



EUROPEAN CENTRAL BANK

EUROSYSTEM

EU BANKS' LIQUIDITY STRESS TESTING AND CONTINGENCY FUNDING PLANS

NOVEMBER 2008

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NOVEMBER 2008

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CONTENTS

1 EXECUTIVE SUMMARY	5	6 EXPERIENCE WITH LIQUIDITY STRESS TESTS AND CONTINGENCY FUNDING PLANS IN RECENT EVENTS	35
2 INTRODUCTORY REMARKS, PROJECT BACKGROUND AND MANDATE	9	6.1 Liquidity risk stress tests	35
3 A CENTRAL BANK PERSPECTIVE ON BANKS' LIQUIDITY RISK MANAGEMENT	10	6.2 Contingency funding plans	41
4 TYPOLOGY OF LIQUIDITY STRESS TESTING TECHNIQUES	13	6.3 Issues for banks regarding central bank interventions	44
4.1 Liquidity risk tolerance	13	ANNEXES	
4.2 Types of scenario	14	1 Methodology and sample	47
4.2.1 Idiosyncratic (bank-specific) liquidity stress test scenarios	15	2 Literature review	49
4.2.2 Systemic (market-wide) liquidity stress test scenarios	17	3 References	55
4.3 Time horizon	18		
4.4 Scenario review	19		
4.5 Perimeter for stress testing	20		
4.6 Barriers to cross-border transfers of liquidity	22		
4.7 Quantification of banks' liquidity positions	23		
4.8 Disclosure of stress test results	24		
4.9 Standardisation of liquidity stress tests	25		
5 TYPOLOGY OF CONTINGENCY FUNDING PLANS	29		
5.1 Main features of contingency funding plans	29		
5.2 Coverage of contingency funding plans	31		
5.3 Assumptions and content of contingency funding plans	31		
5.4 Crisis committees, internal reporting and information flows, activation	32		
5.5 Tests	33		
5.6 Communication	34		



This report carried out by the Banking Supervision Committee (BSC) with the help of its Task Force on Liquidity Stress Testing and Contingency Funding Plans (hereinafter referred to as the “Task Force”) contains insights into the range of bank practices in these areas and assesses their adequacy in the light of recent financial market stresses. It is mainly based on four sources: a literature review, two workshops with market participants, a survey of relevant practices among 84 EU banks and the experience of supervisory authorities and central banks.¹

I EXECUTIVE SUMMARY

The *typology of EU banks’ liquidity stress testing techniques* is highly diverse in respect of all its components, i.e. scenario design, the quantification of their impact on cash flows, their time horizons and the perimeter covered.

The vast majority of banks try to approximate the quantification of liquidity risk tolerance by survival horizons or limit systems, mostly on the basis of expert judgement and liquidity stress tests. The quantifications are conditional on a range of assumptions and highly subjective; consequently, any comparisons across banks would be misleading and erroneous. This notwithstanding, the BSC regards it as important that banks have a well-documented internal view of their liquidity risk tolerance and its main determinants, even if they cannot quantify it objectively and precisely.

The most common scenarios in liquidity stress tests are idiosyncratic scenarios and market scenarios, although not all banks run both types of scenario. Only a sizeable minority run integrated market and idiosyncratic scenarios. The BSC considers it critical that both core scenarios are run, as well as a combined one that tests the impact of an idiosyncratic shock under adverse market conditions.

There is considerable diversity in bank procedures and practices related to scenario reviews in terms of how frequently and how

recently scenarios are/have been adjusted. There also seems to be a trade-off between the need to have updated scenarios and the value of comparing results across time. Nevertheless, the BSC considers it important that reviews focus on the changing nature of banks’ liquidity risk exposure (i.e. account for new products/new markets/new funding sources and/or changes in counterparty behaviour) rather than simply on mimicking past liquidity shocks.

Most banks run stress test scenarios that cover either short-term (e.g. four-week) or longer-term (e.g. 12-month) horizons, but only a few test market scenarios with both short and longer-term horizons. The BSC highlights the need for scenarios to be tested for all time horizons which are relevant to banks’ maturity profiles and vulnerabilities.

The majority of banking groups perform liquidity stress tests both at the group and at the entity level, although a sizeable number do so only either at the group level or at the entity level. However, banks do not always include potential barriers to the cross-border flow of liquidity in their stress tests, even though these can be particularly prevalent in crisis situations. In the face of potential barriers to the cross-border flow of liquidity and collateral, the BSC regards running stress tests at both the group and the entity level and accounting for these potential barriers in liquidity stress tests and contingency funding plans (CFPs) as improvements on current practice.

Banks are reluctant to disclose the results of their liquidity stress tests (apart from to supervisors, rating agencies and some key counterparties) because the results cannot be interpreted without a detailed understanding of the scenarios and the considerations underlying them. The results

¹ The mandate for the analysis in this report focused on liquidity stress testing and contingency funding plans. Where natural overlaps exist, the results in the present report are consistent with the Basel Committee on Banking Supervision (BCBS) “Principles for Sound Liquidity Risk Management and Supervision”, as well as with the “Second Part of the Committee of European Banking Supervisors (CEBS) Technical Advice to the European Commission on Liquidity Risk Management”.

are therefore not comparable across banks. In addition, public disclosure could have negative repercussions on the liquidity situation of some banks under certain circumstances. While more disclosure, in particular on banks' liquidity risk management, is generally to be encouraged, the BSC considers that, in the case of liquidity stress test results, the detrimental effects of mandatory public disclosure are likely to outweigh the benefits. Nevertheless, a majority of banks also regard public disclosure in this area as a tool for enhancing market discipline, subject to certain preconditions. In this respect, concerted rounds of common liquidity stress tests – which are conducted, for example, for supervisory/financial stability purposes without affecting banks' routine liquidity stress tests for internal purposes – would help to increase the comparability of the output of internal models across banks. In such exercises, participating banks use their bank-specific approaches, methods and tools to carry out liquidity stress tests based on a common problem specification. Such concerted rounds of common liquidity stress tests would enable authorities to approximate the potential systemic impact of a certain stress scenario. Furthermore, banks could expect to benefit in various ways through benchmarking and learning effects. The BSC considers that regular and comprehensive information sharing with central banks and supervisors – particularly in concerted rounds of common liquidity stress tests – would substantially improve the monitoring of the liquidity situation of the financial system and its components. Any such concerted rounds of liquidity stress tests at the EU level would be put to the consideration of the appropriate decision-making bodies.

The *typology of EU banks' CFPs* is highly diverse, both in terms of their level of detail and their exact components. The typical CFP consists of a set of liquidity measures, internal procedures, responsibilities and lines of authority to be activated under liquidity stress. CFPs exist at the group level and/or the entity level, but many CFPs seem to cover only parts of the organisation, both in terms of geographic exposure and business areas. Some banks regularly test some parts of their CFP (e.g. annual

“dry runs”), while others have never tested their CFP. A recurring theme in the analysis of CFPs is the importance of balancing the need for well-defined operational procedures that can be implemented immediately with the need for appropriate flexibility in crisis situations. Given the diversity and complexity of practices, supervisors and central banks need to enhance their understanding of individual CFPs. This is useful from a microprudential perspective, in order to assess their adequacy in the light of different business models and risk profiles, and from a systemic perspective, in order to assess the implications of banks' reaction functions in periods of liquidity stress for the stability and the liquidity stance of the financial system. Aggregate evaluations of CFPs across the banking sector can subsequently feed back into and inform individual supervisory CFP reviews.

There is no “ideal” CFP that would be applicable to all banks. However, the analysis highlighted a few desirable characteristics which are consistent with the “Principles for Sound Liquidity Risk Management and Supervision”, which were issued by the Basel Committee on Banking Supervision (BCBS) in 2008: The BSC considers it crucial that the organisational level at which the CFP is set up does not leave any coverage gaps. Conditions and procedures have to be in place to ensure that decisions can be made promptly and that decision-makers have rapid access to timely and detailed liquidity information. The BSC regards the diversification of funding sources and funding maturities in CFPs as important. In the BSC's opinion, it is also important that CFPs take into account potentially destabilising second-round effects on markets from liquidity-saving measures and/or asset sales, particularly in the case of large institutions. Furthermore, potential contagion effects at the money market level stemming from liquidity problems at money centre banks could be reduced by factoring into their CFPs the objective of maintaining the institutions' role at the money market level even in times of stress. Credible communication strategies and effective internal procedures tied closely to their CFPs are considered essential. The

BSC highlights the importance of timely and comprehensive communication with regulators and central banks in periods of stress.

An analysis of EU banks' experience with liquidity stress tests and CFPs during the recent market turmoil shows that there is substantial room for improvement in both areas.

Changes in the strategic behaviour of financial institutions in a stress event, often referred to as “second-round effects”, were a key characteristic of the recent disruptions in financial markets, particularly in banks' funding markets. Banks only include such second-round effects on markets in their stress tests by rule of thumb, if at all. The BSC points out that a better assessment of behavioural effects in future stress test scenarios and also within CFPs would improve the relevance of the results.

During market turbulence, liquidity may not be available for all maturity buckets. Considering unexpected shortening/lengthening of funding terms in banks' liquidity stress tests would be a valuable improvement. The previously unencountered persistence of higher refinancing costs implies that the inclusion of profit and loss (P&L) effects in longer-horizon scenarios would add value.

During the recent turmoil, linkages between different markets and interactions between different types of risk emerged unexpectedly. At present, integrated models accounting for all aspects of liquidity, credit and market risk are not yet available, partly because of the high model risk associated with increased model complexity. However, the BSC would regard it as an improvement if liquidity stress tests were to take such linkages into account in the future, at least in a simplified manner (e.g. in the scenario design).

Another observation made by banks during the financial stress is that triggers used to activate CFPs were not always chosen appropriately to capture the market turmoil in a timely manner. Triggers need to be carefully designed and

reviewed regularly so that a crisis can be recognised both promptly and correctly. This suggests close alignment of CFPs with stress testing results. The BSC considers that triggers should be neither mechanically relied upon nor so flexible that they fail to detect crises or to activate the next escalation level.

The analysis also shows that banks faced or feared potential reputational risks associated with calling upon funding sources in their CFPs. The BSC finds that examining different funding sources in CFPs in the light of such risk and considering possible mitigating factors is essential.

A number of banks said that, in response to the market turmoil, more emphasis will be put on central bank facilities in future CFPs. However, in the opinion of the BSC, recourse to central bank liquidity facilities in CFPs should be limited only to those routinely provided: emergency facilities should not be relied upon in CFPs and potential reputational costs associated with borrowing from the central bank in stress situations should be taken into account. Extraordinary central bank operations (such as the ECB fixed rate tenders with unlimited volume on 9 August 2007) should not be relied upon in CFPs.

During the recent turmoil, several banks encountered various operational problems in accessing contingency funding sources. These were due, in particular, to a lack of experience with certain refinancing sources or a shortage of counterparties. When identifying “fail-safe” refinancing sources for inclusion in CFPs, the necessary operational arrangements have to be in place in order to access these sources easily during episodes of market turbulence. This implies regular and thorough testing and plausibility checks, with a view to potentially revising and updating the CFP in the light of changing conditions inside or outside the bank.

During the recent turmoil several banks also encountered difficulties in selling assets or pledging assets in secured lending. Regularly

testing the capacity of liquid assets to actually generate positive cash flows might not only prove useful in its own right, but also improve the identification of available and easily locatable liquid assets within a banking group in times of stress.

Although recent events indicate that CFPs have proved useful in establishing chains of command, a large number of banks failed to activate their CFPs. In some cases, this was blamed on the reputational costs of doing so. The BSC considers it important that potential reputational challenges associated with the activation of CFPs be overcome, as otherwise they substantially reduce the usefulness of an important liquidity crisis management tool.

While most of the areas in need of improvement identified by the BSC could be addressed in the short term, it is likely that improvements addressing best-practice model developments (such as the inclusion of second-round effects or more integrated views of liquidity, credit and market risk) or the adoption of guidelines can be addressed only in the medium term.

2 INTRODUCTORY REMARKS, PROJECT BACKGROUND AND MANDATE

Liquidity risk is inherent in banks' maturity transformation. Owing to economic frictions (i.e. asymmetric information), liquidity shocks can have negative externalities for the financial system as a whole. Liquidity shocks at one bank can spread to other banks via numerous channels, such as asymmetric information, direct interbank exposures and through the effects on the liquidity of financial markets. At the same time, liquidity problems can increase solvency risks at individual institutions and their counterparties. Indeed, the recent financial market turmoil has demonstrated how sudden drops in liquidity for certain assets can jeopardise the shock absorption capacity of the financial system. To mitigate liquidity risk, effective liquidity management by banks is crucial. Central banks and bank supervisors must therefore be concerned with banks' liquidity risk management and liquidity shock absorption capacity. Stress testing procedures and CFPs constitute an integral part of this.

In order to fully understand how banks prepare themselves for liquidity stress situations, more detailed and in-depth work was deemed necessary. In this context, the Governing Council asked the BSC to further explore banks' liquidity stress testing practices and CFPs.

In October 2007 the BSC mandated the Task Force to address the following questions:

1. What is the typology of EU banks' liquidity stress testing techniques and CFPs?
2. Do banks' liquidity stress tests and CFPs seem adequate as regards the absorption of liquidity shocks? In particular, how did banks' liquidity stress tests perform during the recent liquidity shocks that hit major money markets? What were the implications of shortcomings in banks' liquidity stress tests and CFPs for counterparties and money markets more generally?

A number of reports by international fora discuss banks' liquidity risk management in the light of

the recent market turmoil (e.g. the Financial Stability Forum, the BCBS, the Committee of European Bank Supervisors – see Annex 2 for an overview). Deficiencies in liquidity stress tests and CFPs feature prominently in all of them. This report adds value in several ways. First, the Task Force's focused mandate allows it to dig deeper into the methods and practices of liquidity stress tests and CFPs. With regard to the lessons learned, the report highlights structural issues that go well beyond the mapping of the recent turmoil in future liquidity stress scenarios.² Second, the report provides a typology of liquidity stress tests and CFPs for 84 EU banks in 25 of the EU Member States.³ The sample includes not only major cross-border banks, but also many medium-sized and a few smaller ones. Third, it adds a specific central bank perspective to the usual micro and macro-prudential perspective.

The report comprises six sections and three annexes. Section 1 is the executive summary. Section 2 contains introductory remarks, as well as the project background and mandate. Section 3 presents a central bank perspective on banks' liquidity risk management. Section 4 provides a typology of EU banks' stress testing techniques and analyses the critical aspects of the stress testing process. Section 5 presents a typology of EU banks' CFPs and investigates potential shortcomings. Section 6 elaborates on EU banks' experience with liquidity stress tests and CFPs during recent events and highlights issues to be considered by banks and central banks. Annex 1 describes the methods applied in the Task Force's investigation and the sample of banks included in the survey.⁴ Annex 2 reviews the available literature on liquidity stress testing and CFPs as well as on the recent market turmoil and looks at the views of academics, practitioners, regulators and central bankers. Annex 3 contains the references.

2 Although the report contains "lessons learned", it is not intended to take a prescriptive approach to banks' liquidity stress tests or CFPs.

3 Please refer to Annex 1: Methodology and sample.

4 The following analysis will only refer to sub-samples in case of relevant and significant differences.

3 A CENTRAL BANK PERSPECTIVE ON BANKS' LIQUIDITY RISK MANAGEMENT

The BSC supports the current supervisory focus on banks' liquidity risk management as presented in the reports of a number of international fora,⁵ but regards it as important to highlight in the following section why central banks (independently of their potential supervisory/financial stability roles) should also be concerned about banks' liquidity risk management. Today central banks rely on open market operations to implement their monetary policy decisions and to distribute liquidity to the financial system and thereby to the real economy. Banks' liquidity risk management is an important issue for central banks because liquidity shocks at one bank can have *contagion effects* and could disrupt the efficiency and stability of the *money market* via three channels:

- First, owing to asymmetric information, a liquidity crisis at one bank can lead to increasing uncertainty in the wholesale and retail markets with regard to the liquidity situation of other banks, which – in severe cases – could in turn lead to a drying-up of money market liquidity and/or to a bank run. In less severe cases, it could raise refinancing costs for other banks and increase uncertainty with regard to future cash flows and market conditions, which exacerbates liquidity management.
- Second, the large and increasing share of interbank exposures and money market instruments in banks' funding can cause contagion, as liquidity problems at one bank directly translate into increasing liquidity pressure (e.g. owing to reductions in cash inflows and unexpected refinancing requirements) on its interbank counterparties.
- Third, asset fire sales can lead to a market meltdown under certain circumstances, which in turn decreases the counterbalancing capacity of all banks and, consequently, their liquidity risk-bearing capacity.

These forms of contagion provide a rationale for public intervention in the form of liquidity regulation and reporting requirements, especially in the presence of potential macro liquidity shocks. Such public intervention is in the interests of all banks (not only central banks), as banks increasingly rely on liquid and efficient money markets for funding⁶ and would also have to shoulder the costs of spillover effects of individual banks' liquidity problems at the money market level.

Banks' liquidity problems can *adversely affect central bank core tasks*. First, problems at the money market level could seriously impede the liquidity supply to the financial system and the real economy. Second, volatile money market rates and increased uncertainty about the liquidity stance of the banking system make estimating the structural liquidity deficit⁷ more difficult. This raises the probability that the overnight interest rate will deviate from the intended policy target, which in turn would increase uncertainty about the liquidity stance of the system. In such scenarios, central banks would have to intervene frequently via fine-tuning operations to stabilise the market rate. The elevated level of uncertainty in the system exacerbates the implementation of monetary policy decisions. Third, central banks are responsible for promoting the smooth functioning of the payment system. Banks' liquidity problems can have contagion effects in the payment system and hamper its smooth functioning. Fourth, illiquid banks can come under pressure to sell assets. A vicious circle of decreasing market liquidity and increasing asset sales to raise funds could develop into liquidity (and solvency) problems for the

5 The supervisory perspective on banks' liquidity risk management is extensively covered in many reports of international fora (e.g. Financial Stability Forum, Basel Committee on Banking Supervision, Senior Supervisors Group, Committee of European Banking Supervisors), some of which are included in the literature overview in Annex 2.

