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STRESS TESTING AND CONTINGENCY FUNDING PLANS:

AN ANALYSIS OF CURRENT PRACTICES IN THE LUXEMBOURG BANKING SECTOR

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Contents

Stress testing and contingency funding plans: an analysis of current practices in the Luxembourg banking sector*

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Abstract

This paper analyzes the current practices adopted by a sample of Luxembourg banks on liquidity stress testing and contingency funding plans. The paper covers four main topics: liquidity stress testing coverage, scenario design, policy issues and contingency funding plans. We compare, when relevant, these results to a larger sample of EU peer banks. The results, collected through a questionnaire addressed to forty-seven banking groups, are analyzed by the means of the principal component technique. The paper also highlights the main features and shortcomings of local banks in this field.

Keywords: liquidity risk, liquidity stress testing, contingency funding plan, principal component analysis.

JEL Classification: G21

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Résumé non technique

L'objectif de ce cahier d'étude consiste à analyser les bonnes pratiques de gestion du risque de liquidité dans le secteur bancaire luxembourgeois et, plus particulièrement, l'analyse des systèmes afférents aux tests d'endurance (stress testing) et au plan de refinancement de contingence des banques. La problématique a été approchée à travers la réalisation d'une enquête auprès d'un échantillon représentatif d'établissements de crédit. Cette étude met en parallèle les résultats de l'enquête avec un échantillon plus vaste des banques européennes, ayant utilisé le même questionnaire.

L'analyse des résultats a montré que pour certains établissements de crédit, une marginalisation des entités luxembourgeoises dans le cadre d'un dispositif de refinancement de contingence centralisé au niveau du groupe est susceptible d'amplifier les risques liés à la gestion des liquidités au niveau local. Ce type d'impact est largement dû à une présence structurelle importante des filiales et des succursales de groupes bancaires transfrontaliers. Ceci implique que les entités locales ne sont pas toujours incluses dans la phase de planification des tests d'endurance à un choc de liquidité, même si ce test est mené à Luxembourg. La même observation vaut en matière de plan de contingence.

Les banques luxembourgeoises n'adoptent pas souvent de scénarios combinés. La crise récente à pourtant mis en évidence qu'une crise de marché peut aller de pair avec un choc idiosyncratique. En faisant abstraction de tels scenarios combinés, les banques risquent de ne pas évaluer correctement le risque de liquidité auquel elles font face.

Les résultats du questionnaire ont mis en évidence que les banques actives dans le marché de détail et des prêts hypothécaires ont montré une tendance accrue vers l'adoption d'un « stress testing » au niveau du groupe. A l'opposé, les banques dont les activités sont spécifiques et spécialisées semblent opter pour un test d'endurance à deux niveaux (groupe et entité luxembourgeoise).

En ce qui concerne les types de scenarios adoptés, l'enquête a montré que le marché interbancaire ainsi que les clients institutionnels sont généralement inclus dans le périmètre du test d'endurance, alors que les produits structurés et la titrisation ne sont pas pris en compte. En outre, il semble que le plan de contingence et de test d'endurance ne soient pas caractérisés par une corrélation, comme suggéré dans les analyses des pratiques courantes.

I *Introduction*

The revision of the legal framework[1] which defined the perimeter of the responsibilities of the Banque centrale du Luxembourg (BCL) in the field of liquidity surveillance and the assessment of market operators entailed new tasks for the BCL. This increased responsibility includes among others the evaluation of the soundness of liquidity risk management practices in banks. With a forward-looking approach, the BCL investigated two of the cornerstones of liquidity risk management (LRM) practices: stress testing (LST) and contingency funding plans (CFP). This investigation was based on the results of a questionnaire[2], which was sent to a sample of Luxembourg banks.

This paper consequently explores the results of the above-mentioned survey and integrates a comparison between Luxembourg banks and a wider sample of European peers previously surveyed by the means of the same questionnaire. The results of this survey prove that LST and CFP are widely adopted. However banks rely mainly on the parent company for their implementation. Moreover, we find that local banks are rather passive as concerns the development of these stress tests and contingency funding plans on a local level. We note that the involvement of the respondents in the scenario design and the CFP setup is often limited. This may be due to the effect of centralization of liquidity risk management at the group level and to the presence of a large number of branches and subsidiaries in the domestic banking sector. Indeed, the large majority of banks perform a stress testing merely at group level.

As regards stress test scenarios, Luxembourg banks rarely adopt scenarios combining market-adverse and idiosyncratic shocks. This approach may be rather short sighted, especially when you consider the increasing risk of interaction between financial markets and the entangled risk that a liquidity crisis may have. Moreover, the responses to the questionnaire highlight that banks which are more active in the retail and mortgage businesses are more likely to adopt a group level stress testing. More specialized banks perform their liquidity stress tests both at local and group levels. As concerns idiosyncratic risk, local banks do not include their exposures to special purpose vehicles and the securitization market in their liquidity stress scenarios. This may entail a certain degree of risk, which was neglected by banks carrying these types of exposures. Moreover, certain aspects of the banking business should be better integrated within the

[1] Loi du 24 octobre 2008 portant amélioration du cadre législatif de la place financière de Luxembourg, Mémorial A n° 161 du 29.10.2008, p. 2250.

[2] The questionnaire has been designed in the context of the work of the BSC Task force on Liquidity Stress Testing and Contingency Funding Plan by the Task Force's members. The Task Force, to which the BCL participated, started its work in October 2007. The outcome of this survey is published in the form of a report by the European Central Bank (2008), cited. For the methodology of this study please refer to European Central Bank (2008) "EU banks liquidity stress testing and contingency funding plan", cited.

bank stress tests. One such aspect is the increase in online banking activity whose role as a funding channel is growing. This trend provokes changes in bank funding strategies, with an impact for liquidity risk management. Given the evolution of banking products, the "stickiness" of retail deposits has to be tested, particularly considering that online banking does not enjoy the same characteristics as a traditional deposit, i.e. in the case of a bank-run.

The analysis highlights that the respondents acknowledged the risks involved in the disclosure of stress test results. This appears to be linked to the risks related to a misunderstanding of stress test results by the general public. This factor could be potentially due to a lack of comparability. A proposed solution currently discussed in several fora envisages supervisors and central banks requesting banks to participate in concerted rounds of common liquidity stress tests. Harmonized scenarios could serve as benchmark, particularly for less complex banks. However, this would not much enhance market discipline, as banks would rather retain freedom of manoeuvre in the quantification of the impact of the proposed scenarios and in the calibration of the underlying models.

2 *General background*

2.1 *Conceptual framework*

Liquidity risk may arise from banking intermediation: i.e. lending in the long term and borrowing in the short term. This latter banking structural tendency is usually referred to as "maturity mismatch". This phenomenon originates from the maturities transformation of assets and liabilities [Diamond and Dybvig 1983, Goodhart 2008[3]]. In addition, the BIS [2008] defines liquidity risk as the ability of a bank to fund increases in assets and meet its financial obligations in a timely manner as they come due without incurring excessive cost. This definition is also recurrent in many large banking groups liquidity risk sections of their annual reports. Liquidity (as well as liquidity risk) may be scrutinized from three different perspectives: funding, financial markets and the macroeconomy[4]. Funding liquidity risk could be defined as the ability of a bank to settle obligations with immediacy [Drehmann and Nikolaou 2009].

[3] In Banque de France (2008), cited.
[4] Other concepts of liquidity are identified by several authors. These concepts include inside and outside liquidity, contingent liquidity, etc…for more information regarding these topics, we refer to Financial Stability Review (2008), Banque de France, "Special issue: liquidity", cited.

Liquidity can also refer to a characteristic of a financial instrument that defines its capability[5] of absorbing large trading volumes without its price being significantly affected [Brunnermeier and Pedersen 2007]. We refer to this set of attributes as market liquidity of a financial instrument. The third concept of liquidity is the quantity of liquid assets available in an economy. In this case it includes central bank facilities, monetary aggregates and other highly liquid assets. This can be defined as macroeconomic liquidity[6]. Since market as well macroeconomic liquidities are critical for liquidity risk management, these aspects of liquidity risk should be taken into account in the setup of LSTs and CFPs.

Modelling and managing liquidity risk may necessitate different modelling techniques rather than the ones usually adopted to analyze other typical risks (e.g. credit, market, etc…) originating from banking activities. Given that a liquidity shock is a "black swan" event [Taleb 2007][7], econometric models based on historical time series may underestimate the impact of a liquidity squeeze on the banking business [Haldane 2009]. Best practices in LRM suggest therefore the adoption of tools for liquidity risk management such as liquidity stress testing and contingency funding plan. In general, stress testing and scenario design are two parts of a mechanism used to analyze the response of an organization to potentially severe but plausible future events. LSTs do a better job in assessing the several facets of liquidity risk, due to their implicit forward-looking approach when scenarios incorporate liquidity risks potentially critical for the bank. The transposition of the designed scenarios into a set of actions enabling the bank to survive these predefined shocks should lead to the creation of a contingency funding plan. This latter could be defined as the set of measures which the bank plans to implement in case of liquidity constraints [Matz and Neu 2007].

