

**CEBS Guidelines on aspects of the management of concentration risk  
under the supervisory review process (CP31)**

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**1. Background and introduction**

1. Concentration risk is one of the main possible causes of major losses in a credit institution. Events during the 2008-2009 financial crisis have brought to light many examples of risk concentrations within institutions. Given that it can jeopardise the survival of an institution, this risk type requires special attention by supervisors.
2. Concentration risk is one of the specific risks required to be assessed as part of the Pillar 2 framework set out in Directive 2006/48/EC (hereinafter Capital Requirements Directive or CRD). Aspects of concentration risk are mostly dealt with within the Pillar 2 framework under Articles 123<sup>1</sup>, 124, Annex V, Annex XI of the CRD.
3. These Guidelines address all aspects of concentration risk. It should be noted that in addition to the specific provisions on concentration risk included in the

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<sup>1</sup> Under Articles 123 and 124 institutions and supervisors are expected - within their risk management and internal capital planning processes as well as the supervisory review and evaluation process - to address the “nature and level of the risks to which they are or might be exposed” including concentration risk.

CRD, institutions will continue to be subject to the rules on monitoring and control of large exposures provided for in Articles 106 to 118, and in CEBS Guidelines and standards issued on that subject.

4. It should be also noted that in the Basel Capital Framework (and the CRD), concentration risk is not fully addressed in the context of Pillar 1. For credit risk it is assumed that IRB portfolios are perfectly diversified<sup>2</sup>. Any resultant underestimation of risk should be corrected by allocating capital through the framework of Pillar 2, by which supervisors expect institutions to hold enough capital for all of their risks, including concentration. Any additional capital would be allocated after steps have been taken to mitigate concentration risk, and in relation to the unmitigated part of that risk.
5. Concentration risk has been traditionally analysed in relation to credit activities. However, concentration risk refers not only to risk related to credit granted to individual or interrelated borrowers but to any other significant interrelated asset or liability exposures which, in cases of distress in some markets/ sectors/ countries or areas of activity, may threaten the soundness of an institution.
6. In order to identify the concentration risk within an institution, it is not sufficient only to analyse within a risk type (intra-risk analysis), analysis of concentration risk across risk types (inter-risk analysis) is also necessary. This distinction is somewhat artificial since the end-result of intra- and inter-risk concentration analysis is the same, identification of exposures with the potential to produce losses large enough to threaten the financial institution's health or ability to maintain its core operations, or to produce a material change in its risk profile<sup>3</sup>.
7. The Guidelines promote a holistic approach to concentration risk management which expects institutions to identify and assess all risk concentrations as a single risk event may result in losses or negative impacts in more than one risk category. The Guidelines also aim to promote sound risk management practices in general, and continue the work CEBS started with publication of its High-level principles for risk management.
8. Concentration risk may arise from connected factors which are not readily apparent and identifiable without the implementation of comprehensive processes to identify, manage, monitor and report concentration risk. It is essential to prevent concentrations from accumulating without these being properly identified and controlled by institutions, as well as by supervisors.
9. These Guidelines are closely related to other CEBS guidelines, and they should be read together with, primarily: (i) Guidelines on the Application of

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<sup>2</sup> See also "Studies on credit risk concentration: an overview of the issues and a synopsis of the results from the Research Task Force project", BCBS Working Papers No 15, November 2006, [http://www.bis.org/publ/bcbs\\_wp15.pdf](http://www.bis.org/publ/bcbs_wp15.pdf)

<sup>3</sup> See Joint Forum Report, "Cross-sectoral review of group-wide identification and management of risk concentrations" (April 2008), <http://www.bis.org/publ/joint19.pdf> for a reference definition of risk concentrations.

the Supervisory Review Process under Pillar 2 (GL03)<sup>4</sup>; High-level principles for risk management<sup>5</sup>; and (iii) Guidelines on the implementation of the revised large exposures regime<sup>6</sup>.

10. The Guidelines are structured into four major sections. The first provides the definition of concentration risk and its two-fold focus on intra- and inter-risk concentrations (Section 2). Section 3 deals with general principles for management of concentration risk, Section 4 addresses aspects of concentration risk management specific to particular risk areas (credit, market, operational and liquidity risks) and Section 5 provides underpinnings for the supervisory review and evaluation. The Guidelines are also supplemented by two annexes with examples of concentration risk (Annex 1) and examples of indicators for concentration risk management (Annex 2).
11. The principle of proportionality applies to the measurement and management of concentration risk. Equally, the frequency and intensity of supervisory review and evaluation should have regard to the size, systemic importance, nature, scale and complexity of the activities of the institution concerned, bearing in mind that, quite often, for smaller and less complex institutions concentration risk is mainly related only to credit risk. As a result of their business models some institutions may be excessively concentrated in certain business lines, products or geographies – no matter that they may often be specialists and possess the best knowledge of their markets or product niches. These institutions should be especially careful and prudent with regard to concentration risk as they may be more sensitive to it and potentially could be more affected by problems emerging in a specific market or product.

### ***Implementation of the guidelines***

12. CEBS will expect its members to apply the present guidelines, once finalised, by 31 December 2010. CEBS acknowledges that the implementation of some specific aspects of the guidelines may require modifications to institutions' current procedures. Therefore, CEBS recommends that the implementation of the guidelines can be phased, and - whenever necessary - national supervisors provide the institutions with sufficient flexibility regarding the implementation of specific aspects of the guidelines.
13. To ensure the harmonisation of practices across Member States, CEBS is considering conducting an implementation study one year after the recommended implementation date.

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<sup>4</sup> See <http://www.c-eps.org/getdoc/00ec6db3-bb41-467c-acb9-8e271f617675/GL03.aspx>

<sup>5</sup> See consultation paper [http://www.c-eps.org/getdoc/0861a22e-0eb8-4449-9b3a-f4b1959267c7/CP24\\_High-level-principles-for-risk-management.aspx](http://www.c-eps.org/getdoc/0861a22e-0eb8-4449-9b3a-f4b1959267c7/CP24_High-level-principles-for-risk-management.aspx), to be finalised in early 2010

<sup>6</sup> See [http://www.c-eps.org/documents/Publications/Standards---Guidelines/2009/Large-exposures\\_all/Guidelines-on-Large-exposures\\_connected-clients-an.aspx](http://www.c-eps.org/documents/Publications/Standards---Guidelines/2009/Large-exposures_all/Guidelines-on-Large-exposures_connected-clients-an.aspx)

## 2. Definition of concentration risk

14. For the purpose of these Guidelines the definition of concentration risk is similar to the Joint Forum's working definition of risk concentrations, i.e. exposure(s) that may arise within or across different risk categories throughout an institution with the potential to produce: (i) losses large enough to threaten the institution's health or ability to maintain its core operations; or (ii) a material change in an institution's risk profile. In these guidelines the following terms are used to describe two relationships between risk concentrations<sup>7</sup>:

- **Intra-risk concentration** refers to risk concentrations that may arise from interactions between different risk exposures within a single risk category;
- **Inter-risk concentration** refers to risk concentrations that may arise from interactions between different risk exposures across different risk categories. The interactions between the different risk exposures may stem from a common underlying risk driver or from interacting risk drivers.

