative in this regard means that the co-movement of risk factors and the corresponding reaction of market participants are not implausible or paradoxical but yield a consistent picture of a possible overall future state.

    e. Be internally consistent so that identified risk drivers behave in ways which are consistent with the other risk drivers in a stress.

    f. Take into account developments in technology such as newly developed and sophisticated financial products and their interaction with the valuation of more traditional products.

    g. Be forward-looking and include severe outcomes.

46. Institutions should determine the time horizon of stress testing in accordance with the characteristics of the portfolio of the institution such as maturity and liquidity of the stressed positions, where applicable, as well as the risk profile and purposes of the particular exercise (see also Section 6 for discussion on the time horizon of the stress under ICAAP).

Guideline 8. An institution should identify appropriate and meaningful mechanisms for translating scenarios into relevant internal risk parameters that provide a firm-wide view of risks.

47. The formulation of a scenario includes explicit estimates/assumptions about the dependence structure between the main underlying economic and

financial drivers such as interest rates, GDP, unemployment, equity, consumer and property prices, etc. The chosen scenario should be applied to all relevant positions (on- and off-balance sheet) of the institution

48. It is key that the scenario composition, as well as the translation from macro-economic variables to internal risk parameters, is done consistently. Two main challenges emerge:

    a. the formulation of a scenario that incorporates all facets of an economic environment in a sound manner; and

    b. the transformation of these into internally consistent loss parameters (e.g. PD, LGD, write-offs, fair value haircuts etc.).

49. The links between underlying economic factors and internal losses or stressed risk parameters are likely to be based primarily on institutional experience and analysis, which may be supplemented by external research and at times supervisory guidance. Benchmarks, such as those based on external research, may be quantitative or qualitative.

50. Due to the complexity involved in modelling hypothetical and macro-economic based scenarios:

    a. institutions should be aware of the model risk involved. A regular and conservative expert review of the model's assumptions and mechanics are important as well as a conservative modelling approach to account for model risk; and

    b. a degree of conservatism may be appropriate when making assumptions that are hard to measure in a quantitative way (e.g. diversification) but that influence the model's outputs. Nevertheless, the institution is expected to be aware of the dependencies excluded and review their incorporation on a regular basis.

51. The transformation of external variables or events into internal losses or increased risk parameters is another challenging task. An institution should be aware of the possible dynamic interactions among risk drivers, the effects on earnings and on the off-balance sheet position.

52. A deep (probabilistic) understanding of how macro-economic variables and institution specific effects would impact the institution at any given point in time is important in stress testing modelling. Ideally, this transformation should be based on quantitative modelling where data is relatively rich and be based on expert judgement with supporting quantitative analysis where data is relatively scarce.

Guideline 9. System-wide interactions and feedback effects should be incorporated within scenario stress testing.

53. The stress test should explicitly identify interdependences, e.g. among economic regions and among economic sectors. The overall scenario should take into account system-wide dynamics – such as leverage building up across the system, closure of certain markets, risk concentrations in a whole

asset class such as mortgages, and adverse feedback dynamics, for example through interactions among valuations, losses, margining requirements and insurance relations.

54. The strong links between the real economy and financial economy as well as the process of globalisation have amplified the need to look at system-wide interactions and feedback effects. Such analysis can be very difficult to model quantitatively as it encompasses the reaction and behaviour of other market participants under adverse conditions. Thus, institutions may make qualitative assessments of the feedback effects of stress, for example, these effects would affect assumptions about management actions discussed below. Such assumptions should be documented and reviewed by senior management.

Box 1. Stress testing for internal models for the calculation of regulatory capital requirements for market risks[13]

Under Annex V of the Directive 2006/49/EC, institutions applying for the use of internal models to calculate capital requirements for market risks shall frequently conduct a rigorous programme of stress testing, the results of which shall be reviewed by senior management and reflected in the policies and limits it sets. Depending on the nature of the portfolio, the stress tests could factor in (where applicable):

- illiquidity/gapping of prices (including interest rates and exchange rates),
- concentrated positions (in relation to market turnover);
- one-way markets;
- non-linear products / deep out-of-the-money positions;
- events and jumps-to-default; and
- significant shifts in correlations and volatility.

In particular, they should cover other risks that may not be captured appropriately in the minimum capital requirements for market risks (such as recovery rate uncertainty, implied correlations or skew risk).

For institutions that are allowed to apply internal models where the regulatory capital is calculated under a more risk-sensitive approach, being assessed against a 10 day time horizon and 99 percentile confidence level, it is important that tail events beyond that confidence level, such as those noted in the section above, are considered. Based on current guidelines, a rigorous stress testing programme should satisfy the following criteria:

[13] In the implementation of principles contained in this Box, national supervisory authorities and institutions should be aware about the proposals for changes to stress testing for internal models for market risks to be introduced in the CRD III. The proposals include stress testing for validation of internal risk models for market risks and a disclosure requirement for descriptions of stress tests for market risks. CEBS is closely monitoring the regulatory developments, has participated in the public consultation of the proposals for the CRD III, and will amend, if necessary, the stress testing for internal models for market risks put forward here, once the legislative proposals are finalised.

- all material risk drivers which could entail extraordinarily large losses, or which could severely hamper risk management, should be encompassed. Those factors include events with low probability for all main risk types, especially the various components of market risks. The impact of stress situations on both linear and non-linear products should be captured. The tests should be applied at an appropriate level, as defined by the institution.

- the programme should assess the consequences of major market disturbances and identify plausible situations which could entail extraordinarily high losses. At portfolio level, the effects of changed correlations should be explored. Mitigating effects as consequences of contingency plans may be taken into account if the plans are based on plausible assumptions about market liquidity.

- the programme should encompass situations identified by institutions as exceptional, but plausible, based on their portfolios' characteristics.

- institutions should list the measures taken to reduce their risks and preserve their own funds. In particular, limits on exchange rate, interest rate, equity price and commodity price risks set by institutions should be checked against the results of the stress testing calculations.

Bearing in mind the results of stress testing, supervisors may consider whether an institution has sufficient own funds to cover the minimum capital requirements, taking into account the nature and scale of the institution's trading activities and any other relevant factors, such as valuation adjustments made by an institution.

Box 2. Stress testing for IRB institutions[14]

Article 124 of the CRD requires credit institutions applying an IRB approach to undertake stress testing. These institutions are subject to specific provisions in Annex VII, Part 4 of the CRD, Section 1.8, paragraphs 40 to 42 and paragraph 114.

Furthermore, according to Article 84(2) of the CRD, institutions shall only be given permission to calculate their risk-weighted exposure amounts using the IRB approach if the competent authority is satisfied that the credit institution's systems for the management and rating of credit risk exposures meet the minimum requirements of Annex VII Part 4 of the CRD.

Paragraph 40 of Annex VII Part 4 requires institutions to examine potential unfavourable effects on their credit exposures and their "ability to withstand such changes" by means of stress testing. The "ability to withstand such changes" means,

[14] In the implementation of principles contained in this Box, national supervisory authorities and institutions should be aware about the proposals for changes to stress testing to be introduced in the CRD III and the CRD IV. Current proposals do not include changes to stress testing for IRB institutions which would affect these guidelines. However, changes in further proposals cannot be ruled out. CEBS is closely monitoring the regulatory developments, has participated in the public consultation of the proposals for the CRD III and CRD IV, and will amend, if necessary, the stress testing for IRB institutions put forward here, once the legislative proposals are finalised.

amongst other measures, that the institution's available capital resources cover credit risks for the credit portfolio derived from a particular stress scenario. Stress testing in this case consists of "identifying possible events or future changes in economic conditions that could have unfavourable effects on an institution's credit exposures". By contrast, the paragraph 41 stress test is designed to address the effect of certain specific conditions, including at least mild recession scenarios, on its total capital requirements for credit risk. Since those capital requirements could change depending on the stage within the economic cycle, those stress tests should show the potential impact on capital requirements. The stress tests could, thus, show the need for possible action on the part of the institution, including the possible need for an increase in own funds.

Institutions should assess the impact of ratings migration on capital requirements with respect to the economic cycle. This could include a significant and sustained deterioration in the economic climate. To this end, institutions should consider a range of stress tests and scenario analyses which may go beyond a mild recession. It is up to institutions to determine how this translates into specific risk drivers and how these risk drivers in turn affect an institution's total capital requirements for credit risk. Institutions may find it helpful to develop these linkages on an asset by asset class basis (for example, factors relevant to mortgages may be different to corporate asset classes).

Where an institution has numerous businesses, questions of diversification may arise, particularly across different geographic areas which may be subject to economic conditions that are not synchronised. Therefore, it is not necessarily assumed that the aggregated impact is equal to the simple sum of each business's figures. However, in the spirit of the test, institutions should apply reasonable conservatism in specifying correlations and be able to justify their choices.