Central banks hold several arguments that may justify their interest in monitoring liquidity risk in banks[8]. The importance of assessing the degree of liquidity risk to which banks are exposed to, stems from the core competence of central banks in monetary policy, in preserving financial stability and in minimizing the macroeconomic impact of a liquidity squeeze. In order to achieve these objectives, the central bank should fully appreciate

[5] The capability of an agent to sell a security in a market may be therefore affected either positively or negatively, by these characteristics such as the trading volume, the volatility, the reputation of the issuer.
[6] Tirole [2008] defines it as an "asset [which] must not lose value in those very circumstances in which the corporate sector does need money" in "Liquidity shortages: theoretical underpinnings", Banque de France cited.
[7] Taleb defines a "black swan" as an event which is generally characterized by a high magnitude and low frequency.
[8] A discussion of the potential involvement of central banks in prudential supervision is outside the perimeter of this paper. For more in-depth analyses on these topics we refer the reader to Padoa Schioppa (1999) "EMU and banking supervision" Lecture at the London School of Economics, Financial Markets Group on 24 February 1999.

the impact on banks' liquidity management and the risks related to potential side-effects of its market operations, such as second-round effects, hoarding behavior and contagion effect. This implies a comprehensive knowledge of liquidity risk management of individual banks. This information may be partly found in banks LSTs and CFPs. In particular, LSTs and CFPs are essential to assess the degree of exposure to liquidity risk and may also reduce the ambiguity concerning the solvency of an institution.

2.2 *Methodology adopted*

The methodology adopted in this paper reflects the Delphi approach used by Rouabah [2000]. The questions integrated in the questionnaire reflect the thoughts and ideas of the members of the Task Force on Liquidity Stress Testing and Contingency Funding Plans of the Banking Supervision Committee of the European Central Bank in which the BCL participated. The Task Force conducted in a first stage several preliminary interviews with a limited sample of large EU banks. In a second stage, a questionnaire (*see Annex 1*) was sent to a broader sample of large EU banks. The results of this survey were published in the form of a report[9]. The analysis hereafter differs from the report as:

- It tackles the survey's results by adopting a factor analysis approach
- It focuses on the Luxembourg banking sector.

As regards the methodology adopted, a similar approach for the survey's analysis has been undertaken in the economic literature by several authors such as Rouabah [2000], although this approach is less common in economics than in medicine, physics and other applied sciences.

The BCL has investigated the topics of LSTs and CFPs by the means of the previously mentioned questionnaire[10]. The questionnaire has been sent to a sample of 47 banking groups, different from those targeted by the Task Force and selected according to several criteria: total assets, participation in open market operations with the BCL, systemic relevance for the domestic banking sector etc... 30 banking groups (38 entities) replied to the questionnaire. These 30 groups represented, as at 31st of December 2008, roughly 69% of the total assets of the Luxembourg domestic banking sector and 30% of

[9] European Central Bank: "EU banks' liquidity stress testing and contingency funding plan" (November 2008). Available at ECB: http://www.ecb.int/pub/pdf/other/eubanksliquiditystresstesting200811en.pdf

[10] Other data were collected from annual reports, banks' websites and internal documents provided by banks.

the total number of registered banks[11]. The geographical composition of the banking sample included 26 banks from the Euro-area, 3 banks from the European Economic Area (outside the Euro-area) as well as 1 Joint Venture of mixed origin[12]. As regards the legal status, 5 were parent undertakings, 29 were subsidiaries and 4 were branches.

3 *Liquidity stress testing: current practices and policy issues*

3.1 *Liquidity stress testing in Luxembourg banks*

As concerns liquidity risk, stress tests should in principle appraise this risk on a consolidated basis as well as on an entity level. Business units should in principle be able to assess their liquidity risk. The extent of the granularity of stress tests at group level should be flexible but due diligence should always be guaranteed. Banking groups should especially stress test entities and business lines if they carry a specific and significant liquidity risk[13]. In this context, cross-border banking groups may have to assess wether local entities carrying out locally specific business activities should implement tailored LSTs, in particular when these entities are relevant as group liquidity providers or perform specific activities within the group.

In order to further assess LST breadth and coverage within the Luxembourg banking sector, we investigated a representative sample by means of a data mining technique called principal component analysis[14] (PCA). We aggregate the respondents in an *mxn (34x11) dataset*, where m represents 34 entities of 30 banking groups[15] and n represents their attributes in terms of business activity (domestic retail, trading and sales, etc…). The results of this analysis are reported in *annex 2*. The choice of the most relevant axes

[11] Figures as at 31/12/07. 30 banking groups returned the questionnaire fully or partly completed. This value represents a rather high percentage given the non-mandatory nature of the survey, which highlights the interest of Luxembourg banks in this topic. This rate includes banks which provided joint answers for their branch and subsidiary. Eight further banks were contacted which did not return the questionnaire but provided information on this field in the form of internal documents, reports and other various commentaries.

[12] This composition fairly represented the geographical distribution of Luxembourg banks at the time of the survey.

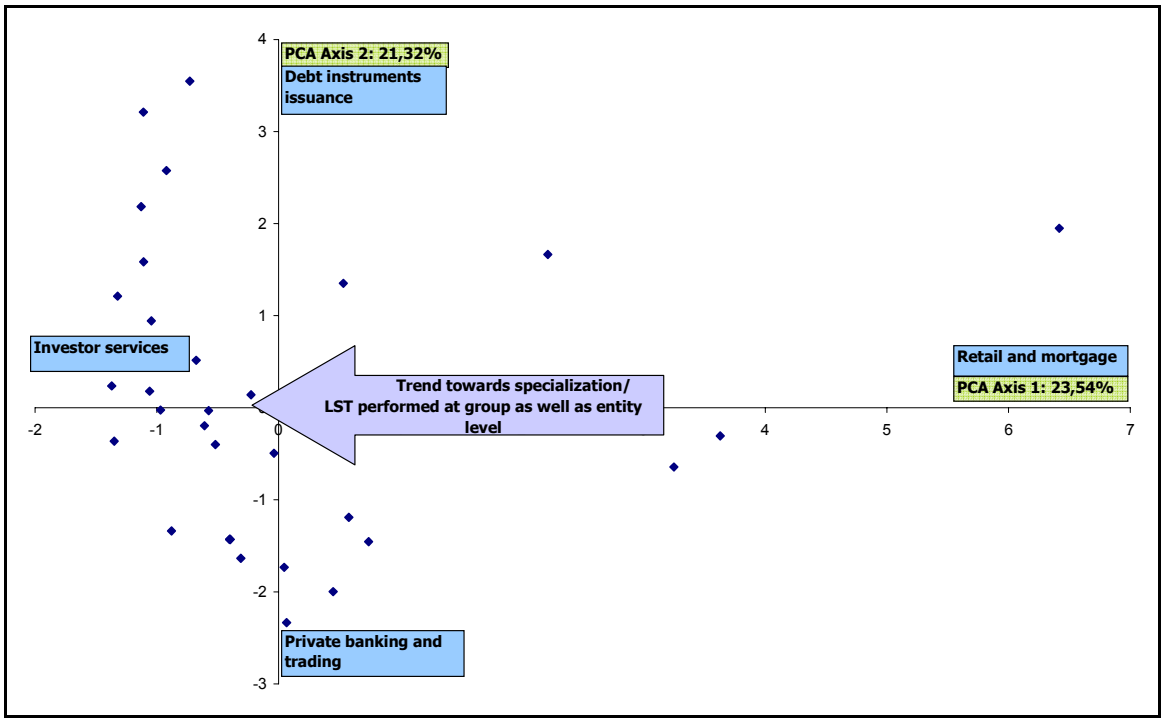
[13] BIS, 2008 principle 6 and CEBS, 2008 principles 2 and 3, cited.

[14] Data mining refers to a set of various statistical techniques which allow for the exploitation of large database repositories. Among these techniques we list multiple correspondence analysis, which integrate qualitative (discontinuous) variables as well as principal component analysis, which deals with quantitative (continuous) data. The advantage of these techniques is the possibility offered to visualize relationships between variables in an n-dimensional matrix by reducing this matrix complexity (from n to usually 2 or 3 dimensions). These new dimensions better capture the variability within the database. For more information on these techniques and their results' interpretation, see e.g. www.cs.otago.ac.nz/cosc453/student_tutorials/principal_components.pdf and http://www.cs.princeton.edu/picasso/mats/PCA-Tutorial-Intuition_jp.pdf .

[15] Entities are separately analyzed given some of them pursue a specific business activity.

is usually based on Kaiser's criterion: therefore 5 axes should be retained[16]. Anyway, given the results of a scree test[17] and for the purpose of visualization, only 2 axes are included in *chart 1*.