6 See European Central Bank (2007) and European Central Bank (2002).

7 We define the structural liquidity deficit as the difference between the aggregate demand for reserves at the central bank and the aggregate supply of these reserves at the intended policy rate (see Schmitz 2006, p. 137).

banking sector, which in turn could negatively affect, inter alia, the efficiency and stability of the money market. Fifth, central banks can play a pivotal role in crisis management. In order to do so effectively, they need reliable information about banks' liquidity risk management and shock absorption capacity in order to form an adequate assessment of the nature and potential impact of the crisis and to decide on an effective and efficient policy response. Given that public funds can be at risk, any action must be based on sound information.

On the basis of these welfare-theoretical considerations, what would *a framework for banks' liquidity risk management* ideally look like from a central bank perspective?⁸

1. Liquidity risk is institution-specific. Any framework for banks' liquidity risk management should acknowledge that banks tailor liquidity management, stress tests and liquidity reserves to their specific needs. This, however, does not preclude the framework from aiming at capturing liquidity risk factors that are common to all banks and at providing cross-bank comparisons.
2. The combination of a tiered market structure and a concentration of activity implies that the potential severity of contagion is higher for money centre banks than for small banks at the fringe of the market. This provides a rationale for central banks to focus on the liquidity risk management, stress tests and CFPs of money centre banks in particular and underlines the case for proportionality.
3. Liquidity risk differs among credit institutions and the underlying risk should be properly reflected. This provides a rationale for a risk-based approach. The lender of last resort function of central banks is regarded as (implicit) insurance for banks and for the money market against liquidity shocks that money market participants are unwilling to absorb (liquidity hoarding⁹) or unable to absorb (macro shocks, such as the money market shock which commenced on

9 August 2007). The value of this (implicit) insurance increases with banks' exposure to liquidity risk, which increases moral hazard. The framework for banks' liquidity risk management should be risk-based; it should reflect the underlying risk exposure, not only for prudential reasons but also to limit moral hazard ex ante, before the onset of a crisis.

4. Central banks need up-to-date information about banks' liquidity risk exposure and liquidity situation on an ongoing basis. Liquidity requirements based on historic balance sheet positions or cash flows are of little use in this respect. Therefore, banks should make available to central banks (directly or indirectly via supervisors) data based on forward-looking measures of liquidity risk exposure and counterbalancing capacity, i.e. liquidity stress tests results (including the necessary background information).
5. All materially relevant sources of liquidity risk should be included under any approach, irrespective of their nature as liabilities or assets, on-balance sheet or off-balance sheet, currency denomination, etc.
6. The approach should be applicable both under business-as-usual conditions and under stress in order to increase simplicity and reduce costs for banks.

To sum up, central banks need to be concerned with banks' liquidity risk management in general and with liquidity stress tests and CFPs in particular. This has two broad implications for central banks. First, in order to avoid potential negative effects on money markets, central banks have to place strong emphasis on the prevention of systemic liquidity crises. This requires a sharper focus on the liquidity situation of individual banks. As Walter Bagehot (1873) pointed out: "In wild periods of alarm, one failure makes many,

⁸ See Schmitz and Ittner (2007).

⁹ The term "liquidity hoarding" is not meant pejoratively in this report; often it might be prudent liquidity risk management and/or a reaction to increased liquidity requirements by authorities.

and the best way to prevent this derivative failures is to arrest the primary failure which caused them". Second, as will be shown in the report, the value of contingency funding sources is highly compromised if banks face technical, legal or procedural hurdles to accessing them in a timely manner – irrespective of whether they are central bank sources or market sources. For central banks, this provides an incentive to be transparent about the technical, legal and procedural prerequisites for accessing central bank funding under stress; but banks should also be transparent about their CFPs vis-à-vis central banks (directly or indirectly via the competent authorities). However, this is not an argument against constructive ambiguity with regard to the conditions under which such funding is provided. There can be no mechanical bail-out option and central banks must retain discretion over potential reactions and the instruments applied. While central banks' regular facilities (e.g. open market operations, standing facilities) are common funding sources in CFPs, their emergency operations – whether at the market or the individual bank level – should, in the opinion of the BSC, not be included.

At the potential emergence of a liquidity crisis, central banks need to make judgements very quickly in an atmosphere of great uncertainty. They need to answer two main questions: 1) what is the scale of the liquidity problem at an individual bank which is asking for liquidity assistance; and 2) what are the potential systemic implications of the liquidity stress? In order to make informed judgements, they need reliable, comparable and comprehensive information in a timely manner. Central banks need to know banks' exposures to liquidity risk and liquidity shocks, their capacity to absorb shocks and their potential reactions to shocks. Such information is contained in liquidity stress test results and CFPs.¹⁰ Concerted rounds of common liquidity stress tests are one option for addressing the issues of reliability, comparability and comprehensiveness. A combined view of banks' stress test results stemming from such exercises could also provide a way to approximate externalities and systemic effects of individual banks' liquidity problems. A combined view of

banks' CFPs can provide information about the systemic impact of banks' reactions to liquidity shocks. These issues and others are investigated in depth in this report.

¹⁰ At the feedback workshop, industry experts underlined the importance of central banks and supervisory authorities understanding banks' CFPs and some suggested that authorities could be involved in CFP testing in the form of "table talk exercises" with banks.

4 TYPOLOGY OF LIQUIDITY STRESS TESTING TECHNIQUES

Liquidity stress tests allow banks to assess the possible impact of exceptional but plausible stress scenarios on their liquidity position. The results of the stress tests can help banks to determine the size of liquidity buffers against potential liquidity shocks.

The following sections illustrate the latest techniques in terms of liquidity stress tests performed by the interviewed banks, structured according to important aspects of the stress testing process.

4.1 LIQUIDITY RISK TOLERANCE

Risk tolerance – the maximum level of risk that the bank is willing to accept, bearing in mind not only normal times but also possible stress situations – is a key concept in banks’ general risk management (especially of credit and market risk), but it appears less prominent in banks’ liquidity risk management. The quantification of risk tolerance presupposes that 1) a probability space can be defined that spans all material realisations of a stochastic variable; and 2) that a probability distribution can be reasonably well approximated over that probability space. On that basis, a bank can then decide what risk-bearing capacity it wants to hold, in terms of the cumulative probability distribution of shocks it wants to survive (e.g. 99.9%). The major problem in the area of liquidity risk management is that it is a low probability and high impact event, which implies that it is not feasible to assign probabilities to all (reasonably well-defined) material liquidity shocks. The number of observable liquidity shocks and their institution-specific nature would attach high uncertainty to the definition of the probability space and the approximation of probability distribution. It is for this very reason that tail events, such as those relevant to liquidity risk management, are approximated by stress tests.

Of the 84 banks in the survey, most (60) report that they quantify their liquidity risk tolerance,

19 report that they do not and five provide no answer to this question (see Chart 1).

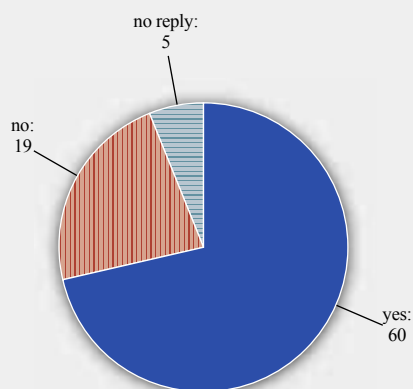
In the sample, 32 banks refer to their *limit system* as quantifications of their liquidity risk tolerance. However, strictly speaking, limit systems are more risk control instruments than quantifications of risk tolerance and should, in the opinion of the BSC, be considered only as proxies for the quantification of liquidity risk tolerance. The relation between limit systems and stress tests differs among banks. In 22 cases, limit systems are based on expert judgement; in six they are linked to liquidity stress test results; in another three, statistical measures of past liquidity positions (variance of excess liquidity reserves or maximum utilisation levels of liquidity reserves over a relatively short period of three to six months) are utilised; and one bank quantifies its liquidity risk tolerance in terms of a buffer over its regulatory minimum liquidity requirement.

In 27 banks, the quantification of liquidity risk tolerance is defined in terms of *survival horizons* within particular liquidity stress tests. The values vary greatly from one to 52 weeks. This cannot be interpreted as differences in risk tolerances alone, because the survival

Chart 1 Quantification of liquidity risk tolerance

(number of banks)

Does your bank quantify its liquidity risk tolerance?



Source: BSC survey.

horizons also depend on the chosen scenario, the respective assumptions, their quantifications and the underlying models and methods.

Out of the 19 banks that do not routinely quantify their liquidity risk tolerance, seven refer to their limit systems as proxy for their liquidity risk tolerance. A number of others (11) point out either that they are in the process of upgrading their liquidity risk management systems, that they have a very comfortable liquidity position or that they basically implement liquidity policies formulated at the group level.

In general, the quantifications are contingent on scenario assumptions and liquidity stress test models. Banks do not routinely provide probabilities (conditional only on their business model and funding sources) on the basis of the historical distributions of net cash flows and/or observed liquidity stress events in their quantification of liquidity risk tolerance. This is mostly due to a lack of reliable long-term time series, which in turn is a consequence of the nature of liquidity stresses as low probability, high impact events that are highly institution-specific. Quantifications of liquidity risk tolerance are based on expert judgement (how likely do experts consider a particular stress event to be?) because survival horizons (and often limit systems too) are based on stress tests. The majority of banks focus on risk containment, i.e. limit systems which are interrelated with liquidity risk tolerance, rather than the quantification of liquidity risk tolerance per se. The survival horizons are not comparable across banks. Given that risk tolerance is a key concept in risk management, the BSC deems it essential that banks form an opinion regarding the nature and severity of liquidity shocks which they plan to be able to absorb. Similarly, the BSC considers that they should have a clear understanding of the shocks which they consider too unlikely and too severe to hold counterbalancing capacity against. Accordingly, banks' risk tolerance and its main determinants should be well documented.

The vast majority of banks try to approximate the quantification of liquidity risk tolerance by survival horizons or a limit system. Among them, the

majority of banks focus on risk containment, i.e. limit systems which are interrelated with liquidity risk tolerance, rather than the quantification of liquidity risk tolerance per se. The quantifications of liquidity risk tolerance are based on expert judgement and are highly subjective and conditional on a range of assumptions. Consequently, they are not comparable across banks. Unsurprisingly, the quantifications of liquidity risk tolerance differ substantially across respondents.

Nevertheless, the BSC deems it essential that banks have a well-documented view of their liquidity risk tolerance and its main determinants, even if they cannot quantify it objectively and precisely.

4.2 TYPES OF SCENARIO

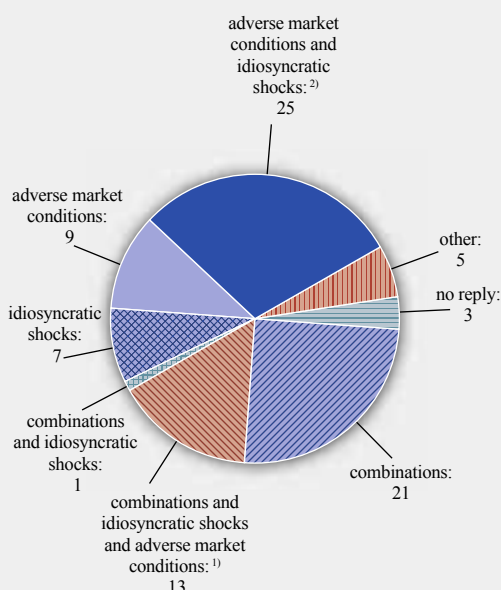
A considerable number of the surveyed banks (35) use a combination of adverse market conditions (system-wide) and idiosyncratic shock to their institutions. Of these banks, 21 run only the combined scenario, while 13 also run both market and idiosyncratic scenarios separately and one bank also runs idiosyncratic scenarios. Of those banks that do not run combined scenarios, most (25) implement both market stress and idiosyncratic stress scenarios separately, while a smaller number rely exclusively on either a market-wide stress scenario (nine) or a firm-specific stress scenario (seven). Ten banks stated that they considered other types of stress test scenario and three banks did not respond to the question.

Banks which focus on isolated risk factors in their stress scenarios (i.e. either a name crisis or a systemic crisis) implicitly assume that i) these risks are independent of each other; ii) they have very low probability; and iii) their combined probability is therefore negligible. These assumptions are too optimistic. Banks are therefore urged to implement combined market and idiosyncratic stress scenarios. In general, banks report that they find it difficult to build severe yet plausible scenarios as the characteristics and impacts of liquidity crises vary substantially.

Chart 2 Types of stress test scenario

(number of banks)

What types of stress test scenario do you consider: adverse market conditions (1), idiosyncratic shocks (2), combinations of (1) and (2) or other scenarios?



Source: BSC survey.

Notes:

1) One of the 13 banks also performed other tests.

2) Three of the 25 banks also performed other tests.

Most banks perform liquidity stress tests with idiosyncratic scenarios and/or market-wide stress scenarios, but less than half of them run combinations of these. Some banks even rely exclusively on either market scenarios or idiosyncratic scenarios. Banks are urged to implement both market and idiosyncratic scenarios as well as combinations thereof.

4.2.1 IDIOSYNCRATIC (BANK-SPECIFIC) LIQUIDITY STRESS TEST SCENARIOS

One of the questions asked banks to specify the assumptions they made within their idiosyncratic liquidity stress test scenarios and to pick out the three most important ones for them. Over one-third of respondents (30) included rating downgrades in their scenarios, varying from one to four notches in severity. Out of these 30 banks, ten complemented their assumptions on rating downgrades with other assumptions, such

as operational risk, withdrawal of corporate and retail deposits, large credit losses, rumours, reduction in counterparty limits, a run on the bank or shortage of liquidity in the market. At least three banks combined long-term and short-term rating downgrades in the stress test scenarios.

Fewer than one-third of the banks interviewed (26) build their stress test scenarios around a potential loss of confidence by fund providers in the bank due to stock price performance, unexpected credit losses or rumours, rather than around rating downgrades. On the whole, these banks assumed that such a loss of confidence would result in higher-than-expected withdrawals of retail deposits and institutional/corporate deposits. The severity of the outflows was normally linked to the length and intensity of the scenario considered.

Other sources of stress envisaged by those banks that do not include rating downgrades in their stress testing scenarios are as follows:

- reduced access to wholesale funding (secured/unsecured markets);
- reduction in credit lines available and counterparty limits;
- increased haircuts and collateral calls;
- reduction in asset prices;
- utilisation of credit commitments;
- inability to draw down on precommitted lines;
- currency conversion; and
- increase in demand for financial funding by the entities within the group.

Given the very limited number of survey responses, it is only possible to make a few

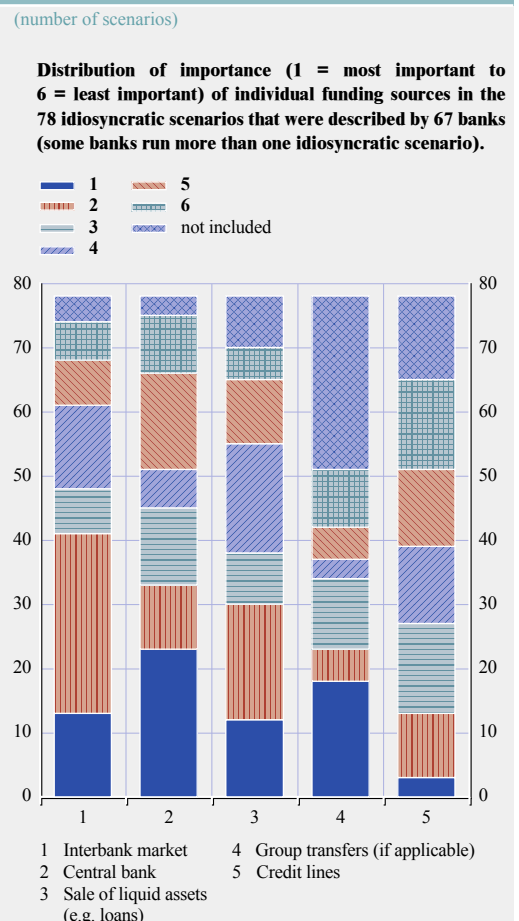
cautious observations about specific scenario assumptions:

- On loss of retail deposits, the most common assumption was that 10% of retail deposits would be withdrawn, although a few banks considered the withdrawal of up to 30% of retail deposits.
- On loss of interbank deposits, more severe assumptions were applied by many banks. Nearly one-fifth of banks expected that interbank deposits would disappear altogether, with the remaining responses scattered in the 0% to 90% range.
- On outflows from investors, the results were polarised with equal numbers of banks expecting either a zero outflow or a complete flight of funds.

These stress test assumptions were in most cases based on expert judgement, either on its own (19 banks) or in combination with statistical analysis (19 banks). Only a few banks (six) relied exclusively on statistical analyses of available time series, perhaps reflecting the scarcity of historical data in relation to liquidity stresses and the difficulty in modelling the data available.

Of the 84 banks surveyed, 67 ranked the importance (1 = most important, 6 = least important) of the following five categories of funding sources within each of their idiosyncratic scenarios: credit lines, interbank market, central bank, group transfers (if applicable) and sale of liquid assets (e.g. loans). The rankings for these funding sources vary greatly in the 78 idiosyncratic scenarios that are run by the 67 banks. Different funding sources appear to be of greater or lesser importance for different banks, although a relatively large number of banks attached a high importance (ranking 1 or 2) to the interbank market and central bank liquidity. By contrast, credit lines seem to be of lesser importance, achieving a more important ranking (1 to 3) in only 27 scenarios, while in 38 scenarios it was ranked less important (4 to 6) and in 13 scenarios this funding source was omitted entirely.

Chart 3 Idiosyncratic liquidity stress test scenarios



Source: BSC survey.
Note: 67 banks described in total 78 idiosyncratic scenarios. 17 banks did not respond to this question.

There is considerable diversity in the implementation of idiosyncratic firm-specific stress tests, both as regards the severity of any ratings downgrade (one to four notches) and the range of funding sources, asset prices and other liquidity factors which are affected. Even in similar idiosyncratic scenario types, the quantitative impact on funding sources and counterbalancing capacity varies widely. Banks regard the interbank market and central bank facilities as reliable funding sources in many idiosyncratic scenarios, although results naturally vary across scenarios and banks.