Inter-risk concentrations may also arise where exposures to one entity or closely related groups of exposures (for example industry or geographic area) are not booked in the same place (e.g. exposures in the banking book and trading book). Where risks have a common risk driver that causes them to crystallise in a concentrated fashion, correlations between risk exposures that were assumed to be low may materialise as high during a stress period.

15. Concentration risk can have an impact on institutions' capital, liquidity and earnings. These three aspects do not exist in isolation, and institutions' risk management frameworks should address them adequately.

16. In addition to concentrations within and across different risk types, an institution may be concentrated in its earnings structure. For example, an institution highly dependent for its profits on a single business sector and/or a single geographic area may be affected to a greater extent by sectoral or regional business cycles. Different sources of income may not be independent of each other. These interdependencies should be taken into account when assessing concentration risk.

17. However while business concentration may increase vulnerability with regard to specific cycles, business and geographic specialisation may still enhance the performance of institutions, since focusing on specific sectors, products or

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<sup>7</sup> See also "Cross-sectoral review of group-wide identification and management of risk concentrations" by the Joint Forum (April 2008), <http://www.bis.org/publ/joint19.pdf>

regions may generate specialised expertise. A balanced view thus has to be taken when assessing business concentration risk.

### **3. General considerations and principles for concentration risk management**

#### **Guideline 1. The general risk management framework of an institution should clearly address concentration risk and its management.**

18. The requirements for general risk management frameworks are elaborated in the CEBS High-Level principles for risk management<sup>8</sup> and the internal governance section of the Guidelines on the Application of the Supervisory Review Process under Pillar 2<sup>9</sup>.
19. In particular, institutions are expected to adequately address concentration risk in their governance and risk management frameworks, to assign clear responsibilities, and to develop policies and procedures for the identification, measurement, management, monitoring and reporting of concentration risk.
20. The management body should understand and review how concentration risk derives from the overall business model of the institution. This should result from the existence of appropriate business strategies and risk management policies.
21. Institutions should derive a practical definition of what constitutes a material concentration in line with their risk tolerance. Moreover, institutions should determine the level of concentration risk arising from the different exposures they are willing to accept (i. e. determine their concentration risk tolerance), with due regard to (inter-alia) the institution's business model, size and geographic activity.
22. The concentration risk policy should be adequately documented explaining how intra- and inter-risk concentrations are addressed at both group and solo levels. The concentration risk management policy should be embedded in the institution's risk management culture at all levels of the business. It should be subject to regular review, taking into account changes in risk appetite and in the business environment.

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<sup>8</sup> See Consultation Paper 24 [http://www.c-ebs.org/getdoc/0861a22e-0eb8-4449-9b3a-f4b1959267c7/CP24\\_High-level-principles-for-risk-management.aspx](http://www.c-ebs.org/getdoc/0861a22e-0eb8-4449-9b3a-f4b1959267c7/CP24_High-level-principles-for-risk-management.aspx), to be finalised in early 2010

<sup>9</sup> See CEBS Guidelines on the Application of the supervisory review process under Pillar 2 (GL03), Chapter 2.1 (see <http://www.c-ebs.org/getdoc/00ec6db3-bb41-467c-acb9-8e271f617675/GL03.aspx>)

23. Any exceptions from the policies and procedures should be properly documented and reported to the appropriate management level. Institutions are expected to have procedures for independent monitoring of any breaches of policies and procedures, including the monitoring and reporting of breaches of limits. Any breaches of policies and procedures, including breaches of limits, should be subject to appropriate escalation procedures and management actions.

**Guideline 2. In order to adequately manage concentration risk, institutions should have an integrated approach for looking at all aspects of concentration risk within and across risk categories (intra- and inter-risk concentration).**

24. Inter-risk concentrations stemming from interdependencies between risk types may not be fully considered when risks that are identified and measured on a stand-alone basis (silo approach) are combined (added up) in a simple way, e.g. by adding up Value-at-Risk figures. In this case, inter-risk concentrations via single factors driving the risks of different business lines may not be captured, for instance how risk mitigation techniques play out under stressed market conditions (e.g. having less liquid instruments as collateral could lead to potential additional exposures).

25. In the integrated approach to concentration risk management institutions should also pay due attention to second order effects, i.e. indirect effects on an institution's exposure caused by changes in the economic environment. For example, an additional loss may arise from the inability to liquidate some assets following a sharp decrease in the value of those assets; in such circumstances inter-risk concentrations may become apparent.

**Guideline 3. Institutions should have a framework for the identification of intra- and inter-risk concentrations.**

26. Risk drivers which could be a source of concentration risk should be identified. Furthermore, the risk concentration identification framework should be comprehensive enough to ensure that all risk concentrations which are significant to the institution are covered, including on- and off- balance sheet positions and committed and uncommitted exposures, and extending across risk types, business lines and entities. It follows that an institution should have adequate data management systems to enable it to identify concentrations arising from different (types of) exposures.

27. As an institution does not operate in isolation, it should consider economic developments that influence the financial markets and their actors and vice versa. For an institution it is important to correctly price its risks in line with its view of the potential evolutions in financial markets and the economic environment. The analysis of these potential evolutions should be thorough enough to enable the institution to implement a forward-looking approach to its concentration risk management.

28. An institution should constantly monitor the evolving interplay between the markets and the economy to facilitate the identification and understanding of

potential concentration risks (at both group and solo levels) and the underlying drivers of these risks. In its monitoring the institution should go further than first-order observations, as mere observation of the changes in market and economic variables will not give the institution the required insights in order to implement a forward-looking approach to its concentration risk management.

29. Stress testing is a key tool in the identification of concentration risk. The analysis should be performed on an institution-wide basis and transcend business unit or risk type focus on concentrations, to which it can be a useful complement<sup>10</sup>. In addition, stress tests may allow institutions to identify interdependencies between exposures which may become apparent only in stressed conditions.

30. Institutions should identify concentration risks when planning to enter into new activities, in particular those resulting from new products and markets.

