

EBA/GL/2018/04

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19 July 2018

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# Guidelines

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on institutions' stress testing

# 1. Compliance and reporting obligations

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## Status of these guidelines

1. This document contains guidelines issued pursuant to Article 16 of Regulation (EU) No 1093/2010<sup>1</sup>. In accordance with Article 16(3) of Regulation (EU) No 1093/2010, competent authorities and financial institutions must make every effort to comply with the guidelines.
2. Guidelines set out the EBA's view of appropriate supervisory practices within the European System of Financial Supervision or of how Union law should be applied in a particular area. Competent authorities as defined in Article 4(2) of Regulation (EU) No 1093/2010 to whom guidelines apply should comply by incorporating them into their practices as appropriate (e.g. by amending their legal framework or their supervisory processes), including where guidelines are directed primarily at institutions.

## Reporting requirements

3. In accordance with Article 16(3) of Regulation (EU) No 1093/2010, competent authorities must notify the EBA that they comply or intend to comply with these guidelines, or otherwise give reasons for non-compliance, by ([dd.mm.yyyy]). In the absence of any notification by this deadline, competent authorities will be considered by the EBA to be non-compliant. Notifications should be sent by submitting the form available on the EBA website to [compliance@eba.europa.eu](mailto:compliance@eba.europa.eu) with the reference 'EBA/GL/201x/xx'. Notifications should be submitted by persons with appropriate authority to report compliance on behalf of their competent authorities. Any change in the status of compliance must also be reported to the EBA.
4. Notifications will be published on the EBA website, in line with Article 16(3).

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<sup>1</sup> Regulation (EU) No 1093/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Banking Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/78/EC (OJ L 331, 15.12.2010, p. 12).

## 2. Subject matter, scope and definitions

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### Subject matter and scope of application

5. These guidelines aim to provide common organisational requirements, methodologies and processes for the performance of stress testing by institutions, taking into account capital adequacy and risk management, as part of their risk management processes ('institutions' stress testing').
6. Within the context of groups, these guidelines also apply to institutions participating in a particular stress testing exercise in accordance with the perimeter of application of that particular stress testing exercise and the level of application set out in Articles 108 and 109 of Directive 2013/36/EU.
7. The terms 'institution' and 'institution-specific' shall be deemed to refer to an institution on a solo basis, or to the parent institution in a given perimeter of application of a particular stress testing exercise or to the parent institution in a Member State or to the EU parent institution on the basis of the relevant consolidated situation as referred to in Article 4(1)(47) of Regulation (EU) No 575/2013.

### Addressees

8. These guidelines are addressed to competent authorities and institutions as defined in point (i) of Article 4(2) of Regulation (EU) No 1093/2010 and to financial institutions as defined in Article 4(1) of Regulation (EU) No 1093/2010 which are also institutions in accordance with point 3 of Article 4(1) of Regulation (EU) No 575/2013.

### Definitions/taxonomy

9. Unless otherwise specified, terms used and defined in Regulation (EU) No 575/2013 and in Directive 2013/36/EU have the same meaning in these guidelines. In addition, for the purposes of these guidelines, the following definitions apply:

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(1) Solvency stress test	means the assessment of the impact of certain developments, including macro- or microeconomic scenarios, on the overall capital position of an institution, including on its minimum or additional own funds requirements, by means of projecting the institution's capital resources and requirements, highlighting the institution's vulnerabilities and assessing its
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capacity to absorb losses and the impact on its solvency position.

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(2) Liquidity stress test means the assessment of the impact of certain developments, including macro- or microeconomic scenarios, from a funding and liquidity perspective and shocks on the overall liquidity position of an institution, including on its minimum or additional requirements.

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(3) Bottom-up stress test means a (solvency or liquidity) stress test with all of the following characteristics:

- i. it is carried out by institutions using their own internally developed models;
- ii. it is based on the institution's own assumptions or scenarios, with possible conservative constraints by authorities;
- iii. it is based on the institution's own data and potentially high level of data granularity, with possible use of external data for some additional information; and
- iv. it concerns particular portfolios or the institution as a whole, producing detailed results on the potential impact of exposure concentrations, institution linkages and contagion probabilities to the institution's loss rates.

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(4) Top-down stress test means a (solvency or liquidity) stress test with all of the following characteristics:

- i. it is carried out by competent authorities or macroprudential authorities;
- ii. it is based on general or systemic (macroprudential) assumptions or scenarios designed by competent or macroprudential authorities and applicable to all relevant institutions;
- iii. competent authorities or macroprudential authorities manage the process and calculate the results with less

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involvement of the institutions than in the case of the bottom-up stress test;

- iv. it is based mostly on aggregate institution data and less detailed information, depending on the assumptions of the stress test, or sometimes based on more detailed institution data if deemed necessary by authorities; and
- v. it enables a uniform and a common framework and comparative assessment of the impact of a given stress testing exercise across institutions.

(5) Static balance sheet assumption means a methodological assumption according to which the impact of the stress test scenarios is to be measured on the assumption of a 'constant balance sheet' and of an 'unchanged or stable business model' throughout the projection period, enhancing the comparability of the results across institutions, thereby:

- i. prohibiting from taking into account, for the calculation of the impact of the scenarios, changes in the assets and liabilities of the institution that derive, indicatively, from management actions, increases or work-outs of existing lending or differences in maturities or other characteristics of these assets or liabilities (despite the application of the stress test methodology, which might lead to changes in the size and the composition of the balance sheet, and particularly the capital base, over the projection period, due to, for example, new defaults, impairments, increases of stock or value adjustments of financial assets); and
- ii. permitting the inclusion of new assets and liabilities as far as these new items bear the same main characteristics (maturities, risk profiles, etc.) with the excluded ones.

(6) Dynamic balance sheet assumption means a methodological assumption according to which the impact of the stress test scenario is to be measured on the possibility of a non-constant balance sheet and of an evolving business model throughout the projection period. Under the

dynamic balance sheet assumption, the outcome of the stress test reflects a combination of the scenario imposed and the responsive actions taken by the management reducing the comparability of the results across institutions. The extent of responsive actions taken by the management may be constrained or unconstrained (e.g. interventions planned from the start and independent from the scenario and/or conditional on the stress test scenario).

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(7) Portfolio level stress test means a stress test of individual or several portfolios with the focus on the implications of the shocks from a single risk factor or multiple risk factors.

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(8) Sensitivity analysis means a stress test that measures the potential impact of a specific single risk factor or simple multi-risk factors, affecting capital or liquidity, to a particular portfolio or to the institution as a whole.

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(9) Scenario analysis means the assessment of the resilience of an institution or of a portfolio to a given scenario that comprises a set of risk factors, which should have all of the following characteristics:

- i. they are aligned in an internally consistent way;
- ii. the risk factors forming the relevant set presuppose the simultaneous occurrence of forward-looking events covering a range of risks and business areas; and
- iii. the set of risk factors also aim to reveal, to the maximum extent possible, the nature of linked risks across portfolios and across time, system-wide interactions and feedback effects.

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(10) Reverse stress test means an institution stress test that starts from the identification of the pre-defined outcome (e.g. points at which an institution business model becomes unviable, or at which the institution can be considered as failing or likely to fail in the meaning of Article 32 of Directive 2014/59/EU) and then explores scenarios and circumstances that might cause this to occur. Reverse stress testing should have one or more of the following characteristics:

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- i. it is used as a risk management tool aimed at increasing the institution's awareness of its vulnerabilities by means of the institution explicitly identifying and assessing the scenarios (or a combination of scenarios) that result in a pre-defined outcome;
- ii. the institution decides on the kind and timing (triggering events) of management or other actions necessary for both (a) rectifying business failures or other problems; and (b) aligning its risk appetite with the actual risks revealed by the reverse stress testing;
- iii. specific reverse stress testing can be also applied in the context of recovery planning (e.g. reverse stress tests applied in a wider context can be used to inform a recovery plan stress test by identifying the conditions under which the recovery might need to be planned).

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(11) Second-round or feedback effects means the spillover effects (the nature of feedback effects is not limited to macroeconomic effects) caused by the responses of individual institutions to an external original shock, which – in aggregate – generally amplify (it may also mitigate) such an original shock, thereby causing an additional negative feedback loop.

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(12) Severity of scenario means the degree of severity of the assumptions or the deterioration of the scenario (from baseline to an adverse scenario) expressed in terms of the underlying macroeconomic and financial variables (or any other assumptions). The greater the severity of the scenario, in general, the larger the impact of the stress test on the institution, thereby determining the actual severity of the stress test.

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(13) Plausibility of scenario means the degree to which a scenario can be regarded as likely to materialise in respect of the consistency of the relationship of that scenario with the current macroeconomic and financial variables, the support of the scenario by a coherent narrative and the backing of the scenario by probability distribution and historical experiences. Plausibility is not restricted to historical

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experiences, and hence expert judgements that take into account changing risk environments (e.g. observed structural breaks) and stress events that were observed in similar risk environments outside the institution's own direct historical experience should play a key role. It is also possible to use simulative methods (e.g. Monte Carlo simulations).

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(14) Anchor scenario	means a type of scenario usually designed by a competent authority to set the severity standard for a particular stress test, which is imposed on institutions, either as the scenario that should be applied in the stress test or as a severity benchmark for the development of the institution's own scenarios.
(15) Risk data aggregation	means defining, gathering and processing risk data according to the institution's risk reporting requirements to enable the institution to measure its performance against its risk tolerance/appetite. This includes sorting, merging or breaking down sets of data.
(16) Data infrastructure	means physical and organisational structures and facilities to build and maintain data and information technology (IT) architecture to support the institution's risk data aggregation and internal policy on risk reporting.