4.2.2 SYSTEMIC (MARKET-WIDE) LIQUIDITY STRESS TEST SCENARIOS

The surveyed banks described a multiplicity of market-wide scenarios, combined with different sets of assumptions concerning the effect that these scenarios were expected to have on both the asset and liability side of their balance sheet. The number of circumstances and assumptions envisaged is almost equal to the number of banks interviewed. However, two clearly discernible patterns emerge from the survey responses.

Approximately half of the respondents described their market-wide events as specific situations, either by referring to:

- a particular geographical context (e.g. central European liquidity crisis, global markets, major financial centres, emerging markets, local money markets or retail deposit markets);
- the cause of the stress (sub-prime market liquidity crisis, government crisis or change in monetary policy, sudden and deep economic recessions or default of primary market counterparty);
- the closure of key funding markets (bond and covered bond markets, unsecured and secured interbank markets or securitisation market);
- a set of negative economic indicators (increase in bond yields, drop in stock prices, rise in credit spreads, rise in short-term interest rates or appreciation/depreciation of domestic currency); or
- the perceived severity of the stress (mild market crisis/severe market crisis).

In some cases the duration of the stress is specified.

On the other hand, a considerable number of banks do not identify specific situations, but rather describe a set of assumptions of varying intensity/severity with consequences for their

funding capability and the value of their assets. The different combinations of assumptions are unique to each respondent. The following is a non-exhaustive list of the most widely used assumptions:

- marketable securities cannot be sold immediately and only at a lower price than may be considered a fair price;
- securitisation is impossible, commercial paper (CP) and certificate of deposit (CD) markets disrupted;
- repo markets and unsecured interbank markets are closed;
- credit lines granted are drawn by corporate clients;
- professional demand deposits are withdrawn;
- retail deposit stability decreases;
- foreign exchange (FX) market dislocation;
- inability to secure intra-group support; and
- no capital market funding.

Banks were also asked – for each of their scenarios – which of a number of given aspects were assumed to be affected and to indicate whether these aspects had been relevant in the recent turmoil and whether such assumptions would receive more weight in future liquidity stress tests.

The unsecured interbank market and the bond market emerged as being of key importance in a majority of the banks' market-risk scenarios: more than one-half of the banks had assumed these markets to be affected, more one-half had found these assumptions to be relevant in the recent turmoil and more than one-quarter of banks confirmed that they would receive more weight when designing stress scenarios going forward.

The withdrawal of retail deposits and disruptions in the repo, CD and CP markets were also of key importance in market-risk liquidity stress tests for a significant minority (around four in ten) of the respondent banks. Repo, CD and CP markets proved to be relevant in over a quarter of cases, but few banks (one in seven) seem to have experienced a shortage of retail deposits since the liquidity crisis commenced. Consequently, more banks will focus on retail deposits in future rather than on the repo, CD and CP markets.

Disruption to the covered bond market was considered by over a quarter of the respondent banks, while the FX swap market and the securitisation market were considered by less than one-fifth of the respondent banks. It is worth noting that, in their assumptions, 22 of the banks surveyed included additional key funding markets, such as wholesale euro deposits, central banks, corporate banks, loans, funding at parent bank, syndicated and bilateral loans, own issuances and repo transactions with non-banking clients. Half of these banks found these aspects to have been significant in recent months and only eight stated that they will receive more weight in the future.

In terms of the location of the markets considered, slightly more than one-half of the banks interviewed considered a stress in national markets, while slightly less than one-half considered stress in international (e.g. euro area) markets. Only one-fifth of respondents considered regional scenarios (e.g. central and eastern European countries).

There is considerable diversity in the implementation of market-wide stress test scenarios. About one-half of the banks focus on specific markets (e.g. geographic or product-specific), while many others are less explicit about the nature of the scenario but focus on the severity of the impact on various liquidity risks or funding sources. Even in similar scenarios the assumptions and quantifications differ widely among banks. Many banks run neither market nor idiosyncratic scenarios.

4.3 TIME HORIZON

One year ago the BSC report on banks' liquidity risk management¹¹ found that the time horizon for liquidity risk management had shortened considerably compared with earlier decades due to a variety of factors, including increased use of financial markets with shorter clearing and settlement cycles, increased internationalisation of business, increased use of real-time gross settlement (RTGS) systems, increased internet banking, etc. One banker's definitions of liquidity-risk time horizons were "short-term is intraday, medium-term is overnight and long-term is one week".

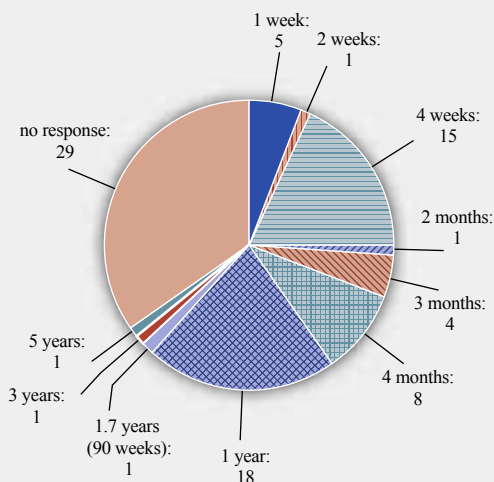
Scenarios based on short-time horizons clearly miss out on important features of chronic liquidity stresses, such as the recent market turmoil. But longer-time horizons do come at a cost, as, for example, behavioural reactions of other market participants may need to be modelled as well. This, in turn, requires assumptions which increase model risk.

¹¹ See European Central Bank (2007).

Chart 4 Time horizon

(number of banks)

What is the maximum horizon of your three most important market scenarios?



Source: BSC survey.

This may be the reason why the responses from the 55 banks which indicated the duration of their market scenarios show that a large proportion of the banks run scenarios for a short or medium-term time horizon (see Chart 4): for 19 banks the maximum market stress scenario horizon lies between one and four weeks and for 13 banks between two and six months. Only 18 banks run stress test scenarios with time horizons of one year, while three banks used horizons of more than one year. Overall, the most commonly used time horizons seem to be four weeks and 12 months.

Generally, it would be advisable for banks to consider shorter-term market scenarios as well as longer-term market scenarios. This would allow banks to consider both short but severe shocks and less severe but persisting shocks. However, only some of the banks interviewed seem to follow this approach. Of the 55 banks that mentioned the duration of their scenarios, in addition to the shorter-term market scenario (less than eight weeks), only three also run a scenario that lasts 26 weeks and only nine also run a scenario that lasts 52 weeks. The remaining banks run either only one market scenario (25 banks) or do not run scenarios with noticeably different time horizons (18 banks).

Only 31 banks responded to the question of whether duration was a problem for them during the market turmoil in any of their relevant key funding markets. Of those, 17 banks said that duration had not been a problem, while 14 said it had. Of the 14 banks that had experienced problems with duration, about one-half use longer time horizons and about one-half shorter horizons.

Time horizons for stress test scenarios mainly vary between four weeks and 12 months (although longer time horizons are also cited), which is considerably longer than the very short-term focus identified in the previous BSC report on liquidity risk management. This could well be related to the recent turmoil. The relevance of liquidity stress tests is substantially improved if a range of time horizons, designed to capture

both potential short-term shocks and longer-term episodes of market turmoil, is considered.

4.4 SCENARIO REVIEW

As far as scenario review is concerned, over one-quarter of respondents indicated that liquidity stress scenarios are normally revised once a year, with a smaller number of banks conducting reviews either more frequently (seven) or even continuously (one). Responses show that, over the last five years, less than one-quarter of banks have adjusted their liquidity stress scenarios between one and five times.

Approximately one-quarter of the banks interviewed would appear not to have introduced any major changes to their stress test scenarios over this same period. In most of these cases, this lack of revision was due to the framework for stress testing having been introduced recently (2006-2007). However, five banks did not provide any explanation for this.

As regards the date when the last significant adjustment took place, nearly one-half of respondents (38) performed such a change within the last 12 months (19 in the second half of 2007; 19 in the first half of 2008). This information, combined with the data collected on the triggers for such adjustments (see below), indicates that many banks reacted to the market turmoil which commenced during the summer of 2007 by fine-tuning their stress test scenarios and assumptions. Of the other banks which answered this question, ten completed the last review during the first half of 2007; three during the course of 2006; and five back in 2005. Responses to the questionnaire reveal that, of those banks which were at the early stages of developing a framework for stress testing liquidity risk, the majority come from new EU Member States. The same applies to those banks which stated that no revision whatsoever was conducted in the period 2003-2008.

The questionnaire also asked banks about the triggers for such adjustments. In approximately one-third of cases, recent changes to stress testing

scenarios were either prompted or informed by the current liquidity/credit crisis. Around one-tenth of the banks interviewed referred to changes in policies, guidelines and practices at the group level as the main reason behind the review. Almost the same proportion of banks reported that the last adjustment to their stress testing scenarios was part of their routine annual revision or other internal processes. Other triggers mentioned, in no particular order of importance, include i) changes in regulations and/or monetary policy; ii) changes in portfolio compositions, budgets or balance sheets; iii) business developments and market changes; iv) higher volatility of revocable assets/liabilities; v) real name crises; vi) growing levels of funds in internet accounts; and vii) the Northern Rock experience and the systemic nature of liquidity risk. Responses to the questionnaire do not show any apparent connection between the triggers identified and the size/country of origin of the respondents.

The final question posed to banks in relation to scenario review was whether, in general, board approval was needed for significant adjustments to the liquidity stress test scenario. Of the 78 banks which answered this question, 42 replied affirmatively, while the remaining 36 did not need such a level of approval.

Scenario reviews are intrinsically challenging given the low frequency/high impact nature of liquidity stress events. In general, reviews should focus on the changing nature of the bank's liquidity risk exposure rather than on mimicking past liquidity shocks. Are the tested scenarios still relevant given the current funding structure of the bank? According to the BSC, special attention should be paid to the question of whether new products/new markets/new funding sources and/or changes in counterparty behaviour are adequately captured by the scenarios. To sum up, the benefit of reviews substantially increases if they place a high weight on structural issues rather than on mechanically repeating past crises.

None of the banks had implemented a stress scenario that resembled recent events. As

scenarios have to be forward-looking, they also have to take into account hitherto unseen severities, durations, correlations, simultaneities, etc. of liquidity drains and funding problems. Thus, their usefulness to some extent relies on "imagination" and an ability to think through plausible but severe shocks. In general, reviews should not be based solely on capturing the characteristics of past crises, which are unlikely to be repeated. An inevitable tension between accuracy in the light of past shocks and the forward-looking nature of liquidity stress tests emerges. Banks also argued that extreme and very innovative stress test scenarios are more likely to be dismissed as implausible by senior management. Moreover, banks appeared to imply that stress testing may need to be kept simple and straightforward and not be changed abruptly, mainly for internal communication and consistency reasons and to facilitate the monitoring of stress test results over time. The potential gain in accuracy resulting from regular reviews of scenario assumptions has to be weighed against the benefit of regularly testing a similar scenario over time.

There is considerable diversity among banks with regard to procedures and practices related to scenario reviews in terms of how frequently and how recently scenarios are/have been adjusted, the triggers for such reviews and the extent of board involvement. Scenario reviews are of particular benefit if they focus on the adequacy of scenarios in the light of internal and external changes in the bank's liquidity risk exposure. However, potential trade-offs between scenario accuracy and the value of being able to compare results across time should be borne in mind.

4.5 PERIMETER FOR STRESS TESTING

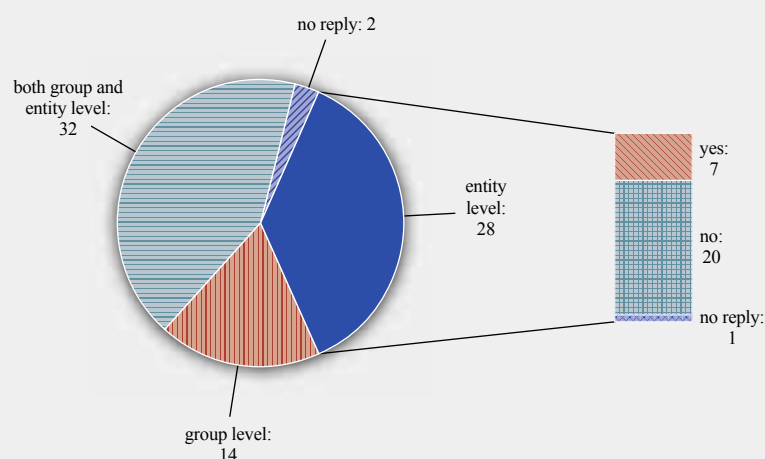
As indicated in BCBS (2008 b), "Sound Practices for Managing Liquidity in Banking Organisations", and Institute of International Finance (IIF) (2007), "Principles of Liquidity Risk Management", banks should ideally at all times have an up-to-date and complete picture of their consolidated group-wide liquidity risks and buffers, both under the assumption

Chart 5 Breadth and coverage of liquidity stress testing

(number of banks)

At what level do you perform your liquidity stress tests?

Did the recent turmoil encourage your institution to perform liquidity stress tests at group level (if it had not already done so)?



Source: BSC survey.

of “business as usual” and under various stress test scenarios. They should also be able to disaggregate that picture by legal entity, business line, geographical location, currency and time horizon. All the banks interviewed strive to achieve this ideal, but the perimeter and scope of liquidity stress tests differ significantly across banking groups. The main constraint is data availability, reflecting the degree of IT integration in each banking group and their changing business profile, in terms of merger history, product mix, changing key counterparties and structural change in markets and, consequently, in behaviour over time. Liquidity risks in new products, such as revealed by the recent market turmoil in structured credit products, may not be fully evident in the bank’s historical dataset and existing management information system reports.

The questionnaire sample consisted of eight solo banks and 76 banks which belonged to groups. Of the 76 banks in groups, 32 carry out liquidity stress testing both at the group and at the entity level, 28 perform stress tests only at the entity level and 14 only at a the group level.

In-depth analysis of the data reveals that there are significant differences between banks of different sizes and with a different country of origin.

In general, there is a positive correlation between the size of the bank and the existence of liquidity stress testing carried out at the group level. While in the case of small banking groups there was no group-wide stress testing at all, most large banks (21 out of 24) perform it on a group-wide basis. Of 51 medium-sized banks, 24 conduct group-wide stress tests. A majority of large banks (17 out of 24) use liquidity stress tests at both the group and the entity level.

Recent events have highlighted the importance of group-wide approaches to stress testing. However, since banks cannot always rely on liquidity support from other group entities, complementary non-consolidated or decentralised stress tests remain crucial. Particularly when local entities may face hurdles (e.g. regulatory or FX-related constraints) in times of stress that could prevent them from accessing liquidity from the parent/group, banks should, in the opinion of the BSC, also run

additional stress tests at the entity level, if the entity carries material liquidity risk.

The vast majority of banking groups perform liquidity stress tests at the group level (either at the group level only or in combination with stress tests at the entity level), but less than one-half of them at both levels. In cases where cross-border or intragroup flows of liquidity are a concern for a banking group, the performance of liquidity stress tests at both the group and the entity level substantially increases the robustness of the results.

4.6 BARRIERS TO CROSS-BORDER TRANSFERS OF LIQUIDITY

Banks sometimes argue that various barriers to the cross-border flow of liquidity impede their liquidity management.¹² Local liquidity requirements, large exposure (LE) limits on intragroup exposure, barriers to cross-border transfers of collateral, differences in central bank frameworks for the provision of liquidity,

operational hurdles and time zone mismatches feature prominently in this respect.

Do banks factor these barriers into their liquidity stress tests? In the sample, 35 banks factor in local liquidity requirements, 19 factor in intragroup LE limits, 11 factor in barriers to the transfer of collateral, 22 factor in differences between central bank operational frameworks, and five factor in time zone mismatches and operational hurdles to the cross-border transfer of liquidity (see left-hand panel in Chart 6).

If they are factored into the liquidity stress tests, what is their impact? Of the 35 banks which factor local liquidity requirements into their liquidity stress tests, 17 report a high impact of this constraint on the stress results, 15 a low impact and the remaining three no impact (see right-hand panel in Chart 6). With regard to LE limits, nine out of 19 banks report a high impact. The

¹² At the feedback workshop, industry representatives re-emphasised the negative impact of barriers to the cross-border flow of liquidity on group level liquidity management.

Chart 6 Barriers to cross-border transfer of liquidity in liquidity stress tests

(number of banks)

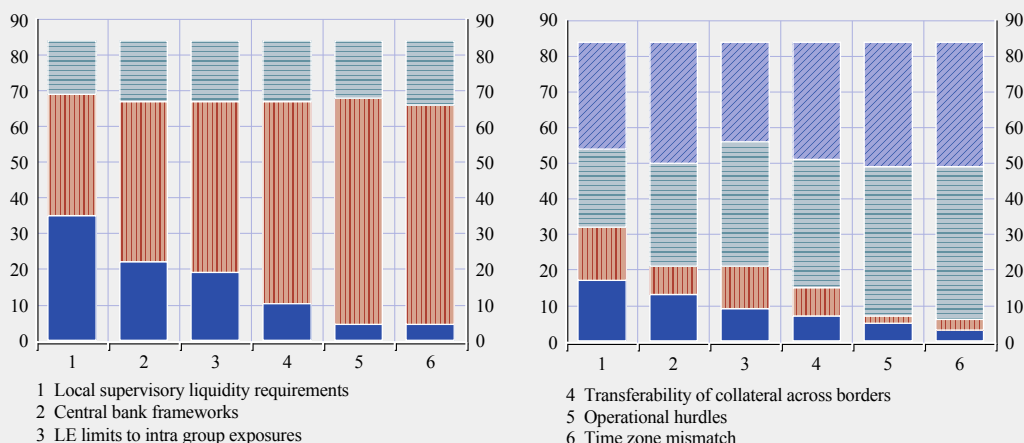
Local supervisory liquidity requirements and large exposure (LE) limits – and other limits listed below – are often mentioned as barriers to intra-group liquidity transfers. Which of the following potential restrictions are mapped into your bank's liquidity stress tests and what is their impact?

