14 December 2009

CEBS Guidelines on Stress Testing (CP32)

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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, 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, published on 14 December 2006[2].

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 second-round 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

[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; 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 6.

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.

[4] See consultation paper http://www.c-ebs.org/getdoc/0861a22e-0eb8-4449-9b3a-f4b1959267c7/CP24_High-level-principles-for-risk-management.aspx, to be finalised in early 2010

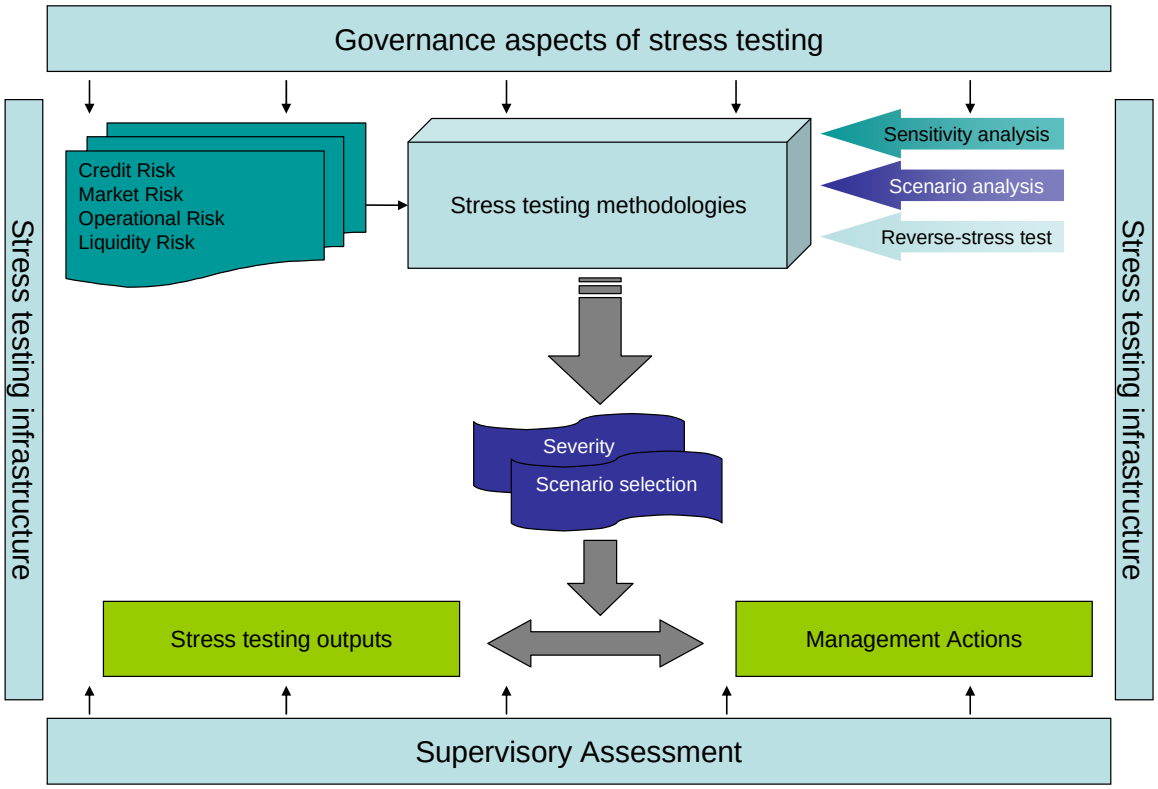

Figure 1. The "building block" approach to the guidelines

7. The guidelines are supplemented by a range of annexes that focus on the stress testing of specific risks (market risk (Annex 1), securitisation (Annex 2), credit risk (Annex 3), operational risk (Annex 4), liquidity risk (Annex 5), interest rate risk in banking book (Annex 6), and concentration risk (Annex 7)). The annexes explain the implementation of the general stress testing principles in the respective risk areas and illustrate existing supervisory expectations in those areas.

8. 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)[5]. The stress testing guidelines do not introduce new Pillar 1 or Pillar 2 guidance and do not address issues such as supervisory stress testing.