**Guideline 4. Institutions should have a framework for the measurement of intra- and inter-risk concentrations. Such measurement should adequately capture the interdependencies between exposures.**

31. The measurement framework should enable the institution to evaluate and quantify the impact of risk concentrations on its earnings/profitability, solvency, liquidity position and compliance with regulatory requirements in a reliable and timely manner. Frequency of measurements should be proportionate to the scale and complexity of the institution's operations. The measurement framework should be regularly reviewed and reflect changes in the external environment as well as possible changes in the risk profile of the institution, taking into account its current and projected activities.

32. Multiple methods or measures may be required to provide an adequate view of the different dimensions of the risk exposure. Scenario stress testing may be a particularly appropriate tool for developing forward looking approaches by introducing views on potential financial market and economic evolutions into the institution's risk measurement methods and to translate these views in terms of risks. If performed outside the standard aggregation methods, the scenario stress testing exercises could be an appropriate tool for assessing the standard methods used.

33. The management body should be aware of the major limitations and underlying assumptions of the measurement framework. The risk control function should take into account adequately all limitations and assumptions of models and their calibration, particularly via the application of stress tests.

**Guideline 5. Institutions should have adequate arrangements in place for actively controlling, monitoring and mitigating concentration risk.**

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<sup>10</sup> More details on stress testing, including concentration risk stress testing is available from the revised CEBS Guidelines on stress testing.

34. Active management of risk exposures is required to mitigate the potential emergence of concentrated exposures within portfolios. Note though that this active management may lead to subsequent risks that may be difficult to deal with (e.g. asset liquidity risk). Also constant assessment and adjustment of business and strategic goals is required to avoid the build-up of undesired long-term risk concentrations.
35. An institution should set top-down and group-wide concentration risk limit structures (including appropriate sub-limits across business units and across risk types) for exposures to counterparties or groups of related counterparties, sectors or industries, as well as exposures to specific products or markets.
36. The limit structures and levels should reflect the institution's risk tolerance and consider all relevant interdependencies within and between risk factors. The limit structures should cover both on- and off- balance sheet positions and the structure of assets and liabilities at consolidated and solo levels. The limit structures should be appropriately documented and communicated to all relevant levels of the organisation.
37. Institutions should carry out regular analyses of their portfolios and exposures, including estimates of their trends, and should take account of the results of these analyses in setting and verifying the adequacy of the processes and limits, thresholds or similar concepts for concentration risk management. The analysis could include, for example:
- undertaking a more detailed review of the risk environment in particular sector(s);
  - reviewing with greater intensity the economic performance of existing borrowers;
  - reviewing approval levels for business;
  - reviewing risk mitigation techniques, their value and their legal enforceability;
  - reviewing outsourced activities and contracts signed with third parties (vendors);
  - reviewing the funding strategy, so as to ensure the maintenance of an effective diversification in the sources and tenor of funding; and
  - reviewing the business strategy.
38. Where issues of concern are identified, institutions should take appropriate mitigating action. Possible actions could include, for example:
- reducing limits or thresholds on risk concentrations;



- adjusting the business strategy to address undue concentrations;
- diversifying asset allocation or funding;
- adapting the funding structure;
- buying protection from other parties (e. g. credit derivatives, collateral, guarantees, sub-participation);
- selling certain assets; and
- changing outsourcing arrangements.

39. With regard to concentration funding risk, limits may include:

- limits related to funding from inter-bank markets;
- limits related to maximum or minimum average maturities; and
- limits referring to the ratio of long-term financing, when relevant.

40. Other limits restricting concentrations of liquidity risk may include:

- limits concerning maturity mismatches, especially limits concerning cumulated liquidity gaps; and
- limits referring to off-balance sheet positions.

41. Other useful instruments are indicators and triggers (internal liquidity ratios) which, as with limits, are targeted at certain thresholds, but usually are established at more conservative levels than limits. They are introduced to warn against potential difficulties and should result in the taking of preventative actions to avoid exceeding limits.

42. Mitigation techniques used by institutions should be adequate, manageable and fully understood by the relevant staff. The institution should ensure that when mitigating concentration risk it does not over rely on specific mitigation instruments, thereby substituting one kind of concentration with another.

**Guideline 6. Institutions should have adequate arrangements in place for reporting concentration risk. These arrangements should ensure the timely, accurate and comprehensive provision of appropriate information to management and the management body about levels of concentration risk.**

43. An institution should have in place a reliable, timely and comprehensive monitoring and reporting framework for risk concentrations which will facilitate efficient decision-making. The management reports should provide qualitative and quantitative information on intra-risk and inter-risk concentrations as well as on material risk drivers and mitigating actions taken. The reports should include information at both consolidated and solo levels, spanning business lines, geographies and legal entities.

44. The frequency of the reporting should reflect the nature of the risk drivers, especially with regard to their volatility. Ad hoc reports can be used to supplement regular reporting.
45. An institution should have adequate management information systems to enable it to monitor concentrations arising from different (types of) exposures against approved limits. The results of such monitoring of limits (limit utilisation) should be included in management reports and operational reports for users of limits. Institutions should have appropriate escalation procedures to address any limit breaches.

**Guideline 7. Institutions should ensure that concentration risk is taken into account adequately within their ICAAP and capital planning frameworks. In particular, they should assess, where relevant, the amount of capital which they consider to be adequate to hold given the level of concentration risk in their portfolios.**

46. Institutions should undertake an assessment of the possibilities for mitigating concentration risk through capital allocation as part of their ICAAP.
47. An institution should take into account its gross exposure to concentration risk and its mitigation to arrive to a net exposure to concentration risk. In assessing the mitigation an institution may take into account a range of relevant factors, including the quality of its risk management and other internal systems and controls, and its ability to take effective management action to adjust levels of concentration risk.
48. While the role of capital must be assessed within this broader context, keeping in mind that the weight attached to the different factors will vary from one institution to another, the expectation is that the higher the levels of concentration, the greater the onus will be on institutions to demonstrate how they have assessed the implications in terms of capital.

## **4. Management and supervision of concentration risk within individual risk areas**

### **4.1 Credit risk<sup>11</sup>**

49. Institutions should derive a concise and practical definition of what constitutes a credit concentration. The definition should encompass the sub-types of credit concentrations being addressed (e.g. single name including issues of connectedness of counterparties, sectoral, geographic etc.) and should be reflective of its exposures and business strategy.