Mapped into liquidity stress tests

■ yes
 ■ no
 ■ no reply

Impact on liquidity stress test results

■ high
 ■ low
 ■ none
 ■ no reply



Source: BSC survey.

corresponding numbers for transferability of collateral are seven out of 11, and for central bank frameworks 13 out of 22. Five out of five banks report a high impact for operational hurdles and three out of five report similar results for time zone mismatches. Roughly similar numbers of banks report a low impact for the respective barriers; the remaining banks none.

There is great diversity in the inclusion by banks of potential barriers to the cross-border flow of liquidity. The results suggest that at least some of the barriers (i.e. local liquidity requirements, LE limits on intragroup exposures and central bank operational frameworks) could have a negative impact on efficient liquidity risk management for cross-border banking groups, although the actual impact during the recent turmoil proved to be confined to a small sub-set of the sample.

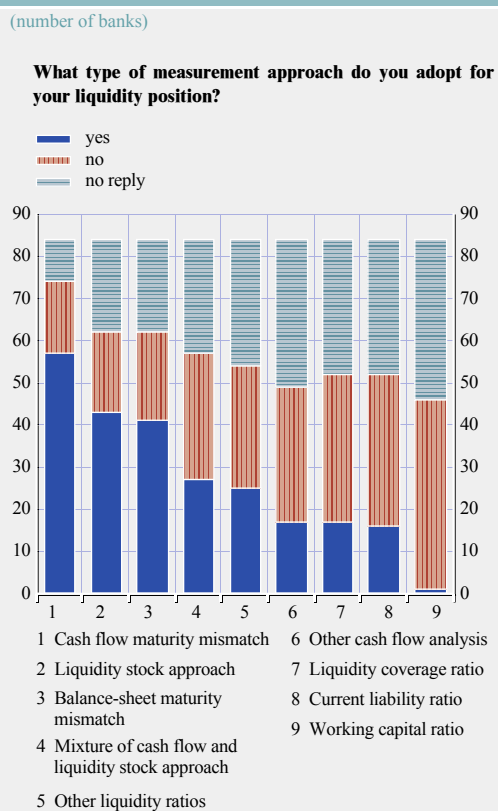
The BSC concludes that barriers to the cross-border flow of liquidity that constrain the capacity of banks to generate liquidity when and where it is needed should be mapped into liquidity stress tests.

4.7 QUANTIFICATION OF BANKS' LIQUIDITY POSITIONS

To a large extent, banks use more than one approach to quantify their liquidity risk exposure (see Annex 2 for a discussion of the different approaches). According to the survey, the single most common type of measurement approach (57 banks) is cash flow maturity mismatch, followed by the liquidity stock approach (43 banks) and balance-sheet maturity mismatch (41 banks). 27 of the banks use a combination of cash flow gap analysis and the liquidity stock approach. This indicates that, in order to get a complete picture of their risk, banks use several approaches.

The main advantages of cash flow maturity mismatch seem to be that it is transparent, flexible, simple and gives a general overview of risk. This is consistent with Matz and Neu (2007) who argue that measures built on

Chart 7 Measurement approach to liquidity stress tests



Source: BSC survey.

maturity mismatch and cash flow modelling help to reflect the dynamic nature of liquidity.

The disadvantages are mainly that it is considered to be a short-term tool which does not reveal long-term liquidity problems. There can also be cash flow mismatches inside time buckets.

The main advantage of the liquidity stock approach is that it is simple to produce. The disadvantages are mainly that it is not dynamic, does not measure probability of inflows or outflows and does not project future cash flows. These conclusions are also in line with Matz and Neu (2007) who argue that balance sheet-based indicators are the most fundamental and easiest to implement, but miss the time dimension of liquidity.

The findings show that banks do not rely on any single measure of liquidity. They usually combine a broad range of approaches to measure liquidity. In many cases, a cash flow maturity mismatch approach is complemented by additional measures.

4.8 DISCLOSURE OF STRESS TEST RESULTS

According to IFRS 7.39, banks have to disclose qualitative and quantitative information about their liquidity risk and its management which encompasses an analysis of the future cash flows along the maturity ladder and a description of liquidity risk management.

Only five banks regularly disclose the results of their liquidity stress tests to top counterparties and 14 do so upon request (see Chart 8). Banks are even more reluctant to share the results with

all important refinancing counterparties (one bank does so regularly and ten upon request). 11 banks regularly provide the general public with information about the results (e.g. in annual reports or 20-F forms) and five do so upon request. Disclosure is not foreseen in any of the three areas by between 50 and 60 banks in the sample. More banks disclose more data to rating agencies: 22 make the results of their liquidity stress tests regularly available to them and 41 do so upon request, while 16 do not foresee doing so. Among other respondents, 21 banks explicitly mention that they share information on the outcome of liquidity stress tests with supervisors and/or central banks, which is becoming an increasingly common practice within the EU.

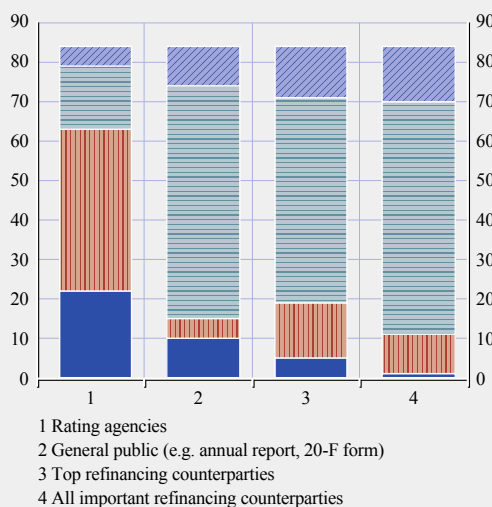
What possible reasons do banks give for this reluctance? The vast majority of banks (78)

Chart 8 Disclosure policy of stress testing

(number of banks)

Does your bank disclose the results of its liquidity stress tests to one of the following audiences?

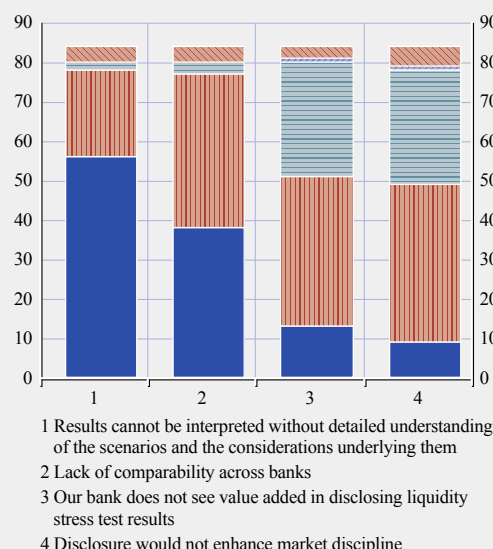
■ regularly
 ■ upon request
 ■ not foreseen
 ■ no reply



1 Rating agencies
 2 General public (e.g. annual report, 20-F form)
 3 Top refinancing counterparties
 4 All important refinancing counterparties

The disclosure of liquidity stress test results is quite rare. What do you consider to be possible reasons for this from your bank's point of view? (multiple answers possible)

■ strongly agree
 ■ agree
 ■ disagree
 ■ strongly disagree
 ■ no reply



1 Results cannot be interpreted without detailed understanding of the scenarios and the considerations underlying them
 2 Lack of comparability across banks
 3 Our bank does not see value added in disclosing liquidity stress test results
 4 Disclosure would not enhance market discipline

Source: BSC survey.

agree/strongly agree that the results of liquidity stress tests cannot be interpreted without a detailed understanding of the scenarios and the considerations underlying them, while two banks disagree. Similarly, 77 banks agree/strongly agree that the results lack comparability across banks, while three disagree. While there was a high level of consistency among banks in respect of these two possible reasons, there was considerable divergence in respect of the other two possible reasons. In the sample, 49 banks agree/strongly agree that disclosure would enhance market discipline in liquidity risk management, while 30 disagree/strongly disagree. Similarly, 51 banks do not see value added in disclosing the results of liquidity stress tests, while 30 disagree/strongly disagree with that statement.

Liquidity risk is very institution-specific, so that the disclosure of the results of liquidity stress tests would have to be accompanied by information about the scenarios, the underlying model, the bank's business model, its funding structure and its liquidity risk management. Furthermore, it must be borne in mind that liquidity risk is a very sensitive issue in banking. On the one hand, negative news about a bank's liquidity position can have serious repercussions on its liquidity position. On the other hand, this feedback could enhance the prudential effect of market discipline and does not justify a lack of transparency and the concealment of liquidity risk exposure. The content of disclosure, the respective framework and the target audience need to be considered carefully. However, given that the results of liquidity stress tests are already disclosed by some banks (including to the general public on 20-F forms), these problems seem in principle to be resolvable. Furthermore, many banks reacted to the recently increased attention to liquidity issues by featuring it in their 2007 annual reports. Irrespective of the wariness towards the mandatory disclosure of liquidity stress test results, more disclosure of information, which would allow market participants to make informed judgements about the soundness of liquidity risk management frameworks and liquidity positions, is important.

Central banks and supervisors can usually demand access to liquidity stress test results (and to the necessary background information to interpret them). This information can provide important insights into the sophistication of a bank's liquidity risk management, liquidity situation and shock absorption capacity. Furthermore, central banks and supervisors are bound by confidentiality provisions in order to avoid market repercussions.

Banks are reluctant to disclose the results of their liquidity stress tests (except to rating agencies and some key counterparties) because the results cannot be interpreted without a detailed understanding of the scenarios and the considerations underlying them. The results also lack comparability across banks. Nevertheless, the majority of banks expect disclosure to enhance market discipline, although a sizeable minority remain sceptical. In any case, any move towards disclosure would have to carefully define the content, framework and target audience.

Given the inherent difficulties associated with the disclosure of liquidity stress test results, regular and comprehensive information sharing with supervisors and central banks (directly or indirectly via supervisors) – particularly in concerted rounds of common liquidity stress tests – would substantially improve the monitoring of the liquidity situation of the financial system and its components.

4.9 STANDARDISATION OF LIQUIDITY STRESS TESTS

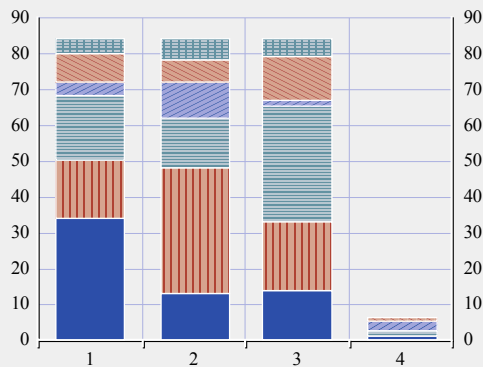
The responses so far suggest that banks consider the results of liquidity stress tests to be easily misunderstood, without a detailed understanding of the scenarios and the considerations underlying them, and to lack comparability across banks. They depend on banks' business models, stress scenarios, assumptions and quantifications, as well as on the stress testing models and methods employed.

Chart 9 Standardisation of liquidity stress tests

(number of banks)

How would you rank (from 1 = most important to 5 = least important) the benefits for your bank of standardisation of liquidity stress tests?

1 2 3 4 5 no reply



1 Benchmarking exercise 3 Knowledge transfer
2 Learning effect 4 Other

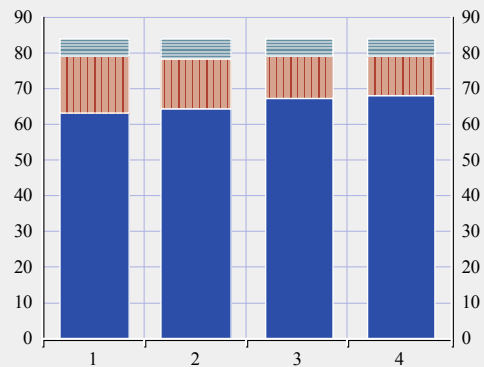
Note:

Other

- Worthy as a leader (1)
- Use in risk rating of bank counterparty (3)
- Counterparty risk measurement (4)
- Market discipline (4)
- Comparability across banks (5)

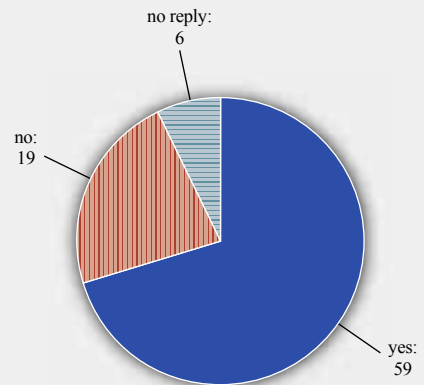
Would standardisation of the following liquidity stress test elements help to improve comparability among banks?

yes no no reply



1 Standardisation of the scenarios in liquidity stress test
2 Standardisation of the output metrics
3 Standardisation of the scope of liquidity stress tests
4 Standardisation of the time horizon

Given standardisation of liquidity stress tests, would disclosure requirements foster market discipline in liquidity risk management?



Source: BSC survey.

In fact, the vast majority of banks expect standardisation¹³ of the scenarios (63 banks), scope (67), output metrics (64) and time horizon (68) to help improve the comparability of liquidity stress test results across banks (see upper right-hand panel in Chart 9). In addition, banks rank the benefits of concerted rounds of common

liquidity stress tests for themselves as important (see upper left-hand panel in Chart 9). Benchmarking benefits are ranked most or second

¹³ In the context of this report, the standardisation of certain elements of liquidity stress tests does not interfere with the institution-specific nature of banks' liquidity stress tests models and methods.

most important by 50 banks, while 48 banks regard learning effects and 33 banks knowledge transfer as most or second most important. Some banks mention other benefits, such as enhanced market discipline, comparability and counterparty risk measurement, but tend to rank them as rather less important.

Without standardisation, the disclosure of liquidity stress test results could lead to a “race to the bottom”. Banks would face incentives to assume mild stresses in order to minimise potential negative repercussions of disclosure on funding. Given the standardisation of liquidity stress tests, would disclosure requirements foster market discipline in liquidity risk management? The vast majority of banks (59) respond affirmatively to this question (see lower right-hand panel in Chart 9).

One way to increase the reliability and comparability of results is concerted rounds of common liquidity stress tests which are conducted, for example, for supervisory purposes without affecting banks’ routine liquidity stress tests for internal purposes. Participating banks in such concerted rounds of common liquidity stress tests rely on their bank-specific approach, methods, data and tools to carry out the liquidity stress tests using a common problem specification as the input. Such exercises are already conducted in a number of countries in the due course of the International Monetary Fund’s (IMF’s) Financial Stability Assessment Programs (e.g. Austria, Portugal and Belgium), by some central banks and by rating agencies. However, even concerted rounds of common liquidity stress tests would not establish full comparability of results, as banks would inevitably retain a large room for manoeuvre in the quantification of a given scenario and in the calibration of their internal models. In addition, the definition of output metrics is not trivial and is likely to involve a set of indicators rather than a single one. The design of common scenarios would have to look beyond the banking sector. The behaviour of other key players (i.e. pension funds, money market mutual funds) would also need to be incorporated (e.g. in scenario

design). The interpretation of the results of such exercises needs to take into account the fact that liquidity is likely to be relocated during crises as otherwise a simple aggregation of individual results could be misleading. It also requires a good understanding of liquidity management and the functioning of the money market. Nevertheless, the reliability and comparability of stress test results would be enhanced relative to the current situation. Furthermore, the information content of such exercises would certainly be higher than that of the simple prescriptive liquidity requirements currently in place in many EU Member States. In particular, results stemming from concerted rounds of common stress tests could enable central banks to relate the potential funding needs of individual banks that are particularly hard hit by the stress to the shock absorption capacity of those that are less affected. The results could thus serve as an approximation of the systemic impact of a certain scenario.

It should be underlined that concerted rounds of common liquidity stress tests recognise the institution-specific nature of banks’ liquidity stress tests models and methods. The BSC hence does not suggest that banks’ liquidity stress tests or their internal models and methodologies should be standardised. It does also not propose any further regulation or homogenisation of banks’ practices. These exercises should subsequently not discourage banks from running a wide range of individual scenarios.

Another issue that has to be addressed is the cost impact on banks. On the one hand, this might entice them to reduce stress testing for internal purposes, leading to a “crowding out” of scenarios. On the other hand, the comprehensibility, comparability and reliability of liquidity stress test results might increase the willingness of central banks/regulators to allow more flexibility in the use of internal models for the calculation of liquidity requirements. Finally, banks might assume that common scenarios define the most severe scenarios they are expected to test (moral hazard). In this respect, it needs to be clearly communicated

that concerted rounds of common stress tests are a complement to banks' own stress tests and that they remain entirely responsible for establishing severe but plausible scenarios in their liquidity risk management. Both the task of limiting the cost impact on banks and the task of containing moral hazard were accomplished in the Financial Services Action Plans (FSAPs) that included standardised liquidity stress tests.

Overall, many participants in the feedback workshop welcomed some form of public input into liquidity stress tests and CFPs. They also found that it would be helpful if banks could expect other banks to follow the high standards of industry practice. In principle, they indicated banks' willingness to take part in such concerted rounds of liquidity stress tests. However, they also pointed out that feedback for banks would be desirable.

The results suggest that a majority of banks consider that concerted rounds of common liquidity stress tests which are conducted, for example, for supervisory purposes without affecting banks' routine liquidity stress tests for internal purposes would help to increase the comparability of the output of internal models across banks, would benefit the banks themselves in various ways, and, if combined with disclosure requirements, would enhance market discipline in liquidity risk management. Relative to simple prescriptive liquidity requirements, such concerted rounds of common liquidity stress tests would enhance the information available to central banks and supervisors and enable them to approximate the potential systemic impact of a certain stress scenario. However, the costs for banks have to be kept in mind, as well as potential moral hazard effects.

5 TYPOLOGY OF CONTINGENCY FUNDING PLANS

5.1 MAIN FEATURES OF CONTINGENCY FUNDING PLANS

A contingency funding plan (CFP) addresses an institution's strategy for handling liquidity crises. It describes procedures for managing (and making up) cash flow shortfalls in stress situations. Effective CFPs are built upon the output of stress tests and scenario analysis. The following summarises the main features of CFPs employed in EU banks.