9. These guidelines should be implemented proportionately, taking account of the nature, scale, and complexity of the activities of the institution concerned. 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

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

developing their stress testing programmes smaller and/or less complex institutions should still consider interactions between risks, for example intra- or inter-risk concentrations, 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.

10. 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)

11. 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.

Implementation of the guidelines

12. CEBS will expect its members to apply the present guidelines, once finalised, by 30 June 2010. CEBS acknowledges that the implementation of some specific aspects of the guidelines may require modifications to institutions' current procedures. Therefore, CEBS recommends that the implementation of the guidelines can be phased, and - whenever necessary - national supervisors provide their supervised institutions with sufficient flexibility regarding the implementation of specific aspects of the guidelines (e.g. reverse stress testing). National supervisors will also monitor the implementation progress, as necessary.

13. To ensure harmonisation of practices across Member States, CEBS is considering conducting an implementation study one year after the recommended implementation date.

Section 2 - Governance aspects of stress testing and use

14. It should be noted that general risk management principles, as stipulated in the CEBS High-level principles for risk management,[6] apply fully to the governance and oversight of stress testing programmes. In this section CEBS

[6] See consultation paper http://www.c-ebs.org/getdoc/0861a22e-0eb8-4449-9b3a-f4b1959267c7/CP24_High-level-principles-for-risk-management.aspx, to be finalised in early 2010

elaborates on these high-level principles with respect to their application to stress testing.

Guideline 1. The management body[7] 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.

15. 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).

16. 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 participate in the design of the programme in particular scenario selection, business assumptions and discussion of the results of firm-wide stress testing. The management body must therefore engage in the discussion of modelling assumptions and scenario selection and are 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 also take responsibility for identifying and agreeing credible management intervention and mitigating actions.

17. 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.

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.

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

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[7] 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).

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;

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.

19. 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[8].

20. 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.

21. 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. The stress testing programme should also allow for ad hoc stress tests.

22. The stress testing programme should be supported by an appropriate infrastructure allowing for both flexibility and appropriate levels of quality and control. Institutions must ensure that they devote sufficient resources to developing and maintaining such infrastructures including appropriate resources and IT systems that facilitate effective data delivery and processing in a quantitative and qualitative manner.

[8] 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)

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

23. The stress testing programme should be used as part of a range of risk management tools supporting 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.

24. The management body and senior management have responsibility for taking appropriate management actions based on the entire stress testing programme. These measures or actions may vary depending on the circumstances (see also Guideline 15 for specific management intervention and mitigating actions to address outcomes of stress tests), for example:

    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. implementing contingency plans.

25. The results of stress tests should also be used as one input in 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.

26. 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.

27. 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.

28. An institution must 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.

29. The effectiveness and robustness of stress tests should be assessed regularly, qualitatively as well as quantitatively, in the light of changing external conditions to ensure that they are up-to-date. An independent control function such as internal audit should play a key role in the process. The quantitative processes should include benchmarking with other stress tests within and, if possible, outside the institution.

30. 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.

Section 3 - Stress testing methodologies

31. 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. In a general sense, an effective stress testing programme should consist of sensitivity analyses (single and simple multi-factor analyses) and complex scenario analyses addressing all material risks at various levels of the institution. The combination of approaches will depend on the size and complexity of the specific institution.

3.1 Sensitivity analysis

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

32. 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 should provide information about key risks and enhance understanding about potential risk concentrations in one or several risk factors.

33. 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).

34. 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.

35. 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.

36. 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.

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

38. 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.

39. A range of scenarios should be considered encompassing different events and degrees of severity. 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 unstressed or 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 all 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.

    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.

40. 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 5.1 for discussion on the time horizon of the stress test for capital planning purposes).

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.

41. 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 positions (on- and off-balance sheet) of the institution

42. 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.).

43. 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.

44. 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 appropriately applied by excluding some assumptions (e.g. diversification) from the model's outputs. Nevertheless the institution should be well aware of the dependencies excluded and review their incorporation on a regular basis.

45. 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.

46. 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.

47. In addition, supervisory experience suggests that the complexity of large institutions is often reflected in their risk management and modelling frameworks. Where a wide variety of models, supporting formulas and varying assumptions are used institutions should consider ways to streamline their stress testing programmes to improve transparency, simplicity and parsimony.