Chart 1 - PCA analysis: mapping of Luxembourg banks by business activity (34 entities, 65% of the total assets of Luxembourg banking sector)



The two selected axes PCA1 and PCA2 contribute to the largest extent to the description of the variability within the sample and describe respectively 23,54% and 21,32% of the whole sample variability. The variability described by these two axes sum up to roughly 45% of the whole sample variability: this value indicates that a bi-dimensional representation provides a rather accurate characterization of the sample. Attributes whose correlation with the axis is higher than 0.7 (in absolute value) are highlighted in *annex 2*: *results of PCA analysis*. Axis 1 main components are business activities "retail" and "mortgage": banks located on the right-hand side of the chart are more likely to be active in both business areas. On the opposite side of the chart, banks are active as investor services providers. This activity is slightly negatively correlated with axis 1.

[16] Kaiser's criterion suggests considering only axes whose eigenvalues are larger than 1. A more practical approach by the use of a Scree's test gives similar results: the number of axes could eventually be reduced for better sample characterization purposes.

[17] The scree test is a rule of thumb test based on a scatterplot. The plot provides a visual aid for deciding at the number of additional components to include in the analysis. The break-even point is set according to the slope of the chart describing the eigenvalues' contribution to the explained volatility.

This latter assessment is important as investor services represent the idiosyncratic aspect of the Luxembourg banking sector with respect to a wider EU sample in terms of business activity (*see box 1*). Likewise, Axis 2 integrates the dimension "private banking and trading" and "debt instruments issuance" as indicated in the chart. Private banking and trading are statistically significantly and negatively correlated with debt instrument Issuances. Moreover, by observing the average profile of the range of services offered by the respondents we notice a shift from less to more specialized banks along axis 1. Given that the largest share of the respondents is located on the left-hand side, we can argue that Luxembourg banking sector is characterized by a rather high degree of specialization. Accordingly, it is possible to notice a shift from LST at group level to both (group and entity) levels[18]. This may point to the following aspects:

- Banks which are active in the retail and mortgage banking business often delegate the design and implementation of their LST to the parent company. This trend fades away as we move to the left-hand side of the chart (to other types of activities).
- Less specialized banks seem to delegate the design of their LSTs to the parent company. Banks whose core business is centered on few specific business activities tend to perform their LSTs *also* at an entity level.

Complexity and frequency of stress tests on a bank should also be aligned with the liquidity role of that bank within its group. From a central bank perspective, LSTs should be aligned with the systemic relevance of each credit institution in financial markets, as the failure of a systemically relevant bank may pose a threat to financial stability[19].

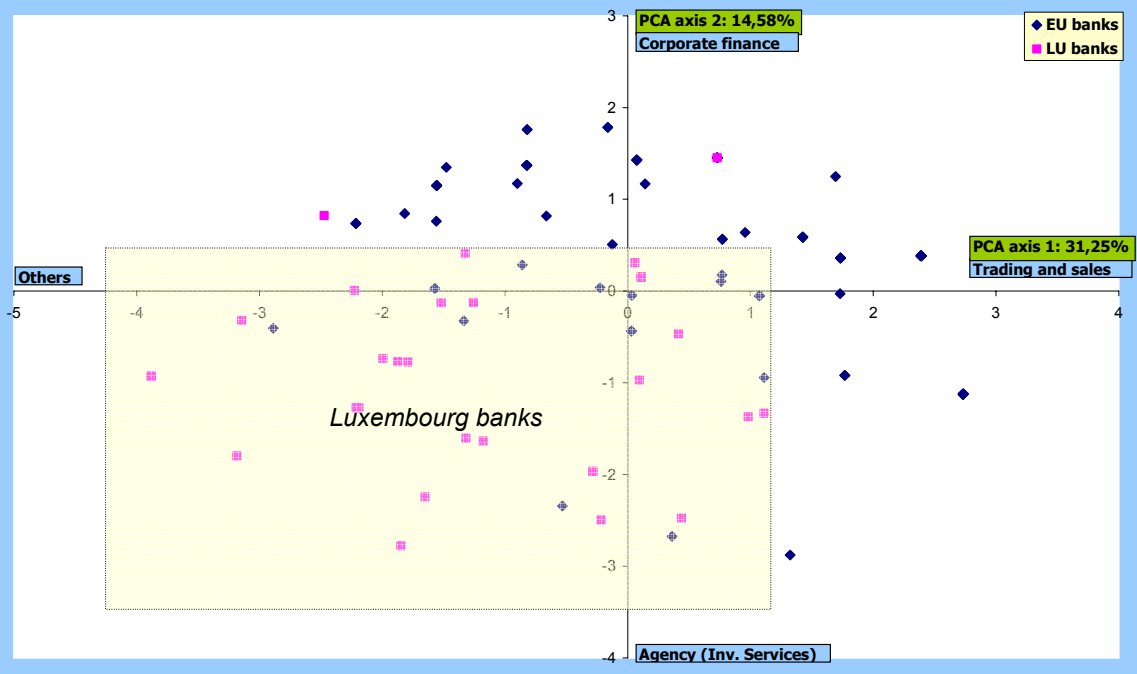
BOX 1

EU banks and LU banks: a comparison by business activities

We compare the results[20] with a wider sample of European peer banks, previously surveyed by the means of the same questionnaire by the Task Force on LST and CFP of the BSC.

[18] Unfortunately the small dimension of the sample does not allow drawing more general conclusions, but this aspect of LRM deserves further investigation.
[19] The events following Lehman Brothers' default have highlighted this type of risk.
[20] To allow comparability of results, we aggregate few attributes of the sample, namely we include Luxembourg retail and private banking into retail, booking of structured credit and issuance into others. Investor services (custody, depository and fund management) have been identified with agency services according to several respondents' indications.

Chart 2 - PCA analysis results: Luxembourg banks vs. EU banking sample by business activity



In particular, the aim of this analysis is to isolate the idiosyncratic factor of Luxembourg with respect to the wider European sample as regards business activities by the means of PCA analysis. The main assumption behind this approach is that different business activities entail different liquidity risk profiles for banks. *Chart 2* highlights the mapping results on a bi-dimensional scatterplot. The results (*Annex 2*) highlight the distinctiveness of the local banking industry as concerns business activities. Indeed, on axis 1 we observe banks which are active in trading and sales of financial instruments. These latter institutions are usually not providing other types of services (structured finance, issuance). On axis 2 we observe the opposition between banks offering agency (investors) services and banks engaged in corporate banking activities. We observe that Luxembourg banks differentiate themselves in terms of business activity. This combination of results identifies Luxembourg banks as providers of services to investors (agency services) and as active in other types of business (e.g. covered and structured finance). All these business activities are rather specific of the domestic banking sector: indeed, only a limited number of other EU peer banks offers a similar range of services.

In particular, as regards banks providing services to investors, custodian and depository banks as well as central securities depositors and settlement systems fall into this category. Their degree of liquidity risk[21] refers particularly to intra-day as well as liquidity risk linked to reputation. Among these types of banks, central securities depositors and

[21] European Central Bank "The securities custody industry" cited.

settlement systems are particularly relevant for systemic liquidity risk. Other activities largely performed at a local level are the booking of debt securities and issuances of covered bonds. These latter activities may entail other types of liquidity risk which are more closely related to, respectively, market liquidity aspects and reputation risk. Market liquidity may play a bigger role in LSTs of banks which manage the portfolio of structured credit in the local entities (e.g. monitoring of liquidity of capital markets referring to certain financial instruments relevant for each bank). All of the above suggests lines of further investigation aiming at a specific approach to liquidity risk monitoring for Luxembourg banks.

3.2 *Liquidity stress test scenarios*

LST scenarios should encompass the many facets of liquidity risk and should be consistent with each bank's liquidity risk profile. Indeed, a liquidity squeeze may originate from several types of event. In general it is possible to generalize the breadth of a liquidity squeeze as follows:

- Market-wide: the bank is hit by a widespread event occurring in the financial markets, entailing consequences for the overall banking sector but no bank-specific events are assumed
- Idiosyncratic: the bank is hit by a specific event limited as regards the concerned entities. It may be a rating's downgrade, a bad media coverage event or an operational issue
- Combined: both the above-mentioned types of event are occurring and the two events (market-wide and idiosyncratic) are closely linked.

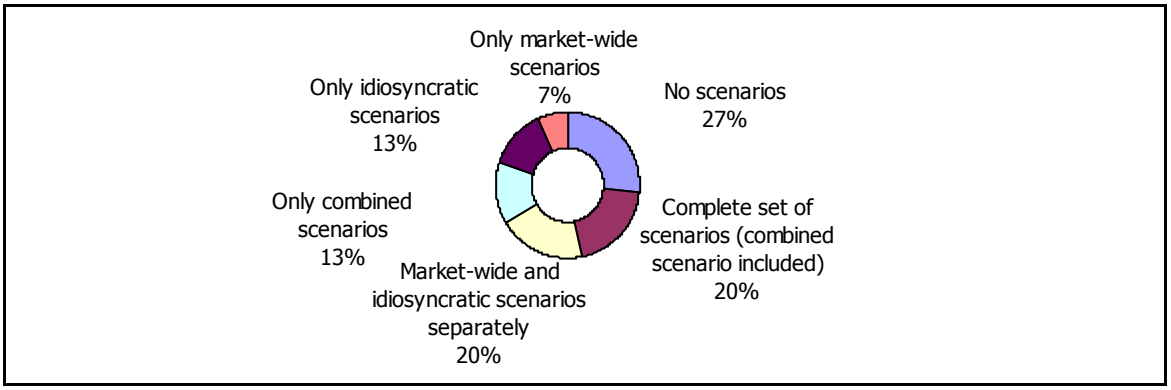
The 30 respondents implemented 61 scenarios, an average of roughly 2 scenarios per bank. Scenarios have been classified according to several criteria: width, core features as well as key funding markets disrupted.