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## 3. Implementation

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### Date of application

10. These guidelines apply from 01 January 2019.

### Repeal

11. The following guidelines are repealed with effect from the date of publication of these guidelines in all EU official languages.

- *CEBS Guidelines on stress testing (GL32)*<sup>2</sup>

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<sup>2</sup> [https://www.eba.europa.eu/documents/10180/16094/ST\\_Guidelines.pdf](https://www.eba.europa.eu/documents/10180/16094/ST_Guidelines.pdf)

## 4. Institutions' stress testing

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### 4.1 Stress testing programme

12. Institutions should have in place a stress testing programme that should cover at least the following:
  - a) the types of stress testing and their main objectives and applications;
  - b) the frequency of the different stress testing exercises;
  - c) the internal governance arrangements including well-defined, transparent and consistent lines of responsibility and procedures;
  - d) in the case of a group, the scope of the entities included and the coverage (e.g. risk types and portfolios) of the stress tests;
  - e) the relevant data infrastructure;
  - f) the methodological details, including models used and possible links between liquidity stress tests and solvency stress tests, namely the magnitude of such dynamic interactions and the capture of feedback effects;
  - g) the range of assumptions, including business and managerial, and remedial actions envisaged for each stress test.
13. Parent institutions in a Member State and EU parent institutions should also develop a group stress testing programme to be approved and monitored by the management body and implemented by their senior management in the context of their centralised risk management policy. A group stress testing programme should include and address, to the extent appropriate, all institutions subject to prudential consolidation.
14. The institutions within the scope of prudential consolidation should, when establishing their individual stress testing programmes, take into account the relevant group stress testing programme.
15. Institutions should also include reverse stress testing and reverse stress testing scenarios in their stress testing programmes.
16. Institutions should ensure that their stress testing programmes are workable and feasible and that they inform decision-making at all appropriate management levels about all existing and potential material risks.
17. Institutions should regularly assess their stress testing programmes to determine their effectiveness and robustness, and should update them as appropriate. The assessment should be made on at least an annual basis and on the basis of both a quantitative and a qualitative analysis, and should fully reflect the changing external and internal conditions. Institutions

should ensure that the frequency of assessments takes into account the frequency of the corresponding stress test applications.

18. Institutions should ensure that their quantitative analysis in accordance with the previous paragraph includes sound quantitative tests as backtesting tools to validate the assumptions, parameters and results of stress testing models (e.g. credit risk models, market risk models, pre-provision net revenue models). Institutions should ensure that their qualitative analysis in accordance with the previous paragraph is based on expert judgements or benchmarking assessments.
19. When assessing the stress testing programme, the institution shall consider at least the following:
  - a) the effectiveness of the programme in meeting its intended purposes;
  - b) the need for improvements;
  - c) the identified risk factors, definitions and reasoning for relevant scenarios, model assumptions and the sensitivity of results to these assumptions, as well as the role of expert judgement to ensure that it is accompanied by sound analysis;
  - d) the model performance, including its performance on out-of-sample data, i.e. on data that was not used for model development;
  - e) how to incorporate possible solvency-liquidity adverse loops;
  - f) the adequacy of possible interlinkages between solvency stress tests and liquidity stress tests;
  - g) feedback received from competent authorities in the context of their supervisory or other stress tests;
  - h) the adequacy of the data infrastructure (systems implementation and data quality);
  - i) the proper level of involvement of senior management and the management body;
  - j) all assumptions including business and/or managerial assumptions, and management actions envisaged, based on the purpose, type and result of the stress testing, including an assessment of the feasibility of management actions in stress situations and a changing business environment; and
  - k) the adequacy of the relevant documentation.
20. The institution's stress testing programme should be appropriately documented for all types of stress tests carried out at the single risk type and/or portfolio level, as well as the firm-wide level. Documentation should cover at least:
  - a) the stress testing approach;
  - b) the possible interlinkages between solvency stress tests and liquidity stress tests, namely a mapping between the deterioration on capital position (solvency) and ability to issue commercial paper and bonds (liquidity), macro-driven probabilities of default shifts

- (solvency) and the implied rating migration of banks unencumbered assets and the effect on collateral deposited at the relevant central bank (liquidity), the increase in expected non-performing loans (solvency) and the reduction in expected inflows from loan repayments or from non-financial corporation bonds (liquidity), or a possible liquidity gap (liquidity) and asset fire sales (solvency), and an increase in funding costs (liquidity) and P&L effects (solvency);
- c) the roles and responsibilities as determined in the internal policy, specifying the roles for the second and third lines of defence, and processes for at least the performance of the stress testing programme;
  - d) a description of the entire process of designing, approving, performing, monitoring the performance and periodically assessing the stress testing programme and its outcomes;
  - e) a description of the processes for evaluating stress test outcomes, including details of areas that require manual or human judgemental in some parts, and also of the process for using the results for informing management actions and the strategy of the institution; and
  - f) a description and inventory of the relevant IT applications used for stress testing (and where a central inventory exists, reference can be made to it).
21. The stress testing programme should be challenged across the organisation, for instance by the risk committee and internal auditors. Business units not responsible for the design and application of the programme and/or non-involved external experts should play a key role in the assessment of this process, taking into account the relevant expertise for specific subjects.
22. Institutions should ensure, both for the initial design and for the assessment of the stress testing programme, that an effective dialogue has taken place with the involvement of experts from all business areas of the institution and that the programme and its updates have been properly reviewed by the senior management<sup>3</sup> and management body of the institution, who are also responsible for monitoring its execution and oversight.

## 4.2 Governance aspects of stress testing

23. The management body should approve<sup>4</sup> the stress testing programme of the institution and oversee its implementation and performance.
24. Without prejudice to the requirement under Article 91(1) of Directive 2013/36/EU<sup>5</sup> that members of the management body must have at all times sufficient knowledge, skills and experience to perform their duties, the institution should ensure that their management body

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<sup>3</sup> See also Title II, section 1, of the EBA Guidelines on Internal Governance.

<sup>4</sup> See also Title II, section 1, of the EBA Guidelines on Internal Governance.

<sup>5</sup> See also Title III, section 8, of the Joint ESMA and EBA Guidelines on the assessment of the suitability of members of the management body and key function holders under Directive 2013/36/EU and Directive 2014/65/EU.

is able to fully understand the impact of stress events on the overall risk profile of the institution.

25. The management body should understand the material aspects of the stress testing programme to be able to:
  - (a) actively engage in discussions with stress testing committees of the institutions, where applicable, or with senior management or external consultants involved in stress testing;
  - (b) challenge key modelling assumptions, the scenario selection and the assumptions underlying the stress tests in general; and
  - (c) decide on the necessary management actions and discuss them with the competent authorities.
26. The stress testing programme should be executed in accordance with the relevant internal policies and procedures of the institution. The management body of the institution should ensure that clear responsibilities and sufficient resources (e.g. skilled human resources and information technology systems) are assigned and allocated for the execution of the programme.
27. Institutions should ensure that all elements of the stress testing programme, including its assessment, are appropriately documented and regularly updated, where relevant, in the internal policies and procedures.
28. Institutions should ensure that the stress testing programme is effectively communicated across business lines and managements levels, with a view to raising awareness, improving risk culture and instigating discussions on existing and potential risks as well as on possible management actions.
29. The stress testing programme should be an integral part of an institution's risk management framework (including in the context of the internal capacity adequacy assessment process (ICAAP) and internal liquidity adequacy assessment process (ILAAP)). Stress tests should support different business decisions and processes as well as strategic planning, including capital and liquidity planning. The decisions should take into account the shortcomings, limitations and vulnerabilities during stress testing.
30. The management body should take the outcomes of the stress tests into account, in particular with regard to identified limitations, vulnerabilities and shortcomings detected, when setting the institutions strategy and when making all relevant decisions affecting capital, liquidity, recovery and resolution planning.
31. The outputs of stress tests (quantitative and qualitative) should be used as inputs to the process of establishing an institution's risk appetite and limits. Furthermore, they should act as a planning tool to determine the effectiveness of new and existing business strategies and their impact on the use of capital. To enable that, the essential outputs from a stress testing exercise should be implied losses, capital and liquidity requirements, as well as available capital and liquidity.

32. To be a meaningful part of the risk management system of an institution, stress tests should be undertaken with appropriate frequency. This frequency should be determined having regard to the scope and type of the stress test, the nature, scale, size and complexity of the institution (proportionality principle), portfolio characteristics as well as changes in the macroeconomic environment or the institution's business activities.

### 4.3 Data infrastructure

33. Institutions should ensure that the stress testing programme is supported by an adequate data infrastructure.
34. To ensure that a proper data infrastructure has been put in place, institutions, including those that are not global systemically important institutions (G-SIIs), should endeavour to also refer, to the extent appropriate, to the principles for effective risk data aggregation and risk reporting of the Basel Committee on Banking Supervision<sup>6</sup>.
35. Institutions should ensure that their data infrastructure has the capacity to capture the extensive data needs of their stress testing programme and that they have in place mechanisms to ensure their continuing ability to conduct stress testing as planned in accordance with the programme.
36. Institutions should ensure that the data infrastructure allows for both flexibility and appropriate levels of quality and control.
37. Institutions should ensure that their data infrastructure is proportionate to their size, complexity, and risk and business profile, and allows for the performance of stress tests covering all material risks that the institution is exposed to.
38. Institutions should devote sufficient human, financial and material resources to guarantee the effective development and maintenance of their data infrastructure, including information technology systems.
39. Institutions should also consider stress testing data infrastructure as part of their overall information technology infrastructure and should give adequate consideration to business continuity planning, the identification of long-term investments and other IT processes.