These stress tests should be undertaken at least annually. This aims to ensure that stress testing becomes a useful tool for both institutions and supervisors in anticipating changes to the level of regulatory capital requirements for credit risk and, therefore, encourages good risk management.

The result of the stress test has no direct effect on the Article 75 requirement and does not necessarily mean an additional requirement (i.e. extra capital or other measures), for example, to the extent that:

- institutions are dealing with products or counterparties that can be shown to be countercyclical;
- institutions can demonstrate credible management actions which can counter potential capital deficits; or
- if the economy is already in a recession. However, there may be repercussions under the supervisory review process (see below).

The function responsible for IRB stress testing could be the Credit Risk Control function (as defined in the CEBS Guidelines on the implementation, validation and assessment of AMA and IRB approaches) in order to maintain the objectivity of stress testing, insofar as that fits into the overall stress testing framework (see above).

Some stress test calculations may function as one tool for assessing the robustness of the LGD estimation. For further details refer to the CEBS Guidelines on the implementation, validation and assessment of AMA and IRB approaches[15].

3.3 Severity of scenarios

Guideline 10. Stress testing should be based on exceptional but plausible events. The stress testing programme should cover a range of scenarios with different severities including scenarios which reflect a severe economic downturn.

55. Ensuring that a stressed scenario is appropriately severe is one of the elements required for ensuring that stress tests are:

    a. meaningful in terms of providing the appropriate type of information, as laid out elsewhere in these guidelines, which is designed to promote the stability of the institution and the financial system at all points in the economic cycle; and

    b. consistently applied across the institution, recognising that identical scenarios are not necessarily severe for all business lines.

56. Various degrees of severity should be considered for both sensitivity analysis and scenario stress testing but for capital planning at least a severe economic downturn is required.

57. Severity is to be understood in the light of the specific vulnerabilities of the respective institution, which might not be equal to the perspective of the total economy, that is, a simple country or region specific macro-economic stress scenario may be less relevant to some institutions' risk profile than others; for example, if they have a specific industry exposure which is counter-cyclical or if their risks are primarily international and less impacted by national scenarios.

58. The assumption of a linear response of the results to stressed parameters may not always hold and it is therefore crucial for an institution to achieve high awareness of non-linear interactions between macro parameters and stressed parameters. For example, it might be that only at a certain level of stress, certain hedging strategies might break down or – on the contrary - come into effect; a subsidiary may also fail to be liquid only at a certain level of stress triggering further repercussion throughout the group.

59. Scenarios may include absolute or relative changes of parameters. An absolute scenario is one which, from a cycle neutral baseline, always has the same degree of severity. Thus, for example, in a downturn the stress would have a smaller impact compared to that experienced during a benign

[15] Guidelines on the implementation, validation and assessment of Advanced Measurement (AMA) and Internal Ratings Based (IRB) Approaches (GL10) published on 4 April 2006. (see: http://www.c-ebs.org/getdoc/5b3ff026-4232-4644-b593-d652fa6ed1ec/GL10.aspx)

economic environment. A relative scenario, on the other hand, is a stress relative to the current situation and thus would be more severe in a downturn. It is unlikely that stress scenarios will be entirely absolute or relative. However, it is important that an institution is aware of the impact of absolute and / or relative changes on the severity of the chosen scenarios. Institutions should be able to explain why they consider absolute or relative stress scenarios.

60. Institutions should consider their capital requirements and resources over a plausible macro-economic base case, as well as a more severe stress scenario. Institutions should be able to provide the forecasts that underpin their base case capital planning.

61. Institutions may assess the appropriate level of severity of their capital planning stress against the scenario outlined in their reverse stress testing programme (see following section). Identifying how the capital planning stress relates to the reverse stress test may help senior management justify why the severe stress scenario is appropriately severe.

62. In developing severe downturn scenarios, institutions should also consider plausibility to the fullest extent possible. For example, as an economy enters recession institutions should not necessarily always assume a further specific level of stress. There may be times when the stressed scenario is close to the base case scenario, but supplemented with specific shocks (e.g. interest rates, exchange rates).

3.4 Reverse stress testing

63. Reverse stress testing consists in identifying a significant negative outcome and then identifying the causes and consequences that could led to such an outcome. In particular, a scenario or combination of scenarios that threaten the viability of the institution's business model is of particular use as a risk management tool in identifying possible combinations of events and risk concentrations within an institution that might not be generally considered in regular stress testing. A key objective of such stress testing is to overcome disaster myopia and the possibility that a false sense of security might arise from regular stress testing in which institutions identify manageable impacts. The scenario considered should remain relevant to the institution.

Guideline 11. Institutions should develop reverse stress tests as one of their risk management tools to complement the range of stress tests they undertake.

64. No single definition of reverse stress testing methodology is provided for the purposes of these guidelines. Reverse stress tests evolve around causes, consequences and impact, all of which are relevant and any of which can be taken as a starting point. Moreover, qualitative and quantitative approaches are appropriate, depending on the size and complexity of the institution. For example, a reverse stress test for simple and small institutions could be a qualitative discussion of key risk factors and their possible combination in

relation to the institution's risk profile at a senior management level[16]. Alternatively, a more sophisticated quantitative approach could be used in identifying a specific loss level, or some other impact on the balance sheet (e.g. movements in capital ratios), and working backwards in a quantitative manner to identify the macro-economic risk drivers, and the required amplitude of movement, that would cause it.

65. Reverse stress testing is seen as one of the risk management tools usefully complementing the "usual" stress testing, which examines outcomes of predetermined scenarios. Reverse stress testing is a useful tool in risk management as it helps to understand potential fault lines in the business. Reverse stress testing is not expected to result in capital planning and capital add-ons. Instead, its use as a risk management tool is in identifying scenarios, and the underlying dynamism of risk drivers in those scenarios, that could cause an institution's business model to fail. This analysis will be useful in assessing assumptions made about the business model, business strategy and the capital plan. Reverse stress test results may also be used for monitoring and contingency planning.

66. Reverse stress testing should be carried out regularly by all institutions at the same level of application as ICAAP. As a starting point reverse stress testing may be carried out in a more qualitative manner than other types of stress testing as senior management consider the types of events likely to lead to insolvency.

67. Even for large and complex institutions reverse stress testing may be undertaken in a more qualitative manner, focusing on the events and materialisation of risk concentrations that could cause their business models to become unviable. As experience is developed, this might then be mapped into more sophisticated qualitative and quantitative approaches developed for other stress testing. Even in a qualitative sense, the impact of macro-economic shocks on an institution's solvency should consider first round and feedback effects as far as possible. Given the importance of a clear narrative running through the reverse stress test to identify business vulnerabilities and to develop an understanding of feedback and non linear effects, reverse stress testing is more than a simple sensitivity analysis e.g. simply shifting one relevant parameter to some extreme.

Section 4 - Portfolio, individual risk and firm-wide stress testing

68. Stress testing programmes should encompass all the material risks (both on- and off-balance sheet) relevant for the banking group. To be effective, stress testing should consist of a multi-layered approach to capture risks at various

[16] For example, some institutions might identify a particular concentration in a particular exposure class or sector that may lead to business failure. Depositors might identify a number of steps that would occur in sequence that would result in reputation risk crystallising and depositors losing confidence in an institution.

levels in an institution. In this regard, according to the proportionality principle, the scope of stress testing could vary from simple portfolio level sensitivity analyses to comprehensive firm-wide scenario stress testing referring to the broadest perimeter.

4.1 Portfolio and individual risk level stress testing

Guideline 12. Institutions should perform stress tests on specific portfolios and the specific types of risk that affect them. Consideration should also be given to changes in correlations between risks that the institution identifies for a given portfolio.

69. It is important to perform stress tests on an individual portfolio basis using both sensitivity and scenario analysis. Institutions should identify stresses that are severe with respect to a specific portfolio. For instance, in the case of a mortgage portfolio a decrease in house prices, high unemployment and a decline in GDP provide a severe scenario. Other portfolios, like for instance insurance, are exposed to different risk drivers and therefore a different stress scenario should be applied[17].

70. Institutions should ensure they stress portfolios and business units to identify risk concentrations that may arise across their book. For example, a credit risk stress across asset classes and portfolios may identify potential concentrations between retail and corporate exposures.

71. Institutions should perform stress tests taking into account changes in correlations between risks recognising interactions between risk types, such as market and credit risk, particularly in times of stress. For example, an institution invested in asset backed securities (ABS) and credit default swaps (CDS) could experience market and credit risk at the same time if ABS values fell and it was downgraded. The downgrade could trigger a clause in the CDS contracts obliging the institution to deliver collateral to counterparties. The call for collateral could decrease the possibility of obtaining secured funding forcing the institution to sell ABS, further decreasing the value of the portfolio.