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

48. 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.

49. 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. Thus, institutions may make qualitative assessments of the second order effects of stress. Such assumptions should be documented and reviewed by senior management.

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.

50. 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.

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

52. 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.

53. 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 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.

54. 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.

55. 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.

56. In developing severe downturn scenarios institutions should also consider plausibility. 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), which should be reflected in the scenarios.

3.4 Reverse stress testing

57. Reverse stress testing consists of identifying a scenario or combination of scenarios that lead to an outcome in which the institution's business plan becomes unviable and the institution insolvent, i.e. stress events which threaten the viability of the whole institution, as well as assessing the probability of realisation of such scenarios.

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

58. No single definition of reverse stress testing methodology is provided for the purposes of these guidelines. Reverse stress tests could range from a simple qualitative discussion of key risk factors to a more sophisticated quantitative approach identifying the level at which insolvency would begin and working backwards in a quantitative manner to identify the macro economic risk drivers that would cause it.

59. 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.

60. Reverse stress testing should be carried out regularly by all institutions. As a starting point reverse stress testing is likely to 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.

61. 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 should 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 and second round effects.

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

62. Stress testing programmes should include a multi-layered approach to capture risks at various levels in an institution. Subject to the principle of proportionality, the scope of the stress testing programme could vary from simple portfolio level sensitivity analyses to comprehensive firm-wide scenario analysis aimed at capturing all material risks (both on- and off-balance sheet) at all levels of the organisation.

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 correlations between risks that the institution identifies for a given portfolio.

63. 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.

64. 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.

65. Institutions should perform stress tests taking into account 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.

4.2 Firm-wide stress testing

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

66. 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.

67. 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).

68. To adequately capture firm-wide risks, institutions should perform stress tests at the consolidated level and the level of material entities, which might be at the solo and/or a sub-consolidated level if appropriate. For instance, an institution having insurance activities (subsidiaries) can perform a stress test on the banking part and a stress test on the insurance part. 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 (e.g. bank vs. insurance) and different geographic regions.

69. 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.

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.

70. One essential output from a stress testing exercise is the estimate of the expected 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.

71. When undertaking stress testing, it is crucial to estimate potential losses which can derive from a specific configuration of macro-economic variables. 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.

72. 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.

73. 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 expected 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.

74. Institutions are expected to put in place mitigating techniques and contingency plans against a range of plausible stressed conditions (not reverse stress tests). The performance of risk mitigating techniques should be challenged and assessed systematically under stressed conditions when markets may not be fully functioning and multiple institutions could simultaneously be pursuing similar risk mitigating strategies.

75. Institutions should not overestimate their ability to take mitigating actions and should consider various alternative options when outright risk reduction may not be feasible.

76. To assess 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.

77. 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.

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

79. A contingency plan should contain emergency actions in case standard measures turn out to be inadequate in the face of the most adverse scenarios.

5.1 Capital planning stress tests under ICAAP

Guideline 16. Institutions should undertake stress tests for capital planning purposes as part of their stress testing programme. These stress tests should be based on a range of scenarios, including a severe economic downturn, cover the appropriate time horizon and be firm-wide covering all relevant risk areas within the institution.

80. An institution should perform a range of stress tests across multiple levels of the organisation. They should include a capital planning stress test that assesses the viability of its capital plan in adverse circumstances. In a firm-wide scenario analysis used for capital planning purposes institutions should use a range of scenarios, including adverse economic scenarios that are severe, but plausible. This should involve consideration of a severe economic downturn and/or a system-wide shock to liquidity.

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

should reflect 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.

82. 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. Capital planning stress tests should be consistent with an institution's risk appetite and strategy and contain credible mitigating management actions.

83. As a part of their stress testing programmes, institutions should develop firm-wide stress tests that are consistent with the risk appetite and strategy of the institution as set by the management body. Institutions are expected to demonstrate a clear link between their risk appetite, their strategy and stress testing programmes.

84. 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.

85. 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 6 - Supervisory review and assessment

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

86. Supervisors should assess institutions' compliance with these guidelines. 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.