#### Data aggregation capabilities for stress testing purposes

40. Institutions should maintain and keep up-to-date accurate and reliable risk data to conduct reliable stress tests and should also have in place a dedicated process for aggregating and producing such data.

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<sup>6</sup> <http://www.bis.org/publ/bcbs239.pdf>

41. Institutions should ensure that their aggregation of risk data is characterised by accuracy and integrity, completeness, timeliness and adaptability.
42. Institutions should ensure that data are aggregated on a largely automated basis so as to minimise the probability of error. In particular, a thorough reconciliation and controls system should be in place.
43. Institutions should have the capacity to guarantee the completeness of risk data. For that purpose, institutions should ensure that risk data also fully capture off-balance-sheet risks and are easily attainable at any level of the institution. Materiality, in terms of existent and potential risk, should be factored in.
44. Institutions should be able to produce aggregated risk information on a timely basis to meet all reporting requirements throughout the process of stress testing following different quality assurance and challenge stages; for that purpose, institutions should develop an efficient structure that ensures timeliness.
45. Institutions should be able to generate aggregate data to meet a broad range of on-demand requests arising both from internal needs in the institution and externally from supervisory queries.

#### Reporting practices for stress testing purposes

46. Institutions should ensure that their risk reporting process:
  - a) is completely supported by data aggregation capabilities;
  - b) accurately and precisely conveys aggregated risk data and reflects risk in an exact manner;
  - c) covers all material risks and, in particular, allows the identification of emerging vulnerabilities that could potentially be further assessed even in the same stress testing exercise;
  - d) offers or is able to offer additional information regarding main assumptions, tolerance levels or caveats; and
  - e) communicates information in a clear and concise manner including meaningful information tailored to the needs of the recipients.

## 4.4 Stress testing scope and coverage

### 4.4.1 General requirements

47. Stress tests should take into account all types of material risk having regard to both the on- and off-balance-sheet assets and liabilities of an institution including relevant structured entities.

48. Stress tests should capture risks at various levels in an institution. In this regard, according to the proportionality principle, the scope of stress testing may vary from simple portfolio level sensitivity or individual risk level analyses to comprehensive institution-wide scenario stress testing.
49. Stress tests should take into account changes in correlations between risk types and risk factors, at individual entity and at a group-wide level. They should also take into account that correlations tend to increase during times of economic or financial distress and that case-by-case analyses of how certain correlations behave in certain scenarios are required.

#### **4.4.2 Portfolio and individual risk level stress testing**

50. Institutions should perform stress tests on an individual portfolio basis, covering all risk types that affect these portfolios, using both sensitivity and scenario analyses. Institutions should also identify risk factors and their adequate level of stress, wherever possible, at the level of an individual portfolio.
51. Institutions should ensure that they stress test portfolios and business lines or units to identify intra- and inter-risk concentrations – i.e. concentrations of common risk factors within and across risk types (including contagion effects).
52. In particular, when considering inter-risk concentrations, institutions should aggregate across risk types notably market and credit risk, to gain a better understanding of their potential risk concentrations in a stress situation. Institutions should identify potential links between exposures that could be risky during periods of economic or financial distress, as well as question assumptions about dependencies and correlations between risk types in a stress situation.

#### **4.4.3 Institution-wide stress testing**

53. In order to deliver a complete and holistic picture of the institution's risks, in addition to stress tests on the level of single entities, stress testing should also be conducted at the group level and across portfolios and individual risk types.
54. It should be taken into account that:
  - a) risks at the institution-wide level may not be well reflected by a simple aggregation of stress tests on portfolios, individual risk areas or business units of the group;
  - b) correlations, offsetting of individual exposures and concentrations may lead to either the double counting of risks or to an underestimation of the impact of stressed risk factors; and
  - c) specific group risks may arise at the institution-wide level and, therefore, institutions should ensure that all material risks and their corresponding risk factors are also identified at an institution-wide level; when looking at risks at an institution-wide level, particular attention should be paid to risk concentrations on a holistic basis.



55. A group or an institution that is internationally active should also perform stress tests at the level of business units in specific geographical regions or business sectors or business lines to account for differing risk factors in different businesses and regions.

## 4.5 Proportionality

56. In accordance with the principle of proportionality, an institution's stress testing programme should be consistent with its individual risk profile and business model.

57. Institutions should take into account their size and internal organisation, and the nature, scale and complexity of their activities when developing and implementing a stress testing programme. Significant institutions and more complex institutions, including at consolidated level, should have more sophisticated stress testing programmes, while small and less complex institutions and groups (consolidated level) may implement simpler stress testing programmes.

58. For the purpose of the application of the principle of proportionality and in order to ensure an appropriate implementation of the requirements, the following criteria should be taken into account by institutions and competent authorities:

- a) the size in terms of the balance-sheet total or the quantity of assets held by the institution or its subsidiaries within the scope of prudential consolidation;
- b) the geographical presence of the institution and the size of its operations in each jurisdiction;
- c) the legal form and whether or not the institution is part of group and, if so, the proportionality assessment performed for the group;
- d) whether the institution is listed or not;
- e) whether or not the institution is authorised to use internal models for the measurement of capital requirements (e.g. the internal ratings-based (IRB) approach);
- f) the type of authorised activity and services (e.g. loans and deposits, investment banking);
- g) the underlying business model and strategy, the nature and complexity of the business activities, and the organisational structure;
- h) the risk strategy, risk appetite and actual risk profile of the institution, also taking into account the result of the annual capital adequacy assessment;
- i) the ownership structure and funding structure of the institution;
- j) the type of clients (e.g. retail, corporate, institutional, small businesses, public entity) and the complexity of the products or contracts;
- k) the outsourced processes, services and activities and their distribution channels;
- l) the existing information technology systems, including IT continuity systems and outsourcing arrangements in this area, e.g. cloud computing.

## 4.6 Stress testing types

### 4.6.1 General requirements

59. The specific design, complexity and level of detail of the stress test methodologies should be appropriate to the institution's nature, scale and size, as well as the complexity and riskiness of its business activities. It should take into account the strategy and business model as well as the portfolio characteristics of the institution.
60. Institutions should take into account the stage within the economic cycle when designing stress test methodologies, including the scenario and the need for possible management actions.
61. Institutions should identify appropriate, meaningful and robust mechanisms for translating risk factors into relevant internal risk parameters (probability of default (PD), loss given default (LGD), write-offs, fair value haircuts, etc.) that provide an institution and a group view of risks.
62. The link between stressed risk factors and the risk parameters not only should be based on institutional historical experience and analysis, but should be supplemented, where available and appropriate, with benchmarks from external sources and, when possible, from supervisory guidance.
63. Because of the complexity involved in modelling hypothetical and macroeconomic-based risk factors/scenarios, institutions should be aware of the model risk involved and ensure that the following have been performed when setting those factors/scenarios:
  - a) a regular and sufficiently conservative expert review of the model's assumptions and mechanics has been performed and a conservative modelling approach to account for model risk has been followed;
  - b) a sufficient degree of conservatism as appropriate has been applied when making assumptions that are difficult to measure in a quantitative way (e.g. diversification, exponential growth projected, fees projected, forward-looking management views) but may have an impact on the model's outputs (e.g. the outputs of pre-provision net revenue models should be based on sufficient statistical support as well as business considerations); and
  - c) the dependencies and sensitivities of the results on the assumptions have been acknowledged and their impact is assessed on a regular basis.
64. Shortcomings of models and mechanisms that link risk factors with losses or increased risk parameters should be understood, communicated clearly and taken into account when interpreting results. Models should take into account the interactions between solvency and funding liquidity and funding costs in order to not systemically and significantly underestimate the impact of a shock. Where possible, results for different modelling approaches should be compared (e.g. for pre-provision net revenue models, a comparison between the model used and other possible approaches and the rationale for their rejection should be available). These

links should be based on robust statistical models. However, if data availability or quality or structural breaks in historical data do not allow for meaningful estimates (e.g. for pre-provision net revenue models, it is necessary to have historical data covering an interest rate cycle and a business cycle, as well as information on changes in business strategy and organisation structure), quantitative analyses should be supported with qualitative expert judgements. Even where the underlying modelling process is robust, expert judgement should play a role in challenging model outputs.

65. Institutions should assess possible non-linear interactions between risk factors and stressed risk parameters.

#### **4.6.2 Sensitivity analysis**

66. Institutions should conduct sensitivity analyses at the level of individual exposures, portfolios or business units, institution wide, and for specific risk types, proportionate to their complexity. Institutions should assess at which aggregation level sensitivity analyses are meaningful or even feasible. The use of expert judgements should be clarified in detail whenever applicable.
67. Institutions should identify relevant risk factors at various levels of application of prudential requirements and across different portfolios, business units and geographical locations. Institutions should ensure that all relevant types of risk factors are covered, including macroeconomic and macrofinancial variables, statistical aspects of risk parameters (such as the volatility of PD parameters) and idiosyncratic factors such as operational risks.
68. Institutions should define the risk factors identified using different degrees of severity as an important step in their analysis to reveal nonlinearities and threshold effects, i.e. critical values of risk factors beyond which stress responses accelerate.
69. Where there are uncertainties about the robustness of the estimated dependency between macroeconomic/macrofinancial risk factors and risk parameters or there is a need to validate the results of more comprehensive scenario analyses, institutions should endeavour to ensure that sensitivity analyses are also carried out by stressing statistical aspects of portfolio risk parameters according to historical distributions supplemented by hypothetical assumptions (e.g. with respect to future volatilities).
70. Single risk factor analyses should be supplemented by simple multi-risk factor analyses, where a combined occurrence is assumed, without necessarily defining a scenario.
71. Institutions should maintain a list of the risk factors identified.