Formal CFPs are a relatively recent tool, with the earliest ones probably having been created in the aftermath of the Long-Term Capital Management (LTCM) crisis in 1998. Out of 84 banks, 77 reported having a CFP in place (see Chart 10). Coverage is (nearly) complete among top-tier banks, but somewhat patchy across smaller institutions. In some cases, CFPs are part of more general business continuity

plans and/or are not formally documented. There is little noticeable difference in coverage according to legal set-up (parent or subsidiary).

CFPs form an integral part of the BCBS' 2000 "Sound Practices for Managing Liquidity in Banking Organisations" (cf. Principle 9) and feature even more prominently in the revised and updated 2008 version which was released in September 2008 (cf. Principle 11).¹⁴ They are also recognised as best practice by industry (cf. Recommendations 35 onwards of the Principles of Liquidity Risk Management which were issued by the Institute of International Finance (IIF) in 2007.

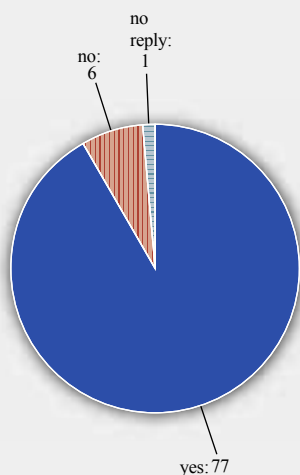
Nevertheless a wide diversity in CFP practices across banks can be observed, both in their level of detail and their exact components. This holds true for different sizes of banks, whether they are subsidiaries or not. Furthermore, no relationship between the degree of dependence

¹⁴ See Annex 2 for references.

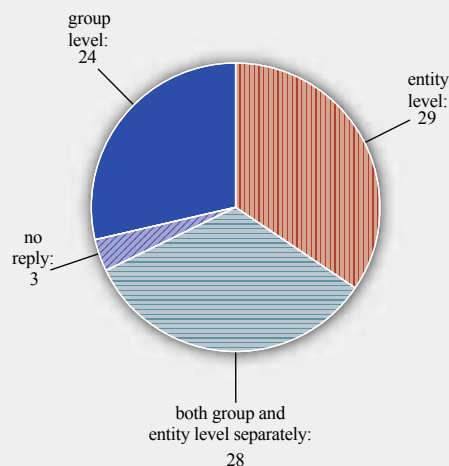
Chart 10 Coverage of contingency funding plans (CFPs)

(number of banks)

Does your bank have a contingency funding plan (CFP) in place?



At which organisational level is the CFP set?



Source: BSC survey.

on market funding of a bank and the complexity of its CFP can be observed. Approaches range from relatively simple operational procedures establishing the responsibilities of the crisis management committee to fully-fledged “war plans”. The latter may set down early warning indicators, escalation levels, a division of roles and responsibilities between departments, potential liquidity-enhancing actions and internal and external communication strategies, etc. To illustrate this diversity, in the examined sample of EU banks, the number of escalation levels varies considerably across banks (see Chart 11).

A wide diversity in CFP practices across banks can be observed, both in their level of detail and their exact components. Given the diversity of practices and their complexity, supervisors and central banks need to enhance their understanding of individual CFPs: the former from a microprudential perspective, with a view to assessing their adequacy in the light of different business models and risk profiles; the latter in order to assess the systemic implications of banks’ reaction functions in periods of liquidity

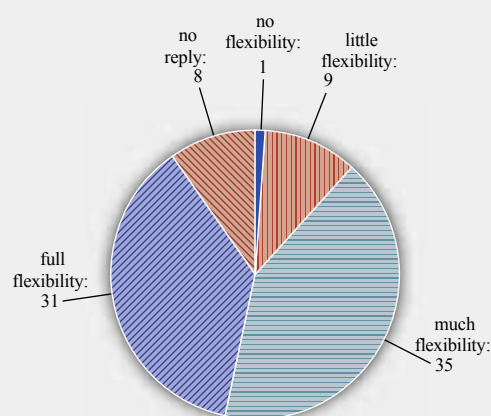
stress. Central banks’ aggregate evaluations of sector-wide CFPs can subsequently be fed back into and inform individual supervisory CFP reviews.

Some CFPs are prescriptive, while others only provide a menu of possible actions to consider. In this regard, a recurring theme in the analysis of CFPs is the balancing act between the need for predesigned and tested operational procedures for crisis management and the need for appropriate flexibility in crisis situations. This means that, in practice, crisis management might draw on elements of the CFP, but does not follow it blindly. Indeed a large majority of banks in the sample consider that their CFP offers them a considerable amount of flexibility (see Chart 11). This seems to be true irrespective of the size of the bank. Moreover, some banks indicate that activating a CFP (especially when this action is publicly observable) risks exacerbating an already volatile situation and, in that case, it might be preferable to deal with liquidity issues “more quietly”. Similar observations have also been made during recent market events (see Section 6.2).

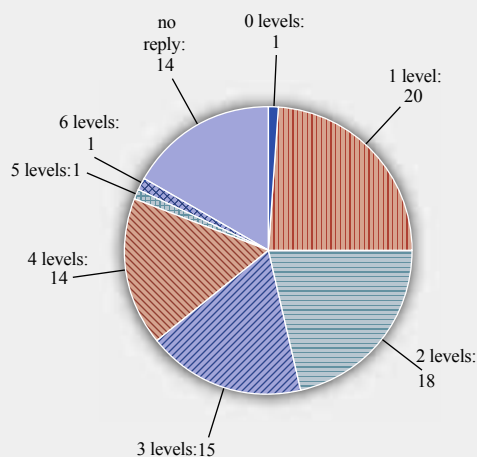
Chart 11 Activation and alarm/escalation levels of CFPs

(number of banks)

On a scale from 1 to 4 (1 = none, 4 = full), how much flexibility does your CFP offer the decision makers in managing a liquidity crisis?



How many such “alarm/escalation” levels does your CFP have?



Source: BSC survey.

Consistent with the BCBS's updated and revised "Sound Practices for Managing Liquidity in Banking Organisations", banks should have in place formal and carefully thought-through operational CFPs that clearly define liquidity strategies to be adopted in periods of liquidity stress and the respective allocation of tasks and responsibilities. In addition, conditions and procedures have to be in place to ensure that decisions can be made promptly, that decision-makers have rapid access to timely and detailed liquidity information and that a diversified set of viable contingency (funding) measures can be executed swiftly. This implies regular and thorough testing of procedures – including a testing of access to central bank funds – and plausibility checks, with a view to potentially revising and updating the CFP in the light of changing conditions inside or outside the bank.

The following sections consider more specific organisational elements of CFPs. As already indicated, most banks would normally incorporate only some of the elements described below in their plans.

5.2 COVERAGE OF CONTINGENCY FUNDING PLANS

CFPs can be formulated at the group level, entity level or both the group and the entity level separately (see Chart 1). CFPs often have incomplete coverage, both in terms of geographic exposure and business area (e.g. insurance subsidiaries are often excluded, partly reflecting regulatory constraints on banks' ability to draw on insurers' liquidity). Typically, banks shift to ever more centralised (global) management as the extent of the problem increases. International banks, however, also often identify the need to focus on specific local issues (e.g. sizeable non-convertible currency positions) in their overall approach.

The perimeter of CFPs necessarily varies across institutions, reflecting more or less complex organisational structures and cross-border activities. Banks need, however, to make sure

that individual CFPs complement each other, avoiding the creation of coverage gaps.

5.3 ASSUMPTIONS AND CONTENT OF CONTINGENCY FUNDING PLANS

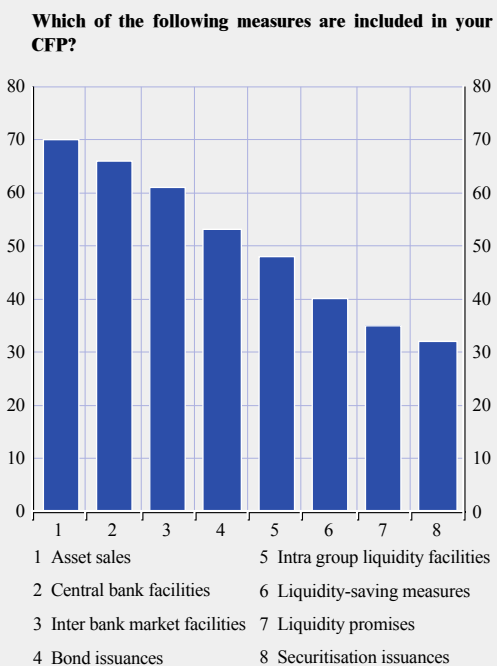
In a broad sense one can identify two levels within a CFP: pre-alarm and alarm. The pre-alarm phase consists of the intense monitoring of a set of early warning indicators following an observed idiosyncratic or systemic shock. The alarm phase is typically composed of various sub-phases or "escalation levels". Colour coding is often used to reflect them and to specify associated actions. Higher levels can be triggered by a range of factors derived from internal monitoring and information (e.g. observed large widening in spreads of a significant counterparty), external information (e.g. news release about the bank's financial health and resulting deteriorating funding conditions). Banks have set qualitative triggers depending on expert opinion or quantitative triggers (e.g. limit system on liquidity). Possible breaches of regulatory liquidity minima, shortfalls on central bank reserve accounts or expectations of some sort of official intervention may also trigger escalations in CFP levels (for recent experiences of banks as regards CFP triggers and related findings, see Section 6.2).

CFPs tend to be designed to be applicable under a variety of circumstances that can have a detrimental impact on the institution's liquidity position. Both idiosyncratic and broader market shocks may be considered. Examples of idiosyncratic shocks can be changes in spreads that a large client asks for (at the pre-alarm level), intensifying to default of the same entity (at the alarm level). Systemic shocks could cover swings in money markets (at the pre-alarm level), intensifying to aggregate funding shortages (at the alarm level). Operational problems in payment and settlement systems can also constitute triggering events for CFP activation.

Contingency measures are diverse (see Chart 12). The most popular appear to be

Chart 12 Sources of liquidity in CFPs

(number of banks)



Source: BSC survey.

asset sales, followed by central bank facilities. In the examined sample, this appears to be the case for 70 of the banks. Much less common are securitisation-driven funding or liquidity lines. These features were relevant in the 2007 and 2008 market turmoil and policy conclusions are elaborated in Section 6.2.

Some banks make the scope of CFP actions contingent on different types of scenario, both at the group and the entity level. For example, in a systemic crisis, banks would refrain from loan sales or securitisation as a cash-generating device, but this would not be the case if the problem is considered to be more bank-specific. Feedback effects (e.g. from unwinding positions on collateral values) are most often ignored.

Two important objectives of CFPs are i) to reduce cash-consuming activities as much as possible; and ii) to maintain the franchise value. Thus,

the BSC finds that some basic consideration is given to P&L effects when assigning priorities to liquidity-generating/saving activities.

Most banks stress that another two key objectives of a CFP are to maintain confidence and to continue as a going concern. In the case of an idiosyncratic shock, some liquidity-reducing actions (such as debt buybacks or non-participation in central bank tenders) might be taken if they help signal confidence in the viability of a bank. When a decision is taken to scale back some business, this measure is often first undertaken in financial and wholesale markets and only much later in respect of corporate or retail clients, highlighting the importance of maintaining activity in these market segments. The BSC points out that potential contagion effects at the money market level stemming from liquidity problems at money centre banks could be reduced by factoring into their CFPs the objective of maintaining the institutions' role at the money market level even in times of stress. Some banks argue that "continue as a going concern" also includes the continuation of the money centre bank's role at the money market level. The BSC acknowledges that a double standard needs to be avoided between money centre banks and smaller banks and that the latter must not shift the costs of prudent liquidity management to money centre banks.

Further desirable characteristics of CFPs include having a diverse range of funding sources, efforts to lengthen maturities and limit liquidity-consuming activities, the alignment of CFPs with stress testing results and finally, notably in the case of a large institution, the recognition of potential destabilising second-round effects on markets from liquidity-saving measures and/or asset sales.

5.4 CRISIS COMMITTEES, INTERNAL REPORTING AND INFORMATION FLOWS, ACTIVATION

CFPs are typically drawn up, agreed upon and activated by the entity's asset and liability

management committee (ALCO) or other relevant senior management committee. Approval of the activation by the chief executive officer (CEO) is usually necessary.

CFPs may address the following administrative policies and procedures:

- the responsibilities of senior management during a funding crisis;
- names, addresses and telephone numbers of members of the crisis team; and
- where, geographically, team members will be assigned.

Upon activation, relevant crisis committees (CCs) are called together via call trees. The global CC takes the lead, coordinating and deciding on group-wide and often local liquidity management and communication. Local CCs are expected to handle local liquidity issues and prevent contagion to other parts of the group. CCs tend to be broadly composed and can include the chief risk officer (CRO), the chief financial officer (CFO), heads of relevant business sectors/departments and representatives from different time zones. For minor events or at an early stage of a crisis, the CCs may be narrower in composition and more strategic in purpose (i.e. deciding on whether and how to activate the CFPs). CCs are typically in close contact with the relevant bodies in the communication department and relationship managers for large depositors or other key clients. Some banks state that CCs are composed of only a very small number of people, who are authorised to take decisions and who stipulate how these decisions are communicated and to whom.

5.5 TESTS

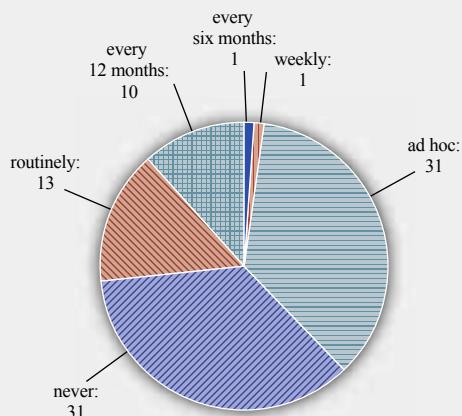
Some banks execute “dry runs” relatively frequently (e.g. annually), while others have never tested their CFP (see Chart 13).

Here, the differences according to the size of bank are marked: a large number of small and medium-sized banks have never tested their CFP, while many large banks perform routine testing. On the basis of “dry runs” a number of banks reported that relevant data were sometimes not sufficiently granular or accurate and covered only very short-term horizons. Overall, one observes a wide range of practices: for a number of banks it involves testing only internal procedures, such as call trees, the rapid assembly of CCs and assignment of responsibilities. By contrast, more operational tests focus on the availability of stand-by lines, the validity of assumed haircuts, the feasibility of asset sales or securitisation. Some industry representatives also suggested that “dry runs” would be particularly helpful in identifying potential barriers to cross-border flows of liquidity. Only a small minority of banks test operational aspects of central bank facilities. Few simulate a full liquidity crisis spanning over several days. Given the relevance of operational hurdles in recent market events, findings on CFP testing are developed further in Section 6.2.

Chart 13 CFP tests

(number of banks)

How often do you perform such CFP tests?



Source: BSC survey.

5.6 COMMUNICATION

Many CFPs focus on the importance of internal and external communication during liquidity events. To avoid confusion and inconsistencies, some CFPs stipulate exactly the nature and direction of information flows and assign respective tasks and responsibilities. In the early stages of a liquidity concern, banks may aim to keep the problem from markets, investors, rating agencies and depositors. In general, communication with the official sector differs from that with the market or the media, both in terms of content and contact (only a small minority of EU banks in the sample examined state otherwise). Most banks emphasise the importance of extensive information exchange with relevant central banks and regulators, with which members of ALCO would hold frequent and detailed technical interchange meetings. By contrast, media, markets and investors would be informed more selectively through communication departments or relationship managers with the aim of restoring confidence. The size and type of bank appears not to influence how communication is designed within a CFP. It is noteworthy, however, that, in order to maintain confidence, some banks even have a strategy to avoid information circulating

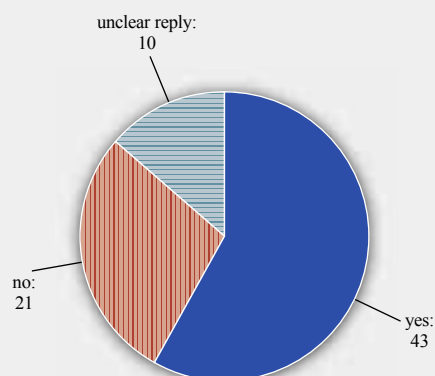
internally. In over one-quarter of the sampled EU banks, communication is not formally covered by the CFP (see Chart 14).

Banks recognise that effective communication to markets and depositors in times of liquidity stress is of utmost importance. Modalities and content are, of course, institution and situation-specific. It is essential, however, that banks have a credible communication strategy and effective internal procedures, tied closely to their CFP. Communication with regulators and central banks in periods of stress needs to be timely and comprehensive.¹⁵

Chart 14 Communication

(number of banks)

Is communication formally covered by your CFP?



Source: BSC survey.

¹⁵ In a cross-border context, this also involves, for example, the communication between banks, host supervisors, home supervisors and central banks.

6 EXPERIENCE WITH LIQUIDITY STRESS TESTS AND CONTINGENCY FUNDING PLANS IN RECENT EVENTS

6.1 LIQUIDITY RISK STRESS TESTS

This section summarises shortcomings of liquidity stress tests that were exposed by the recent market turmoil, triggered by the sub-prime crisis in late summer 2007. Before going into details, it has to be recognised that both the stress test methods used and the size of the impact of the turmoil depended foremost on the business model and the quality of the risk management of the individual institution. Furthermore, the existence of shortcomings in their stress testing procedures does not preclude the possibility that some banks had already imposed stress test assumptions in advance of the sub-prime crisis that proved sufficiently conservative during recent events.

The remainder of this section differentiates between four key aspects: (1) the scenario design; (2) the time horizon of the impact of the stress event; (3) the term structure of projected cash flows; and (4) the general set-up of stress tests and organisational aspects.

Scenario design

Recent events have underlined the importance of including the systemic dimension of liquidity crises, such as the severe and simultaneous disruption of key funding markets, herd behaviour, restrictions on currency convertibility, the interaction between market liquidity and funding liquidity, basis risk and funding needs of off-balance sheet vehicles. This is confirmed by the results of the survey, in which many of the respondent banks indicated that they had been vulnerable in the recent crisis, in particular to liquidity hoarding by other market participants (38 out of the 44 banks that answered the question) and second-round effects leading to a drying-up of market liquidity (47 out of the 53 banks that answered the question).