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<sup>11</sup> See also CEBS Guidelines on the implementation of the revised large exposures regime (see [http://www.c-eps.org/documents/Publications/Standards---Guidelines/2009/Large-exposures\\_all/Guidelines-on-Large-exposures\\_connected-clients-an.aspx](http://www.c-eps.org/documents/Publications/Standards---Guidelines/2009/Large-exposures_all/Guidelines-on-Large-exposures_connected-clients-an.aspx))

50. Credit concentration risk can arise from:

- Large and connected individual exposures, following the CRD definition of connected clients. Article 4(45) CRD refers to interconnections arising from the following:
  - one client has control over the other;
  - the clients are interconnected by some form of material economic dependency as for instance:
    - direct economic dependencies such as supply chain links or dependence on large customers, or
    - the clients have a common main source of funding in the form of credit support, potential funding or direct, indirect or reciprocal financial assistance.<sup>12</sup>
- Significant exposures to a group or groups of counterparties whose likelihood of default is driven by common underlying factors, such as:
  - economic sector;
  - geographic location;
  - instrument or product type: e.g. credit risk mitigation measures (including, for example, risks associated with large indirect credit exposures to a single collateral issuer or collateral type).

**Guideline 8. Institutions should employ methodologies and tools to systematically identify their overall exposure to credit risk with regard to a particular customer, product, industry or geographic location.**

51. The infrastructure used to aggregate and consolidate credit exposures and manage credit risk limits should be sufficiently robust to capture, on an institution-wide basis, the complexity of the credit portfolio from an obligor relationship and subordination perspective.

52. Institutions with exposures having the support of guarantees (unconditional, partial or letter of support) or utilising other forms of credit enhancement (such as monoline insurance or CDS protection) can have complex inter-obligor relationships. Such subordination issues can complicate the production of an aggregate credit exposure list, particularly for consolidated group purposes, and can thus compromise the process of identifying credit concentration risk.

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<sup>12</sup> The components of the definition of connected clients are explained in detail in the CEBS Guidelines on the implementation of the revised large exposures regime (see [http://www.c-eps.org/documents/Publications/Standards---Guidelines/2009/Large-exposures\\_all/Guidelines-on-Large-exposures\\_connected-clients-an.aspx](http://www.c-eps.org/documents/Publications/Standards---Guidelines/2009/Large-exposures_all/Guidelines-on-Large-exposures_connected-clients-an.aspx) )

53. Credit concentration risks may arise in both the banking and trading books (or stem from a combination of the two), with the latter arising in terms of counterparty risk and significant exposure to particular instrument types exposed to the same idiosyncratic risk.
54. In addition, institutions should take into account the credit concentration risks that may arise from the structure underlying complex products, such as securitised products.
55. Finally, interdependencies between creditors due to shared counterparties, links via supply chains, shared ownership, guarantors, etc., which may go beyond sectoral or geographic links, may only become apparent under stressed circumstances. Hence, stress testing is a helpful tool to gauge the size of possible hidden concentrations in the credit portfolio.

**Guideline 9. The models and indicators used by institutions to measure credit concentration risk should adequately capture the nature of the interdependencies between exposures.**

56. Model risk can be substantial in the modelling credit concentration risk. A fundamental factor underlying the modelling of borrower interdependencies concerns the type of model. Models may have fundamentally different structures (e.g. reduced form versus structural models) or may be run in different set ups (e.g. in default mode versus mark-to-market mode). Since the choice of model has significant impact on the credit concentration risk assessment of an institution, institutions need to have a full understanding of the underlying assumptions and techniques embedded in their models.
57. Institutions should demonstrate that the model structure chosen fits the characteristics of their portfolios and the dependency structure of their credit exposures. Not all models will capture different types of interdependencies equally well. Failing to include relevant portfolio characteristics may result in underestimation of credit concentration risks
58. As an example, when modelling interdependencies for retail or SME exposures, where no market data is available, institutions may often rely on data that may not be representative for such exposures. In addition, the assumptions, e.g. concerning the dependency structure among borrowers, may only hold 'locally' or may be violated under adverse circumstances.
59. Another area of concern is the extent to which the sample period that is used to calibrate the model is sufficiently reflective of severe economic circumstances and leads to robust estimates. Institutions should demonstrate how an adequate degree of conservatism is included, especially in cases where the time series used for estimation do not cover years of economic downturn.
60. Finally, challenges also arise in the measurement of credit concentration risk from aggregating (different types) of credit exposures to similar counterparties over all the business units of an institution. Exposures could emerge from different activities in different parts of the organisation, for

example, loan origination, counterparty credit risk from trading activities, collateral management, and the issuance of credit lines.

## **4.2 Market risk**

61. Market concentration risk can arise either from exposures to a single risk factor or exposures to multiple risk factors that are correlated. It may not always be apparent that multiple risk factors are correlated as this may only be revealed under stressed market conditions. Institutions should identify all material risk factors and understand, in particular through stress testing and sensitivity analysis, how their market risk profiles and the value of their portfolios may be affected by changes in correlations and non-linear effects. In particular, concentrations can arise from exposures in the trading and non-trading books.

62. Many institutions use a VaR model and related limits to monitor the positions that are exposed to market risk. VaR models can use unstressed correlations among risk factors. In stressed conditions however, interdependencies change and the benefits of asset diversification in the trading portfolio may be overestimated. In addition, prices used in models might not be based on true market prices but be the result of valuation techniques based on market observables or non-observable assumptions of limited validity in times of stress, thereby not representing the true concentration risk of an instrument. Concentration risk can also arise as a result of actions by other market participants. Systemic risk can also be a significant source of concentrations and this can be underestimated by the models.

63. VaR models may not capture market risk concentrations adequately. An institution's VaR measure may not reflect stressed market conditions and as such concentrations will not be identified. In particular, net positions may potentially conceal large gross underlying positions that can give rise to significant concentration risk. Therefore the measures used to monitor concentration risk should have the potential to anticipate and detect the build up of concentrated positions in one or multiple risk factors.

**Guideline 10. An institution's assessment of concentration risk should incorporate the potential effect of changing liquidity horizons<sup>13</sup>.**

64. Market liquidity risk is the risk that a position cannot easily be unwound or offset at short notice without significantly influencing the market price because of inadequate market depth or market disruption.

65. An institution should assess its concentration risk assuming different liquidity horizons. Given the impact that liquidity may have on concentration risk, careful assessment of liquidity horizons in normal and stressed market

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<sup>13</sup> Please also refer to the discussion on liquidity risk in Section 4.4

conditions is needed. This should be considered when an institution sets its risk limits.

### **4.3 Operational risk**

66. Operational risk concentration (OPRC) means any single operational risk exposure or group of operational risk exposures with the potential to produce losses large enough to worsen the institution's overall risk profile so that its financial health or its ability to maintain its core business is threatened.

67. However, the concept of OPRC is relatively new and both supervisors' and institutions' understanding of it and its similarities with other forms of concentration risk are in the early stages of development.