[17] In the conduct of stress tests on other than banking portfolios and banking-related risks, institutions should be mindful of the special requirements for the stress testing of such risks and activities set up by the respective supervisory authorities, where relevant (e.g. stress testing of insurance operations might be subject to specific requirements put forward by insurance regulators/supervisors).

4.2 Firm-wide stress testing

Guideline 13. Stress testing should be conducted on a firm-wide basis[18] covering a range of risks in order to deliver a complete and holistic picture of the institution's risks.

72. Risks at the firm-wide level may not be well reflected by simple aggregation of stress tests on individual risk areas or business units. Correlations, offsetting of individual exposures and concentrations may not be adequately captured and there may either be double counting of risks or underestimation of the impact of a stress scenario. Alternatively specific group risks may arise at a firm-wide level.

73. Therefore stress tests should be undertaken at a firm-wide level for all material risks. Once the material risks have been identified, institutions should derive material risk drivers to inform the firm-wide stress. When looking at risks at a firm-wide level particular attention should be paid to risk concentrations on a holistic basis. Better insight can be obtained with respect to the correlations between and within risk categories. Notably, in times of stress correlations between risk categories tend to increase (for instance between market and funding liquidity risk).

74. Depending on the organisational structure and business model of a particular institution, a complete evaluation of all the risks affecting the institution would require the performance of stress test exercises at both consolidated and the level of material entities, which might be at the solo and/or a sub-consolidated level if appropriate. For instance, financial conglomerates are also expected to take into account the risks stemming from their insurance activities[19]. Furthermore, an institution which is internationally active is also expected to perform stress tests at the level of business units in specific geographic regions or business sectors or business lines. The added value is that a severe stress scenario differs for different businesses and different geographic regions.

75. Firm-wide stress tests should be embedded in the risk management framework of the institution and should incorporate views from parties across the organisation. This is also the case for scenario selection and any assumptions used in stress testing programmes.

[18] The firm-wide stress test or enterprise-wide stress should consider all the risks in an enterprise to the broadest perimeter of consolidation. This should include, as necessary, relevant non-banking financial institutions in a group.

[19] In the conduct of stress tests on other than banking portfolios and banking related risks, institutions should be mindful of the special requirements for the stress testing of such risks and activities set up by the respective supervisory authorities, where relevant (e.g. stress testing of insurance operations might be subject to specific requirements put forward by insurance regulators/supervisors).

Section 5 - Outputs of stress testing programmes and management intervention actions

Guideline 14. An institution should identify outputs in relation to its regulatory capital and resources, and also relevant balance sheet and P&L impacts, as a result of its stress testing programme.

76. One essential output from a stress testing exercise is the estimate of the losses under a range of scenarios. The aim is to assess the capacity of an institution to absorb losses stemming from various shocks applied in the scenarios.

77. When undertaking stress testing, it is crucial to estimate potential losses which can derive from a specific configuration of macro-economic variables determined internally or exogenously. These potential losses mainly depend on:

    a. the risks already taken by an institution at a certain point in time - the starting point of the exercise; and

    b. developments in the volume, asset quality and prices of investment and funding activities under the scenarios contemplated.

78. When stress testing over a specific time period, consideration should be given to appropriately conservative adjustments to profit and loss forecasts. Notably, loss assumptions in the stress do not have to coincide with accounting losses shown at that specific point in time.

79. With regard to credit risk, institutions need to be aware of the impact of their ratings philosophies on the outcome. Misunderstandings can arise if they are not clearly specified when analysing measures of losses in a stress test.

Guideline 15. Institutions should identify credible management actions addressing the outputs of stress tests and aimed at ensuring their ongoing solvency through the stressed scenario.

80. Institutions are expected to consider a broad range of mitigating techniques and contingency plans against a range of plausible stressed conditions (not necessarily reverse stress tests) with a focus on at least a severe but plausible negative scenario.

81. To assess their possible responses to a stressed situation institutions should consider the actions that are most relevant and when they would have to take them. Some actions may be required immediately. Others might be contingent on specific events happening, in which case clearly defined triggers for action should be identified beforehand. Others may be actions which the management would take, but these should be clearly agreed upon beforehand (for example, shareholders should be aware that dividends would be cut in some circumstances). Institutions should not overestimate their ability to take mitigating management actions recognising the possible impact of the stressed scenarios on other market participants (e.g. capital raising in stressed market conditions can be challenging).

82. When considering the impact of management actions, institutions should explain the impact of the stress on both gross and net bases. Gross would obviously include assumptions about strategy, growth and associated revenue but exclude specific management actions in a stress such as winding down a business line or raising capital.

83. Management intervention and mitigating actions may involve, for example:

    a. the review of limits;

    b. the revision of policies, such as those that relate to funding or capital adequacy;

    c. changes in the overall strategy and business plan including a reduction of exposures to specific sectors, countries, regions, instruments or portfolios;

    d. recourse to risk mitigation techniques; and

    e. capital raising.

84. One of the measures available to management may be the raising of additional capital. The presence of a capital buffer, of appropriate quality, can be a significant mitigating factor as higher levels of capital increase the degree of freedom management has when taking mitigating actions.

85. A contingency plan should contain emergency actions in case standard measures turn out to be inadequate in the face of the most adverse scenarios. When defining their contingency plans institutions should take into consideration the reduction of the efficiency as a consequence of extremely severe stressed situations.

Section 6 - Stress tests under ICAAP

Guideline 16. Institutions should evaluate the reliability of their capital planning based on stress test results[20].

86. Stress test results should be used to assess the viability of its capital plan in adverse circumstances. To be effective for capital planning purposes, a range of scenarios should be considered including at least an adverse economic scenario that is severe but plausible, such as a severe economic downturn and/or a system-wide shock to liquidity. The stress should be firm-wide covering all relevant risk areas and material entities within the institution.

87. The stress tests should be forward-looking, cover the same period as the institution's ICAAP, be updated at least as regularly as the ICAAP and reflect

[20] It should be noted that the assessment of stress tests is an important element of the ICAAP-SREP dialogue between institutions and supervisors (Element 4 of the dialogue as discussed in the CEBS Guidelines on the application of supervisory review process under Pillar 2 (GL03)).

all entities on which ICAAPs for the group are required. Selection of an appropriate time horizon for the forward-looking capital planning stress test will vary with the size and complexity of an institution, but all capital planning stress tests undertaken by institutions should cover a period of at least two years.

88. The scenarios used for the capital planning stress test should take account of all relevant material risks that the institution is exposed to including all Pillar 1 risks and any relevant Pillar 2 risks (as per firm-wide stress testing). This may involve institutions combining individual stresses of specific risk areas or undertaking a holistic firm-wide stress (see Section 4 of these guidelines).

Guideline 17. Stress tests under ICAAP should be consistent with an institution's risk appetite and strategy and contain credible mitigating management actions.

89. As a part of their stress testing programmes, institutions should develop firm-wide stress tests that are consistent with the risk appetite and overall (i.e. including business) strategy of the institution as set by the management body. Institutions are expected to demonstrate a clear link between their risk appetite, their business strategy, their capital planning and stress testing programmes. In particular, institutions should assess and be able to demonstrate (by credible management actions, plans and other concrete steps, including changes in business strategy, reinforcing the capital base and/or other contingency plans) their ability to remain above regulatory minimum capital requirements during a stress that is consistent with their stated risk appetite.

90. The assumptions used in the capital planning stress tests should be accurate with respect to institutions' possible behaviour in a time of stress and should be consistent with their stated risk appetite and business strategy. Resulting management actions based on changes to business strategy should have been identified, discussed and agreed at the most senior levels of the organisation if they are to be considered credible.

91. Institutions should document the results of their stress tests both gross and net of management actions. Mitigating management actions designed to reduce the impact of a stressed event should be clearly documented including explanations that justify the credibility and feasibility of those actions in a stressed environment. For example, actions such as asset sales, capital raising, capital injections from other parts of the group and rapid shifts in business strategies should all be treated with caution in times of stress.

Section 7 - Supervisory review and assessment

92. The review and assessment of the stress testing programmes and their results, including management mitigative actions is a part of the overall assessment of an institution's risk and business profile, as well as its compliance with the CRD and other regulatory requirements. Supervisors acknowledge the limitations of stress testing and the need for a flexible

approach reflecting the principles of proportionality and relevance to the particular institutions.

Guideline 18. Supervisors should undertake regular reviews of institutions' stress testing programmes covering scenario selection, methodologies, infrastructure and use of stress tests.

93. Supervisors should assess institutions' compliance with these guidelines taking into account the principle of proportionality and relevance. In their review, supervisors should evaluate the extent to which stress testing is embedded in an institution's risk management framework. They should also assess whether institutions devote sufficient resources and have adequate procedures in place to undertake rigorous, forward-looking stress testing in order to identify circumstances that could result in significant adverse impact on the institution and its viability.