#### **4.6.3 Scenario analysis**

72. Institutions should ensure that scenario analyses are a core part of their stress testing programmes.

73. The design of the stress test scenarios should not only be based on historical events, but should also consider hypothetical scenarios based on non-historical events. Institutions should ensure that scenario designs are forward-looking and take into account systematic and institution-specific changes in the present and foreseeable future. For that purpose, institutions should endeavour to have recourse to external data from similar risk environments relevant for institutions with similar business models. Institutions should use data that are relevant and available. Relevant data may be internal and/or external and incorporate benchmarking and supervisory guidance.
74. A range of scenarios should be considered to encompass different events and degrees of severity when meaningful and feasible.
75. Institutions should ensure that their stress test scenarios meet at least the following requirements:
- a) address the main risk factors that the institution may be exposed to; in this regard, the results obtained from single risk factor analyses, which aim to provide information about the sensitivity towards single risk factors, should 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;
  - b) address major institution-specific vulnerabilities, deriving from the regional and sectoral characteristics of an institution, as well as its specific product or business line exposures and funding policies: concentration and correlation risks, both of an intra- and of an inter-risk type, should be identified a priori;
  - c) include a coherent narrative for the scenario, covering all main risk factors as well as their (forward-looking) development on the basis of multiple trigger events (i.e. monetary policy, financial sector developments, commodity prices, political events and natural disasters); institutions should ensure that the scenario narrative is plausible and non-contradictory when assuming the co-movement of risk factors and the corresponding reaction of market participants; and, where certain risk factors are excluded from the scenario narrative, institutions should ensure that this exclusion is fully justified and documented;
  - d) are internally coherent, so as to ensure that the identified risk factors behave consistently with other risk factors in a stress event and that they contain explicit estimates and assumptions on the dependence structure among the main underlying risk factors; importantly, co-movements in risk factors that may appear contradictory should be explored to identify new sensitivities;
  - e) take into account innovation and more specifically technological developments or sophisticated financial products without disregarding their interaction with more traditional products; and
  - f) ensure that stressed risk factors translate into internally consistent risk parameters.

76. Institutions should determine the time horizon of stress testing in accordance with the aim of the exercise, the characteristics of the portfolio of the institution such as its maturity and liquidity of the stressed positions, where applicable, as well as the risk profile. Solvency stress testing and liquidity stress testing require different time horizons and scenarios.
77. Institutions should ensure that:
- a) stress tests explicitly take into account dynamic interdependences, e.g. among economic regions and among economic sectors, including the financial sector;
  - b) the overall scenario takes into account system-wide dynamics, e.g. closure of certain markets, and risk concentrations in a whole asset class (e.g. mortgages); and
  - c) adverse feedback dynamics, caused by factors such as interactions among valuations, losses and margining requirements, are covered.
78. Institutions should make qualitative assessments of second-round or feedback effects of stress at the individual level, where appropriate and in particular if no robust quantitative estimates can be established. For instance, an individual institution might create some price or volume adjustments to take into account some strategic effects (e.g. the level of lending strategy) and respond endogenously to the scenario.

#### **4.6.4 Severity of scenarios**

79. Institutions should ensure that stress testing is based on severe but plausible scenarios and the degree of severity should reflect the purpose of the stress test. To that end, stress tests should be:
- a) meaningful in terms of addressing relevant risks to the institution with a view to promoting the stability of the institution under adverse conditions and, in the case of systemically important banks, also the financial system at all points in the economic cycle and over market fluctuations including funding markets; and
  - b) consistently applied across the institution, recognising that the impact of identical scenarios is not necessarily severe for all business lines.
80. Institutions should ensure that various degrees of severity are considered for both sensitivity analysis and scenario stress testing covering at least one severe economic downturn for the assessment of capital adequacy and capital planning purposes.
81. Institutions should ensure that severity is set taking into account the specific vulnerabilities of each institution to a given scenario on the basis of its business model (e.g. exposed to international markets). Institutions should develop their own scenarios and should not be dependent on scenarios from the supervisors. When assessing the severity of a scenario, the institution should be aware of the dynamics of risk environments and of experiences of institutions with similar business models.

82. Institutions should ensure that their scenarios assess absolute and relative changes of risk factors. In an absolute scenario, the degree of severity should be a direct change of the risk factor and not depend on the current level. In a relative scenario, the degree of severity should depend on the current level and economic situation (e.g. GDP growth decreases by 2%, i.e. a relative change to the absolute level). For example, will a 2% negative relative change in GDP from a starting point with a substantial positive output gap (i.e. current GDP is substantially above the structural GDP) not necessarily lead to a severe stress effect on GDP in absolute/level terms. Likewise, the worse the current economic situation at the outset the more severe the stress of a relative scenario. Institutions should ensure that their choice of the scenario is sufficiently severe in both relative and absolute terms. Both the choice and its impact on the degree of severity should be justified and documented.
83. For assessing the appropriate degree of severity of scenarios, institutions should also compare them with the scenarios outlined in their reverse stress testing, considering specific implications of the reverse stress test design for the scenario's plausibility.

#### **4.6.5 Reverse stress testing**

##### **Requirements**

84. Institutions should perform adequate reverse stress tests as part of the stress testing programme, sharing the same governance, an effective infrastructure and quality standards, and to complement other types of stress testing, taking into account the nature, size, scale and complexity of their business activities and risks. Small and less complex institutions may focus more on the qualitative aspects of reverse stress testing while more sophisticated reverse stress testing techniques are required of larger or more complex institutions. The reverse stress testing should be clearly defined in terms of responsibilities and resources allocated and should be supported by an infrastructure that is suitable and flexible and by written policies and procedures. Reverse stress testing should be carried out regularly by all types of institutions and at the same level of application as ICAAP and ILAAP (e.g. institution wide and covering all relevant risk types).
85. Institutions should include scenarios identified through the reverse stress testing to complement the range of stress test scenarios they undertake and, for comparison purposes, in order to assess the overall severity, allowing the identification of severe but still plausible scenarios. Reverse stress testing should be useful for assessing the severity of scenarios for ICAAP and ILAAP stress tests. The severity of reverse stress testing scenarios can also be assessed by comparing it to, inter alia, historical or other supervisory and publicly available scenarios.
86. In carrying out their reverse stress tests, institutions should also consider whether failure of one or more of their major counterparties or a significant market disruption arising from the failure of a major market participant (in a separate or combined manner) would cause the pre-defined outcome.

### Use of reverse stress testing

87. Institutions should use reverse stress testing as a regular risk management tool in order to improve their awareness of current and potential vulnerabilities, providing added value to institutions' risk management. The principle of proportionality applies to all aspects of the use of reverse stress testing. Institutions should also consider that the pre-defined outcome of reverse stress testing can be produced by circumstances other than the circumstance analysed in the stress test.
88. As part of their business planning and risk management, institutions should use reverse stress testing to understand the viability and sustainability of their business models and strategies, as well as to identify circumstances where they might be failing or likely to fail within the meaning of Article 32 of Directive 2014/59/EU. It is important that institutions identify indicators that provide alerts when a scenario turns into reality. To that end, institutions should:
- identify the pre-defined outcome to be tested (e.g. of a business model becoming unviable);
  - identify possible adverse circumstances that would expose them to severe vulnerabilities and cause the pre-defined outcome;
  - assess (depending on the institution's size, as well as the nature, scale, complexity and riskiness of its business activities) the likelihood of events included in the scenarios leading to the pre-defined outcome; and
  - adopt effective arrangements, processes, systems or other measures to prevent or mitigate identified risks and vulnerabilities.
89. Institutions should use reverse stress testing in planning and decision-making and to challenge their business models and strategies in order to identify and analyse what could possibly cause their business models to become unviable, such as the assessment of both the ability to generate returns over the following months and the sustainability of the strategy to generate returns over a longer period based on strategic plans and financial forecasts. The engagement of the management body and senior management throughout the process is expected.
90. Where reverse stress testing reveals that an institution's risk of business model failure is unacceptably high and inconsistent with its risk appetite, the institution should plan measures to prevent or mitigate such risk, taking into account the time that the institution should have to react to these events and implement those measures. As part of these measures, the institution should consider if changes to its business model are required. These measures derived from reverse stress testing, including any changes to the institution's business plan, should be documented in detail in the institution's ICAAP documentation.
91. Institutions with particular business models, e.g. investment firms, should use reverse stress testing to explore their vulnerabilities to extreme events, in particular where their risks are not sufficiently captured by more traditional (e.g. solvency and liquidity) stress scenarios based on macroeconomic shocks.