68. Accordingly, the following guidelines provide only a first set of recommendations on OPRC and are structured to promote dialogue and the exchange of experience between supervisors and institutions<sup>14</sup>.

#### **Guideline 11. Institutions should clearly understand all aspects of OPRC in relation to their business activities.**

69. Institutions should identify as part of their operational risk management framework the main (actual and potential) sources of OPRC and clearly understand what effects they have generated or are able to produce.

70. All sources of OPRC should be considered. In theory, most of these are linked to the characteristics of the institution's activities or organisational structure.

71. For example, institutions with large payments and settlements functions or that are active in high frequency trading or that are dependant on one or few external suppliers/providers for key aspects (e.g. IT platforms/suppliers, outsourcers, insurance undertakings) are potentially exposed to OPRC. However it is unclear whether or not such sources represent a potential threat from an OPRC perspective.

72. Other potential sources of OPRC (for example a business decision to carry out a campaign of "aggressive selling" that later produces losses through refunds to clients), are more clearly identifiable for their negative consequences and their negative impact on the institution's overall risk profile.

73. Many high frequency/medium impact (HFMI) loss events and low frequency/high impact (LFHI) loss events could be classified as OPRC events given (inter-alia) their impact. The frequent repetition of medium impact events can jeopardise an institution's survival in the long run, while events with low probability of occurrence but with high impact may cause the immediate default of an institution.

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<sup>14</sup> CEBS plans to revise these guidelines when good practices for identification, assessment and management of OPRC have been identified within the industry.

74. Although not all the HFMI and LFHI loss events are related to OPRC, their proper recognition and treatment is crucial to understanding the operational risk profile within the institution and the role that OPRC can play in this regard.

75. Frequently the HFMI and LFHI loss events stem from multiple time losses and multiple effect losses<sup>15</sup>. Given that such losses usually stimulate organisational responses and mitigation actions for operational risk, all institutions should define appropriate principles and set specific criteria and examples to correctly identify, classify and treat multiple time losses and multiple effect losses within their business and organisational structure.

**Guideline 12. Institutions should use appropriate tools to assess their exposure to OPRC.**

76. All institutions should take into account possible risk concentrations when they evaluate their operational risk exposure. The assessment tools should be proportionate to the size and complexity of the institution as well as to the type of method used for the purpose of calculating the operational risk capital figure.

77. In particular the analysis of patterns of frequency and severity of loss data (internal and/or external) can reveal the major determinants and effects of OPRC.

78. Near misses and also operational risk gains<sup>16</sup> on one hand and scenario analysis or similar processes containing expert judgements on the other can give a more forward looking perspective on the exposure to OPRC inherent in the current environment or related to new areas of business, changes in the institution's structure, or recent management decisions, etc.

79. Operational risk managers and internal audit functions should be involved in the assessment of an institution's exposure to OPRC. The collection of loss data should also form part of that assessment.

80. Sound internal processes and systems and sufficient human resources are crucial to avoiding unnecessary risk concentrations. However, banking

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<sup>15</sup> Paragraphs 526 and 527 of the CEBS Guidelines on the implementation, validation and assessment of Advanced Measurement (AMA) and Internal Ratings Based (IRB) Approaches (GL10) define "multiple time losses" and "multiple effect losses" as, respectively, a group of subsequent losses occurring in different periods of time, but relating to the same operational risk event and a group of associated losses affecting different entities or business lines, units, etc., but relating to the same root event. Paragraph 530 states that the associated losses should be aggregated in one cumulative loss before being used by the AMA institutions for capital calculation purposes.

<sup>16</sup> As stated in GL10, paragraphs 524, 525 and 526, and reminded in the CEBS Guidelines on Scope of operational risk and operational risk losses (GL20), footnotes 13 and 14, the terms "near-miss event" and "operational risk gain event" can be used to identify, respectively, an operational risk event that does not lead to a loss and an operational risk event that generates a gain.

businesses will usually be exposed to some OPRC and therefore an appropriate internal control system is paramount to mitigating those risks.

81. The CRD stipulates that contingency plans and continuity plans should be established by institutions in order to ensure their capacity to operate on a continuous basis and to restrain losses due to serious interruptions of their activities<sup>17</sup>. These plans are crucial for concentration risk management, especially with regard to events with a low probability of occurrence, but associated with severe losses resulting from business disruptions.
82. OPRC can also be addressed by the use of risk mitigation techniques such as the adoption of insurance programmes to cover losses caused by, for example, fraud, an aggressive selling campaign or the inability of external providers to offer their services.
83. The use of risk mitigation techniques may give rise to other risk types (e.g. credit risk) that may render overall risk reduction less effective (e.g. legal risk or other additional operational risk). This could also be considered as a secondary OPRC. Such a concentration risk may arise if a bank insures its risks or concentrated risks at only one insurance company which either does not have sufficient capacity to cover all the different operational risks transferred by the bank or is not able to find eligible co-insurers and re-insurers to pool and share those risks.
84. In using risk mitigation techniques for OPRC, institutions should consider the residual risk which may remain with the institution and whether additional risks, including OPRC itself, associated with risk mitigation tools have been acquired.

#### **4.4 Liquidity risk<sup>18</sup>**

85. Concentration risks may be a major source of liquidity risk as concentrations in both assets and liabilities can lead to liquidity problems. A concentration in assets can disrupt an institution's ability to generate cash in times of illiquidity or reduced market liquidity<sup>19</sup> for certain asset classes. A liability concentration (or funding concentration) exists when the funding structure of the institution makes it vulnerable to a single event or a single factor, such as a significant

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<sup>17</sup> See annex V of the CRD

<sup>18</sup> This section should be read in conjunction with the CEBS's technical advice on liquidity risk management (second part), September 2008, [http://www.c-eps.org/getdoc/bcadd664-d06b-42bb-b6d5-67c8ff48d11d/20081809CEBS\\_2008\\_147\\_%28Advice-on-liquidity\\_2nd-par.aspx](http://www.c-eps.org/getdoc/bcadd664-d06b-42bb-b6d5-67c8ff48d11d/20081809CEBS_2008_147_%28Advice-on-liquidity_2nd-par.aspx); Liquidity Identity Card, June 2008, <http://www.c-eps.org/getdoc/9d01b79a-04ea-44e3-85d2-3f8e7a9d4e20/Liquidity-Identity-Card.aspx>; and CEBS Guidelines on liquidity buffers and survival period (see <http://www.c-eps.org/documents/Publications/Standards---Guidelines/2009/Liquidity-Buffers/Guidelines-on-Liquidity-Buffers.aspx>)

<sup>19</sup> See section 4.2



and sudden withdrawal of funds or inadequate access to new funding. The amount that represents a funding concentration is an amount that, if withdrawn by itself or at the same time as similar or correlated funding sources would require the institution to significantly change its day-to-day funding strategy.