94. Supervisors should consider whether senior management have been sufficiently involved in the stress testing programme and the management body sufficiently informed. Supervisors should require institutions to submit firm-wide stress testing results to them on a regular basis. They should also assess the extent of integration of stress testing outputs into decision-making throughout the organisation, including the strategic business decisions of the management body and senior management.

95. In cases where a supervisory assessment reveals material deficiencies in the stress testing programme and its use, supervisors should require the institution to develop a plan of remedial actions aimed at improving the stress testing programmes and practices. For example, where liquidity stress testing output is insufficiently integrated into the institution's decision-making, supervisors may suggest actions ranging from improvements in the stress testing framework to increasing the liquidity buffer of the institution until stress testing improves.

96. An important aspect of the supervisory review of stress testing programmes is the ongoing dialogue with an institution at all levels, both technical and management. In their reviews, supervisors will consider all sources of information about stress testing programmes and methodologies, including institutions' own internal assessments and validation as well as reviews undertaken by independent control functions. It is important that supervisors also engage in the dialogue with the management bodies and senior management of institutions in relation to major macro-economic and financial market vulnerabilities as well as institution-specific threats to institutions' ongoing business.

97. Supervisors are expected to review institutions' stress testing programmes in their entirety and with due consideration for the institution's organisation and business models. Such reviews will also address the extent to which reverse stress testing is used as a risk management tool, acknowledging that this does not lead directly to capital outcomes.

Guideline 19. Supervisors should review stress testing outputs in order to assess the resilience of individual institutions to adverse economic conditions and whether they are able to maintain sufficient

capital and liquidity. In doing this, supervisors should take into account details of movements in capital and capital needs, and liquidity and liquidity needs, under stressed conditions[21].

98. Supervisors should review how firm-wide stress scenarios for capital planning impact total capital and capital needs, including details of the anticipated sequence of these impacts. For example, losses or reductions in an institution's revenues and profits will negatively impact capital. In addition, it is expected that in a stressed scenario capital needs will change where, for example, credit migrations occur. Supervisors should ensure they have access to the details of the main assumptions and drivers of movements in capital and capital needs.

99. Supervisors should review and assess institutions' stress tests in order to understand the combined impact of changes in capital and capital needs, and liquidity and liquidity needs, under stressed conditions on the institution's capital adequacy and liquidity in relation to all relevant ratios in the supervisory framework. To that end, supervisors should assess whether the institution is able to remain above the minimum required regulatory capital ratios at all times in a severe but plausible stressed event. They may also consider how the quality of capital the institution is holding effects the results of the stress test and should ensure that capital is available to absorb losses and increases in regulatory capital requirements.

100. In conducting this assessment, supervisors should consider the transferability of capital and liquidity in financial groups during stressed conditions, taking account of potential funding difficulties that may be expected in stressed conditions.

Guideline 20. Supervisors should evaluate and challenge the scope, severity, assumptions and mitigating actions of firm-wide stress tests.

101. Supervisors should ensure that an institution conducts stress tests at multiple levels in the organisation. They should ensure that an institution's stress tests are rigorous, include different types of tests, and incorporate a range of scenarios (from mild to severe). Supervisors should assess the scenarios chosen by the institution for consistency with its risk appetite and overall risk profile and business plan.

102. When challenging scenarios and assumptions, supervisors may use appropriate benchmarking criteria and compare the severity of scenarios, their parameters and other assumptions, where applicable, with scenarios used in the relevant regional stress test exercises done by various authorities, including CEBS/EBA, IMF and ESCB/ESRB.

103. Supervisors should consider the effectiveness of institutions' stress testing programmes in identifying relevant business vulnerabilities. This will include a review of the key assumptions used in stress testing in the light of current (at the time of the exercise) and future market conditions.

[21] See also CEBS Guidelines on liquidity buffers and survival period (GL28) published on 9 December 2009 (see http://www.c-ebs.org/documents/Publications/Standards---Guidelines/2009/Liquidity-Buffers/Guidelines-on-Liquidity-Buffers.aspx)

104. Supervisors should assess the feasibility of proposed management actions in stressed conditions, challenge their credibility and, if necessary, require stress tests to be re-run with a range of different mitigating management actions.

105. In cases where material shortcomings are identified in how an institution addresses the outputs of stress tests, or if mitigating management actions are not deemed credible, supervisors should require the institution to take further remedial actions.

106. Based on all the information provided to the supervisor from a range of stress tests, including a severe downturn, and the credibility of the mitigating management actions identified therein, supervisors may decide to take actions as set out in the Article 136 of the CRD. These actions may involve requesting an institution to take additional remedial action such as considering its strategy or future management actions to ensure its solvency during a stress.

107. The range of remedial actions as an outcome of the SREP might include supervisors identifying appropriate institution specific (idiosyncratic) capital buffers[22] and/or liquidity buffers. Supervisors may also require, where deemed necessary, an institution to maintain appropriate additional institution-specific capital buffers in the current time such that those reserves are available to absorb losses during a severe scenario. In order for this to be effective, supervisors, institutions and other relevant parties need to understand that these capital buffers differ from other types of capital reserves that supervisors expect institutions to maintain as these reserves are designed to be used during an economic downturn.

108. In the case of a cross-border banking group, any discussion on the institution specific capital buffers which might be required to mitigate the outcome of stress tests should take place in the course of the process of the joint decision regarding the consolidated and solo capital adequacy as required by the Article 129(3) of the CRD and conducted in the context of the college of supervisors[23].

Guideline 21. In the case of a cross-border operating institution, appropriate discussions should be held between consolidating and host supervisors to ensure coordination of supervisory activities, including the stress testing activities, and also that firm-wide stress tests are undertaken at group level to address all the material risks of the institution and that stress test results reflect the impact of a scenario on

[22] In the discussion on capital buffers, one should clearly distinguish between general or systemic buffers (e.g. counter-cyclical capital buffers) being created to address wider issues, such as pro-cyclicality or systemic relevance of an institution, which are currently being debated in international and EU fora, and institution-specific (idiosyncratic) capital buffers set in order to cover the specific features and risk profile of a given institution.

[23] CEBS has elaborated on the process of the joint decision of the adequacy of own funds in the draft Guidelines for the joint assessment of the elements covered by the supervisory review and evaluation process and on the joint decision regarding the capital adequacy of cross border groups (CP39) , currently available as a consultation paper, see http://www.c-ebs.org/documents/Publications/Consultation-papers/2010/CP39/CP39.aspx.

the group as a whole. Results of such group level firm-wide stress tests should be taken into account in the risk assessment of the institution and discussed in the relevant college of supervisors.

109. Following the principles of the home-host supervisory cooperation elaborated in the CEBS Guidelines for operational functioning of colleges[24], colleges of supervisors play an essential role in the coordination of supervisory activities, including stress testing. In the context of the colleges of supervisors, home and host supervisors should assess the stress tests performed by a cross-border operating group as part of their stress testing programmes in order to ensure that all material risks to the group as a whole and all its material entities (subsidiaries) are adequately captured. The principles of the supervisory process described above also apply to discussions between consolidating and host supervisors.

110. Results of firm-wide stress tests should be discussed and challenged by the college of supervisors and should be taken into account in the risk assessment of the group and its entities.

111. The results of such firm-wide stress tests may be taken into account when deciding on the adequacy of the consolidated level of own funds held by the group with respect to its financial situation and risk profile and the required level of own funds for the application of Article 136(2) to each entity within the banking group and on a consolidated basis, as required by the Article 129(3) of the CRD.

Guideline 22. Supervisors may consider recommending scenarios to institutions and undertaking their own stress tests on an individual institution-specific basis as well as implementing system-wide stress test exercises based on common scenarios as a part of their assessment of the overall system's resilience to shocks.

112. Institutions should be aware that as part of the supervisory review process, supervisors may consider, in addition to institutions' own stress testing, implementing recommended scenarios for institutions to use, as well as requiring institutions to undertake further stress tests. In addition, as part of their work on the assessment of the overall health of the system, supervisors may consider implementing system-wide supervisory stress test exercises, based on common scenarios for institutions within their given jurisdictions, or centrally coordinated EU-wide or regional exercises.

113. It should be clearly acknowledged, both by institutions and supervisors, that scenarios recommended by supervisors and supervisory stress tests are not a substitute for institutions' own scenario setting or stress testing and institutions are, in any event, expected to maintain compliance with these guidelines. Nonetheless, where supervisory assessments suggest that the scenarios used by institutions are inconsistent with an institution's risk profile

[24] CEBS Guidelines for the operational functioning of supervisory colleges (GL34) published on 15 June 2010 (see http://www.c-ebs.org/documents/Publications/Standards---Guidelines/2010/Colleges/CollegeGuidelines.aspx).

or prevailing macro-economic conditions, supervisors may require institutions to use recommended scenarios or assumptions. Indeed, supervisor-recommended stress and/or scenarios can allow supervisors and institutions to better understand the impact of specific stress events on the institution. Recommended stress scenarios should be a complement to an institution's own stress testing programme.