Before the sub-prime crisis, stress tests usually assumed that key funding markets (e.g. CP and repo markets, unsecured interbank markets, FX swap markets, securitisation markets and some asset markets) do not fail, or at least not at the same time. In the survey, 70 banks indicated¹⁶ that they stressed on average no more than four of the eight key funding markets at the same time. In the recent market turmoil, however, *key funding markets were simultaneously affected* on a wider scale and market liquidity dried up completely in some previously highly liquid markets. For instance, in the survey, 44 banks (out of 70) stated that the bond market and 43 (out of 70) that the unsecured interbank market were relevant hurdles to them in the market turmoil.

Before the turmoil, most banks had not contemplated the scale and severity with which key funding markets could break down simultaneously. The BSC is of the opinion that reviews of the assumptions in liquidity stress test scenarios regarding simultaneous breakdowns of several key funding markets are warranted. Where necessary, stress test scenarios should be adapted accordingly.

Another common assumption in stress tests was the *availability of secured funding* in stressed market conditions. In the survey, 52 out of 70 banks stated that they had not imposed any restrictions on securitisation in any of their stress test scenarios.¹⁷ However, in the recent turmoil, banks faced severe restraints, especially in accessing secured funding in securitisation markets. This was reinforced by the responses of banks in the survey which ranked securitisation as the least accessible funding source out of eight key funding markets (out of 32 banks which responded, 13 had no access, 15 little, 3 good and 5 full access). Furthermore,

¹⁶ The eight key funding markets were: retail deposits, repo market, CD/CP market, FX swap market, unsecured interbank market, bond market, covered bond market and securitisation market.

¹⁷ However, it could be that not all of the 52 banks make active use of securitisation.

in the recent turmoil, the spread between secured and unsecured debt widened dramatically, even for senior debt. Bond issuance volume by European banks was considerably lower than before the turmoil. This was highlighted in the survey results, according to which bond issuance was the second least accessible source of funding during the recent turmoil (out of the 54 banks that responded, 11 had no access, 16 little, 19 good and 8 full access). However, it is unclear how many banks made a deliberate decision not to use this funding because of higher costs and how many banks really had no access to that source. At least some banks that needed to issue bonds (e.g. because of acquisitions or to improve liquidity ratios) were still able to place bonds, but at higher cost. Both low accessibility and higher costs, however, were not always adequately incorporated into stress tests by banks. Also, it is very likely that once market conditions improve, there will be an overhang of bond issuances, and banks with good ratings will be likely to be served first. Banks with lower ratings will then face an even longer time lag before they can access funding via bond issuances.

Recent events have shown that the assumption of easy access to securitisation markets should be reconsidered. Banks that intend to use securitisation during episodes of market turbulence should adequately stress this funding source in their stress tests. Banks should also consider that, in times of stress, spreads between secured and unsecured debt, even for senior debt, can widen significantly. The BSC views it as important that these costs are integrated into stress tests and that these are taken into account when contingency funding sources are identified. In addition, likely backlogs of issuances once market conditions improve should be factored into CFPs, as they will result in prolonged refinancing time lags, especially for banks with lower ratings.

Strategic interactions (behavioural changes) among market participants, such as *herding and second-round effects*, had a strong impact on both the availability and the diversity of

funding during recent events. Uncertainty about future liquidity needs led to “liquidity hoarding” by banks. This strategic behaviour triggered a vicious circle which affected wholesale funding in particular and which was further exacerbated by a “flight to quality”. Correlation increased among both financial products and financial markets. Consequently, the diversification of funding sources was impaired. In the survey, 43 out of the 47 banks that answered the question said they adequately included the second-round effects leading to a drying-up of market liquidity, which corresponds with the outcome that most banks cover market-wide scenarios and/or combined market and bank-specific scenarios in their stress tests. However, such behavioural changes are hard to capture in statistical models. Hence, out of the 71 banks that answered the question, 42 (including large banks) indicated that they integrate behavioural aspects into their stress tests by rule of thumb. In the opinion of the BSC, banks should at least consider more refined ways of addressing behavioural aspects, such as herding and second-round effects, in future stress test scenarios. In this regard, it should also be considered whether and, if so how, increased standardisation of liquidity stress tests could contribute to herding behaviour. Standardisation might lead to banks having similar reactions to possible liquidity crises. However, it could also be a valuable instrument in that it would enable central banks to see how banks react in identical liquidity crises and thus identify potential herding behaviour in advance.

Banks might think that they adequately include second-round effects on markets, but behavioural interactions among market participants are hard to capture in statistical models and most banks integrate behavioural aspects in their stress tests by rule of thumb. The BSC calls on banks to rethink if and how second-round effects could be addressed in future stress test scenarios.

Some banks assumed, in their stress test scenarios, *asset transferability* within their banking groups between different currency zones and zero-cost asset transferability within currency zones. This assumption of easy access to foreign currency

funding was called into question by recent events. For instance, the volume traded in swap currency markets during the market turmoil was significantly lower than in normal times. Other potential barriers to the cross-border flow of liquidity (e.g. local liquidity requirements, different central bank frameworks and hurdles to the transferability of collateral across borders) could impede effective crisis management in cross-border banking groups. Were such barriers actually relevant during the recent market turmoil? The number of respondents that report a high relevance of such barriers during recent events (see Chart 15) is considerably lower than in the case of the results of liquidity stress tests (see Chart 6). Six banks state that local liquidity requirements were relevant during the

recent turmoil; four declare that LE limits were relevant; and seven assert a similar finding for differences in central bank frameworks. The remaining barriers did not have any relevance for the banks in the sample. A larger number of banks state that the impact of the respective barriers was low (local liquidity requirements 18, LE limits 12, transferability of collateral 8, central bank frameworks 9, operational hurdles 7, time zone mismatches 8).

In the further elaboration of their liquidity stress tests, banks seem to focus on operational hurdles (20 banks) and central bank frameworks (18) (see right-hand panel in Chart 15). Some eight to 14 banks declare that the mapping of local liquidity requirements, LE limits, cross-

Chart 15 Barriers to cross-border transfer of liquidity in liquidity stress tests

(number of banks)

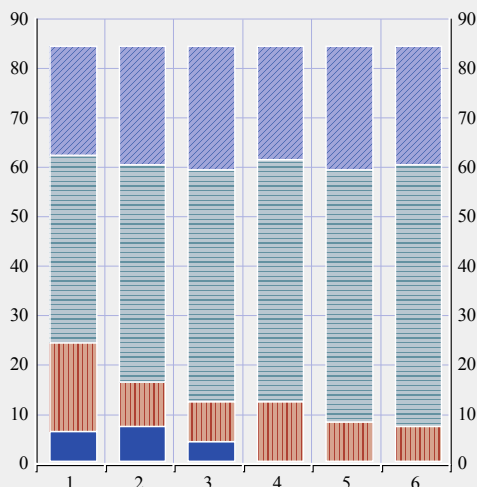
Local supervisory liquidity requirements and large exposure (LE) limits - and other limits listed below - are often mentioned as barriers to intra-group liquidity transfers. Which of the following potential restrictions were relevant to your banking group during the recent turmoil and which warrant further elaboration?

Relevance to your banking group during recent turmoil

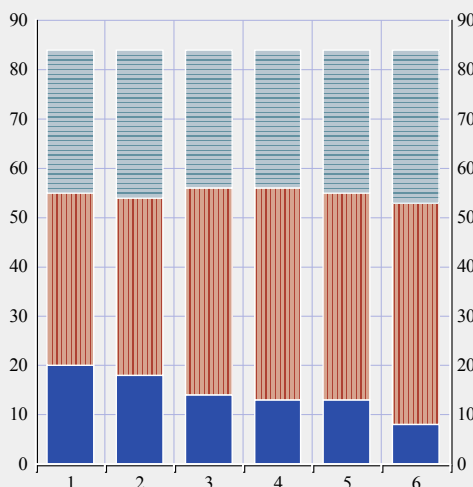
- high
- low
- none
- no reply

Warrants further elaboration in future liquidity stress

- yes
- no
- no reply



- 1 Local supervisory liquidity requirements
- 2 Central bank frameworks
- 3 Transferability of collateral across borders
- 4 LE limits to intra group exposures
- 5 Time zone mismatch
- 6 Operational hurdles



- 1 Operational hurdles
- 2 Central bank frameworks
- 3 LE limits to intra group exposures
- 4 Local supervisory liquidity requirements
- 5 Transferability of collateral across borders
- 6 Time zone mismatch

Source: BSC survey.

border transferability of collateral and time zone mismatches warrant further elaboration in their liquidity stress tests.

As recent events have shown, foreign currency funding cannot be taken for granted. Considering potential hurdles, such as a collapse of swap markets, in stress tests would substantially improve liquidity stress tests in banks in which foreign currency markets play a considerable role in times of stress. This holds true especially for those banks that are dependent on foreign currency wholesale funding. Potential barriers to the cross-border flow of liquidity (i.e. depth and breadth of FX swap markets) and collateral should be reflected in both liquidity stress tests and contingency funding plans.

Some banks carried out silo-based stress tests restricted to sub-sets of assets while ignoring other asset classes. Silo-based stress tests, however, were not sufficient to capture the characteristics of the recent market turmoil. In the survey, out of the 70 banks that answered the question only four considered warehouse risk of leveraged loans and five considered structured credit products in their stress test scenarios, even though these risks were deemed relevant in both cases by eight banks.

Another shortcoming of stress tests relates to *contingent liabilities*. The survey indicates that only 33 out of the 70 banks that responded to the question took into account (off-balance sheet) contingent commitments in their stress tests.¹⁸ Also, from discussions with banks, it seems that in most cases banks assumed little or no drawdown of committed liquidity lines and that they often did not take into account liquidity support to sponsored vehicles where there was no legal obligation. Indeed, 28 out of the 44 banks that responded to the question tended to underestimate the liquidity risk resulting from exposures to off-balance sheet vehicles, such as special investment vehicles (SIVs) or conduits, in their stress tests. In the market turmoil, these assumptions proved to be wrong, since committed liquidity lines were drawn to a great extent and support was granted even in cases

where there was no legal obligation in order to avoid reputational risks. Although it appears from the survey that such reputational risks related to the funding of third parties had an impact on only nine out of the 61 banks that answered the question (of which about one-half were large banks), the BSC considers it important that assumptions regarding the drawdown of liquidity lines are reviewed, where applicable. One reason for the reluctance of banks to include contingencies may be attributable to difficulties in incorporating them properly (e.g. credit commitments and structured products, new and complex financial instruments). Another (related) reason might be

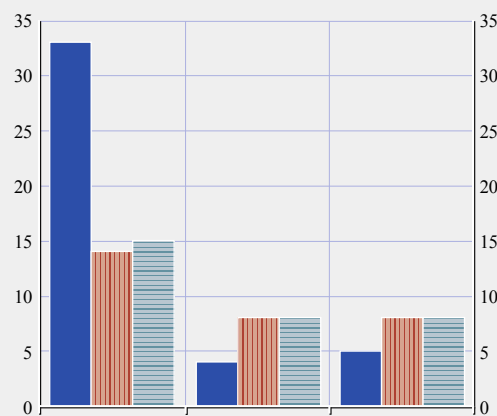
18 However, it is unclear how many of the banks actually have off-balance sheet items.

Chart 16 Adverse market liquidity stress test scenarios

(number of banks)

Please mark for each of your calculated scenarios which of the mentioned aspects are assumed to be affected, if those aspects were relevant to your bank in the recent turmoil and if they will receive more weight in future liquidity stress tests (you can tick more than one market under each scenario).

- number of banks that included the respective item in at least one scenario
- relevant during recent turmoil?
- will receive more weight in future liquidity stress test scenarios?



- 1 Off-balance commitments (e.g. liquidity facilities to asset-backed commercial paper (ABCP))
- 2 Warehouse risk of leveraged loans
- 3 Structured credit products

Source: BSC survey.

that these contingencies did not seem to have much relevance for many banks in the sample. The relevance of off-balance sheet items during the recent turmoil was reported by 14 banks and that of leveraged loans and structured credit products by eight banks. The results of the survey show that banks, for which off-balance sheet items were relevant during the recent turmoil, are more likely to pay more attention to them in future liquidity stress scenarios.

While a sizeable share of banks assume off-balance sheet commitments to be affected in at least one market scenario in their liquidity stress tests, only very few banks assume warehouse risk and structured credit products to be affected in any of their market stress scenarios. These two risk sources were relevant during the recent turmoil for more banks than actually included them in their liquidity stress tests. The results suggest that the market stress scenarios of many banks do not take into account all material sources of liquidity risk. In the future, banks should, in the opinion of the BSC, pay more attention to the coverage of their liquidity stress tests. In particular, banks should adequately incorporate off-balance sheet items into their stress tests. Reputational risk in particular should be considered in this context as an important driver of liquidity risk.

Term structure of projected cash flows (shortening of funding terms)

In their stress test scenarios, banks differed widely regarding their assumptions on the availability of funding sources under stress and not all banks were conservative enough. For instance, banks usually did not expect a severe shortening of funding terms and a drying-up of longer-term funding as experienced in recent events. Although it has been possible to roll over liquidity lines in recent events (the roll-over parameters in stress tests even proved to be on the conservative side), banks could only refinance themselves at very short maturities. In other words, market liquidity was still around but “displaced” along the maturity structure. Therefore, a shortening of funding maturities seems to be an important aspect to address in future stress tests.

In episodes of market turbulence, liquidity may not be available for all maturity buckets. Maintaining sufficiently long funding profiles, which can reduce the impact of short liquidity shocks and price hikes for external funding, is regarded as an important amelioration of liquidity stress tests. Potential shortening/lengthening of funding terms should be considered when appropriate.

General set-up and organisational aspects

Furthermore, the market turmoil also underlined the importance of accounting for the interaction between market liquidity and funding liquidity. In current industry practice, “joint” stress tests that account for simultaneous stress scenarios for credit risk, market risk and liquidity risk, and allow for an aggregation of risks across risk categories, are embryonic at best. In most liquidity stress tests, the assumption was that if a bank faces illiquidity other risks do not matter. This was supported by the general notion that liquidity crises last only a short period of time. The recent market turmoil, however, has persisted over several months, so higher funding costs have accumulated over time and have become an area of concern. Furthermore, recent market developments have demonstrated that a liquidity shortage can easily develop into a credit crisis and, even more likely, that a credit crisis can cause a liquidity shortage. In addition, both the drawdown of liquidity facilities and the bringing back of asset-backed commercial paper (ABCP) conduits onto the balance sheet could affect regulatory (and potentially also internal) capital requirements and capital ratios. In other words, rather than focusing only on the impact on expected cash flows, it may also be important to account for P&L and capital effects. The evaporation of meaningful market prices for certain structured products which created severe problems for the valuation and risk measurement of these instruments is a case in point. Models of credit risk and market risk, however, often assume well-functioning capital markets. Joint stress tests have important advantages compared with stand-alone approaches; they increase the comprehensiveness of stress tests and capture the interaction between various risk factors.

But they also have drawbacks at the current level of development. Joint stress tests are more complex; they require additional assumptions and models to capture correlations of various risk factors and the interdependence of effects which can increase model risk.

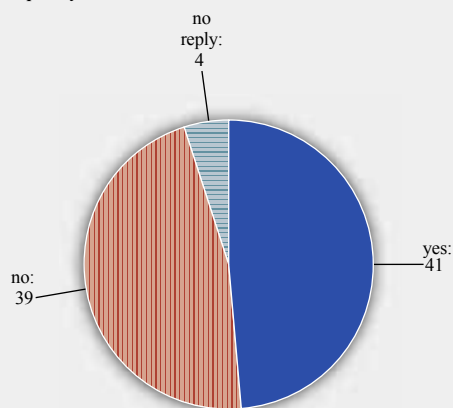
The survey results (see Chart 17) show that, on the one hand, banks recognise the increasing links between different risk types (for instance, credit and liquidity risk), but, on the other hand, they are also well aware of the challenges involved in modelling such linkages. This probably explains why the surveyed banks are split between

intending to introduce joint stress tests for different types of risk (including liquidity risk) (41 banks) and not intending to do so (39 banks). In dealing with and assessing liquidity stress tests results and outcomes, most surveyed banks estimate cash flows only and do not include effects on P&L accounts or on capital (56 banks). The majority (43 banks), however, intend to do so in future liquidity stress tests. Most liquidity stress tests were developed before the recent turmoil, a period that was characterised by favourable refinancing conditions, which probably explains why stress tests do not incorporate the potential impact on P&L accounts.

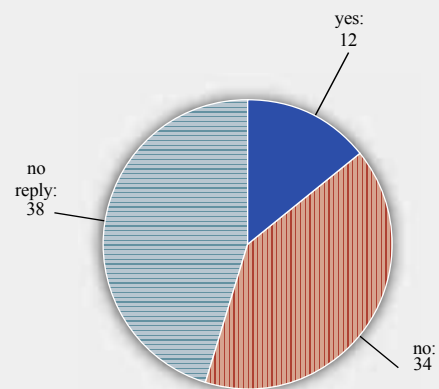
Chart 17 Future developments in banks' liquidity stress testing

(number of banks)

Do you plan to introduce joint stress tests which account for stress scenarios for credit risk, market risk and liquidity risk at the same time?

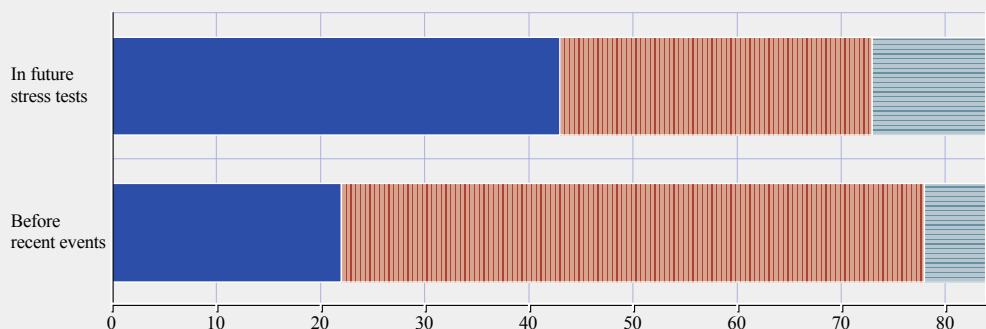


If you already have joint stress tests in place, are you working on elaborating them?