86. In recent years, the increasing use of complex financial instruments and the globalisation of financial markets were accompanied by a shift from deposit-based to market-based funding. Due to the increasing dependence on wholesale funding, institutions face higher exposures to market prices and credit volatilities. Furthermore, the extension of interbank market activity brings the risk of contagion effects.

**Guideline 13. In order to be able to identify all major kinds of liquidity risk concentrations, institutions need to have a good understanding of their funding structure and be fully aware of all underlying influencing factors over time. When relevant, depending on its business model, an institution should be aware of the vulnerabilities stemming from its funding structure, e.g. the proportions of retail and wholesale funding. Also, when relevant, the identification of liquidity risk concentrations should include an analysis of geographic specificities. Finally, the identification of concentrations in liquidity risk should take into consideration off-balance sheet commitments.**

87. The identification process of liquidity risk concentrations needs to take into consideration both market liquidity risk and funding liquidity risk as well as the possible interaction of the two. Institutions need to manage their stocks of liquid assets to ensure to the maximum extent possible that they will be available in times of stress. Institutions should avoid large concentrations in less liquid asset classes relative to their long-term stable funding. Otherwise in a market downturn this may severely damage the institution's liquidity generation capacity.

88. High concentrations in wholesale funding typically increase liquidity risk as institutional funding providers are more credit-sensitive and susceptible to market rumours about the financial difficulties of institutions than retail funding providers. Inter-bank funding entails contagion-risk and can be a volatile funding source, especially in times of crisis, when confidence among institutions is lost and they become reluctant to lend to each other. When assessing the probability of withdrawal for each concentrated source of funding both behavioural and contractual considerations should be taken into account.

89. For institutions active in multiple countries and currencies, access to diverse sources of liquidity in each currency in which the institution holds significant positions is required since credit institutions are not always able to swap liquidity easily from one currency to another.

90. There may be legal or regulatory constraints on the free flow of assets between jurisdictions (e.g. tax issues, regulatory ring-fencing) restricting the ability of groups to allocate assets where they are most needed. Institutions

should be able to identify intra-bank (between the head office and the foreign branches) and intra-group (either between the parent company and its subsidiaries or among different subsidiaries) concentrations in liquidity.

91. Another important factor influencing liquidity risk concentration is off-balance sheet items. Off-balance sheet liquidity needs may arise both from contractual and non-contractual commitments. Off-balance sheet contractual obligations may include such items as commitments to provide financing, guarantees, execution of limits within agreed credit lines, etc. Covenants in securitisation contracts should be screened for clauses - e. g. performance or downgrade triggers - that can impose collateral requirements or the obligation to provide liquidity support. The necessity to support entities such as SPVs in order to maintain a good reputation, market share or business relations may come unexpectedly, especially in times when an institution already faces stress, and may severely threaten the institution's liquidity position. Potential liquidity needs relating to the execution of such off-balance sheet commitments should be regularly assessed. Early repayment of debt instruments (instruments callable or with trigger clauses) should also be considered.

**Guideline 14. In identifying their exposure to funding concentration risk institutions should actively monitor their funding sources. A comprehensive analysis of all factors that could trigger a significant sudden withdrawal of funds or deterioration in their access to funding should be performed.**

92. There are no fixed thresholds or limits that define a funding concentration which depends on the institution and its balance sheet structure. Amongst other things, funding concentrations can include:

i) Concentrations in one particular market / one particular instrument:

- the inter-bank market;
- funding through debt issuance (commercial paper, medium-term notes, hybrid bonds, subordinated bonds, etc.);
- other wholesale funding (deposits from institutional investors and large corporations); and
- structured instruments (FX swaps, asset-backed commercial paper, covered bonds), both due to funding reliance and exposures due to margin and collateral calls.

ii) Concentrations in secured funding sources:

- securities financing arrangements such as repurchase/reverse repurchase agreements, stock borrowing/lending and specific assets used in these operations;
- asset-backed commercial paper;

- securitisation of loans, (credit cards, mortgages, autos, etc.);
- covered bonds; and
- dependence of open market operations.

iii) Concentrations on a few providers of liquidity stemming from concentrated counterparty credit risk. This dependence on one or a few liquidity providers could even go along with the use of different markets or instruments. Without a specific concentration risk analysis, the concentration on a few providers of liquidity could be less visible and difficult to identify. These concentrations could stem from:

- wholesale market providers (deposits from institutional investors and large corporations);
- funding from the financial group the institution belongs to;
- large individual depositors or counterparties;
- connected counterparties; and
- geographic and currency concentrations of funding sources.

iv) Maturity concentrations, such as over-reliance on short-term funding to finance longer term lending. While acknowledging the fact that maturity transformation is an integral part of banking business, liquidity problems can arise in the event that an institution is unable to roll-over its short-term liabilities. Another type of maturity concentration occurs when similar maturity dates of different funding sources (like debt issuance) require the bank to issue a large number or amount of debt instruments in a short period of time, leading to difficulties in market absorption.

**Guideline 15. The qualitative assessments of concentrations in liquidity risk should be complemented by quantitative indicators for determining the level of liquidity risk concentration.**

93. One example of such an indicator is the ratio of wholesale funding to total liabilities. It captures the extent to which an institution relies on – more volatile and vulnerable – market funding sources. In this example, wholesale funding could be defined as the funding provided by deposits from institutional investors and large corporations. Another example is a ratio consisting of the five largest depositors as a percentage of total deposits.

**Guideline 16. Institutions should take into account liquidity risk concentrations when setting up contingency funding plans.**

94. A contingency funding plan should consider the following:

- early warning indicators capturing any increase in the concentration of liquidity risk and the measures to be taken when a crisis situation/concentration stress strikes; and

- any increase in concentration stemming from the implementation of contingency measures should be carefully monitored and addressed as quickly as possible.

95. Among the early warnings are those indicators monitoring breaches of concentration limits, as mentioned above (e. g. per individual issuer, sector, liquid facility, asset quality).

96. Among the strategies to be implemented to address a crisis/stress situation when one or more early warning indicators on concentration is triggered are those measures aimed at keeping diversification stable.

## 5. Supervisory review and assessment

**Guideline 17. Supervisors should assess whether concentration risk is adequately captured in the institution's risk management framework. The supervisory review should encompass the quantitative, qualitative and organisational aspects of concentration risk management.**

97. As part of their assessment supervisors should review the compliance of institutions with these Guidelines. They should also evaluate the extent to which concentration risk management is embedded in an institution's risk management framework and whether the institution has considered all possible areas where risk concentrations may arise.