114. Scenarios recommended by supervisors could be used in both system-wide stress testing and in individual institution-specific risk analysis. However, with regards to a system-wide stress test, supervisors should be aware that a given set of assumptions may be very severe for one institution but less severe for another due to differing characteristics of the underlying businesses. Furthermore, as previously stated, supervisors should make clear to the institutions that their recommended scenarios are not a substitute for stress tests that the institution has designed itself.

115. In the case of cross-border operating groups, stress testing programmes and their results will be discussed by the respective colleges of supervisors, in which, if deemed necessary, consolidating and host supervisors may agree within the college to prescribe a scenario reflecting potential macro-economic developments (see Chapter 5 of the CEBS Guidelines on the operational functioning of colleges[25]).

[25] CEBS Guidelines for the operational functioning of supervisory colleges (GL34) published on 15 June 2010 (see http://www.c-ebs.org/documents/Publications/Standards---Guidelines/2010/Colleges/CollegeGuidelines.aspx).

INDIVIDUAL RISK AREA ANNEXES

1. The following annexes illustrate some practices in relation to stress testing in individual risk areas with the aim of enhancing risk management and capital planning processes. These examples should not be considered as an exhaustive list of practices. They do not intend to duplicate or propose new regulatory requirements affecting capital or liquidity regimes, and they acknowledge that there is no one way of setting up stress testing practices, but rather different ways that fit in with each institution's approach to the management of risks. Some of the practices discussed in the annexes are applicable to all institutions, whereas others are related specifically to the institutions using advanced approaches for the calculation of regulatory capital requirement (internal market risk models, IRBA and AMA).

2. Each annex is divided into three sections: (i) an introduction, (ii) practices applicable to all institutions and (iii) practices applicable to institutions using advanced models. Bearing in mind the principle of proportionality, stress tests are conducted by institutions with material exposure to any of the following risks. For institutions which are less complex and less exposed to a certain risk, the use of simpler forms of analysis may suffice.

Annex 1 - Market risk

1. Market risk is the risk of losses in on- and off-balance-sheet positions arising from movements in market prices (e.g. stock prices, interest rates, foreign exchange rates).

2. Interest rate risk in trading book positions is a component of market risk (for interest rate risk in the banking book see Annex 6 of these guidelines.)

3. Under paragraph 10 of Annex V of the CRD, all institutions, irrespective of the method used for the calculation of capital requirements for market risks, shall implement policies and processes for the measurement and management of all material sources and effects of market risks.

Applicable to all institutions

4. Stress tests are usually conducted by all institutions for their positions in financial instruments in the trading book as part of their firm-wide stress testing as well as for market risk management approaches and measures purposes.

5. If applicable, institutions can consider a range of exceptional but plausible market shocks or scenarios for their trading book positions. For example, "exceptional" changes in market prices, shortages of liquidity in the markets and defaults of large market participants can be taken into account.

Dependencies between different markets and consequentially increasing correlations can also be factored in.

6. The stress tests applied and the calibration of those tests may reflect:

   a. the nature of the portfolios;

   b. the trading strategies of the institution; and

   c. the possibility, and time it could take, to hedge out or manage risks under severe market conditions.

7. As instruments and trading strategies change, the stress tests evolve to accommodate the changes.

Applicable to institutions using advanced models

8. Under Annex V of the CRD, institutions applying to use internal models to calculate capital requirements for market risks must frequently conduct a rigorous stress testing programme.

9. As the internal models for market risk are Value at Risk (VaR) models the main weakness identified is related to fat tails. Reliance on historical data means that tail risk will be underestimated and not appropriately captured. Therefore, stress testing with severe hypothetical scenarios, reviewed by senior management, and a reflection in the policies and limits set, is essential.

10. For those institutions where regulatory capital is calculated under a more risk sensitive approach by being assessed against a 10 day time horizon and 99 percentile confidence level, it is still important that tail events beyond that confidence level are considered. Based on current guidelines, a rigorous stress testing programme could consider the following criteria:

    a. Assessing the consequences of major market disturbances and identifying plausible situations which could entail extraordinarily high losses. These plausible situations might also include events with low probability for all main risk types, especially the various components of market risks. At portfolio level, the effects of changed correlations might be explored. Mitigating effects as consequences of contingency plans may have to be taken into account if the plans are based on plausible assumptions about market liquidity.

    b. A list of the measures taken to reduce risks and preserve own funds. In particular, limits on exchange rate, interest rate, equity price and commodity price risks set by institutions may be taken into account against the results of the stress testing calculations.

Annex 2 – Securitisation

Applicable to all institutions

1. With respect to securitisation the stress testing programme could cover complex and bespoke products such as structured credit products (securitisation positions). Stress tests for securitised assets consider the underlying assets, their exposure to systemic market factors, relevant contractual arrangements and embedded triggers in the securitisation structure, and the impact of leverage, particularly as it relates to the subordination level in the securitisation structure.

2. Institutions have underestimated the risk of some products (such as CDOs of ABS) by relying too much on external credit ratings or historically observed credit spreads related to (seemingly) similar products like corporate bonds with the same external rating. Such approaches cannot capture the relevant risk characteristics of complex, structured products under severely stressed conditions. Therefore, stress tests could include all relevant information related to the underlying asset pools - their dependence on market conditions - dependence of the securitisation positions on market conditions, complicated contractual arrangements and effects related to the subordination level of the specific tranches.

3. Institutions enhance their stress testing methodologies to capture the effect of reputational risk. Institutions integrate risks arising from off-balance sheet vehicles and other related entities in their stress testing programmes.

4. In particular, to mitigate reputational spill-over effects and maintain market confidence, institutions can develop methodologies to measure the effect of reputational risk on other risk types, with particular focus on credit, liquidity and market risks. For instance, an institution might include non-contractual off-balance sheet exposures in its stress tests to determine the effect on its credit, liquidity and market risk profiles.

5. Careful assessment of the risks associated with commitments to off-balance sheet vehicles related to structured credit securities and of the possibility that assets will need to be taken on balance sheet for reputational reasons. Therefore, stress testing programmes could include scenarios assessing the size and soundness of such vehicles relative to their own financial, liquidity and regulatory capital positions. This analysis could include structural, solvency, liquidity and other risk issues, including the effects of covenants and triggers.

Annex 3 - Credit risk and counterparty risk

Applicable to all institutions

1. All institutions exposed to credit risk as a material risk are subject to credit risk stress testing. An important aspect of testing is the method applied for capital requirement calculations as there are specific requirements for IRB institutions[26]. Credit risk concentration and credit risk parameters are subject to stress testing. Credit risk concentration stress tests play an important role for Pillar 2 risk. For IRB institutions relevant parameters are PD for all IRB institutions and LGD and CF, if own estimates of LGD and CF are used for calculating the capital requirement.

2. Often institutions using the standardised method for calculation of credit risk capital requirements are exposed to credit risk as a material risk and the requirements for stress testing apply.

3. Stress tests may have to assess future credit losses and changes in capital requirements due to, for example, changes in credit quality and collateral values.

4. For credit losses, the estimation of future losses in stress tests may in some cases rely on institutions' credit risk parameters although these would not be applied in the calculation of capital requirements. Credit risk model approaches for losses and approaches which challenge historical relations and data are encouraged.

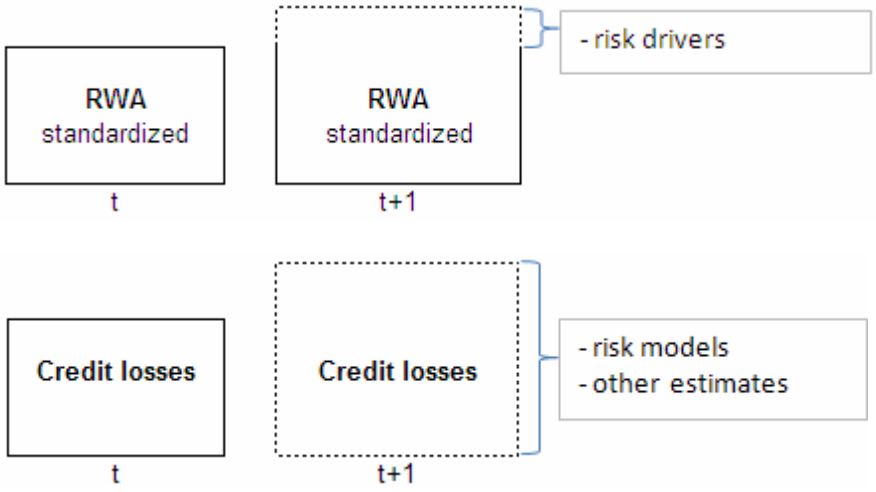
5. Institutions may simulate credit quality migrations among categories of exposure and provide an estimate of the losses.