Chart 3 highlights the choice of the set of scenarios which were selected by banks as tools for their liquidity risk management framework. The breakdown of LST scenarios within the respondents indicates that 27% of the banks did not adopt a scenario for the local entity at the time of the survey[22]. Moreover, 20% of the respondents adopted a

[22] Banks reported as LST scenarios also stress tests based on "business as usual" conditions (4 respondents). These latter did not seem to respond to the minimum requirement for LST (*severe* but plausible event) and were not included in the further analyses.

complete set of scenarios (combined, market-wide and idiosyncratic), while 13% implemented only combined scenarios. These two categories have adopted at least one combined scenario including some market-wide ("flight to quality" event, key markets disruption, etc…) as well as idiosyncratic elements (such as a rating downgrade, rumor, bank run etc…).

Chart 3 - Choice of scenarios set by bank (30 banking groups, 65% of the total assets)



The results highlight that the implementation of combined scenarios is limited. Indeed, local banks seem to opt for idiosyncratic scenarios and to a lesser extent pure (lacking any bank-specific feature) market-wide ones. The reasons for this pattern may lie in the major presence in the local banking sector of subsidiaries and branches of international banking groups. The lack of autonomy and the centralization of several LRM functions at a higher level may lead Luxembourg entities to identify their liquidity risk as mainly related to reputation. This risk may be linked to the occurrence of an idiosyncratic event, particularly at their parent company level (downgrade or bank run).

Several banks relied exclusively on either a market-wide or an idiosyncratic scenario. These banks adopted a so-called "silo-based" approach. This latter is based on the assumption that idiosyncratic and market-wide events have a negligible joint probability of occurrence. The current crisis has highlighted that these assumptions are not realistic. Combined liquidity shocks should be monitored as they may have systemic effects on the financial system. A market-wide event may amplify an idiosyncratic weakness at one or more specific banks. Symmetrically, an idiosyncratic event in one bank may trigger a crisis of broader spectrum by contagion effect. In both cases, these risks should be considered when designing a liquidity scenario.

In order to define similarities across *all* types of scenarios we adopt a PCA technique to analyze 50 (out of 61) scenarios for which we had a suitable set of information. We classified each scenario according to the following features[23]:

I. Core dimensions:
    a. idiosyncratic
        i. downgrade
        ii. rumors/bank run
        iii. internal crisis
    b. market-wide
        i. liquidity squeeze
        ii. economic crisis
        iii. financial markets crash
II. Sources of liquidity assumed as disrupted in the scenario[24]:
    a. retail deposits
    b. secured inter-bank market (repo)
    c. unsecured inter-bank market (CD/CP, FX swaps, inter-bank deposits)
    d. bond and covered bond market
    e. structured finance market (including liquidity lines to conduits/SPVs)
    f. institutional deposits (corporate/holdings/investment funds)
    g. central banks

Chart 4 illustrates the relationships across these variables in a bi-dimensional space. The purpose of the analysis was to define the type of scenarios run by the respondents in order to identify potential shortcomings in their implementation at a local level. The mapping exercise highlighted the following:

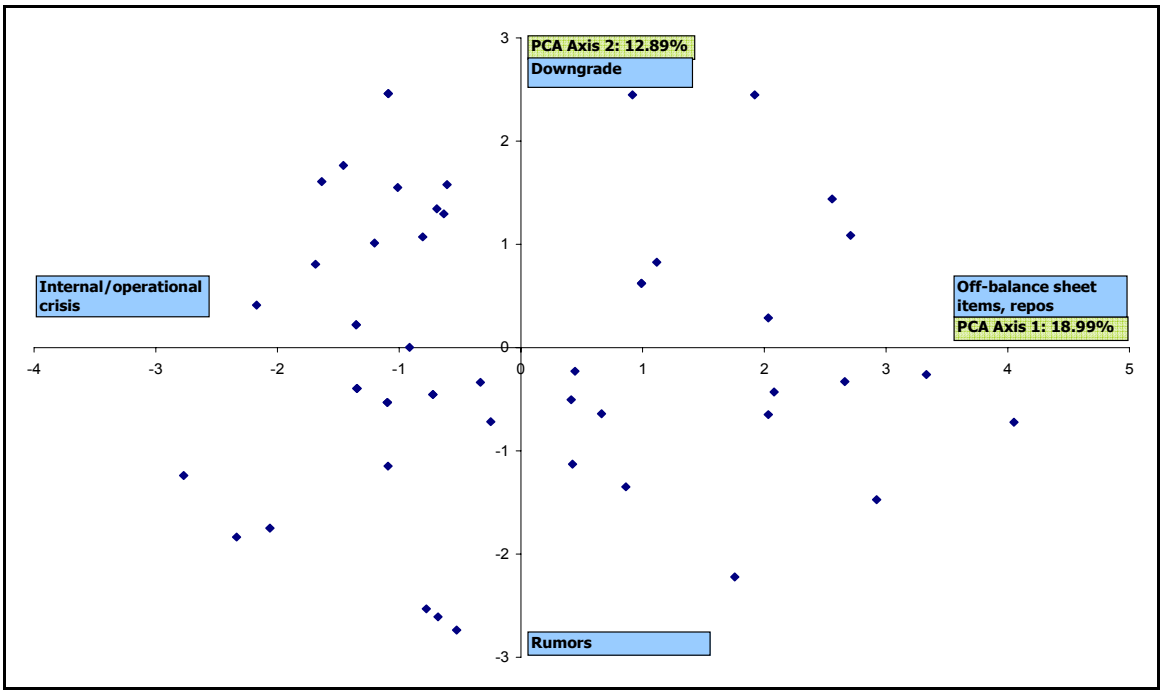
I. Scenarios may have several mixed features: idiosyncratic scenarios may also carry some market-wide assumptions
II. Scenarios featuring a downgrade often included the unsecured inter-bank as well as the institutional clients and not the retail channel as disrupted
III. Bank run/rumors events included the retail market as the most commonly included in these scenarios

[23] Internal reports of the respondents as well as questionnaire results were used in this analysis. The geographical dimension could not be included among the model variables due to the incomplete dataset collected from the respondents. As concerns idiosyncratic scenarios only those for which we disposed of complete information collected from internal documents were included. This would reduce to a minimum the bias triggered by the questionnaire setup in this respect.

[24] As regards core assumptions about disrupted markets, these were gathered from the analysis of the questionnaire responses as well as from internal documents collected from local entities. Some markets were aggregated for the purpose of the analysis.

IV. The bond and repo markets were affected in scenarios assuming global/regional economic crises and financial market crashes
V. The retail and institutional client markets were often not simultaneously affected

Chart 4 - PCA analysis: LST scenarios by main assumptions and markets affected (50 scenarios)



The PCA analysis results are reported in *annex 2*. The variability captured by the two main axes adds to roughly 32%. According to our "visual" approach, we select these axes. Axis 1 defines, on the right-hand side, scenarios stress-focused on off-balance sheet items and repurchase agreements. Both these channels are positively and significantly correlated. Axis 2 defines scenarios by their triggers, which, according to PCA outcome, are either downgrade or rumor. Downgrades usually impact the unsecured inter-bank channel (inter-bank deposits, FX swaps, CD/CP) as well as institutional clients. These sources of funding, as expected, are perceived by the respondents as the most sensitive to changes in rating and are often disrupted together.

The events following the financial crisis may have shifted banks to fund their activities through other channels, perceived as more secure (e.g. through central bank facilities, publicly-guaranteed issuances, etc…). This should trigger an adjustment of LST scenarios according to the new funding strategy: markets perceived as safe havens may tighten their rules for future access. This possibility should therefore be integrated into future stress tests. Liquidity crises triggered by rumors were mostly assuming disruption in the retail channel. There is low correlation between rumors and this channel since it treated as affected by other event types.

A main shortcoming of the scenarios is the lack of integration of structured finance products in the respondents' LSTs, in particular in market-wide scenarios. The aspect of market liquidity seemed to have been overlooked. The sudden dry-up of a proper market for structured finance products may impair the ability of banks to dispose of these products to generate cash without large losses[25]. In this context, market liquidity issues were rather dismissed by the respondents. The intervention of central banks, which relaxed collateral eligibility requirements, allowed banks to post part of their structured products as collateral in open market operations. This measure should nevertheless be perceived as temporary and LST scenarios adjusted accordingly. Assuming these extraordinary measures as permanent may increase the magnitude of future liquidity squeezes. Moreover, securitization was widely neglected as a source of funding in a disrupted market. This may mirror the lack of activity of the respondents in this funding channel.