87. 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.

88. 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.

89. It is important that supervisors also engage in ongoing 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.

90. Supervisors are expected to review institutions' stress testing programmes in their entirety. 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[9].

91. 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.

92. 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.

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

93. 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 scenarios.

94. 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.

95. 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.

96. 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 moment of the exercise) and future market conditions.

97. 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.

98. 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.

99. 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.

100. The range of remedial actions as an outcome of the SREP should include supervisors identifying appropriate institution specific (idiosyncratic) capital buffers[10] and/or liquidity buffers. Supervisors may also require an institution to maintain appropriate additional institution-specific capital buffers in the

[10] 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.

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.

Guideline 21. Appropriate discussions should be held between consolidating and host supervisors to ensure 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 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.

101. Home and host supervisors should assess the stress tests performed by institutions 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.

102. 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 an institution.

103. 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 Articles 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.

104. 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.

105. 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 still 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 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.

106. 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.

INDIVIDUAL RISK AREA ANNEXES

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

Market Risk 1. All institutions should conduct stress tests 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.

4. If applicable, institutions should consider a range of exceptional but plausible market shocks or scenarios for their trading book positions. In particular, “exceptional” changes in market prices, shortages of liquidity in the markets and defaults of large market participants have to be taken into account. Dependencies between different markets and consequentially increasing correlations should also be factored in.

5. The stress tests applied and the calibration of those tests should 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.

6. As instruments and trading strategies change, the stress tests should also evolve to accommodate the changes.

Applicable to institutions using advanced models

7. 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.

8. As the internal models 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 is essential. Additionally, stress testing results must be reviewed by senior management and be reflected in the policies and limits they set.

9. Depending on the nature of the portfolio, and having in mind relevant outputs, the stress tests should factor in (where applicable):

   a. illiquidity/gapping of prices (including interest rates and exchange rates);

   b. concentrated positions (in relation to market turnover);

   c. one-way markets;

   d. non-linear products / deep out-of-the-money positions;

   e. events and jumps-to-default; and

   f. significant shifts in correlations and volatility.

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

11. 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 should satisfy the following criteria:

    a. The programme should assess the consequences of major market disturbances and identify plausible situations which could entail extraordinarily high losses. These plausible situations should 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 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.

    b. 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.

Annex 2 – Securitisation

Applicable to all institutions

Securitisation 1. The stress testing programme should explicitly cover complex and bespoke products such as structured credit products (securitisation positions). Stress tests for securitised assets should 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.

1. 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, institutions should include in their stress tests 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.

Securitisation 2. The stress testing programme should cover pipeline and warehousing risks. Institutions should include such exposures in their stress tests regardless of their probability of being securitised.

2. Stress testing is particularly important in the management of warehouse and pipeline risk associated with underwriting and securitisation activities. Many of the risks associated with pipeline and warehoused exposures emerge when an institution is unable to access the securitisation market due to either institution-specific or market stresses. Institutions should therefore include such exposures in their regular stress tests regardless of the probability of the pipeline exposures being securitised.

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

3. To mitigate reputational spill-over effects and maintain market confidence, institutions should 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 should include non-contractual off-balance sheet exposures in its stress tests to determine the effect on its credit, liquidity and market risk profiles.

4. Institutions should carefully assess the risks associated with commitments to off-balance sheet vehicles related to structured credit securities and the possibility that assets will need to be taken on balance sheet for reputational

reasons. Therefore, in their stress testing programmes, institutions should include scenarios assessing the size and soundness of such vehicles relative to their own financial, liquidity and regulatory capital positions. This analysis should 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

Credit risk 1. All institutions which are 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[11].

1. 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 test should 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 are expected to simulate migration between the different default categories and provide an estimate of the losses.