6. Collateral values of residential real estate may be a relevant risk driver for institutions using the standardised approach.

7. Credit quality effects include changes in risk weights of externally rated companies and changes in past due credits.

8. In computing the effect of stress tests on capital requirements, institutions may use methodologies coherent with the standardised framework. This requires developing a link between internal risk parameters and regulatory weights. If the institution uses external ratings it can infer, by the movements of the internal risk estimation, the rating migration. Credit stock volume may be treated in various ways in stress tests; as a risk driver in sensitivity analysis, part of a scenario or an indirect effect from a scenario. Whether the volume change is part of the scenario or an indirect effect from the scenario, careful consideration is given to market factors. Different institutions may end up with different views about market factors such as credit supply, credit demand and competitors' behaviour in a stress situation which may limit the use of the result.

[26] According to Annex XI, paragraph 1a of the CRD, results of the stress tests performed by the institutions applying IRB is one of particular focus for SREP. Annex VII Part 4 of the CRD, Section 1.8, paragraphs 40 to 42 and paragraph 114.



Example of credit risk stress test methods and analysis targets for institutions using the standardised method for credit risk. For future period t+1 risk weighted assets (RWA) may be influenced by risk drivers. Credit risk models can be used to estimate credit losses for future periods.

Applicable to institutions using advanced models

9. For IRB institutions, the levels of applied risk parameters form the basis for the stress tests. Depending on the IRB approach applied, parameters are PD, LGD and CF. Stress tests also consider rating migrations, risk-weighted assets and credit losses. Capital requirements for the IRB approach could change depending on the stage within the economic cycle and stress tests should show the potential impact on capital requirements. The stress tests could thus show the need for possible action on the part of the institution, including the possible need for an increase in own funds.

10. Stress tests may assess the impacts of ratings migrations, as well as PD changes, on capital requirements with respect to the economic cycle. The approach towards pro-cyclicality of the IRB capital requirement outlined in the CEBS Position paper on pro-cyclicality[27] is not directly linked to stress tests and the ongoing discussion in international and EU fora regarding the approach to pro-cyclicality of the Basel 2 framework should be noted.

11. Institutions may determine specific risk drivers for credit risk and how these risk drivers in turn affect an institution's total capital requirements for credit risk. Institutions may find it helpful to develop these linkages on an asset class by asset class basis. For example, factors relevant to mortgages may be different to corporate asset classes.

12. Where an institution has numerous businesses, questions of diversification may arise, particularly across different geographic areas which may be subject to economic conditions that are not synchronised. Therefore it is not

[27] See CEBS position paper on a countercyclical capital buffer published on 17 July 2009 (see http://www.c-ebs.org/getdoc/715bc0f9-7af9-47d9-98a8-778a4d20a880/CEBS-position-paper-on-a-countercyclical-capital-b.aspx)

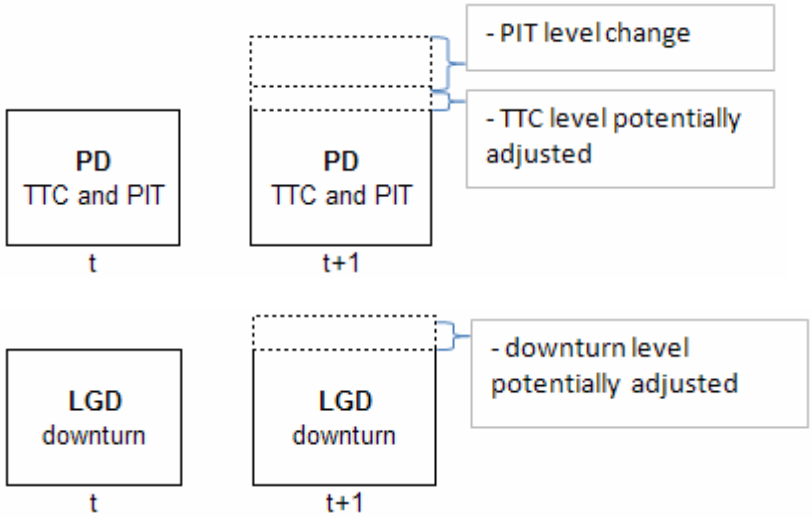
necessarily assumed that the aggregated impact is equal to the simple sum of each business's figures. However, in the spirit of the stress test, institutions may apply reasonable conservatism in specifying dependencies and be able to justify their choices. Analysis of the effects from simultaneous realisation of risks would support diversification effects.

13. Stress test results may include changes in relevant credit parameters, in RWA and in EL levels. For the PD parameter, institutions may apply different estimates for purposes other than capital requirement calculation, such as pricing or economic capital models. Under stressed conditions it is expected first point-in-time PD estimates will be affected and as a consequence there may be a need to adjust through-the-cycle estimates of parameters.

14. There is no expectation that the stress tests will necessarily produce an LGD that is either lower than, or higher than, the LGD estimated according to the IRB downturn requirement. To the extent that the identification of downturn periods coincides with the stress tests the calculation may turn out to be similar. More generally, some stress test calculations may function as one tool for assessing the robustness of the LGD estimation.

15. Stressed LGD rates may reflect downturn conditions; if observed LGD rates for a given obligor cohort are higher than those implied by the downturn LGD figures, then the stress tests may be updated to include the observed conditions and perhaps might also include scenarios where LGD rates deteriorate even further.

16. The level of capital needed to absorb potential credit migration/default losses is a function of the relationship between obligors in a given portfolio. As the correlation between portfolio obligors typically increases significantly during stressed periods, institutions may test the impact of changes in the relationships between obligors using plausible yet adverse scenarios. In particular the relationship between the largest standalone capital consumers in a given portfolio.



Example of evaluation of the IRB parameters in stress tests. Through-the-cycle (TTC) parameters are expected to vary less in a stress situation than point-in-time (PIT) parameters.

Financial collateral values (in connection with large exposures) [28]

17. The following text focuses on one specific aspect of credit concentration risk, i.e. financial collateral values in connection with large exposures.

18. When considering stress testing of financial collateral values in relation to large exposures, institutions using the comprehensive method may identify conditions which would adversely affect the realisable value of the specific collateral held by the institution including deterioration in the credit quality of collateral issuers or market illiquidity. In doing this, institutions are taking account of the specific characteristics of the financial collateral they hold.

19. Institutions using the comprehensive method for calculating the effects of financial collateral, or permitted to use their own estimates of LGDs and conversion factors, may identify conditions which would adversely affect the realisable value of their financial collateral.

20. These conditions are not defined in the CRD. Such conditions may include scenarios for which the appropriate degree of severity is discussed in Section 3 of these guidelines. Additionally, events which may affect the realisation of the collateral's estimated value, such as a decrease in the credit quality of the collateral issuers or market illiquidity which impacts the liquidation period, may be taken into account when calculating the effects of financial collateral for those institutions using the comprehensive method based either on

[28] This section should be read in conjunction with the CEBS Guidelines on the implementation of the revised large exposures regime (GL26) published on 11 December 2009 (see http://www.c-ebs.org/documents/Publications/Standards---Guidelines/2009/Large-exposures_all/Guidelines-on-Large-exposures_connected-clients-an.aspx)

supervisory volatility adjustments or on their own estimates of volatility adjustments.

21. The potential for such events to occur may be determined by institutions based on the type of financial collateral used. Different assumptions may legitimately be used for sovereign debt collateral and equities/convertible bonds collateral. Other examples which may affect the financial collateral's estimated value include currency mismatches between exposure and financial collateral, arrangements for marking to market and the realisation of value from large amounts of financial collateral from a single source in a 'distressed sale'.

22. According to Article 114(3) of the CRD, where the results of the stress testing indicate a lower realisable value of the collateral, the value of collateral taken into account for the purpose of determining an institution’s LE limits should be adjusted accordingly. To avoid such adjustments, institutions may think it prudent to ensure that an appropriate margin over the collateralised exposure is maintained. This would cover fluctuations in the market value of the collateral to ensure that it does not fall below the reported level.

Counterparty risk

23. Enhancing stress testing approaches for highly leveraged counterparties is appropriate when considering vulnerability to specific asset categories or market movements and when assessing potential wrong-way risk related to risk mitigating techniques.