92. Institutions using internal models for credit risk, counterparty credit risk and market risk, when carrying out reverse stress testing in accordance with Articles 177, 290(8) and 368(1)(g) of Regulation (EU) No 575/2013, should endeavour to identify severe, but plausible, scenarios that could result in significant adverse outcomes and potentially challenge an institution's overall viability. Institutions should see these reverse stress tests as an essential complement to their internal models for calculating capital requirements and as a regular risk management tool for revealing the possible inadequacies of these internal models. In severe stress scenarios, even though this should not necessarily be taken as an indication that the modelling of the inputs into the IRB formula are inadequate, model risk will increase and may lead to a breakdown in the model's predictability.
93. Institutions should perform qualitative analyses in developing a well-defined narrative of the reverse stress testing and a clear understanding of its feedback and non-linear effects, taking into account the dynamics of risk, and combinations of and interactions between and across risk types. When developing a well-defined narrative, an institution should consider external exogenous events such as economic events, an industry crash, political events, litigation cases and natural events, as well as risk factors such as operational risks, concentration and correlations, reputational risks and loss of confidence, and combinations of these events and factors. The proper engagement of the management body of the institution in the discussions of the narrative is fundamental, taking into account possible specific vulnerabilities and the impact on the whole institution.
94. Institutions should perform quantitative and more sophisticated analyses, taking into account the institution's size as well as the nature, scale, complexity and riskiness of its business activities, in setting out specific loss levels or other negative impacts on its capital, liquidity (e.g. the access to funding, in particular to increases in funding costs) or overall financial position. Institutions should work backwards in a quantitative manner to identify the risk factors, and the required amplitude of changes, that could cause such a loss or negative impact (e.g. defining the appropriate loss level or some other measure of interest on the balance sheet of the financial institution such as capital ratios or funding resources). Institutions should understand and document in detail the drivers of risk (e.g. outputting the exact factor draws that had the most impact on the portfolio tail region), the key business lines and a clear and consistent narrative around weaknesses and the corresponding scenarios (e.g. about the underlying assumptions and sensitivity of the results to those assumptions over time) that cause the pre-defined outcomes and the events chain and the likely flow through (e.g. the most important factors may be mapped to macroeconomic variables according to the combinations for a given target loss/capital in a portfolio), identifying hidden vulnerabilities (e.g. hidden correlations and concentrations) and overlapping effects.
95. Institutions should, where appropriate, use sensitivity analyses as a starting point for reverse stress testing, e.g. shifting one or more relevant parameters to some extreme to reach pre-defined outcomes. An institution should consider various reverse sensitivity analyses for credit risk (e.g. how many large customers would have to go into default before the loss absorbing capital is lost), market risk, liquidity risk (e.g. stress on deposits in the retail sector and



circumstances that would empty the institution's liquidity reserves) and operational risk, among other risks, and a combination analysis where all risks are covered simultaneously. However, an institution should not primarily use a sensitivity analysis and simple metrics to identify the scenario relevant for the reverse stress test. The qualitative analysis should lead to the identification of the relevant scenario, combining expert judgement from different business areas, as thinking might be the most effective way to prevent a business model failure. A joint stressing of all relevant risk parameters using statistical aspects (e.g. volatility of risk factors consistent with historical observations supplemented with hypothetical but plausible assumptions) should be developed. The plausibility of the parameter shifts required to reach the pre-defined outcome gives a first idea about possible vulnerabilities in the institution. To assess the plausibility, historical (multivariate) probability distributions – adjusted, where deemed necessary, according to expert judgements – should, inter alia, be applied. Qualitative analyses and assessments, combining expert judgements from different business areas, should guide the identification of relevant scenarios.

96. Institutions should use reverse stress testing as a tool to gather insights into scenarios that involve combinations of solvency and liquidity stresses, where traditional modelling may fail to capture complex aspects from real situations. Institutions should use reverse stress testing to challenge their capital plans and liquidity plans. Where appropriate, institutions should identify and analyse situations that could aggravate a liquidity stress event and transform it into a solvency stress event, and vice versa, and eventually to a business failure. Institutions should endeavour to apply reverse stress testing in an integrated manner for risks to capital or liquidity with a view to improving the understanding and the management of related risks in extreme situations.

### Recovery actions and recovery planning

97. Institutions should develop scenarios of severe macroeconomic and financial distress, varying in their severity (including system-wide events, legal entity-specific stress and group-wide stress), to be used in recovery plans under Article 5(6) of the Bank Recovery and Resolution Directive (BRRD) and EBA/GL/2014/06, and use specific reverse stress testing to develop 'near-default' scenarios (institution close to failure but no further) and as an input to inform and test the efficiency and effectiveness of their recovery actions and their recovery planning, and analyse sensitivities around corresponding assumptions. Such 'near-default' scenarios should identify and describe the point that would lead an institution's or a group's business model to become non-viable unless the recovery actions were successfully implemented. The scenarios should allow the estimation of results and the suitability of all the available recovery options. The terminology used in the description of recovery scenarios should help to determine which recovery options were tested under particular stress scenarios. The description should have a sufficient level of detail, through both a set of quantitative assumptions and a qualitative narrative, in order to determine whether or not the scenario is relevant for the institution and how severe it is. The events should be described in a logical sequence and the assumptions underlying the main drivers (e.g. net income, risk-weighted assets (RWAs), capital) should be laid down very clearly. The scenarios should also take into account a possible estimation of the

cross-effects of executing different recovery plan options in the same stress scenario. The scenarios should also allow an understanding of how the events unfold by providing an appropriate timeline that makes it clear at which point in time certain actions will be developed (with implications for their credibility and feasibility). The purpose of this exercise is to test the effectiveness of the institution's recovery options in restoring financial strength and viability when the institution comes under such severe stress.

98. Because of the different objectives of the two sets of reverse stress tests, the stress tests for ICAAP and ILAAP purposes and recovery planning should not be interlinked but compared with one another.
99. Institutions should use reverse stress testing to assist with the development, assessment and calibration of the 'near-default' scenarios used for recovery planning.
100. Institutions should use reverse stress testing to identify the risk factors and further understand and describe the scenarios that would result in 'near default', assessing effective recovery actions that can be credibly implemented, either in advance or as the risk factors or scenarios develop.
101. Reverse stress testing should contribute to the recovery plan scenarios by using a dynamic and quantitative scenario narrative, which should cover:
  - a) the recovery triggers (i.e. at which point the institution would enact recovery actions in the hypothetical scenario);
  - b) the recovery actions required and their expected effectiveness, including the method of assessing that effectiveness (i.e. indicators that should be monitored to conclude that no further action is required);
  - c) the appropriate timing and process required for those recovery actions; and
  - d) in the case of further stress, points (b) and (c) for the potential additional recovery actions required to address residual risks.

## 4.7 Individual risk areas

102. Institutions should ensure that the stress testing of individual risk is proportional to the nature, size and complexity of the business and risks.
103. Institutions should take into account, at the individual level, the impact of second-round effects in the individual risk for stress testing.

### 4.7.1 Credit and counterparty risks

104. Institutions should analyse at least:
  - a) a borrower's ability to repay their obligations, e.g. the PD;

- b) the recovery rate in the event of a borrower defaulting including the deterioration of the collateral values or credit worthiness of the guarantee provider, e.g. the LGD; and
  - c) the size and dynamics of credit exposure, including the effect of undrawn commitments from borrowers, e.g. the exposure at default (EAD).
105. Institutions should ensure that their institution-wide credit risk stress tests cover all their positions in their banking and trading book, including hedging positions and central clearing house exposures.
106. Institutions should endeavour to determine specific risk factors and set out, on a preliminary basis, how these factors can affect their total credit risk losses and capital requirements. Institutions should endeavour to make that determination on an exposure class by exposure class basis (e.g. factors relevant to mortgages may be different from those relevant to corporate asset classes).
107. Institutions should ensure that credit risk is assessed at various levels of shock scenarios, from simple sensitivity analyses to institution-wide stress tests, or to group-wide stress tests, in particular:
- a) market-wide shock scenarios (e.g. a sharp slowdown of the economy that affects portfolio quality for all of the creditors);
  - b) counterparty-specific and idiosyncratic shock scenarios (e.g. bankruptcy of the largest bank creditor);
  - c) sector-specific and region-specific shock scenarios; and
  - d) a combination of the above.
108. Institutions should subject risk factors to sensitivity analyses, which in turn should provide quantitative background information for the design of scenarios.
109. Institutions should apply different time horizons when applying their stress scenarios. The time horizon should range from overnight (one-off effects) up to longer terms (e.g. a creeping economic downturn).
110. When stress testing financial collateral values, institutions should identify conditions that would adversely affect the realisable value of their collateral positions including deterioration in the credit quality of collateral issuers or market illiquidity.
111. In the design of scenarios, institutions should consider the impact of stress events on other risk types, e.g. liquidity risk and market risk and the possibility of spillovers between institutions.
112. Institutions should quantify the impact of the scenario in terms of credit losses (i.e. provisions), risk exposures, income and own funds requirements. In addition, institutions should be able to quantify such impacts by relevant segments/portfolios.

113. Institutions should consider, wherever possible, the following relevant parameters: PD, LGD, EAD, expected loss (EL) and risk exposure amount, and the impact on credit losses and own funds requirements.
114. For the estimation of future losses in stress tests, institutions should, where appropriate, rely on credit risk parameters different from the ones applied in the calculation of capital requirements, which are usually through-the-cycle or hybrid parameters (a combination of through-the-cycle and point-in-time parameters) for PD and under downturn conditions for LGD. In particular, institutions should, where relevant, apply estimates based on point-in-time parameters in accordance with the severity of the scenario for the purpose of estimating credit losses.
115. For the computation of EAD, an institution should also consider a credit conversion factor (CCF) and, in particular, the effect of the institution's legal capacity to unilaterally cancel undrawn amounts of committed credit facilities especially in stressed conditions.
116. Institutions should apply, to the extent appropriate, credit risk internal model approaches that challenge historical relations and data, and simulations of credit quality migrations among categories of exposures to provide an estimate of losses.
117. When assessing their risk to leveraged counterparties or shadow banking entities, institutions should take into account risk concentrations and they should not presume the existence of collateral or continuous re-margining agreements, which may not be available in case of severe market shocks. Institutions should endeavour to capture such correlated tail risks adequately.