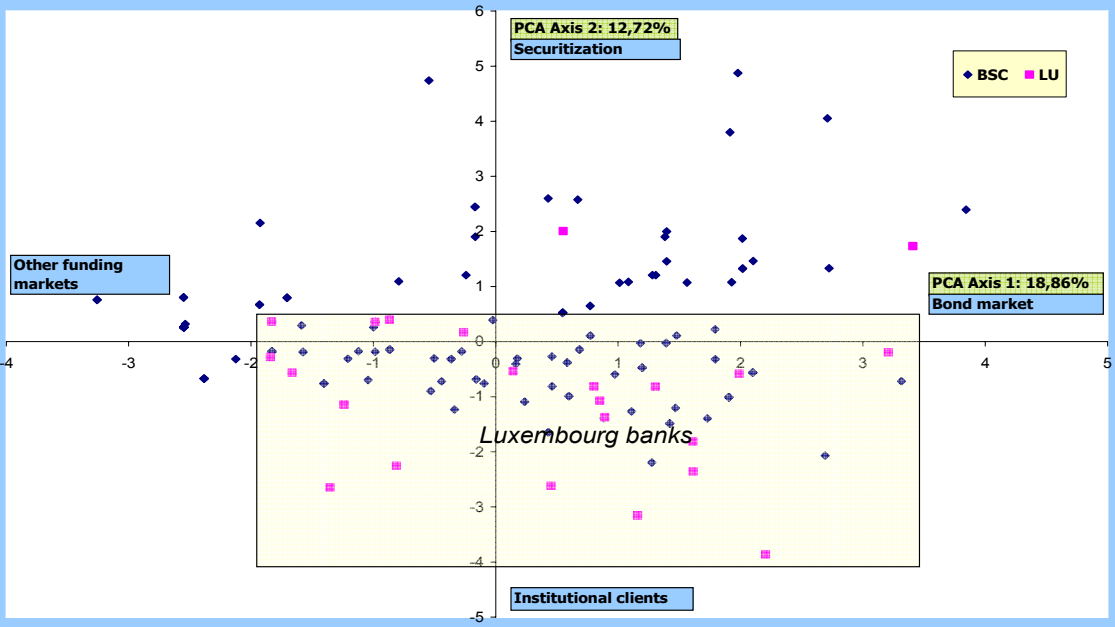
BOX 2

EU banks and LU banks: a comparison by scenario components

This comparative analysis is based on different hypotheses, given that we do not have access to the same information for the two samples. In particular, we do not integrate market-wide and idiosyncratic features, as the questionnaire clearly separates these two aspects and as we do not have access to internal documents of the EU banking sample. Our approach takes into consideration therefore the two aspects of LSTs, market-wide and idiosyncratic, separately. We integrated the Luxembourg and EU banks into an aggregate sample and we ran a PCA analysis. As regards market-wide scenarios, we find that axis 1 integrates bond and other funding markets as main opposing features. Axis 2 is defined by the assumed disruption of securitization or institutional clients. Axis 2 is the most relevant to characterize Luxembourg banks as it emerges from *chart 5*. Local banks LSTs did not integrate securitization as a disrupted market, whereas compared to their EU peers, institutional clients were retained as more important. As concerns idiosyncratic scenarios, the results are displayed in *chart 6*. A trend seems to emerge which highlights a preference to include downgrades rather than rumors as perceived triggers for liquidity crises.

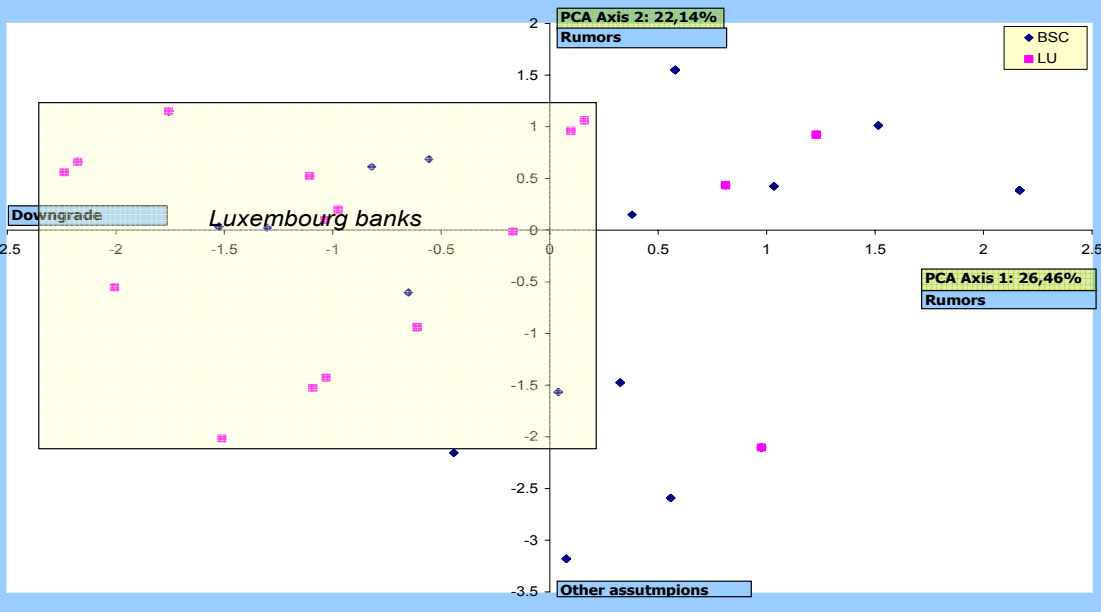
[25] The intervention of central banks which entangled a widening of collateral eligibility requirements allowed banks to post part of their structured products as collateral in open market operations. This measure should nevertheless be perceived as temporary and LSTs' scenarios adjusted accordingly.

Chart 5 - PCA analysis: LU banks vs. EU banks, comparison by market-wide LST scenarios (157 scenarios overall – 26 scenarios by Luxembourg banks)



The results confirm this facet of the Luxembourg banking sector, as Luxembourg banks seem to recognize in their scenarios the aspect of liquidity risk caused by their specific activity (e.g. the risk linked to deposits of investment funds and financial holdings).

Chart 6 - PCA analysis: LU banks vs. EU banks, comparison by idiosyncratic LST scenarios (116 scenarios overall – 24 scenarios by Luxembourg banks)



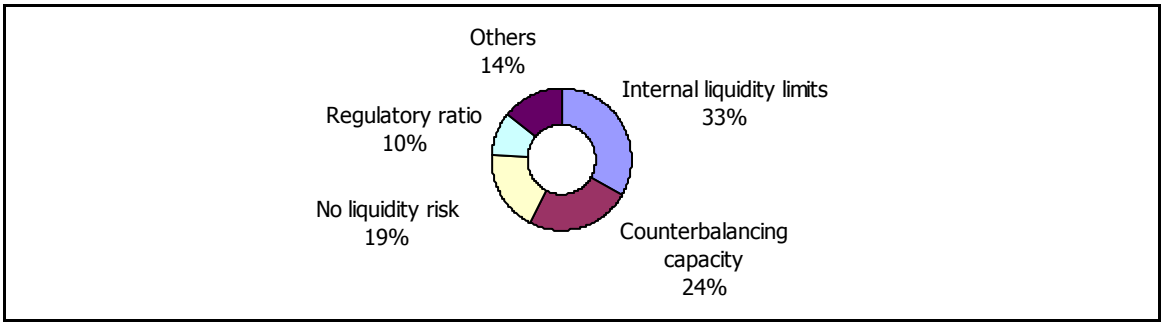
In general, the main funding market for local banks appears to be the unsecured inter-bank market[26]. According to the respondents, this funding market carries the main potential liquidity risk, followed by retail (private banking) and institutional deposits, as well as the CD/CP channel.

4 Liquidity risk tolerance

Liquidity risk tolerance is defined as the degree of uncertainty that a bank is willing to accept as regards its liquidity position in a certain interval of time [ECB 2008]. In order to define a level of liquidity risk tolerance, the bank should in principle be able to attribute, for a certain stochastic event, the frequency and magnitude of its occurrence and to define a probability distribution for the outcomes of such an event. The definition of these parameters would be based on a statistical analysis of historical time series. Given the widely accepted notion that a liquidity squeeze is a "black swan"[27] occurrence, econometric techniques seem to be insufficient to assign realistic probabilities to these events based on historical observations. Hence the difficulties for banks to derive their liquidity risk tolerance levels from past observations. In this case, stress test scenarios should help banks to define their level of liquidity risk tolerance over a predefined interval of time (the duration of the scenario).

Nevertheless, the definition and the settings of liquidity risk tolerance levels are a commonly adopted liquidity risk management practice. Indeed, the large majority of the respondents define their liquidity risk tolerance. The results are displayed in the chart below.