Do you include P&L and capital effects (e.g. higher refinancing costs) as well as cash flow effects in your scenarios?

■ yes
■ no
■ no reply



Source: BSC survey.

Liquidity risk is often an incidental risk of market and credit risk. The integration of liquidity risk stress tests with credit risk and market risk into a single model can improve banks' risk management, but it can also increase model risk. In the absence of reliable integrated models, it is important that banks take into account potential interactions between these risk categories in a non-formal way in their risk management.

One of the main characteristics of the current turmoil is the surprisingly long period of higher refinancing costs for banks. Including P&L effects in liquidity stress tests with longer horizons would substantially increase the accuracy of liquidity stress tests with regard to the impact of such chronic events.

6.2 CONTINGENCY FUNDING PLANS

During recent events the following aspects in banks' CFPs have proved to be crucial, although they were not always addressed appropriately.

Organisational aspects

In the market turmoil, CFPs proved useful in establishing a recognised "chain of command" for internal communication. Clearly defined responsibilities and reporting lines helped banks to take decisions rapidly and to buy time to think through the range of possible measures to protect the liquidity position. However, in order to achieve these benefits, it was recognised by banks both in discussions and in the survey that CFPs need to be regularly reviewed and updated to take into account both internal and external developments, that procedures need to be carefully documented and that the chain of command needs to be tested regularly.

In order to be a valuable tool in times of stress, CFPs need to be regularly reviewed and updated to take into account both internal changes (e.g. mergers) and external changes (e.g. structural changes in market liquidity), the procedures mentioned in the CFP need to be carefully documented and the chain of command needs to be tested regularly.

Not all banks seem to have tackled potential operational hurdles adequately in their CFPs. Recent events have shown that banks which already had appropriate *legal and operational arrangements* to raise funding in stress situations in place at the outset of the turmoil and banks that already had *experience with the funding sources and sufficient reliable counterparty relationships* were better equipped to withstand the market disruptions (e.g. concerning the securitisation process). The survey¹⁹ confirms that quite a number of banks had to deal with these issues. For 36 (out of 78 respondents), a shortage of counterparties was of at least some relevance, while limited experience (e.g. regarding rarely or not previously used instruments) was of at least some relevance for 33 (out of 77 respondents), inadequate operational arrangements for 24 (out of 77 respondents) and inadequate legal arrangements for 22 (out of 75 respondents). According to the results, medium-sized banks are much more exposed to these operational hurdles, especially to having insufficient experience and a shortage of counterparty relationships. Consequently, a medium-sized bank in particular will face one or more of the above-mentioned issues. Of the 47 medium-sized banks, 22 are going to work on gaining more experience, 17 on establishing more counterparty relationships, 12 on improving operational arrangements and five on improving legal arrangements. Since these issues were not of relevance to most of the larger banks, only two or three of the 25 large banks will give more weight to those issues in the near future. It is worth mentioning that for minimising such operational hurdles in advance and for verifying that CFPs are reliable in crises, CFP tests seem to be a valuable tool. Seven banks (out of the 55 that responded to the question) explicitly acknowledged this in the survey, stating that they needed to intensify/set up CFP tests.

In the recent turmoil, quite a few banks faced operational hurdles. CFPs can be a good tool

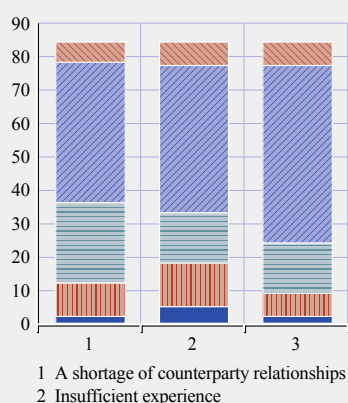
¹⁹ The survey results for this issue do not include small banks owing to a shortage of responses.

Chart 18 Operational problems

(number of banks)

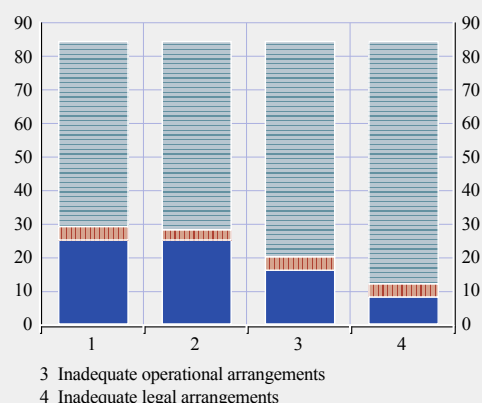
Relevance for your bank
(1 = very relevant, 4 = not relevant)

1
2
3
4
no reply



Which operational problem will receive more attention in future?

yes
no
no reply



Source: BSC survey.

for checking whether the necessary legal and operational arrangements are in place. While identifying sources to rely on in times of stress in their CFPs, banks should, in the opinion of the BSC, make sure that they have enough experience and enough counterparty relationships to be prepared when resorting to those sources. Furthermore, regular tests of CFPs are a very good way of checking that the necessary operational arrangements are in place.

In addition, triggers within banks' CFPs were not always suitable for detecting the market turmoil, since liquidity aspects were not taken into account adequately. Therefore, it is advisable to include liquidity aspects in future CFPs when setting limits and establishing triggers in order to recognise warning signals in time, such as results from liquidity stress tests. It is also advisable to have triggers in place for the activation of the different escalation levels. Indeed, in the survey, 11 out of 73 banks (eight medium-sized and three large) referred explicitly to the need to review triggers and to work on fine-tuning existing triggers, including looking

into the introduction of new triggers or refining the description or improving the monitoring of triggers.

Triggers that activate the CFP need to be carefully designed and reviewed regularly so that a crisis can be recognised both promptly and correctly. According to the BSC, well-defined triggers for the activation of the different escalation levels should be in place. Banks should neither rely too much on mechanical triggers, nor should they have triggers that are too flexible and make it difficult to detect crises or activate the next escalation level. Also, banks should take account of liquidity aspects, as well as results from stress tests, when establishing triggers.

Reputational aspects

The recent market turmoil should serve as an example that suspicions about a bank's solvency can arise quickly. For this reason, it proved to be important to take account of the standing of the bank in the markets when identifying funding sources in CFPs. Tapping a specific market for funding in a crisis situation often requires

the bank to have previously been a regular and active participant in that market under normal conditions. Otherwise the bank's sudden appearance in a market during a turmoil could be interpreted as a negative signal, triggering rumours regarding the bank's solvency.

In the market turmoil, banks faced several asymmetric information problems. For instance, the disruption of the interbank market was, to some extent, caused by asymmetric information between counterparties. Such problems could be solved, for example, by establishing dependable relationships between counterparties. By identifying markets and reliable market players to which banks can take recourse in times of stress, CFPs can give guidance on appropriate actions before and in stress situations, whether or not they are classified as contingent.

Another aspect that proved to be crucial in recent events was that some liquidity sources were especially vulnerable to suspicions regarding the bank's liquidity. For instance, available liquidity lines turned out to be a less effective mitigation technique, since drawing them could be perceived as a sign of weakness. The survey indicates that 29 out of the 53 banks that answered the question had identified reputational risks from calling upon available liquidity promises of counterparties before recent events, but that this risk had almost no impact on the surveyed banks, possibly because there was no need to call upon liquidity lines during the events. However, to be able to withstand potential future funding pressures, reputational risks connected to drawing specific liquidity sources need to be addressed in banks' future CFPs when identifying funding sources which will still be available under stress.²⁰

When identifying funding sources for times of stress, reputational risks associated with some funding sources (e.g. calling upon liquidity promises) should be taken into account. Funding sources should be carefully analysed and possibly replaced with others that carry less reputational risk – dependent on the activation level of their CFPs.

The sale of assets is a typical element of CFPs, in addition to accessing central bank facilities and interbank market facilities (out of 84 banks, 70 included asset sales, 66 central bank facilities and 61 interbank market facilities). In the recent turmoil, however, several banks encountered difficulties selling assets or pledging assets in secured lending transactions in due time at reasonable costs.²¹ In the survey, asset sales were ranked the third least accessible funding source out of eight key funding sources. While 16 banks reported full and 27 good access, 22 banks stated that there was only little access and two banks stated that there was none at all.

In the opinion of the BSC, a sufficient liquid buffer is indispensable in episodes of market turbulence in the event that other liquidity sources fail. Banks should attach reasonable haircuts to these assets and make sure that they would indeed be available and easily locatable in times of stress.

According to the survey, 20 banks (mostly large) activated the lowest level of their CFP, two the medium level and two the highest level, while 49 banks said they had not activated their contingency funding plans during the recent events. Since the episodes of market turbulence were quite severe, the BSC would have expected more banks to activate their CFPs. From discussions with banks, it seems that one reason for not activating their CFPs was a concern that this step could send a negative signal internally within the institution, as well as externally to financial markets. Generally, the activation of CFPs should not be interpreted as a negative signal, but as a positive measure to address and be prepared for liquidity challenges. Indeed, the BSC encourages the use of CFPs in times of

²⁰ However, in principle, the Task Force does not denounce the use of any particular instrument in CFPs on the basis of any potential reputational risk associated therewith.

²¹ Participants at the feedback workshop pointed out that, in assessing the adequacy of the liquidity buffer, not only its level and composition, but also its funding must be taken into account.

stress when CFPs are an appropriate liquidity management tool to support banks.

6.3 ISSUES FOR BANKS REGARDING CENTRAL BANK INTERVENTIONS

During the recent market turmoil, the role of central bank interventions in terms of a facilitated and broadened access to central bank liquidity was an important issue for the majority of banks. The events have highlighted some relevant aspects regarding potential problems which both banks and central banks have to deal with when it comes to central bank interventions.

Reputational effects of using central bank facilities

Recent events have shown that recourse to central banks' liquidity facilities can have material adverse reputational effects on banks ("stigma" of using central bank facilities). From the survey, it appears that 29 (nearly all medium-sized or large banks) out of the 54 banks that answered the question recognise the reputational risks associated with calling upon central bank standing facilities. However, they indicated that this risk had almost no impact on them, possibly because some central banks have flexible operational frameworks that incorporate a broad range of operations and a broad list of eligible collateral, as well as ensure the anonymity of counterparty relationships.²² Moreover, reputation side effects may be downplayed if there is a risk that the liquidity problem will become a solvency problem or if it already has. Nonetheless, banks might need to re-evaluate their assumptions regarding a potential recourse to central bank facilities, both in their stress tests and in their CFPs (one bank, for example, explicitly stated that it does not include central bank facilities at all in its CFPs for reputational reasons).

Recourse to central bank facilities can have negative reputational side effects for banks. These should be taken into account in liquidity stress tests and CFPs. However, central banks with flexible operational frameworks that grant anonymity to counterparty relationships can

contribute substantially to a reduction in the reputational risk associated with drawing on their facilities.

Use of central bank facilities: practical issues

Many observers have identified that the range of accepted eligible collateral in central banks' operations is noticeably heterogeneous across countries. Some central banks, for example, accepted credit claims during the current turmoil while others did not. In the survey, however, most of the 60 banks that answered the question did not consider such central bank framework issues relevant. Seven banks said these issues were of high relevance and nine banks said that they were of low relevance. Nonetheless, according to the survey results, next to intragroup facilities, central bank facilities were still the most accessible funding source during the recent turmoil. However, given the cost of holding eligible collateral, this issue might lead to a redistribution of liquid assets within a banking group. It may entice banks, for example, to exploit local market advantages so that local entities hold (or relocate) riskier assets to be used for repurchase operations (repos). As a consequence, assumptions concerning the location, time delay, cross-border transferability and costs of eligible collateral for secured central bank operations, such as repos, should be critically evaluated. Moreover, in the survey, 18 banks (out of the 54 that responded) mentioned that central bank facilities will receive more weight in future CFPs.²³ This could well reflect efforts by those banks to be better prepared for differences in central bank frameworks and responses, e.g. gathering information on requirements in advance.

²² For details regarding the actions taken by central banks during the recent market turmoil and related recommendations for central banks, see Committee on the Global Financial System (2008).

²³ As a consequence of the recent turmoil, some commentators fear that banks might be more inclined to implicitly factor emergency facilities into their CFPs. However, the Task Force concludes that liquidity stress tests, the resulting liquidity buffers and CFPs should be designed in such a way as to avoid the need for recourse to central bank emergency facilities and that the latter should therefore not be included in CFPs.

It seems that central bank facilities are an essential part of CFPs in banks. However, in the opinion of the BSC, banks should ensure that they can manage their liquidity risk on their own and not rely on central bank refinancing beyond common lending facilities and open market operations. Extraordinary central bank operations (such as the ECB fixed rate tenders with unlimited volume on 9 August 2007) should not be relied upon in CFPs.

I METHODOLOGY AND SAMPLE

In order to establish the findings and conclusions in this report, the BSC Task Force collected information from various sources.

- One source was academic and professional literature and reports by national and international institutions and bodies. From this source, the Task Force was able to carry out a stocktake of regulatory practices and issues and obtain methodological benchmarks.
- The second source was the experience of staff members in central banks and supervisory authorities. The members of the BSC Task Force itself have a variety of backgrounds and responsibilities within their institutions, ranging from involvement in on-site banking supervision to research activities.
- The third source was workshops with risk managers and other relevant contacts from large EU banks and with industry experts. Besides getting an insight into industry practices and challenges in the area of liquidity risk management, the main purpose of two workshops was to ensure that a questionnaire intended to serve as the basis for the empirical analysis of relevant practices among a larger set of EU banks would adequately address the issues of liquidity stress testing and CFPs. In addition, a third workshop provided international banks with the opportunity to comment on the Task Force's findings.
- The survey itself was the fourth source of information. Compared with previous studies looking at smaller samples of large banks, the Task Force tried to broaden the sample by including banks along different dimensions, such as cross-border activities, cross-currency business, different sizes, different levels of sophistication, etc. Based on relevance for national banking sectors, national authorities selected 84 EU banks carrying out liquidity stress tests. This set of banks was interviewed during the period between 10 March and 11 April 2008.

Although not representative in a statistical sense, it was believed that this sample would provide a fair picture of the range of practices in EU banks. Time and cost constraints, as well as considerations for the considerable regular and ad hoc reporting requirements to which banks are currently subject, ruled against any attempt to achieve statistical representativeness in the sample.¹

Replies were received from 84 banks in 25 EU countries (see Table 1), consisting of 44 banks from old Member States (OMS) and 40 from new Member States (NMS – 2004 and subsequent enlargement rounds) or, alternatively, 47 banks from the euro area and 37 from non-euro area countries (see Table 2 and Table 3 respectively). More than one-half of the sample consisted of medium-sized banks (45 out of 84), while 25 large banks made up the second largest sub-sample.² Most of the 14 small banks came from non-euro area and new Member States. The composition according to euro/non-euro area and old/new EU Member States is more balanced for the other size categories. While 15 banks in the sample operate on a stand-alone basis, 39 of the banks belong to a banking group. No branch of a banking group is represented in the sample.

The analysis in the report only refers to sub-samples in line with the above-mentioned categories if the difference is of relevance and significant.

1 At the end of 2007 Eurosystem counterparties totalled 1,693 (see the ECB's Annual Report 2007), whereas the total number of credit institutions was much larger (see table below).

	Credit institutions	Local units (branches)
MU13	6,127	138,760
EU27	8,350	182,154

Source: ECB.

2 Banks were defined as large when total assets exceeded €140 billion (€15 billion for NMS), medium-sized when total assets ranged between €1.5 and €140 billion (between €1.5 and €15 billion for NMS) and small if total assets were below €1.5 billion.

Table 1

Country name	Code	Number of replies	Country name	Code	Number of replies
Belgium	BE	3	Luxembourg	LU	4
Bulgaria	BG	5	Hungary	HU	5
Czech Republic	CZ	3	Malta	MT	5
Denmark	DK	2	Netherlands	NL	4
Germany	DE	3	Austria	AT	4
Estonia	EE	2	Poland	PL	5
Ireland	IE	0	Portugal	PT	3
Greece	GR	2	Romania	RO	5
Spain	ES	5	Slovenia	SI	3
France	FR	2	Slovakia	SK	3
Italy	IT	3	Finland	FI	3
Cyprus	CY	3	Sweden	SE	4
Latvia	LV	1	United Kingdom	GB	2
Lithuania	LT	0	Total	EU27	84

Table 2

Bank size	Banks that belong to a group	Banks that operate on a stand-alone basis	Grand total
Large OMS	15	2	17
Large NMS	7	1	8
Total large	22	3	25
Medium OMS	15	9	24
Medium NMS	20	1	21
Total medium	35	10	45
Small OMS	1	2	3
Small NMS	11	0	11
Total small	12	2	14
Grand total	69	15	84

Table 3

Bank size	Banks that belong to a group	Banks that operate on a stand-alone basis	Grand total
Large euro area	13	1	14
Large non-euro area	9	2	11
Total large	22	3	25
Medium euro area	20	7	27
Medium non-euro area	15	3	18
Total medium	35	10	45
Small euro area	4	2	6
Small non-euro area	8	0	8
Total small	12	2	14
Grand total	69	15	84

2 LITERATURE REVIEW

RATIONALE AND METHODOLOGIES FOR STRESS TESTING LIQUIDITY

One possible *definition of liquidity risk* is the risk of not being able to cover the liquidity gap within a certain time period at a reasonable cost. In a balance-sheet approach, the liquidity gap is approximated on the basis of short-term assets and short-term liabilities. The positions at the short end of the balance sheet are put into maturity buckets according to their residual maturities (either estimated behavioural or simple contractual maturities). For each maturity bucket, net positions (the liquidity gaps) are calculated. Given the central role of maturity transformation in banking, these liquidity gaps would be expected to be negative (i.e. short-term liabilities exceed short-term assets). The cumulative liquidity gap is then calculated by summing liquidity gaps across maturity buckets.