#### **4.7.2 Securitisation**

118. Institutions should take into account securitisation risks that arise from structured credit products, usually created by repackaging the cash flow from a pool of assets into various tranches or asset-backed securities, taking into account the different positions that institutions can have in the securitisation process, by acting as originator, sponsor or investor.
119. Institutions should ensure that the stress testing of securitised assets addresses the credit risk of the underlying pool of assets, including the default risk, the possibly non-linear and dynamic default correlations as well as the evolution of the collateral values. Institutions should take into account all relevant information with regard to the specific structure of each securitisation, such as the seniority of the tranche, the thickness of the tranche, credit enhancements and granularity, expressed in terms of the effective number of exposures.
120. The sensitivity to systemic market effects, affecting, for example, liquidity dry-outs or increasing asset correlations, on all levels of the structured product should be carefully taken into account. In addition, the effect of reputational risks, resulting in, for example, funding issues, should be assessed.

121. Stress tests should address all relevant contractual arrangements, the potential impact of embedded triggers (e.g. early amortisation provisions), the leverage of the securitisation structure and the liquidity/funding risks arising from the structure (i.e. cash-flow mismatches and prepayment conditions including in relation to interest rate changes).
122. Scenarios should also consider the default of one or more of the contractual counterparties involved in the securitisation structure, especially of those acting as guarantors of certain tranches.
123. If the institution relies on external ratings to assess the risk of securitised products, the external ratings should be critically reviewed and scenarios stressing the ratings including the rating classes' specific impairment rates should be assessed, e.g. by stressing (historical) rating transition matrices.
124. When designing the stress testing approach, institutions should consider the following:
  - a) the impacts of stress tests for structured credit products will materialise on the level of the asset pool in increased defaults (or PDs and LGDs, where applicable) and hence increased expected loss/impairment rates and regulatory capital requirements (as well as increased probabilities for downgrades) should be expected during shocks; and
  - b) that further impacts may arise from decreases in the net cash flow, increases in trading losses and value adjustments, or from the deterioration of regulatory metrics such as the net stable funding ratio.

#### **4.7.3 Market risk**

125. Institutions should take into account market risk, notably risks derived from losses resulting from adverse changes in the value of positions arising from movements in market prices across commodity, credit, equity, foreign exchange and interest rate risk factors. Interest rate risks in trading book positions should be considered by institutions as a component of market risk.
126. Institutions should conduct stress tests for their positions in financial instruments in trading and fair value reported in other comprehensive income (FVOCI) portfolios (i.e. accounting terms to classify financial assets), including securitisation instruments/positions and covered bonds. These stress tests should be undertaken as part of institution-wide stress testing as well as for market risk management and calculation purposes.
127. Institutions should apply a range of severe but plausible scenarios for all positions referred to in the previous paragraph, e.g. exceptional changes in market prices, shortages of liquidity in the markets and the defaulting of large market participants. Dependencies and correlations between different markets and, consequently, adverse changes in correlations should, where appropriate, also be taken into account and factored in. The impact on accounting credit value adjustment (CVA) and on reserves related to institutions' portfolios (e.g. reserves for liquidity, for modelling uncertainties) should be taken into account equally in stress tests. Market risk reserve stress testing should be substantiated.

128. When calibrating these stress tests, institutions should take into account at least the nature and characteristics of their portfolios and related financial instruments (e.g. vanilla/exotic products, liquidity, maturity), their trading strategies, and the possibility of, associated cost of and potential time involved in hedging out or managing risks under severe market conditions.
129. As instruments and trading strategies change over time, institutions should ensure that their stress tests evolve to accommodate those changes.
130. Institutions should develop an appropriate approach to capturing the underestimation of tail risk by historical data (fat tails) where applicable, e.g. by applying severe hypothetical scenarios, and, where risk is assessed against percentile confidence levels, should consider tail events beyond those confidence levels.
131. Institutions should in particular:
- a) assess the consequences of major market disturbances and identify plausible situations that could entail extraordinarily high losses, which should, where appropriate, also include events with a low probability for all main risk types, especially the various components of market risks; for portfolio level stress tests, the effects of adverse changes to correlations might be explored; and mitigating effects of management actions may be taken into account if they are based on plausible assumptions about market liquidity; and
  - b) have in place a list of the measures containing limits and other possible actions taken to reduce risks and preserve own funds; in particular, limits on exchange rate, interest rate, equity price and commodity price risks set by institutions should, where appropriate, be taken into account against the results of the stress testing calculations.

#### **4.7.4 Operational risk**

132. Institutions should be aware that relevant risk parameters related to operational risk may derive from inadequate or failed internal processes, people and systems, including legal risks, or from external events, and may affect all products and activities within the institution.
133. In order to stress relevant risk parameters, institutions should use the profit and loss (P&L) effect of operational losses as the main metric. Any intrinsic impact caused by the operational risk event should be considered as an operational risk loss (e.g. intrinsic impacts from opportunity costs, or internal costs such as overtime/bonuses, etc., where they relate to an operational risk event). In addition, and only for the purpose of stress testing, any loss of future earnings caused by operational risk events (excluding second-line effects on the macroeconomic environment) should be included. At least the institutions under the advanced measurement approach (AMA) should also take these losses into account as they flow into the internal loss database to calculate the additional capital requirements. When using historical data, external data or scenarios as inputs for both P&L and RWA projections, institutions should take into account and avoid possible double-counting effects on the input side.

134. As operational losses may induce second-round effects (i.e. reputational risk), in order to account for such effects, the operational risk stress testing programme should be thoroughly integrated into the institution-wide stress test and should include interconnections with liquidity and own funds requirements. Institutions should analyse at least:
- a) the exposure of the institution to activities and its associated risk culture and past record of operational losses, with a focus on the level and change in losses and gross income in the past few years;
  - b) the business environment, including geographical locations, in which the institution operates and macroeconomic conditions;
  - c) the evolution in headcount and in balance-sheet size and complexity over the past few years, including structural changes due to corporate events such as mergers and acquisitions;
  - d) changes to significant elements of the information technology infrastructure;
  - e) the degree and orientation of incentivising in compensation schemes;
  - f) the complexity of processes and procedures, products and information technology systems;
  - g) the extent of outsourcing, with regard to the concentration risk associated with all outsourcing arrangements and external market infrastructures; and
  - h) the vulnerability of modelling risk, especially in areas related to the trading of financial instruments, risk measurement and management, and capital allocation.
135. Idiosyncratic risk factors should also be explored and used as inputs for scenario design. Indicatively, institutions under the AMA should stress their business environment and internal control factors (BEICFs).
136. Institutions should consider the interactions of, and individual exposures to, such idiosyncratic risk factors in determining their operational risk exposure.
137. Institutions should analyse carefully the possible interaction of operational risk losses with credit and market risks.
138. The analysis of the stress test events should involve expert judgement, to include at least low-frequency high-severity events.
139. Institutions should design severe but plausible stress events. Assumptions may differ from assumptions used in credit and market risk stress scenarios. When an institution expands its business in the local or in the international markets through mergers and acquisitions, the design of new products or a new business line, the severe but plausible stress test scenarios should be based on expert judgement to overcome the possible lack of historical information.
140. Institutions should build their stress testing programme based on both internal and external data, while analysing carefully:

- a) the use of scaling factors (e.g. in a situation where external data were scaled down, the scaling may be reduced) and the possible need for additional impacts stemming from changing scaling factors in a stress situation; and
- b) the criteria for determining the relevance of data (e.g. data on a large loss considered not relevant may be used within the stress test, in addition to Capital Requirements Regulation (CRR) requirements).

#### **4.7.5 Conduct-related risk and associated litigation costs**

141. Institutions should take into account that conduct-related risk, as part of legal risk under the scope of operational risk, arises because of the current or prospective risk of losses from the inappropriate supply of financial services and the associated litigation costs, including cases of wilful or negligent misconduct.
142. In their stress testing, institutions should assess the relevance and significance of the following exposures to conduct-related risk and associated litigation costs:
- a) the mis-selling of products, in both the retail and the wholesale markets;
  - b) the pushed cross-selling of products to retail customers, such as packaged bank accounts or add-on products that customers do not need;
  - c) conflicts of interest in conducting business;
  - d) the manipulation of benchmark interest rates, foreign exchange rates or any other financial instruments or indices to enhance an institution's profits;
  - e) unfair barriers to switching financial products during their lifetime and/or to switching financial service providers;
  - f) poorly designed distribution channels that may result in conflicts of interest with false incentives;
  - g) unfair automatic renewals of products or exit penalties; and
  - h) the unfair processing of customer complaints.
143. When measuring conduct-related risk, institutions should consider (a) the uncertainty around provisions or expected losses originating from conduct-related events; and (b) extreme losses associated with tail risks (unexpected losses). Institutions should assess their capital needs under such events and scenarios and should also take into account the reputational effect of conduct losses. In principle, expected losses from known conduct-related issues should be covered by provisions and included in the P&L account, whereas unexpected losses are quantified and covered by capital requirements from the institution. The possible excess of amounts after projection of stressed conduct losses should be included in the institution's assessment of potential capital needs.
144. In order to capture the risk that the provisions are insufficient or timely inconsistent, institutions should assess expected losses from conduct-related risk in excess of existing



accounting provisions and factor these into their projections. Where appropriate, institutions should assess whether or not future profits will be sufficient to cover these additional losses or costs in the scenarios and incorporate this information into their capital plans.