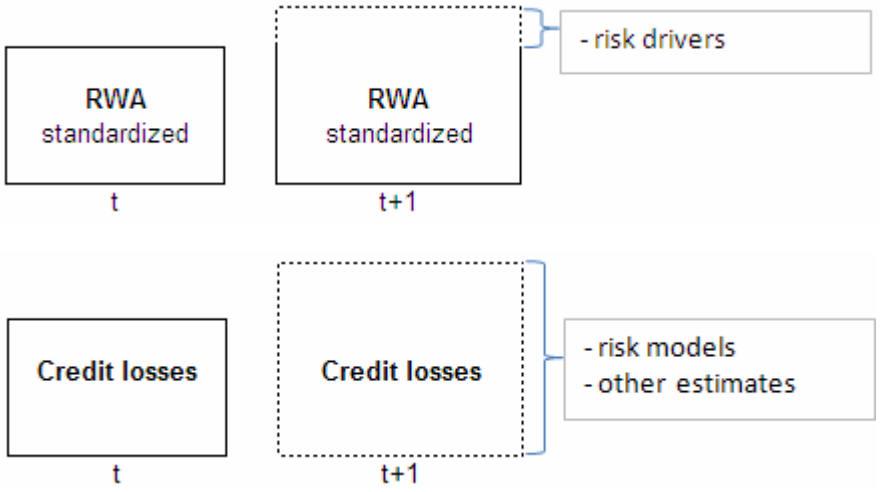
6. Collateral values of residential real estate may be a relevant risk driver for institutions using the standardized approach. Stress tests including real estate prices may result in changes in capital requirements.

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 should adopt 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 should infer by the movements of the internal risk estimation the rating migration. Credit stock volume changes in stress tests could affect the capital requirement. Credit stock volume may be treated in various ways in stress tests. It can be used 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 should be given to

[11] 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 of SREP. Annex VII Part 4 of the CRD, Section 1.8, paragraphs 40 to 42 and paragraph 114.

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.



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 IRB institutions

Credit risk 2. 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 should also consider rating migrations, risk weighted assets and credit losses.

9. The results of the stress tests are required from credit institutions applying an IRB approach. 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 should 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[12] 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. It is up to institutions to determine specific risk drivers for credit risk and how these risk drivers in turn affect an institution's total capital requirements for

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

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.

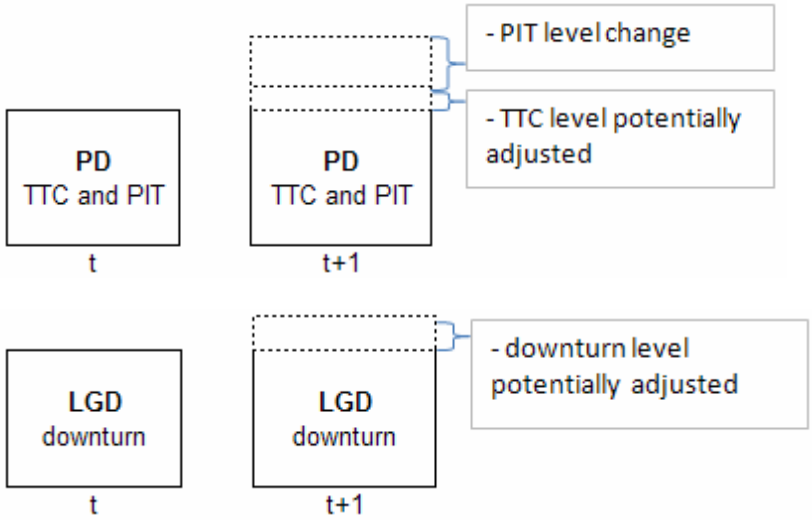
12. Where an institution has numerous businesses, questions of diversification may arise, particularly across different geographic areas which may be subject to economic conditions that are not synchronised. Therefore it is not necessarily assumed that the aggregated impact is equal to the simple sum of each business's figures. However, in the spirit of the stress test, institutions should 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 should 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 should 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 should, at a minimum, be updated to include the observed conditions and perhaps should 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 should test the impact of changes in the relationships between obligors using plausible yet adverse scenarios. Particular attention should be given to 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) [13]

17. The following detailed guidance 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 should 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 required to take 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, should 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, should be taken into account when calculating the effects of financial collateral for those institutions using the comprehensive method based either

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

on 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

Credit risk 3. Institutions should enhance their stress testing approaches for highly leveraged counterparties in considering their vulnerability to specific asset categories or market movements and in assessing potential wrong-way risk related to risk mitigating techniques.