Chart 7 - Liquidity risk tolerance parameters: how do you define your liquidity risk tolerance? (21 respondents, 43% of the banking sector total assets)



The measures which are listed by the respondents to define the liquidity risk tolerance are mainly of four kinds:

[26] In this category we include intra-group as well as extra-group funding.
[27] This definition indicates events characterized by "…rarity, extreme impact and retrospective (though not prospective) predictability…" Taleb N.N., cited.

- Internal liquidity limits
- Counterbalancing capacity
- No liquidity risk
- Regulatory ratio

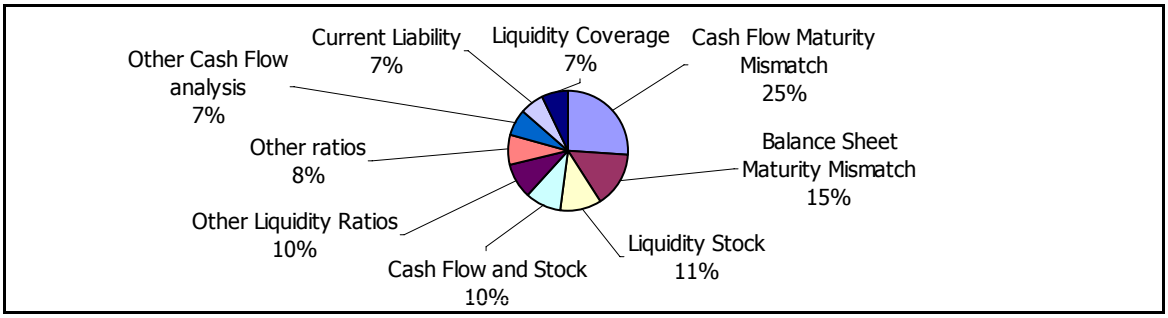
The most common set of measures of liquidity risk tolerance in our survey (33% of the respondents) is the setting of internal liquidity risk limits (such as lending volume, long term asset funded by stable funding sources, etc… which should not be trespassed during a predefined interval of time). This risk is also measured through the comparison between the expected future cash outflows and the bank counterbalancing capacity (i.e. net position of cash inflows/outflows and liquidity buffer) over a predefined time horizon (as was favored by 24% of respondents). The smallest group of respondents (19%) declared to accept no liquidity risk: this implicitly would mean that the bank has at its disposal a sufficient portfolio of liquid assets to face the entire set of potential liquidity events *on a continuous basis*. Many respondents (38%) did not set a survival horizon and only rarely (14%) banks associate their liquidity risk tolerance to the duration of their LST scenarios.

Liquidity risk tolerance should in principle integrate LST assumptions regarding the type of liquidity shock, its duration and its severity. The respondents' approach highlighted that several did not define any survival horizon. Although internal limits and counterbalancing capacity are recognized measurements for liquidity risk, it is important for banks to be able to define the size of liquidity buffers and the level of internal limits. Best practices in this field would suggest setting these latter features (size and level) by defining survival horizons according to scenario outcomes (based on severe but plausible events). The lack of clarity as regards the setting of time horizons may expose banks to an accrued risk during a liquidity squeeze, if this latter event is protracted or exacerbated by an excessive incurred cost, e.g. in case a bank would hold an excessive counterbalancing capacity.

Internal measurements are usually implemented to control and monitor liquidity risk. Many combinations of indicators can be implemented. The choice of indicators is particularly relevant for LSTs, as these are the tools which are used to transpose assumptions into figures. The ability of these indicators to combine all aspects of a scenario is very important in order to obtain a consistent LST outcome. Among the respondents, measurements based on cash-flow maturity mismatch appear to be the most common. A large number of respondents (79%) adopt at least one such indicator for liquidity risk (maturity mismatch risk), either related to a more static balance sheet

analysis or to a more dynamic, cash-flow based forward looking approach[28]. Some indicators which are suggested in theoretical analysis and relying on more sophisticated techniques, such as Value Liquidity-at-Risk[29] or other statistically-based ratios, seem to be rather neglected by the respondents[30] as highlighted below.

Chart 8 - Measurements of LSTs (24 respondents, 52% of the banking sector total assets)



The respondents seem to prefer to integrate a selected set of liquidity indicators into their measurement "toolbox". Banks rarely adopted many indicators at once. "Cash-flow gap analysis" is commonly adopted; its value as an indicator depends on the bank's business activity, for longer as well as short maturities bands. The adoption of a liquidity buffer may represent a form of "insurance" cost that banks may be required to sustain to protect themselves from abrupt changes in liquidity conditions. Indeed, banks should perform a thorough monitoring of the market liquidity of their liquidity buffers, e.g. where liquidity stocks are composed of structured finance products.

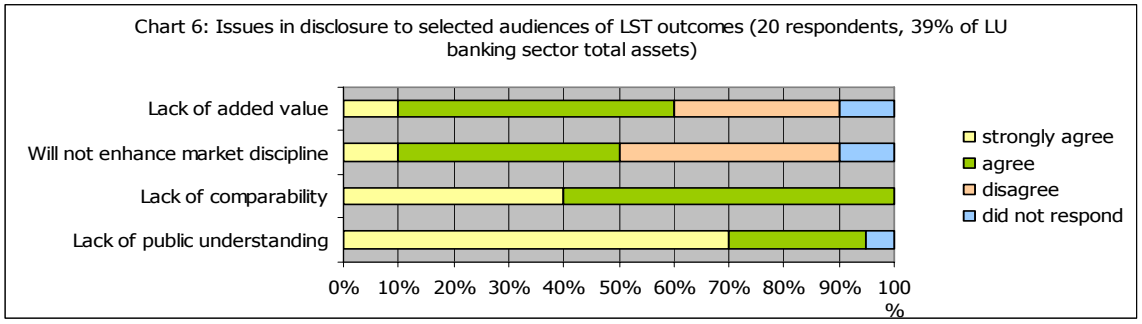
5 Policy issues in liquidity stress tests

The disclosure and standardization of stress test results showed that respondents were indifferent to standardization despite acknowledging the risks involved in the disclosure of such results (*chart 9*). Reluctance to disclose LST results may be traced back to issues related to the interpretation of these outcomes without knowledge of their actual meaning in terms of liquidity risk for the bank. Despite the opposition of the respondents in disclosing stress test results[31], this information may be found in quite a few annual reports published by the banks parent companies. This contradiction may be explained by two opposing arguments:

[28] Cash-flow gap analysis is usually based on treasury cash flows, while the balance sheet maturity mismatch analysis, by using the same approach, integrates the asset and liabilities dimension of items present in the balance sheet by the means of residual maturities and stability of funding sources. The largest share of the respondents identified this indicator with a structural funding gap ratio.
[29] See Fiedler R., 173-203, in Neu and Matz [2007], cited.
[30] Only one respondent indicated the introduction of such indicator among their LRM tools.
[31] The Task Force in Liquidity Stress Testing and Contingency Funding Plan's report highlights the persistence of this phenomenon at a European level, by investigating a larger sample.

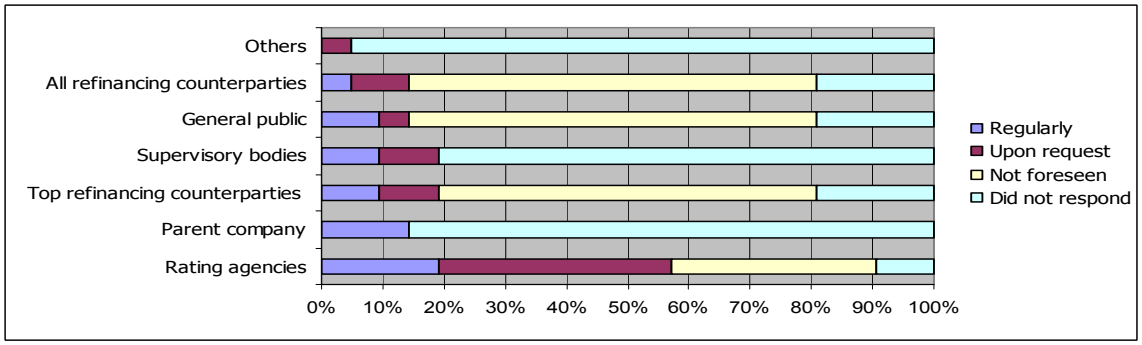
– Banks which publicly disclose their LST outcomes may indeed have an interest in doing so, if they have a better liquidity position: this might represent a competitive advantage
– Banks may feel obliged to disclose LST results given that the lack of this information may be detected and interpreted by market participants as a sign of a negative liquidity position

Chart 9 – Objection to disclosure of LST outcomes (20 respondents, 39% of LU banking sector total assets)



This ambiguity confirmed by the results of the survey[32] raises the issue of harmonization of LSTs across banks. Disclosure to the public is nevertheless currently foreseen by very few of the respondents (*chart 10*). Those who disagree have also rather strong arguments, such as the need of a broad knowledge of the banking business, its funding profile, its liquidity risk tolerance, etc… Several respondents in other parts of the survey stressed the risk of disclosing any information which may be misinterpreted by market participants. LST outcomes may be just one of these. Nevertheless, transparency must be ensured among market participants so that investors can take informed decisions. This issue may be partly addressed by referring to different standardized scenarios (e.g. by scope/survival horizon/type of shock) for different banks adopting similar business models or having similar funding profiles.