145. Institutions should collect and analyse quantitative and qualitative information about the extent of their business in relevant, vulnerable areas. Institutions should also provide information to support material assumptions underlying their estimates of conduct-related costs.
146. In rare cases where an institution is unable to provide an estimate for an individual material conduct-related risk because of the extent of uncertainty, the institution should clarify that this is the case and provide evidence and assumptions supporting its assessment.
147. Stress testing should also, where appropriate, be used to assess extreme losses associated with tail risks (unexpected losses) and whether or not additional capital should be held under Pillar 2.
148. Institutions should form a view on the unexpected losses that may originate from conduct-related events based on a combination of:
  - a) judgement;
  - b) historical loss experience (e.g. the institution's largest conduct-related loss over the past five years);
  - c) the level of expected annual loss for conduct-related risk;
  - d) conduct-related scenarios where potential exposures over a shorter time horizon (e.g. five years) are considered; and
  - e) losses experienced by similar entities or by entities in similar situations (e.g. in cases of litigation costs).

#### **4.7.6 Liquidity risk**

149. Institutions should take into account that liquidity or funding risks arise when an institution is not able to meet current and future cash flows.
150. Institutions should take into account that liquidity or funding risks encompass:
  - a) short- to medium-term liquidity risks; and
  - b) funding risks.
151. Institutions should analyse and measure themselves against risk factors relating to both asset- and liability-related items, as well as to off-balance-sheet commitments as defined in the EBA Guidelines on the supervisory review and evaluation process (SREP).
152. Institutions' analysis of risk factors should take into account, but should not be limited to:

- a) the impact of macroeconomic conditions, e.g. the impact of interest rate shocks on contingent cash flows;
  - b) the currency of assets and liabilities including off-balance-sheet items, to reflect convertibility risk and possible disruptions in the access to foreign exchange markets;
  - c) the location of liquidity needs and available funds, intragroup liquidity transactions and the risk of constraints for the transfer of funds between jurisdictions or group entities;
  - d) actions that the institution may take to preserve its reputation or franchise (e.g. the early repayment of callable liabilities);
  - e) the internalisation of risks related to specific activities, as in the case of prime brokerage where symmetry, to a certain extent, might be required between the lending side and the borrowing side of securities, i.e. customer long positions are funded using the proceeds from customer short trades. Such symmetry is subject to counterparties' behaviour and is therefore sensitive to reputational risk. In the event of such risk, it may trigger the unwinding of trades that would unexpectedly leave the institution with securities on its balance sheet, along with the need to fund them;
  - f) the vulnerabilities within the funding term structure due to external, internal or contractual events;
  - g) realistic run-off rates under normal conditions that accelerate in stressed times;
  - h) concentration in funding; and
  - i) estimates of future balance-sheet growth.
153. Institutions should subject these risk factors to sensitivity analyses which in turn should provide the appropriate quantitative background information for the design of scenarios.
154. Institutions should apply the following three types of stress scenarios: an idiosyncratic scenario, a market-wide scenario and a combination of the two. As idiosyncratic stress scenario should assume institution-specific events (e.g. a rating downgrade, the default of the largest funding counterparty, a loss of market access, a loss of currency convertibility, the default of the counterparty providing the largest inflows), whereas a market-wide stress scenario should assume an impact on a group of institutions or the financial sector as a whole (e.g. a deterioration in funding market conditions or the macroeconomic environment, or rating downgrades of countries in which the institution operates).
155. Institutions should design different time horizons in their stress testing: the time horizons should range from overnight up to at least 12 months; there should also be separate stress tests relating to intraday liquidity risks. The time horizon should display, for example, a short acute phase of stress (up to 30 days in order to cover such periods without having to change the business model) followed by a longer period of less acute but more prolonged stress (between 3 and 12 months).

156. Institutions should combine the stress of the short- to medium-term liquidity risk with a stress of funding risk, considering a time horizon of at least 12 months.
157. Institutions should design a set of adverse behavioural assumptions for customers including depositors, other providers of funds and counterparties for each different scenario and time horizon.
158. In the design of scenarios, institutions should consider the impact of stress events for other risk types, e.g. credit risk losses and reputational risk events, on their liquidity position, and the possibility of an impact of fire sales from other institutions (e.g. spillovers) or from their own liquidity buffer on the market-to-market value of other assets they hold.
159. The main methodology used for calculating the magnitude of the impact should be the net cash flow profile. For each scenario, at each stress level, the institution identifies cash inflows and outflows that are projected for each future time period and the resulting net cash flows. Institutions should consider the lowest cumulative point of net cash flows within the time period assessed in each given scenario.
160. Institutions should extend the analysis, if appropriate, to other metrics, such as:
- a) liquidity ratios and other metrics used in the framework, which should include, but may not be limited to, supervisory liquidity ratios and metrics, in particular the liquidity coverage ratio and net stable funding ratio;
  - b) their available liquidity buffer, over and above the ratios referred to above, and other counterbalancing measures, i.e. their counterbalancing capacity, for each stress scenario; the stress testing of this metric should be accompanied by an assessment of the impact on the proportion and nature of encumbered assets;
  - c) the survival horizon of the institution as derived from its counterbalancing capacity, i.e. the institution's ability to hold, or have access to, excess liquidity over short-term, medium-term and long-term time horizons in response to stress scenarios as defined in the EBA Guidelines on common procedures and methodologies for SREP, and stressed cash flows, taken jointly, before and after the impact of counterbalancing measures;
  - d) solvency and profitability.
161. When applying the different stress scenarios, institutions should assess and highlight counterbalancing effects provided by central banks (monetary policy) and adopt a conservative approach.
162. Liquidity stress test metrics should include, if appropriate and in particular for at least all material currencies, a granularity per currency to allow the analysis of currency-specific assumptions in scenarios (e.g. volatility in exchange rates or currency mismatches).
163. Institutions should, where appropriate, integrate liquidity stress test in their institution-wide stress tests, and take into account differences in the time periods covered in liquidity

stress tests from those covered in institution-wide solvency stress tests. At a minimum, institutions should assess the impact of increasing funding costs on P&L. Institutions should take into account that linking funding costs to solvency position may influence the quality of the liquidity stress test, namely a too slow deterioration in liquidity.

#### **4.7.7 Interest rate risk from non-trading activities**

164. This section is without prejudice to the EBA Guidelines on interest rate risk arising from non-trading activities.
165. Stress tests should support and be an integral part of the interest rate risk in the banking book (IRRBB) internal management system.
166. The interest rate scenarios used for stress testing purposes, including for the purposes of the application of Article 98(5) of Directive 2013/36/EU for the interest rate risk arising from the non-trading activities, should be adequate to identify all material interest rate risks, e.g. gap risk, basis risk and option risk.
167. Institutions should ensure that the tests referred to in the previous paragraph are not only based on a simple parallel shift but that they consider movements and changes in the shape of the yield curves in their scenario analyses.
168. Institutions should consider the following elements:
- a) the spread risk, which arises from reference rates mismatching between time-matched funding and investments; and
  - b) early termination risks included in contracts with an embedded option, which might force the institution into a new transaction on less favourable terms.
169. Institutions should be aware of potential indirect interest rate effects triggering losses elsewhere (e.g. that a pass-through onto lending rates could trigger further credit risk losses because of a deterioration in customers' ability to pay).
170. Where less complex financial instruments are employed, institutions should calculate the effect of a shock using sensitivity analysis (without the identification of the origin of the shock, and by means of the simple application of the shock to the portfolio). Where an institution uses more complex financial instruments on which the shock has multiple and indirect effects, it should use more advanced approaches with specific definitions of the adverse (stress) situations reflecting relevant idiosyncratic risks.

#### **4.7.8 Concentration risk**

171. Stress testing should be a key tool in the identification of concentration risk, as it allows institutions to identify interdependencies between exposures, which may only become apparent in stressed conditions as well as hidden concentrations.

172. In assessing this risk in their stress testing programmes, institutions should take into account the credit risk of each exposure but also consider the additional sources of risks arising from the similar behaviour of certain exposures (i.e. higher correlation). These additional sources of risk under analysis should cover, but not be limited, to the following:
- a) the single-name concentrations (i.e. client or group of connected clients as defined in Article 4(39) of Regulation (EU) No 575/2013);
  - b) the sectoral concentrations;
  - c) the geographical concentrations;
  - d) the product concentrations; and
  - e) the collateral and guarantee concentrations.
173. In stress testing, especially institution-wide and including group stress testing, institutions should assess concentration risk considering on- and off-balance-sheet exposures, as well as banking, trading and hedging positions.
174. Stress tests should take into account changes in the business environment that may occur and that would lead to the materialisation of concentration risk. In particular, stress tests should consider unusual but plausible changes in correlations between various types of risk factors as well as extreme and unusual changes in risk parameters, going beyond single risk factors, to look at scenarios that take account of interrelated risk factors and that feature not only first-round but also feedback effects.
175. The way in which concentrated exposures perform in response to the same risk factors should be factored into the stress tests, including the risk of additional short-term losses as a result of concentrated exposures across the retail and corporate credit books or across different entities in a group.
176. Institutions should consider the impact on trading books from exposures to a single risk factor or from multiple risk factors that are correlated.
177. In order to assess the ex ante level of concentration risk and/or impact of the scenario on the concentration level, institutions should, where appropriate, consider more or less complex indicators, for instance the Herfindahl-Hirschman Index (HHI) and Gini coefficients.
178. Institutions should consider the potential existence of overlaps between different concentration sources. Institutions should not simply sum risk impacts but also put in place aggregation methods that consider the underlying drivers.