24. Institutions may have large gross exposures to leveraged counterparties including hedge funds, financial guarantors, investment banks and derivatives counterparties that may be particularly exposed to specific asset types and market movements. Under normal conditions, these exposures are typically completely secured by posted collateral and continuous re-margining agreements yielding zero or very small net exposures. In cases of severe market shocks, however, these exposures may increase abruptly and potential cross-correlation of the creditworthiness of such counterparties with the risks of the assets being hedged may emerge (i.e. wrong-way risk). Institutions may enhance their stress testing approaches related to these counterparties in order to capture adequately such correlated tail risks.

Annex 4 – Operational risk

Applicable to all institutions

1. Institutions may use either the simpler approaches (i.e. Basic Indicator Approach, Standardised Approach or Alternative Standardised Approach) or the Advanced Measurement Approach (AMA) to calculate the capital requirement for operational risk, provided that the corresponding provisions are complied with. Institutions should ensure that operational risks are sufficiently and adequately stressed; however, in the AMA some requirements already include stress testing components.

2. The stress assumptions may be different from the ones used in credit and market risk stressed scenarios and should be based on external (for example damage to tangible assets due to a natural disaster) and internal events (such as new products, systems, areas of business and outsourced activities.). Especially in new areas with a lack or scarcity of loss data, stress tests may be based on scenario analysis.

3. Besides stressing the operational risk capital requirements, institutions should consider whether an operational risk scenario might impact capital planning analysis.

4. A robust analysis of major operational risks includes stresses and analyses of historical and hypothetical operational risk events and assessments of the adequacy of the capital calculated against these stressed events.

5. Stress tests may be based on severe, but plausible, operational risk events. Historical and plausible hypothetical operational risk events (e.g. rogue trader scenarios, natural disasters) used for stress testing have the nature of low frequency and high severity. The stressed operational risk exposure in Pillar 2 should also take account of the overall operational risk exposure.

6. The analysis of operational risks may be based on a top-down or bottom-up assessment of the risk or may comprise both elements. The chosen approach should be consistent with the size and complexity of the business (proportionality principle). Senior staff may be involved in the assessment of operational risk exposures that result from possible events that impact multiple business lines at the same time.

7. The analysis of the stress test events could involve expert opinion and include the macro-economic environment (e.g. to reflect increasing fraud risk in an economic downturn) and other external risks and factors.

Applicable to institutions using advanced models

8. Relevant variables of the model, including the four AMA elements need to be adequately stress tested within the AMA capital calculation and validation as well as the additional Pillar 2 capital calculation.

9. The CRD, Annex X, Part 3 defines the four elements (internal and external data, scenario analysis, and business environment and internal control factors) which must be used within the AMA, and which must take into account all significant risk exposures and capture the major risk drivers. If the AMA is used together with a simpler approach (Partial Use) to calculate the operational risk capital requirements, the stress test results for the latter should be added to the stressed AMA capital within Pillar 2.

10. Stress tests based on internal and external data may consider the occurrence of additional severe tail events, carefully analyse the boundaries of operational risk losses (e.g. large losses which are related to market risk are to be considered in the scope of the capital requirement for operational risk, for example, rogue trading due to sharp falls in market values), use scaling factors (e.g. in a situation where external data were scaled down, the scaling may be reduced or the data may even be scaled up accounting for, e.g., expectations on increasing inflation rates) and the criteria for determining the relevance of data (e.g. large loss data considered not to be relevant may be used within the stress test).

11. Institutions also stress their business environment and internal control factors, as well as considering macroeconomic developments and other relevant external factors.

12. Stress tests may include scenario analysis as an input to the model for extreme values (e.g. by assuming combined scenarios, an increasing number or probability of high severity events, or taking into account possible chain reactions and possible effects on/of other risk types).

Annex 5 - Liquidity risk[29]

1. It should be noted that liquidity risk has two dimensions:

   a. funding liquidity risk: the current or prospective risk arising from an institution's inability to meet its liabilities/obligations as they fall due without incurring unacceptable losses; and

   b. market liquidity risk: the risk that a bank cannot easily offset or sell a position without influencing the market price (and incurring a significant loss) because of inadequate depth in the market or market disruption.

2. Each institution is expected to manage its individual funding liquidity risk, taking into account the possible impact of market liquidity risk.

Applicable to all institutions

3. All material liquidity risk drivers are expected to be considered in identifying the potential liquidity gap. The drivers incorporate both asset and liability side factors. The methodology used for calculating the shock effects is to estimate the net cash flows. For each scenario, at each stress level, the institution identifies cash inflows and outflows that can be expected to occur in each future time period and the resulting net cash flows.

4. Liquidity risk arises for two sets of reasons, liability side and asset side, Both are considered when identifying liquidity risk drivers. The liability side reasons include diminishing ability to raise new funding, failure to roll over liabilities and withdrawal risk (e.g. unforeseen withdrawal of deposits). The asset side (on– and off-balance sheet) reasons include the unexpected utilisation by customers of committed credit lines, back-up/stand-by facilities and other lending facilities. In asset side scenarios declines in market liquidity and/or value of liquid assets may also have to be taken into account as they determine the amount of liquidity an institution is able to generate from them. Asset side shocks could also cause declines in asset values which might lead to liquidity stress through margin calls (when those assets are pledged).

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[29] This section should be read in conjunction with CEBS's technical advice on liquidity risk management (second part), published September 2008, (see http://www.c-ebs.org/getdoc/bcadd664-d06b-42bb-b6d5-67c8ff48d11d/20081809CEBS_2008_147_%28Advice-on-liquidity_2nd-par.aspx); Liquidity Identity Card, June 2008, (see http://www.c-ebs.org/getdoc/9d01b79a-04ea-44e3-85d2-3f8e7a9d4e20/Liquidity-Identity-Card.aspx); and CEBS Guidelines on liquidity buffers and survival period, published December 2009 (see http://www.c-ebs.org/documents/Publications/Standards---Guidelines/2009/Liquidity-Buffers/Guidelines-on-Liquidity-Buffers.aspx)

In the implementation of principles contained in this annex, national supervisory authorities and institutions should be aware of ongoing discussions regarding the proposals for changes of the liquidity regime to be introduced in the CRD IV. CEBS is closely monitoring the regulatory developments, has participated in the public consultation of the proposals for the CRD IV, and will amend, if necessary, the principles put forward here, once the legislative proposals are finalised.

5. In each scenario at each stress level there are two types of cash flows that can be expected to occur, the contractual cash inflows and outflows, either discretionary or non-discretionary, e.g. liquidity drains from margin calls and required posting of collateral; and the cash inflows and outflows resulting from customer behaviour. They may also cover the following, where applicable:

   a. impact of covenants - downgrade triggers;

   b. impact of non-contractual liquidity support (reputation-linked); and

   c. impact of liquidity back-up/stand-by facilities.

6. By summing up all the cash flows an institution may end up with the forecast liquidity requirement for each time period in each scenario at each stress level. It may then calculate the net cash flow for each time bucket in each scenario at each stress level. This is the amount by which the forecast cash inflows exceed (or fall short of) the forecast outflows.

7. Potential liquidity gaps are identified and quantified through liquidity stress testing in specified stress scenarios, as well as means of closing those gaps and the funding cost. The liquidity gaps are created by loss of available funding (e.g. reduction in deposits) and/or increased demand for liquidity (e.g. funding contingent liabilities). The institution may define the different ways at its disposal to close those gaps according to the scenario contemplated (unsecured funding if assumed to be available, secured funding). Changes of business structure like reducing credit expansion may be contemplated for long-lasting stress scenarios depending on the business model of the institution. In each case the funding cost is an important parameter.

8. Three types of stress scenarios are expected to be applied: idiosyncratic, market-wide, and a combination of the two. The idiosyncratic stress might assume no rollover of unsecured wholesale funding and some outflows of retail deposits. In addition, a typical bank-specific scenario is, for example, a downgrading (for example, a 3 notches downgrade) of an institution's debt instruments (including SPV issued CP) by external rating agencies. The market-wide stress might assume a decline in the liquidity value of some assets and deterioration in funding market conditions. In addition, market stress scenarios can involve market disruptions or changes in the macro-economic environment in which the institution is operating, or the downgrading of countries in which the institution is operating.

9. To provide a complete view of the various risk positions, stress testing of other risks are considered in constructing 'alternative liquidity scenarios'.

10. Institutions increasingly rely on funding sources that are more sensitive to interest rate, market, credit, and reputation risks. Therefore, in assessing stress testing scenarios the impact of other risks on liquidity risk may be considered. As these other risks can generate liquidity drains (through increased funding costs or through margin calls or required posting of collateral, for example), sound management of these risks helps but does not provide sufficient liquidity risk mitigation.