In a cash flow approach, the liquidity gap is defined as the difference between daily cash inflows and daily cash outflows over the envisaged time horizon. The objective of liquidity risk management is to ensure that a potential liquidity gap in a certain maturity bucket (e.g. on a certain day in the future) is reduced by fine-tuning the timing of cash inflows and outflows (e.g. through a limit system) and/or that future potential net cumulative cash outflows are covered by available counterbalancing capacity. The latter consists of cash reserves, deposits at the central bank and other liquid assets which can be used to generate cash flows in a timely manner at a reasonable cost (either via outright sales or through repos).

Fender et al. (2001) highlight that financial institutions rely heavily on stress tests for markets, products and risk factors which are not adequately captured by statistical tools, such as value-at-risk (VaR). Stress test scenarios can take into account stressed market conditions in which historical asset price relationships used in VaR approaches break down. In the context of liquidity risk management, stress tests help to assess a bank's liquidity need during extreme market events and to prepare liquidity risk management for stressed conditions.

Some individual publications present *general frameworks for stress testing procedures*. The outline for liquidity stress testing as defined by, for example, Neu and Matz (2007) can serve as an illustration of consistent liquidity stress testing.³ They develop a step-wise approach to the design of liquidity stress tests. First, the bank determines its liquidity risk tolerance. Then it defines the preferred measures of available counterbalancing capacity and expected cash flows over the envisaged time horizon. Both can then be stressed on the basis of properly defined scenarios. Scenario design and quantification of their impact on projected cash flows are central to liquidity risk management, but also particularly challenging. Based on the stressed cash flows, the bank determines its limit structure and its counterbalancing capacity in line with its liquidity risk tolerance.

Building extreme but still plausible scenarios is one of the most difficult tasks in liquidity stress testing. Persaud (2003) discusses episodes of sudden liquidity evaporation in various markets (FX, fixed income and credit transfer markets). Theory and case studies of vanishing liquidity are helpful in selecting extreme but plausible scenarios.

Choosing a proper way of *measuring liquidity* is also a challenging problem. Neu and Matz (2007) provide an overview of various measures of liquidity that can be used to analyse the impact of stress events on liquidity. Balance sheet-based indicators are the most fundamental and the easiest to implement. However, they miss the time dimension of liquidity and off-balance sheet commitments, and fail to take into account accounting rules that could distort the assessment of liquidity risk and of the available counterbalancing capacity (e.g. by assuming immediate marketability of securities). Measures built on maturity mismatch and cash flow modelling

³ Similarly, Chorafas (2002) describes the process of liquidity stress testing under both stock and cash flow-based approaches, outlining how the liquidity gap should be constructed in order to be subject to "what if" analyses later.

help to reflect the dynamic (stochastic) nature of liquidity.

Chorofas (2002) points out *general problems in building stress test models*, including the approximation of non-linear phenomena with linear models, the estimation of the term structure of off-balance sheet items, and the communication of assumptions to the banks' management, especially those defining severity of shock. Adequately capturing second-round effects in liquidity stress tests presents a particular challenge. Second-round effects include, for example, spillover effects of liquidity problems at an individual bank on asset market liquidity or behavioural reactions of other banks. Endogenous embedding of second-round effects in liquidity stress tests is almost non-existent in the literature, although Pedersen and Brunnermeier (2007) and Adrian et al. (2007) make attempts to capture these phenomena in theoretical models.

A number of publications focus on *statistical or mathematical tools* to perform stress tests. Zeransky (2006) presents a statistical method for estimating extreme events, the Peaks-over-Threshold method. Bervas (2006) looks at market liquidity risk and argues that the VaR of a marketable position of a bank should be adjusted if the price is a random function of the net volume of trades. The VaR of prices can be directly applied in stress tests to assess extreme event scenarios. Bervas discusses the application of extreme value theory (EVT) to estimate the distribution of rare tail events (e.g. prices). Fiedler (2002) argues that measures of extreme liquidity shortage could be constructed on the basis of the additional cost of funding compared with normal market conditions. In this context, he proposes the use of value-liquidity-at-risk (VLaR) based on estimates of the (increased) funding costs to cover an unexpected funding gap under stress. VLaR is then defined as the difference between the funding costs under normal and under stressed circumstances, respectively. An alternative approach rests on liquidity-at-risk (LaR) models which represent an adaptation of the

VaR approach to funding liquidity. This rests on the estimation of a probability distribution of the net cumulative liquidity gap over the envisaged time horizon that should properly take into account extreme events. On the basis of the bank's liquidity risk tolerance, the bank's management decides to what extent it wants to hold counterbalancing capacity to cover the net cumulative liquidity gap also under rare tail events. However, Matz and Neu highlight the weaknesses of relying on advanced statistical methods in scenario design. The most important drawback of EVT usually lies in the shortage of observations to estimate the distributions of tail events. Similarly LaR models suffer from measurement and model uncertainty which dominate at small percentiles. At a 0.01 percentile they reassure the bank's management that the bank will avoid future liquidity problems over the envisaged time horizon with a probability of 99.99%, which sounds comfortable. But the results crucially depend on the underlying models, the scenarios and the data fed into the LaR (in particular the estimation of the probability distribution and its ability to properly cover extreme but plausible events). The parameterisation of the model and the estimation of the probability distribution introduce a high degree of model uncertainty into LaR approaches which is not properly reflected in the model output, so the models are at risk of underestimating the risk of liquidity problems and of providing a false sense of security.⁴

There are a number of general publications summing up the *practical approaches* of banks to liquidity stress testing. One such publication outlines the liquidity stress testing process of Deutsche Bank (Martin, 2007) and also outlines a few broader surveys of banking sector practices. Martin provides good examples of how market and idiosyncratic scenarios are used to project cash flow profiles and to assess the counterbalancing capacity. He argues that, in practice, the main

⁴ At the feedback workshop, industry representatives also stressed their scepticism with regard to stochastic modelling in the area of liquidity risk management owing to insufficient data.

challenges are not methodological ones but the parameterisation of the model, scenario design and the quantification of scenario impact (i.e. assumptions concerning reliable rollover ratios of short-term assets and short-term liabilities and concerning the cash flows that can be generated from available inventories of liquid assets).

Matz (2007) provides a brief overview of the main *critique of current liquidity risk management practices* (which also apply to liquidity requirements in place in many countries). He asserts that there is a need to turn away from the traditional “retrospective” approaches and to focus on “prospective approaches”. Matz identifies three key problems of traditional approaches: first, traditional approaches often rely upon historical accounting data, which only contain information about what the risk was and not what it may be in the future. Second, few of the traditional ratios take off-balance sheet items into account. Bearing in mind the ongoing financial market turmoil, this approach is clearly no longer adequate. Finally, traditional ratios do not capture the temporal nature of liquidity risk. In order to mitigate some of the risks emanating from the traditional approach to liquidity risk management, Matz outlines a number of key components in a more “prospective” approach. Such an approach would include multi-period cash flow projections on sets of deterministic forecasts, the quantification of banks’ liquidity reserves (i.e. unencumbered liquid assets that could be used to buy time in the event of a crisis) and the use of a set of key risk indicators (KRIs) (e.g. maturity profiles, concentration profiles, etc.).

To sum up, the academic literature assigns a central role to stress testing in liquidity risk management, but no uniform best practice with regard to measuring, modelling and stress testing liquidity risk has emerged so far. The literature highlights the weaknesses of more recent statistical approaches, such as LaR and EVT, to adequately capture extreme events. The design of extreme but plausible scenarios and

the assumptions concerning their quantitative impact on cash flows emerge as critical but, at the same time, particularly challenging components of liquidity stress tests. Attempts to capture second-round effects in stress tests seem to be only in their infancy at this stage of theoretical development.

SURVEYS AND RECOMMENDATIONS CONCERNING BANK PRACTICES BY REGULATORS AND PRACTITIONERS

The *Committee on the Global Financial System (CGFS)* carried out two surveys on stress testing practices. In 2001 the Committee produced a broad survey on stress testing related to all types of risk in major financial institutions. The report underlines an important and supplementary role for stress tests in VaR analysis in risk management. However, it also points out that no more than one-quarter of banks used liquidity stress tests to allocate capital or to monitor liquidity risk in 2001.

In 2005 the survey was repeated with 64 major international banks and securities firms. The report concludes that stress testing of funding liquidity risk and operational risk is already employed quite regularly (although sometimes implemented as part of market risk stress tests). Over the period between the two surveys, stress testing emerged as common practice in major international banks and securities firms. The authors highlight the wide range of stress testing practices applied in banks and securities firms. The study points out that the treatment of market liquidity in stress tests varies substantially across firms. Although firms are aware of possible second-round effects, these are rarely incorporated into the stress tests. The primary reasons suggested in the report are difficulties in measuring and estimating these effects. The assumed funding crises in the scenarios have a wide variety of causes, such as a rating downgrade, a sharp increase in committed credit lines by borrowers or a change in the composition of deposits. The report concluded that liquidity scenarios in general seemed to be well-articulated and highly diverse.

A brief survey of stress testing within major cross-border financial groups is provided by *The Joint Forum* (2006). It states that two contradictory approaches are taken by groups: stress testing at the group level versus testing at the subsidiary or regional level. Both approaches have their advantages, but the primary advantage of the group level method is the fact that it can help to avoid the omission of important group effects, such as accessibility of support and cross-border legal and timing impediments.

More recently, the *Basel Committee on Banking Supervision (BCBS)* (2008a) surveyed the regulatory provisions on stress testing in member countries and how the interaction between supervisors and banks works in practice. According to the report, supervisors in some countries set broad standards regarding the typologies of shocks to be considered, some even require banks to run pre-specified scenarios, while others leave the selection of the stress events entirely to the banks themselves. In both cases, intermediaries are then expected to estimate the reaction of future cash flows to the shock on the basis of internal methodologies which are highly heterogeneous across the institutions in the sample. The assumptions employed by banks in quantifying the scenario impact on cash flows are subject to supervisory scrutiny in many countries. In addition, some supervisors require banks to feed the results of their liquidity stress tests into CFPs and into other components of liquidity risk management (e.g. limit systems).

The *BCBS* published its earliest recommendations on liquidity stress testing in 2000. In the light of recent events, an updated version of these recommendations was released in September 2008 (see *BCBS* (2008 b), “Principles for Sound Liquidity Risk Management and Supervision”). The draft version for consultation required banks to perform liquidity stress tests to check the robustness of their liquidity shock absorption capacity in accordance with a bank’s liquidity risk tolerance and to have CFPs in place. The

BCBS requires banks to consider different shocks in stress testing simulations, including both market and idiosyncratic shocks and combinations thereof, as well as short-term and long-term shocks. The interaction with various other risk types should be taken into account. The results of liquidity stress tests should feed into a bank’s liquidity risk strategy and policy, as well as into its CFP. The recommendations acknowledge that subjective judgement plays a central role in scenario design. In general, many of the *BCBS*’s recommendations are in line with the results of the Task Force report.

The industry’s perspective is set out in *Institute of International Finance (IIF)* (2007). The report outlines a number of key recommendations in relation to liquidity risk management in financial institutions. A fundamental premise explored in the paper is that firms should deliver, and supervisory and regulatory approaches should recognise, risk management frameworks that are tailored to each bank’s business model and market position. The *IIF* points out that banks’ needs and strategies vary widely for a variety of reasons. This implies that any liquidity recommendations or guidelines must be seen as describing a “range of good practices” and not necessarily a list of “best” practices. Governance and organisational structures are identified as critical in managing liquidity risk. The report devotes a whole sub-section (containing 14 recommendations) to liquidity stress testing and CFPs. It recommends that banks should conduct liquidity stress tests or at least sensitivity analyses. All material sources of liquidity risk should be included. The results should feed into liquidity risk management practices (i.e. limit systems). The assumptions in the scenarios should be regularly reviewed and challenged. The *IIF* recommends that emergency lending facilities should be incorporated into banks’ liquidity stress tests, but only in extreme events and under due consideration of all legal and operational prerequisites. Banks are expected to have CFPs in place. These should also take into account the role that the bank plays in the financial system. The CFP should not only ensure that the bank survives a liquidity crisis,

but also that it is able to continue to play its role in the financial system. The effectiveness of CFPs should be assessed regularly.

The surveys of bank practices show that major cross-border banks usually have liquidity stress tests and CFPs in place, but that the approaches differ widely. They also demonstrate that supervisory involvement in liquidity stress tests varies across jurisdictions from the pre-specification of scenarios, to the setting-up of broad guidelines, to no involvement at all. The recommendations concerning bank practices underline the central role of liquidity stress tests and CFPs.

ASSESSMENTS OF BANKS' LIQUIDITY RISK MANAGEMENT PRACTICES IN THE LIGHT OF THE MARKET TURMOIL

As a consequence of the market turbulence, international fora are analysing banks' liquidity risk management practices in order to identify potential shortcomings.

In the EU, the *Committee of European Banking Supervisors (CEBS)* (2007) argues that the usefulness of stress testing relies primarily on the adequacy and the severity of the shocks used in the simulations. According to a survey of practices in major cross-border EU banking groups, liquidity stresses in play during the summer were only very partially contemplated in stress testing exercises. The scenarios employed by banks did not adequately reflect the switch from the buy-and-hold to the originate-and-distribute model. Some of the risks entailed by such a model (e.g. liquidity risk, pipeline and warehousing risks, and model and valuation risks) were hardly ever considered in stress tests. The disruption of several markets was also rarely contemplated. While some scenarios included some characteristics of the turmoil (e.g. closing of some funding markets), they did not consider simultaneous liquidity drains and unavailable funding sources. Similarly, liquidity drains arising from liquidity support granted to SIVs, conduits or money market funds as a result of formal (and implicit) commitments and the interactions of different risks were not

modelled. The CEBS concludes that there is room for improvement in liquidity stress tests and that adequate liquidity buffers are crucial in liquidity risk management.

BCBS (2008 a) also confirms that banks' stress tests did not anticipate the nature, magnitude or duration of the shocks across much of the global financial system. In most cases, stress testing had focused on idiosyncratic or firm-specific shocks. The report also points out that there appears to be some reluctance among banks to make more rigorous and comprehensive simulations. The challenge of defining an appropriate level of stress remains a formidable one for both banks and supervisors. The BCBS calls for higher liquidity cushions that should enable banks to weather prolonged periods of financial market stress and illiquidity. It also stresses the need for stricter enforcement of compliance of qualitative liquidity regulation by regulators and supervisors.

Similar arguments are also presented by the International Monetary Fund (IMF) in the April 2008 issue of its Global Financial Stability Report and by the President's Working Group on Financial Markets (2008). With regard to banks' liquidity risk management practices, the *IMF* calls for more severe funding liquidity stress tests, for the disclosure of their assumptions and results, and for more transparency regarding liquidity risk management policies and practices. On the interaction between different risks, the report highlights the potential correlation between funding and market liquidity risk and promotes more severe stress tests also of the latter. With regard to liquidity regulation, the IMF recommends tougher liquidity risk management standards, higher liquidity buffers (including higher minimum liquidity requirements and stricter limits on maturity mismatches) and tighter rules to ensure the diversification of funding sources and the ability to survive disruption in funding markets. The *President's Working Group (PWG)* discusses the weaknesses at several financial institutions in terms of the concentration of risks, the valuation of illiquid instruments, the pricing of contingent

liquidity facilities and the management of liquidity risk. Among the similarities between US and European banks, the report mentions the failure of stress testing to identify institutions' vulnerabilities arising from system-wide shocks to markets and market participants, and difficulties aggregating exposures across business lines and valuing instruments when markets became illiquid.

The report drafted by the *Senior Supervisors Group (SSG) (2008)* found that while for some banks the size of price movements in their stress tests generally matched the actual market movements during the crisis, for other intermediaries the widening of credit spreads proved to be larger and of a longer duration than expected. Interestingly, at some firms, problems emerged in the interaction between risk managers, senior management and business line staff, who were reluctant to accept more extreme stress test assumptions. This again underlines the inherent difficulties in calibrating the most adequate shocks and scenarios.

The *Financial Stability Forum (FSF)* report to the G10 (2008) recommends supervisors to focus on the capacity of a firm as a whole to manage risk. Supervisors should require intermediaries to focus on tail risks and strengthen stress testing practices. Along with banks' risk management practices, supervisors should also assess the extent to which firms integrate their risk assessments into the decision-making processes and controls. The link between stress testing and contingency funding planning is considered crucial for sound risk management. The FSF stresses the need for larger and more robust liquidity buffers. In addition, it recommends that large banks should disclose their CFPs to the central bank.

The UK *Financial Services Authority (FSA)* (2007) analyses preliminary lessons from the market turmoil and concludes that there have been clear limitations in liquidity risk management. These include, inter alia, the quality and robustness of banks' liquidity stress tests in terms of scope of application,

assumptions regarding the scenarios, the follow-up to stress tests and CFPs. Against this background, the FSA provides some guidance on stress tests, which include the following recommendations: inclusion of both chronic (less severe but long-lasting) and shock (extreme but short) liquidity stresses; consideration of the disruptions and closures of both the unsecured and secured funding markets; contemplation of a prolonged lack of access to sources of long-term funding; consideration of contingent liabilities; and adequate behavioural assumptions with regard to contingent funding commitments. But the FSA also stresses the inherent difficulties in quantifying the drivers of liquidity risk and concludes that objective validation of internal models and the assumptions in liquidity stress tests is almost impossible. In addition, it argues that internal models cannot take into account externalities. For both reasons, they are not considered substitutes for quantitative liquidity requirements which should reduce maturity mismatches and ensure shock absorption capacity (liquidity buffers). Regulators and supervisors should improve reporting requirements as well as compliance with qualitative and quantitative requirements.

This section provided a brief overview of a number of reports on lessons to be drawn from the recent market turmoil regarding liquidity risk management, regulation and supervision. Deficiencies in liquidity stress tests and CFPs feature prominently in all reports. Common lessons for banks include improvements in both of the aforementioned areas and the need to hold higher liquidity buffers. Common lessons for regulators and supervisors focus on stricter liquidity regulation (i.e. higher liquidity buffers) and stricter enforcement of qualitative regulation.

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