23. 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 should 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

Operational risk 1. Institutions should ensure that operational risks are sufficiently and adequately stressed and that relevant operational risk scenarios are incorporated into overall capital planning stress testing.

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 capital requirements 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 events (including a stock exchange crash scenario causing an increase in litigation).

3. The stress test should account for material changes within the institution, such as new products, systems, areas of business and outsourced activities. Especially in new areas with a lack of loss data, stress tests should be based on scenario analysis.

4. Besides stressing the operational risk capital requirements, institutions should consider whether an operational risk scenario might impact capital planning analysis and take this into account appropriately.

Applicable to institutions using simple approaches

Operational risk 2. Institutions should undertake a robust analysis of their major operational risks including stresses and analyses of historical and hypothetical operational risk events and an assessment of the adequacy of the capital calculated against these stressed events.

5. Stress tests should 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 should be of a low frequency and high severity. The stressed operational risk exposure should not only be assessed on the basis of single stressed events, but also account for the overall operational risk exposure in Pillar 2.

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). Institutions should ensure that sufficient senior

staff are 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 should involve expert opinion and include the macro-economic environment (e.g. to reflect increasing fraud risk in an economic downturn).

Applicable to AMA institutions

Operational risk 3. Institutions should ensure that relevant variables of the model, including the four AMA elements, are adequately stressed within the AMA capital calculation and validation as well as the additional Pillar 2 capital calculation.

8. 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. However, the CRD contains no specific requirements as to how the elements should be combined or what weights should be assigned to the different elements. Due to this, institutions need to implement stress tests which take into account their specific AMA. 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.

9. Stress tests based on internal and external data should consider the occurrence of additional large but plausible losses, carefully analyse the boundaries of operational risk losses (e.g. large losses which are partly considered to be market risk within the AMA model, could be considered to be pure operational risk losses), 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).

10. Institutions should stress their business environment and internal control factors, as well as considering macroeconomic developments.

11. Stress tests should 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 other risk types).

12. Stress tests may include an increase in the confidence level of the capital calculation in accordance with the desired rating of the institution.

Annex 5 - Liquidity risk[14]

1. 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 has to manage its individual funding liquidity risk, taking into account the possible impact of market liquidity risk.

Applicable to all institutions

Liquidity risk 1. In identifying the potential liquidity gap all material liquidity risk drivers should be considered. The drivers should 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 should identify cash inflows and outflows that can be expected to occur in each future time period and the resulting net cash flows.

3. Liquidity risk arises for two sets of reasons, liability side and asset side, and institutions should consider both 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 value of liquid assets should also 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).

4. An institution should identify in each scenario at each stress level two types of cash flows, the contractual cash inflows and outflows, that can be expected to occur, 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 should also cover the:

[14] This section should be read in conjunction with the CEBS's technical advice on liquidity risk management (second part), 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, December 2009 (see http://www.c-ebs.org/documents/Publications/Standards---Guidelines/2009/Liquidity-Buffers/Guidelines-on-Liquidity-Buffers.aspx)

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.

5. By summing up all the cash flows an institution should end up with the forecast liquidity requirement for each time period in each scenario at each stress level. It should 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.

Liquidity risk 2. The liquidity stress testing should identify and quantify potential liquidity gaps in specified stress scenarios and identify means of closing those gaps and the funding cost.

6. The liquidity gaps are created by loss of available funding (e.g. reduction in deposits) or increased demand for liquidity (e.g. funding contingent liabilities). The institution should 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.

Liquidity risk 3. Institutions should apply three types of stress scenarios: idiosyncratic, market-wide, and a combination of the two.

7. The core of the idiosyncratic stress should assume no rollover of unsecured wholesale funding and some outflows of retail deposits. In addition, a typical bank-specific scenario is 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 should assume a decline in the liquidity value of some assets and deterioration in funding market conditions. In addition, market stress scenarios should 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.

Liquidity risk 4. To provide a complete view of the various risk positions stress testing of other risks should be considered in constructing 'alternative liquidity scenarios'.