11. Furthermore, assumptions used when constructing liquidity stress scenarios should be proportionate with other risks' stress scenarios (results and assumptions). As, when other risks materialise, they usually have an impact on the liquidity position of an institution and so it is necessary to acknowledge the assumptions and results of other risks' specific stress testing to attain a coherent system of stress tests. In particular the impact of market risk on assets value, credit risk on assets value and expected cash flows and reputation risk can be appropriately incorporated into all liquidity stress scenarios.

12. To the extent that liquidity risks may derive from other sources of risk positions, 'alternative liquidity scenarios' may be designed in liaison with other risks. When other risks materialise, they may impact the liquidity position of an institution. Those spill-over effects may be analysed and measured within a globally consistent stress test framework. As an example, the impact of market risk on asset value, credit risk on asset value and expected cash flows and reputation risk may be appropriately incorporated into liquidity stress scenarios. Another example is when an institution relies on funding sources that are sensitive to interest rate, market, credit, and reputation risks.

13. A survival period of at least one month is applied in specifying the chosen stress scenarios. Within this period, a shorter time horizon of at least one week may also be considered to reflect the need for a higher degree of confidence over the very short term. The time period considered may be divided into two phases: a short acute phase of stress (for example, up to one or two weeks for idiosyncratic risks in order to cover such periods without having to change the business model) followed by a longer period of less acute but more persistent stress (for example, up to one or two months for more general liquidity risk). This approach has the merit of looking at different levels of severity for the stress scenarios. Beyond these basic time horizons, longer time horizons may be considered (for example, 1 year to cover the structural liquidity position) and alternative remedial measures such as a contingency funding plan, activity adjustment, business model change, etc.

14. A set of behavioural assumptions may have to be designed for each different scenario and time horizon. The behaviour of depositors and funds providers will be driven by several factors influencing their actions with regard to the specific institution. The degree to which these factors will result in withdrawal or withholding of funds is determined by their sensitivities to the perception of the soundness of the institution. This behaviour can be analysed and some assumptions can be made when constructing the stressed liquidity scenarios.

15. The basic impact of the liquidity shock is on the net cash flow. However, the analysis may be extended to other metrics, such as liquidity ratios, liquidity buffer. Although net cash flows is the basic measure for liquidity stress testing, the impact may be extended. The institution may have to continue the analysis by calculating the effect on its liquidity ratios and liquidity buffer. The liquidity ratios can be simple liquidity ratios (e.g. loans/deposits) or more complicated supervisory liquidity ratios. The definition of the liquidity buffer is derived from the CEBS paper on liquidity buffers and survival periods: "the

liquidity buffer should be the short end of the counterbalancing capacity. It is defined as the excess liquidity available outright to be used in liquidity stress situations within a given short-term period. In other words, it is liquidity available without the need to take any extraordinary measures"[30]. Thus the liquidity ratios and the liquidity buffer should comply with regulatory minima after the conduct of the stress test exercise.

16. When conducting liquidity stress testing exercises on a consolidated basis, possible strains on transfers of liquidity among the entities in the group are considered and may have to be incorporated into the relevant scenarios.

17. Stress testing on a consolidated basis means that there should be free and unconstrained "movement" of liquidity among the entities of the group. In some cases there are legal and other types of obstacles and these may be built in to the scenarios. The problem may be particularly acute in the case of entities located in other countries. In these cases cross-border liquidity transfer problems may have to be considered. Apart from legal risk, other types of risk (e.g. country risk in the form of transfer risk) may have to be considered and incorporated into the liquidity stress testing scenarios. The potential for ring fencing also underlines the need for performing stress tests at different levels, since the legal entity by itself needs to hold a certain amount of liquidity.

18. All-in-all, the results of the stress tests can provide input into adjusting and improving liquidity risk management, including internal policies, limits and contingency funding plans.

[30] See also CEBS Guidelines on liquidity buffers and survival period (GL28) published on 9 December 2009 (see http://www.c-ebs.org/documents/Publications/Standards---Guidelines/2009/Liquidity-Buffers/Guidelines-on-Liquidity-Buffers.aspx)

Annex 6 - Interest rate risk from non-trading activities[31]

1. For the purposes of these annexes, interest rate risk is the exposure of institutions' positions to adverse movements in interest rates. For the purposes of this Annex, positions in the banking book only are considered, as positions in the trading book are considered as an element of market risk and subject to the market risk stress tests (see Annex 1 of these guidelines). Interest rate risk includes current and future effects on the institution's earnings and capital.

Applicable to all institutions

2. All sources of interest rate risk in the banking book are relevant for stress testing interest rate risk in the non-trading book, namely,` re-pricing risk, yield curve risk, basis risk and option risk. Pursuant to Article 124(5) of the CRD, institutions must assess their exposures to the interest rate risk arising from non-trading activities. Should the economic value decline by more than 20% of an institution's own funds as a result of a sudden and unexpected change in interest rates, supervisors should require the institution to undertake appropriate measures. This test is usually achieved by means of a 200 basis point parallel shift of the yield curve.

3. However, the purpose of this annex is to demonstrate that a simple parallel shift may not suffice. Therefore, institutions may have to consider movements and changes in the shape of their yield curves in their scenario analysis, as a non-parallel shift in the curve can entail additional declines in both the net interest income and the economic value of an institution.

4. Basis risk is an important aspect of interest rate risk. Basis risk can arise from mismatching between funding and investments with regard to a reference interest rate, despite the funding and investments being matched in terms of time.

5. In adverse situations, the holder of an embedded option may make use of the right to terminate the contract early, which can force the institution into a new transaction on less favourable terms.

6. The complexity of interest rate risk varies from institution to institution with regard to the sophistication of the financial instruments used. Where less complex financial instruments are employed, the effect of a shock can be calculated by the institution using sensitivity analysis (without identification of the origin of the shock, and by means of the simple application of the shock to the portfolio). Where an institution uses more complex financial instruments on which the shock has multiple and indirect effects, it should use more advanced approaches with specific definition of the adverse (stress) situations.

[31] This section should be read in conjunction with CEBS Guidelines on Technical aspects of the management of interest rate risk arising from non-trading activities under the supervisory review process, 3 October 2006 (see http://www.c-ebs.org/getdoc/e3201f46-1650-4433-997c-12e4e11369be/guidelines_IRRBB_000.aspx)

Annex 7 - Concentration risk[32]

Applicable to all institutions

1. Considerations affecting concentration risk (both intra- and inter-risk) are an important part of the stress testing framework, since stress tests can be helpful in revealing interrelationships between risk drivers and their impact on an institution under adverse economic conditions.

2. Stress testing is a key tool in the identification of concentration risk. Such analysis, like concentration risk management, is most useful when it is performed on an institution-wide basis and is able to transcend business unit or risk type focus on concentrations, to which it can be a useful complement.

3. In addition, stress testing would allow institutions to identify interdependencies between exposures, which may only become apparent in stressed conditions as well as hidden concentrations, even though the probability of such adverse scenarios is significantly low.

4. In stress testing, especially firm-wide stress testing, institutions could identify risk concentrations taking into account single risk concentrations and interrelated risk types considering on- and off-balance sheet exposures, as well as banking, trading and hedging positions.

5. Stress tests are expected to take into account changes in the business environment that may occur which would lead to risk concentrations materialising. In particular, stress tests may consider unusual but plausible changes in correlations between various types of risk drivers as well as extreme and unusual changes in risk parameters, going beyond single risk drivers or risk types, to look at scenarios that take account of interrelated risk drivers and that feature not only first round effects but also feedback effects.

6. The link between a macro-economic scenario and the impact on a particular concentrated risk factor, such as geographic region or industry sector can be identified. The way in which concentrated exposures perform in response to the same risk drivers may be factored into the stress tests, including the risk of short-term large increases in losses as a result of concentrated exposures across, say, the retail and corporate credit books or across different entities in a group.

7. Institutions would also consider inter-risk concentrations, aggregating across risk types notably market and credit risk, to gain a better understanding of their potential credit, liquidity and trading book risk concentrations in a stress. Institutions may identify potential links between exposures and question assumptions about correlations between risk types in a stress.

8. Institutions may have to consider these correlations in extreme events and question what confluence of events could lead to correlations of such magnitude that they would threaten the viability of the institution. It is in this

[32] This section should be read in conjunction with the CEBS Guidelines on aspects of the management of concentration risk under the supervisory review process.

regard that institutions may have to consider the use of reverse stress testing that would allow them to test the plausibility of the assumptions that have been made for main case business planning. Analysis of unlikely but still plausible events that lead to unusual correlations allows the institution to consider in its risk analysis and mitigation programme.

9. Stress tests are expected to be performed both on a solo basis for individual legal entities - in order to take account of potential risk concentrations specific to local markets - as well as on the type of concentrations that can materialise at group level. The results of concentration risk stress tests could be communicated within the institution and used in decision making processes and limit setting as part of concentration risk management.