Chart 10 - Disclosure to selected audiences of LST outcomes (21 respondents, 41% of LU banking sector total assets)



[32] This analysis is based on a lower rate of response (on average, 20 respondents and roughly 40% of the LU banking sector total assets) and should therefore not be taken as reference but only as indication.

Concerted rounds of macro-stress tests coordinated by the central banks to assess bank-specific liquidity issues or a broader systemic liquidity risk may be implemented on a selected sample of banks or on the whole banking sector if needed.

6 *Contingency funding plans in Luxembourg banks*

Liquidity stress testing, in general, leads to a contingency funding plan. These two LRM tools should be closely related. Banks should identify potential liquidity risks, draw appropriate scenarios and define a contingency funding plan accordingly[33]. The CFP may be differently structured. It should at least consist of a document, describing activation and escalation rules in case of liquidity crisis, whether systemic or idiosyncratic. Not every bank has a formalized CFP. For some banks a CFP consists of a list of planned actions, for others of a simple list of contacts. In principle, each bank should have a CFP: where the local entity is characterized by a specific funding profile or is independent in terms of liquidity risk management, the CFP should be implemented locally.

The large majority of the respondents have adopted a CFP, either at both (15 respondents) or at a group level (11). Only a small minority has a CFP at the entity level (2). A limited number of banks have not yet implemented a CFP (4). Moreover, it appears[34] that respondents rely mainly on the following triggers as "early warning" indicators to activate a CFP: price volatility, asset quality deterioration, systemic liquidity squeeze, rumors on financial markets related to the bank, etc…These triggers may be mostly classified as:

- External (e.g. bad media coverage)
- Internal (e.g. liquidity limits breach)

Triggers originating from financial markets observation were mainly referring to events having an impact on the bank's business, particularly on the funding profile: notably credit spread increase and interest rates shift. Operational triggers seem to be less relevant in this context. On aggregate, the respondents seem to adopt CFPs whose triggers are rather bank-specific (internal limits, bad media coverage) and only to a lesser extent, CFPs which integrate the two aspects (idiosyncratic as well as market-

[33] See BIS (2008), principle 10.
[34] No figures are provided as regards CFP triggers as the level of detail of CFPs was different among respondents and this could have led to overweight of triggers cited in more detailed CFPs.

wide monitoring). CFPs whose triggers were originating from the monitoring of market variables (e.g. interest rates, CDS volatility, etc…) appeared to be less common.

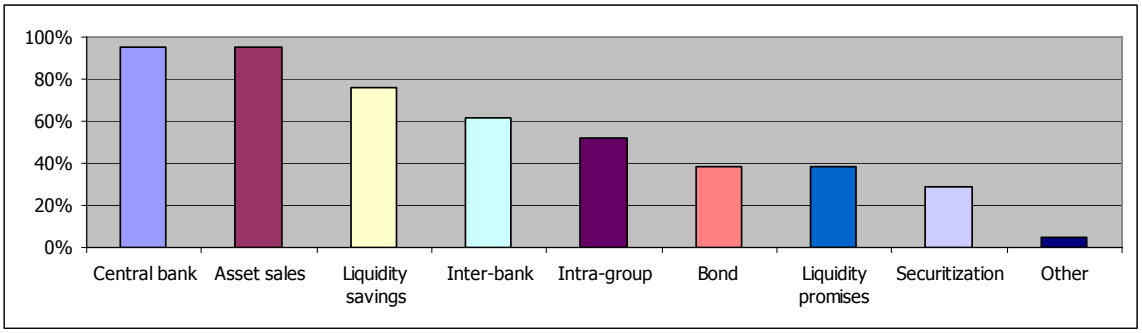
CFPs appear to be slightly detached from LSTs. Banks rarely align CFP triggers to designed scenarios, although this would be desirable. Local banks seem to adopt mainly idiosyncratic triggers for liquidity risk monitoring purposes. Banks prefer to detect issues related to bank-specific events such as limit breaches, downgrades, rumors, etc… rather than receiving market feedback. These results raise some questions:

- Is liquidity risk mainly a bank-specific risk? If this is true, the monitoring of internal limits would be sufficient to control and monitor the bank's liquidity risk
- Is liquidity risk a risk originating in the market? If this is true, market liquidity matters for liquidity risk and a broader monitoring activity is needed
- Do banks separate funding and market liquidity risk and truly monitor these two components separately?

The current crisis seems to point to a broader monitoring activity of liquidity risk. Banks should internally assess their degree of exposure to liquidity risk originating from external market events. This investigation should deserve further insight from a larger banking sample as well as a more accurate and statistically consistent analysis.

Chart 11 displays the sources of liquidity which were taken into consideration by the respondents in their CFPs. Almost all banks (95%) integrated asset sales as well as central bank facilities as contingency funding measures. Securitization (invoked by only 29% of the respondents), bond issuances and liquidity promises (invoked by 38% each) were widely neglected.

Chart 11 -: Sources of liquidity included CFPs (21 respondents, 38% of the banking sector total assets)



CFPs were usually structured according to levels: several respondents indicated some escalation procedure as well as various alarm levels. The CFPs are rather diverse: they may vary from:

- A formalized document, defining each step of the crisis and the actions to be taken to a very detailed level
- A more generic approach, where the type of crisis and the actions are not specifically defined.

The responsibility for activation lies mainly with the treasury department and eventually with the board of directors and the asset/liability committee. Some banks allocate the tasks for activation to different departments depending on the type of crisis. In general, each CFP can be summarized as belonging to the following four subgroups:

- The bank defines usually two (acute vs. mild crisis) or more crisis levels. A set of actions is explicitly described for each of these scenarios
- The bank defines a set of escalation measures, according to the gravity of the crisis. These actions include measures that apply to assets (sale of liquid assets, freeze/reduction of credit portfolio) and liabilities (increased funding through central bank operations)
- The bank merely relies on the parent company to increase intra-group funding
- The bank does not define a set of measures: actions will be defined when/if a crisis arises

The survey's results highlight the heterogeneity of the local banks approach as regards the structure of their CFPs. It appears as local banks' CFPs do not attain a high level of sophistication in terms of measures to be implemented in case of crisis. However, the mere reliance on the parent company in terms of funding may expose the local entity to an accrued liquidity risk. An alignment of measures/actions and scenarios should therefore be envisaged.

An important aspect of CFP is communication. The respondents highlight this facet in several different responses. In general CFPs integrate formally covered procedures for communication with external stakeholders (media, regulators, counterparties). Certain respondents opt for non-disclosure of measures to take in case of a liquidity crisis, on the grounds that any disclosure may trigger negative media coverage. Other banks do not integrate this aspect in their CFPs. As there is no common view on CFP structure, each bank should arrange its CFP according to its own culture and hierarchical structure. More detailed CFPs, while less flexible, may offer a faster and more effective response to a crisis.

7 *Conclusions*

This paper describes LST (Liquidity Stress Testing) and CFPs (Contingency Funding Plans) management practices commonly adopted in the Luxembourg banking sector. Luxembourg banks widely assess their liquidity risk tolerance mainly in terms of counterbalancing capacity or by adopting liquidity limits. As regards LSTs, there seems to be a positive correlation between specialization of Luxembourg banks and implementation of LSTs on a local basis. Nevertheless, despite LRM techniques being implemented on a local basis, LST scenarios are mainly designed at the parent company level and implemented locally. The results also showed that combined scenarios (featuring joint idiosyncratic and market-wide events taking place simultaneously) are rarely adopted by Luxembourg banks. Local banks have not often included structured finance products and related market liquidity issues within their stress test scenarios. The idiosyncratic component of scenarios highlights the perception of institutional clients and rating downgrades as main factors of liquidity risk.

As concerns policy issues, the respondents prefer not to disclose stress test results. In the matter of harmonization of stress test scenarios and indicators among banks, the respondents highlighted the need for a more standardized approach. These results deserve further analysis. In the area of CFP, although most respondents have adopted a plan at the local entity level, the triggers for CFP action appear to lack an in-depth analysis, in particular regarding the market liquidity aspect of the portfolio of a bank. This is more critical for banks active as “hubs” for their parent company’s structured credit portfolio. A closer alignment between scenarios and triggers should be achieved in order to increase the efficiency of LRM. Sources of funding in CFPs are concentrated in few categories and they may encounter issues related to diversification. Finally, the evidence provided in this paper highlights the specific characteristics and the level of specialization of the Luxembourg banking sector in terms of business activity within banking groups. These findings reinforce the case for further investigation as regards the degree of liquidity risk analysis carried out by local institutions and of the need for specific liquidity risk monitoring.