98. Supervisors should consider using quantitative indicators in their Risk Assessment Systems (RAS) to assess the level of concentration risk within institutions. Supervisors can build up these indicators based on the set of limits, thresholds or similar concepts defined internally by institutions. They may also develop their own models and tools such as indicators based on the existing supervisory reporting from institutions.

99. These indicators should be used within the supervisor's RAS to carry out peer comparisons and identify outliers. Supervisors should recognise that simple concentration risk indicators built on the information provided from supervisory reporting have shortcomings (e.g. they might not fully capture the interdependencies between exposures). Therefore, at least for the largest and most complex institutions, these measures are to be regarded as supplementary only and are not expected to cover the risk profile of an institution completely. In any case, these measures are not expected to serve as a replacement for the internal assessment of an institution itself.

100. As regards inter-risk concentrations, supervisors are aware that the methodological approaches to measure inter-risk concentration in the industry are still under development and anticipate that models which capture a holistic approach will evolve over time.

101. Supervisors should recognise that the assessment and management of concentration risk does not only rely on quantitative modelling techniques but also on qualitative factors e.g. the expertise of people with regard to the

identification and management of risks in individual sectors, markets and financial instruments, and the quality of the risk management, such as expertise and local knowledge, market information, etc. These factors are often relevant for institutions where concentrations are a reflection of their business models and strategies. All relevant information should be considered while conducting the assessment.

102. Supervisors should assess the reliability of proposed or implemented risk-mitigating actions, including their effectiveness in times of stress or illiquid markets and the way any potential shortcomings are addressed.

**Guideline 18. In cases where supervisory assessment reveals material deficiencies, supervisors, if deemed necessary, should take appropriate actions and/or measures set out in the Article 136 of the CRD.**

103. These actions might entail requesting an institution to take additional remedial action such as considering its strategy or future management actions with respect to mitigation of the concentration risk.

104. For example, if the limit structure does not reflect the chosen risk tolerance and no other mitigation approaches towards concentration risk have been established, the supervisor could in dialogue with the institution ask it to bring its limit structure and mitigation approaches into line with its risk tolerance (i.e. change the limits).

**Guideline 19. Supervisors should assess whether institutions are adequately capitalised and have appropriate liquidity buffers in relation to their concentration risk profile, focusing on buffers (liquidity and capital) in relation to the unmitigated part of any concentration risk.**

105. The supervisor should ensure that the institution holds an adequate amount of capital and liquidity buffer against its concentration risk. In this regard, special consideration should be given to concentrations which are inherent in the business strategy.

106. While it is recognised that the role of capital needs to be assessed within the broader context, the overall supervisory expectation is that the higher the levels of concentration, the greater the onus will be on institutions to demonstrate how they have assessed the implications in terms of capital.

107. Should the capital held by an institution not adequately cover the nature and level of the concentration risks to which it is or might be exposed, the supervisor should take appropriate action aimed at reducing risk exposures, possibly including obliging the institution to hold additional own funds as described under Article 136 of the CRD.

108. Finally, obliging institutions to hold own funds in excess of the minimum level is one of the measures that can be used by supervisors where institutions do not exhibit to their satisfaction the appropriateness and adequacy of their internal processes for identifying, measuring, monitoring and mitigating concentration risk.

109. Supervisors acknowledge that capital may not be the best way to mitigate liquidity risk. However, capital may have a role to play in protecting institutions against the possibility of having to liquidate assets from the liquidity buffer at fire-sale prices – a likely scenario in a period of banking sector stress. Supervisors should further be satisfied with the composition of institutions' liquid asset buffers in accordance to CEBS Guidelines on liquidity buffers and survival periods<sup>20</sup>.

**Guideline 20. Supervisors should assess whether concentration risk is adequately captured in firm-wide stress testing programmes.**

110. Supervisors should assess the extent to which concentration risk is adequately captured in firm-wide stress testing programmes<sup>21</sup>. In addition, supervisors may perform or request institutions to perform additional stress tests.

**Guideline 21. Supervisors should pay particular attention to those institutions which are highly concentrated, e. g. by customer type, specialised nature of product or funding source.**

111. Generally, supervisors should expect a positive relationship between the degree of concentration and the level of capital. However, other relevant factors linked to the quality of risk management, such as expertise and local knowledge, should also be considered. Those factors are often relevant for institutions where concentrations are a reflection of their business models and strategies.

112. In those institutions, focusing on selected products and/or certain categories of borrowers may generate a specialised expertise (or, conversely, a specialised expertise may lead to focus on specific activities) that may result in portfolios of relatively higher quality despite the degree of concentration.

113. A balanced view has thus to be taken when assessing the focused activity that may inherently lead to concentrated exposures, generally requiring a higher level of capital, though potentially reflecting a relatively better portfolio quality given the greater local knowledge.

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<sup>20</sup> See <http://www.c-ebs.org/documents/Publications/Standards---Guidelines/2009/Liquidity-Buffers/Guidelines-on-Liquidity-Buffers.aspx>

<sup>21</sup> More details on stress testing, including concentration risk stress testing is available from the revised CEBS Guidelines on stress testing.

## **Annex 1. Examples of concentration risk**

### **1. Inter-risk concentration – description of events of the sub-prime crisis of 2007-2008**

The crisis has clearly shown how inter-risk concentrations may arise within financial institutions as risks and losses steeply increased because of single or interacting risk drivers. The interactions between the risk exposures and the difficulty of measuring and managing risks under these conditions can give rise to the rapid growth of unexpected risk positions and losses. What follows is a short abstract of some of these experiences:

Severe doubts about the credit quality of US sub-prime mortgages coupled with valuation difficulties and uncertainties about the adequacy of credit rating agency ratings led to a severe drop in investor demand. This left originators and structurers with the inability to transfer assets to the securitisation markets and unexpectedly concentrated exposures to assets whose values were sensitive to market variables, credit quality and asset liquidity changes. Due to the uncertainties about the underlying quality of the collateral the ABCP markets also seized up. The freezing of the ABCP markets led to some funding difficulties for certain financial institutions, forcing some to draw on their liquidity lines and/or to shorten the maturity of their debt. These concentrated funding exposures to short-term horizons increased the fragility of the liquidity position. Large (sponsoring) institutions were faced with a build-up of exposures to structured credit assets and further pressure on liquidity positions. The increase in risk aversion, the steep rises in some reference interest rates and credit and liquidity hoarding led to forced asset sales and subsequently to severe price decreases in multiple asset classes (equity, traded credit, corporate bonds, etc.). These falls in asset values often provoked additional collateral requirements leading to further deterioration in the liquidity situation of the credit institutions. This general liquidity squeeze, the uncertainties about the institutions' own contingent exposures and heightened counterparty risk concerns, brought the inter-bank market to a standstill. Hedging the credit and market risks proved extremely hard under these conditions and often less effective than expected, rendering the exposures to those risks much higher (basis risk). Through the losses and downgrading of the monoline insurance companies, the issue of (indirect) counterparty risk suddenly attracted much more attention, again, as hedges proved ineffective. Given the generally declining markets the number of litigation cases rose strongly. In addition institutions faced with, for instance, rogue trades found it much harder to close those positions without incurring severe losses.