8. Institutions increasingly rely on funding sources that are more sensitive to interest rate, market, credit, and reputation risks. Therefore, when assessing stress testing scenarios they should be able to assess the impact of other risks on liquidity risk. 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.

9. Furthermore assumptions used when constructing liquidity stress scenarios should be commensurate 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 absolutely 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 cashflows and reputation risk should be appropriately incorporated into all liquidity stress scenarios.

Liquidity risk 5. A survival period of at least one month should be applied in specifying the chosen stress scenarios. Within this period, a shorter time horizon of at least one week should also be considered to reflect the need for a higher degree of confidence over the very short term.

10. The time period considered should 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 should 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.

Liquidity risk 6. When considering the different types of shock and time horizons, a set of behavioural assumptions has to be designed for each scenario and time horizon.

11. 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 should be analysed and some assumptions should be made when constructing the stressed liquidity scenarios.

Liquidity risk 7. The basic impact of the liquidity shock is on the net cash flow. However, the analysis should be extended to other metrics, such as liquidity ratios, liquidity buffer.

12. Although net cash flows is the basic measure for liquidity stress testing the impact should not be confined to them but the institution should 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"[15]. Thus the liquidity ratios and the liquidity buffer should comply with regulatory minima after the conduct of the stress test exercise.

Liquidity risk 8. When conducting liquidity stress testing exercises on a consolidated basis possible strains on transfers of liquidity among the entities in the group should be considered and incorporated into the relevant scenarios.

13. 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 should 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 should be considered. Apart from legal risk, other types of risk (e.g. country risk in the form of transfer risk) should 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.

Liquidity risk 9. The results of the stress tests should be used as an input for adjusting and improving liquidity risk management.

12. Stress test results should be analysed precisely and utilised to verify and improve liquidity risk management, including internal policies, limits and contingency funding plans.

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

Annex 6 - Interest Rate Risk in the Banking Book[16]

1. For the purposes of these guidelines, interest rate risk is the exposure of institutions' positions to adverse movements in interest rates. For the purposes of this Annex, institutions should only take into account positions in the banking book, 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

IRRBB 1. Institutions should consider all sources of interest rate risk in the banking book in their stress tests, namely re-pricing risk, yield curve risk, basis risk and option risk. For institutions that are less exposed to interest rate risk, the use of simpler forms of analysis may suffice, while larger and more complex institutions should adopt more complex scenario analysis.

2. Pursuant to Article 124 point 5 of the CRD, institutions must stress test 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, a simple parallel shift may not suffice. In their scenarios institutions should also take account of movements and changes in the shape of their yield curves, as a non-parallel shift in the curve can entail a decline in the interest margin and consequently a decline in net interest income.

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

[16] 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)

to the portfolio). Where an institution uses more complex financial instruments on which the shock has multiple and indirect effects, it must use more advanced approaches with specific definition of the adverse (stress) situations.

Annex 7 - Concentration risk[17]

Applicable to all institutions

Concentration 1. A comprehensive view of concentration risk (both inter- and intra-concentration risk) should be considered.

1. Considerations affecting concentration 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 may 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 should therefore clearly identify risk concentrations, taking into account single risk concentrations and interrelated risk types. On- and off-balance sheet exposures, as well as banking, trading and hedging positions must be considered.

5. Stress tests should take into account changes in the business environment that may occur which would lead to risk concentrations materialising. In particular, stress tests should take into consideration 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 second round 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, should be identified. The way in which concentrated exposures perform in response to the same risk drivers should 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 should 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

[17] This section should be read in conjunction with the CEBS Guidelines on aspects of the management of concentration risk under the supervisory review process (see Consultation Paper at http://www.c-ebs.org/documents/Publications/Consultation-papers/2009/CP31/Draft-revised-concentration-risk-guidelines.aspx)

stress. Institutions should identify potential links between exposures and question assumptions about correlations between risk types in a stress.

8. Institutions should 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 regard institutions should consider the use of reverse stress testing that would allow them to test the plausibility of the assumptions that have 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 without making assumptions about capitalising for such risks.

9. Stress tests should 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 should be communicated within the institution and used in decision making processes and limit setting as part of concentration risk management.