#### **4.7.9 Foreign exchange lending risk**

179. Institutions should take into account that foreign exchange lending risk:
- a) may arise from the unhedged borrower's (i.e. retail and as small and medium-sized enterprise-SME borrowers without a natural or financial hedge that are exposed to a

- currency mismatch between the loan currency and the hedge currency, as defined in EBA/GL/2014/13) inability to service debt denominated in currencies other than the currency of the Member State in which the institution has been authorised;
- b) is related to pure credit and foreign exchange market risk;
  - c) is characterised by a non-linear relationship of credit and foreign exchange market risk components;
  - d) is influenced by the general exchange rate risk; and
  - e) may arise from conduct-related risk.
180. In their stress testing programmes, institutions should take into account foreign exchange lending risk affecting credit facilities in the asset side of their balance sheet and its multiple sources of risk, taking into account that the debtor's inability to repay its debt may originate from:
- a) risks related to the debtor's internal source of income;
  - b) risks related to the economic situation in the country in which the currency is denominated; and
  - c) foreign exchange risk.
181. Institutions should consider, when designing or implementing their stress test scenarios, that foreign exchange lending risk impacts may arise from the increase in both the outstanding value of debt and the flow of payments to service such debt, as well as an increase in the outstanding value of debt compared with the value of collateral assets denominated in the domestic currency.
182. Institutions should develop stress scenarios by changing different parameters to allow them to forecast foreign exchange credit portfolio performances in different cases, such as:
- a) assuming the exchange rate appreciation of the host currency by a predetermined percentage;
  - b) assuming a shift in the foreign exchange interest rate by a predetermined percentage point; or
  - c) combining both of the above.
183. In order to assess potential vulnerability, institutions should be able to demonstrate additional credit risk losses stemming from foreign exchange lending risk separate from the credit risk losses and risk exposure amounts resulting from the impact of the scenario on credit risk factors.
184. When stress testing the foreign exchange lending risk, institutions should take into account at least:

- a) the type of exchange rate regime and how this could impact on the evolution of the foreign exchange rate between domestic and foreign currencies;
  - b) the sensitivity impact of exchange rate movements on a borrower's credit rating/score and debt servicing capacity;
  - c) the potential concentration of lending activity in a single foreign currency or in a limited number of highly correlated foreign currencies;
  - d) the potential concentration of lending activity in some specific sectors of the economy, in the country currency, that have a core business in foreign currency countries or markets and the corresponding evolution of such sectors highly correlated with foreign currencies; and
  - e) the ability to secure financing for this type of portfolio; for institutions applying internal models for the calculation of credit risk capital requirements, the additional risk related to lending in foreign exchange currencies should be reflected in higher risk weights of such assets, and the non-exhaustive list of variables used in the models should include interest rates disparities, loan-to-value (LTV) ratios, currency cross correlation and volatility.
185. Institutions should take into account possible significant weaknesses that may be built into internal models with a possible underestimation of currency depreciation in relation to the client's ability to service its debt, taking into account the following indicative elements:
- a) monetary policies during a crisis period are often focused on stimulating the real economy by significantly decreasing reference interest rates, with potentially misleading information from internal models regarding these indirect effects; and
  - b) currency appreciation may be partially offset by falling interest rates and this may cause an underestimation of risk related to foreign exchange lending because, in zero interest rate environments, such a trade-off may not be possible in the long term.
186. While assessing the potential impact of foreign exchange lending on profitability in a certain scenario, institutions should, where appropriate, include the legal regime and the relevant jurisdiction, which may force institutions to denominate foreign exchange lending in the domestic currency at exchange rates significantly below market ones.

## 4.8 Application of stress testing programmes

### 4.8.1 Stress testing for ICAAP/ILAAP purposes

187. As part of ICAAP and ILAAP, institutions should ensure that they have enough capital and liquidity resources to cover for the risks that institutions are, or might be, exposed to, and ensure the appropriate allocation of capital and liquidity resources across the entities of an institution over the economic cycle. This assessment should be reflected in the capital and liquidity plans that institutions should submit to the competent authorities as part of their ICAAP and ILAAP information and as part of the group risk assessment and liquidity profiles.

188. Furthermore, by means of stress testing, institutions should evaluate the reliability of their capital plans under stress conditions to ensure that they meet the capital requirements applicable to them. Any evaluation of capital plan reliability under stressed conditions should take into consideration scenario severity and occurrence probability. Institutions should also test the reliability of their liquidity plans to ensure that they can meet liabilities as they fall due under stress conditions. Institutions should assess the level of transferability of capital and liquidity resources in stressed conditions and consider any possible impediments, including legal, organisational and operational impediments. Institutions should, where appropriate, recognise that certain elements of capital requirements, as well as the liquidity buffers, may be used in stressed conditions (e.g. elements of the combined buffer requirements as specified in Chapter 4 of Title VII of Directive 2013/36/EU).
189. In addition to the general requirements related to institutions' stress testing programmes specified in these guidelines, stress tests used for ICAAP/ILAAP purposes should meet the following specific requirements:
- a) institutions should cover all material risk categories (and sub-categories) that the institutions are exposed to with regard to both on- and off-balance-sheet assets and liabilities in relation to all material portfolios or sectors/geographies, including relevant structured entities;
  - b) a range of scenarios should be considered including at least an adverse economic scenario that is severe but plausible, such as a severe economic downturn and/or a market-wide and idiosyncratic shock to liquidity;
  - c) ICAAP and ILAAP stress testing should be performed through comprehensive institution-wide stress testing and reflect all entities for which ICAAPs or ILAAPs are required;
  - d) ICAAP and ILAAP stress tests should cover the same forward-looking period as the institution's ICAAP and ILAAP, respectively, and be updated at least as regularly as the ICAAP and ILAAP; ICAAP stress tests should cover a period of at least two years.
190. ICAAP and ILAAP stress tests should be consistent with the risk appetite and overall strategy (i.e. including the business strategy) of the institution. Institutions should demonstrate a clear link between their risk appetite, their business strategy, and their ICAAP and ILAAP stress tests. In particular, institutions should assess their capital and liquidity plans, and any internal capital planning, including management capital buffers, consistent with their stated risk appetite and strategy, and overall internal capital needs, and rebuild their liquidity positions after using liquidity buffers to meet their liabilities during a stress period.
191. Furthermore, in their ICAAP stress test, institutions should assess their ability to stay above applicable regulatory and supervisory capital requirements (e.g. total SREP capital requirements-TSCR) in stressed conditions.



192. When doing solvency stress tests for the purposes of ICAAP, institutions should also consider the impact of scenarios on the institution's leverage ratio as well as eligible liabilities held for the purposes of minimum requirements for eligible liabilities (MREL).
193. Supervisory stress testing conducted pursuant to Article 100 of Directive 2013/36/EU or the scenarios or assumptions prescribed to an institution as a result of supervisory challenges and assessments of institutions' own stress tests should not be seen as replacing the obligations of institutions to carry out stress tests as part of their ICAAPs and ILAAPs.

#### **4.8.2 Management actions**

194. Institutions should identify credible management actions addressing the outputs of stress tests and aimed at ensuring their ongoing solvency through the stressed scenario.
195. Institutions should consider a broad range of management actions (including within the liquidity contingency plans) against a range of plausible stressed conditions with a focus on at least one severe but plausible scenario.
196. To assess possible responses to a stressed situation, institutions should identify the credible actions that are most relevant and when they would have to take them. Institutions should take into account that some management actions are required immediately and others are contingent on specific events happening, in which case clearly defined triggers for action should be identified beforehand. Management actions should be consistent with stated strategies and policies, for example in the context of stated dividend<sup>7</sup> policies. Institutions should be conservative about their ability to take mitigating management actions, recognising the possible impact of the stressed scenarios on other markets.
197. Institutions should explain the qualitative and quantitative impacts of the stress before and after mitigating management actions. The impact before management actions should include assumptions about strategy, growth and associated revenue, but exclude management actions that would not be available in a stress event such as winding down a business line or raising capital.
198. Acceptable management actions will be subject to the guidance and judgement of competent authorities, and might include the following:
- a) the review of internal risk appetite and risk limits;
  - b) the review of the use of risk mitigation techniques;
  - c) the revision of policies, such as those that relate to liquidity and funding or capital adequacy;
  - d) the reduction of distributions to shareholders;
  - e) the changes in the overall strategy and business plan and risk appetite; and
  - f) the raising of capital or funding.

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<sup>7</sup> For example, see Article 141 CRD (maximum distributable amount).

199. Anticipated management actions differentiated by scenario and adjusted to the severity of the scenario should be documented. Institutions should take into consideration the reduction of the efficiency as a consequence of extremely severe stress situations. In the ICAAP and ILAAP information they must provide to the competent authorities, institutions should also explain management actions already taken based on the results of stress tests.