### **2. Examples of inter-risk concentration**

Credit - liquidity risk: failure of material counterparties impairs an institution's cash flow and its ability to meet commitments.

Credit - market risk: where counterparties may be closely related, or the same, or where unsystematic or undiversifiable risk (i.e. the part of the market risk which derives not from general price movements but from specific ones due to,

for example, changes in the perception of the inherent credit risk of an issuer) is considered. Furthermore, the worsening credit quality of an issuer can be the source of inter-risk concentration between market risk and credit risk. This, for example, would be the case where an institution has given a loan or granted a credit facility in addition to investing in the equity of the same company. All these positions will be adversely affected by a deteriorating credit quality. Therefore the different types of risks cannot be measured independently and the risks cannot be seen as uncorrelated. This confirms the necessity for the adequate management of inter-risk concentrations.

Credit - operational risk: exposure to credit risk may be related to potential operational risk drivers, or the credit quality of risk mitigants (e.g. insurance purchased) may affect the adequacy of operational risk buffers.

Market - liquidity risk: interruptions, increased volatility, rapid changes in value or the drying up of markets for certain instruments may negatively affect the liquidity of a given institution.

### **3. Market risk concentration and inter-risk concentration based on the credit quality of the issuer as risk driver**

The credit quality of an issuer is an example of a single risk driver which affects different types of risks and leads to market risk concentration. Deterioration of an issuer's creditworthiness has a negative impact on its share price as well as on the prices of its bonds and it influences the prices of corresponding derivatives. The equity trading desk of an institution could have bought equity, the fixed-income desk bonds and the derivatives desk could have sold credit protection on the same issuer. Since the prices of all instruments are dependent on the same risk driver, the correlations between these different instrument types are very high. This risk concentration must be taken into account because otherwise the risk situation would not be reflected correctly.

### **4. Market risk concentration and inter-risk concentration based on the risk aversion of market participants**

Another cause of a market risk concentration is a change in the risk preference of market participants. Greater uncertainty about the economic outlook could lead to reluctance to buy risky positions. Risk premiums on all risky products will rise and their prices will fall. This increases the correlations between different asset classes. Some markets will possibly even dry up completely because market participants are no longer willing to buy those products. An institution, although holding a diversified portfolio, will suffer losses on all types of instruments. This risk concentration caused by a change in the risk premium and the accompanying change in correlations ("correlation breakdown") must be included in the risk management of an institution.

The rise in the risk premium could also be the source of an inter-risk concentration between market risk and liquidity risk. An institution can generate



less liquidity by selling assets because of the lower prices. It is possible that some assets cannot be sold at acceptable prices if the markets are illiquid as a consequence of market participants' risk aversion. In addition the issuance of debt or equity is more expensive because the institution has to pay a higher risk premium itself. Here again the connection between different risk types demands appropriate management of risk concentrations.

## **5. Inter-risk concentration between market risk and credit risk based on the FX rate<sup>22</sup>**

Lending in foreign currency to domestic borrowers is exposed to both market (FX rate) and credit risk. When the domestic currency depreciates, the value of the loan in the domestic currency increases which (by increasing the cost of instalments) may reduce the ability of borrowers to repay. This effect becomes fairly non-linear at higher depreciation rates.

## **6. Examples of inter-relationships between liquidity and other risk factors**

The institution's overall exposure to other risks and their possible influence on the level of liquidity risk should be analysed in conjunction with the institution's funding profile.

Interrelationships between liquidity risk and other risks driven by the same factors can occur especially in times of stressed market conditions. Such dependencies can strengthen the effect of concentrations that exist in liquidity risk. Examples of such interrelationships may comprise:

- own-credit – liquidity risk: a deterioration in market prices or a downgrade of a counterparty could trigger a margin call or lead to the obligation to deliver additional collateral;
- reputational – liquidity risk: reputational difficulties may lead to a loss of trust in the institution on the part of counterparties and as a consequence to a reduction in funds available to the institution as well as to the withdrawal of funds;
- reputational – liquidity risk: in order to maintain a good reputation and to avoid adverse market perceptions, institutions may wish to provide funding support to associated parties, even if not contractually obliged to, which leads to a deterioration in their liquidity position;

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<sup>22</sup> See also „Towards the integrated measurement and management of market and credit risk: The dangers of compounding versus diversification“ by Philipp Hartmann, Myron Kwast, Peter Praet, September 2009, <http://www.voxeu.org/index.php?q=node/3953>

- operational – liquidity risk: interruptions in the payment or settlement process may result in liquidity problems; and
- legal – liquidity risk: potential errors or inaccuracies existing in legal arrangements may make it impossible to enforce the fulfilment of counterparty contracts to provide financing. It may particularly threaten the liquidity of an institution if shortcomings exist in arrangements regarding contingency financing for times of market stress.

## Annex 2. Examples of indicators used for concentration risk management

The following are examples of simple indicators of concentrations. When used and where applicable, concentration indicators should be based upon a risk sensitive measure (such as internal capital, risk-weighted assets or expected loss) rather than simply upon the size of an exposure:

- Commonly related to a relevant numeraire (e.g. size of the balance sheet, own funds, net profit):
  - Size of a certain number of large exposures (e. g. the ten largest exposures),
  - Size of a fixed number of large connected exposures,
  - Size of key sectoral/geographical concentrations,
  - Exposure to a specific financial instrument;
- Diversity scores, such as the Herfindahl Hirschmann index (HHI), Simpson's equitability Index, Shannon-Wiener index, Pielou's evenness index, Moody's Diversity Score, etc;
- Concentration curves<sup>23</sup>;
- Gini coefficients<sup>24</sup>;
- Portfolio correlations; and
- Variance/ covariance measures.

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<sup>23</sup> A concentration curve provides a means of assessing for instance whether a certain risk is more concentrated in some countries/sectors than in others.

<sup>24</sup> Gini coefficient can be used to measure any form of uneven distribution. It is a number between 0 and 1, where 0 corresponds with complete risk homogeneity (where every exposure has the same risk) and 1 corresponds with absolute concentration (where one exposure carries all the risks, and the other exposures have zero risks).