References:

Bagehot, W. (1873) “Lombard Street: a description of the money market”. Available at: http://www.econlib.org/library/Bagehot/bagLomCover.html

Banque de France: “Special issue: liquidity” (February 2008). Available at Banque de France : http://www.banque-france.fr/banque_de_france/gb/publications/rsf/rsf_022008.htm

Basel Committee on Banking Supervision: “Principles for sound liquidity risk management and supervision” (September 2008). Available at BIS: http://www.bis.org/publ/bcbs144.htm

Basel Committee on Banking Supervision: “Liquidity risk: management and supervisory challenges” (February 2008). Available at BIS: http://www.bis.org/publ/bcbs136.pdf?noframes=1

Basel Committee on Banking Supervision, the Joint Forum: “The management of liquidity risk in financial groups” (May 2006). Available at BIS: http://www.bis.org/publ/joint16.pdf

Brunnermeier, M. K. and Pedersen, L. H.: “Market liquidity and funding liquidity” (March 2007). CEPR Discussion Paper No DP6179. Available at SSRN: http://ssrn.com/abstract=1133823

Committee of European Banking Supervisors: “Second Part of CEBS’s technical advice to the European Commission on liquidity risk management - Analysis of specific issues listed by the Commission and challenges not currently addressed in the EEA” (June 2008). Available at C-EBS: http://www.c-ebs.org/getdoc/9474df47-8e3f-4130-b3d7-58046b5215d5/CP19_Liquidity.aspx

Degryse, H. A. and Nguyen, G. (2006) “Interbank Exposures: An Empirical Examination of Contagion Risk in the Belgian Banking System” TILEC Discussion Paper No. 2006-016, Available at SSRN: http://ssrn.com/abstract=913691

Diamond, D. W. and Dybvig P. H. (1983) “Bank Runs, Deposit Insurance, and Liquidity" Journal of Political Economy, vol. 91 no. 3, 401-419

Drehmann M. and Nikolaou K. (2009) “Funding liquidity risk: definition and measurement”, European Central Bank, Working paper series n. 1024, March.

European Central Bank: “EU banks’ liquidity stress testing and contingency funding plan” (November 2008). Available at ECB: http://www.ecb.int/pub/pdf/other/eubanksliquiditystresstesting200811en.pdf

European Central Bank: “The securities custody industry” (August 2007), occasional paper n. 68, Various Authors, available at ECB: http://www.ecb.int/pub/pdf/scpops/ecbocp68.pdf

Haldane, A. G. “Why banks failed the stress test” Bank of England (February 2009), speech given at the Marcus-Evans Conference on Stress-Testing, 9-10 February 2009

Matz, L. and Neu, P.: “Liquidity risk measurement and management: a practitioner's guide to global best practices” (2007) Singapore: Wiley. ISBN 0-470-82182-5.

Mishkin F. S. (2007) “Systemic Risk and the International Lender of Last Resort” Speech delivered at the Tenth Annual International Banking Conference, Federal Reserve Bank of Chicago, Chicago, Illinois, September 28.

Rouabah, A. (2000) “Quelles prospectives pour les banques luxembourgeoises dans un marché européen décloisonné? – une analyse selon la méthodologie Delphi” Document de travail/working paper n° 00-1, Mai, CREA and CRP Gabriel Lippmann.

Rychtarik, S. (2009) “Liquidity scenario analysis in the Luxembourg banking sector”, Working paper n° 41, Banque centrale du Luxembourg, September 2009.

Taleb N. N. (2007) “The black swan: the impact of the highly improbable”, April, New York: Random House, c2007.

Tan P-N., Steinbach, M. and Kumar V. (2006) “Introduction to data mining“, Pearson International Edition, ISBN: 0-321-42052-7

Shlens, J. [2009] “A Tutorial on Principal Component Analysis”, April 22, Center for Neural Science, New York University, New York City, NY 10003-6603 and Systems Neurobiology Laboratory, Salk Insitute for Biological Studies La Jolla, CA 92037

Smith L. I. [2002] “A tutorial on Principal Components Analysis”, February 26, 2002, Department of Computer Science, University of Otago, New Zealand, available at: http://www.cs.otago.ac.nz/cosc453/student_tutorials/principal_components.pdf

Annex 1: the questionnaire

I. GENERAL INFORMATION

I.1 Contact information

Please give the contact details of the supervisory authority / central bank expert.

Surname and given name:	
Institution :	
Phone:	
E-Mail:	

I.2 Identifier for bank

For verification purposes during the evaluation phase, please provide a three character identifier for the interviewed bank (consisting of country code in ISO format (i.e. two characters) plus a number for the interviewed bank (i.e. 1 to 9).
Please use the identifier as file name when saving and sending the replies of the interviewed bank to the Task Force Secretariat.

Identifier: ☐

I.3 Banking group vs. single bank

Is the interviewed bank a subsidiary or a branch of a larger banking group?

☐ *yes (subsidiary)* ☐ *yes (branch)* ☐ *no*

I.4 Origin of banking group

Is the interviewed bank originating from the Euro area or the non-Euro area EU?

☐ *yes (Euro area)* ☐ *yes (non-Euro area)* ☐ *no*

I.5 Total assets of bank

What are the total assets of the interviewed bank?

☐ *in Euro billions* ☐ *as % of total group assets* ☐ *as % of total banking sector assets*

I.6 Important business activities of bank

What are the important business activities of the interviewed bank?

Funding source	*Please tick if important business activity*
Corporate finance	☐
Trading and sales	☐
Retail banking	☐
Mortgage banking	☐
Payment and settlement	☐
Asset management	☐
Agency services	☐
Bank-assurance	☐
Others:	☐

If ticked others, please specify:

II. QUESTIONS ON LIQUIDITY STRESS TESTING

II.1 Percentage of funding sources

What is the approximate percentage of your funding from the following sources?

Funding sources (averages for year 2007)	*% of total funding (including off-balance-sheet funding)*
Retail deposits	
Repo market	
CD and CP market	
FX swap market	
Unsecured inter-bank market	
Bond market	
Covered bond market	
Securitisation market	
Other key funding markets, please specify:	

II.2 Breadth and coverage of liquidity stress-testing

II.2.1 On what level do you perform your liquidity stress tests?

☐ *group level* ☐ *entity level* ☐ *both group and entity level separately*

II.2.2 Did the recent turmoil encourage your institution to perform liquidity stress tests at the group level (if not already done so)?

☐ *no* ☐ *yes*

II.3 Types of stress test scenarios

What types of liquidity stress test scenarios do you consider?

Adverse market conditions (system-wide) (1)	
Idiosyncratic shock to your bank (2)	
Combination of (1) and (2)	
Other	

If ticked "other", please specify:

II.4 Adverse market liquidity stress test scenarios

Note: Market scenario (MS) is a scenario which does not affect only your bank, but also others. If you run more than three sets of market scenarios within your liquidity stress tests, please choose the three most important ones for your bank.

II.4.1 What are the assumptions as regards the adverse market conditions in your liquidity market stress test scenarios?

MS 1	
MS 2	
MS 3	

II.4.2 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 a scenario).

Key funding markets	*MS 1*	*MS 2*	*MS 3*	*Relevant during recent turmoil?*	*Will receive more weight in future liquidity stress test scenarios?*
Retail deposits	☐	☐	☐	☐	☐
Repo market	☐	☐	☐	☐	☐
CD and CP market	☐	☐	☐	☐	☐
FX swap market	☐	☐	☐	☐	☐
Unsecured inter-bank market	☐	☐	☐	☐	☐
Bond market	☐	☐	☐	☐	☐
Covered bond market	☐	☐	☐	☐	☐
Securitisation market	☐	☐	☐	☐	☐
Other key funding markets, please specify:					
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

Scope of assets / liabilities	*MS 1*	*MS 2*	*MS 3*	*Relevant during recent turmoil?*	*Will receive more weight in future liquidity stress test scenarios?*
Off-balance commitments (e.g. liquidity facilities to ABCP)	☐	☐	☐	☐	☐
Warehouse risk of leveraged loans	☐	☐	☐	☐	☐
Structured credit products	☐	☐	☐	☐	☐

Geographic markets	*MS 1*	*MS 2*	*MS 3*	*Relevant during recent turmoil?*	*Will receive more weight in future liquidity stress test scenarios?*
National	☐	☐	☐	☐	☐
Regional (e.g. CEECs)	☐	☐	☐	☐	☐
International (e.g. Euro area)	☐	☐	☐	☐	☐

Shock duration assumed in the respective scenario	*MS 1*	*MS 2*	*MS 3*	*Was duration a problem (in any of the above key funding markets) your bank experienced during the recent turmoil?*
Number of weeks	☐	☐	☐	☐

II. 5 Idiosyncratic liquidity stress test scenarios

Note: An idiosyncratic scenario (IS) is a scenario which affects only your bank, not others. If you run more than three sets of idiosyncratic scenarios within your liquidity stress tests, please choose the three most important ones for your bank.

II.5.1 What assumptions do you impose within your idiosyncratic liquidity regarding your scenario assumptions?

	Rating downgrade in notches	*Please specify any other assumptions besides a rating downgrade your scenario includes.*
IS 1		
IS 2		
IS 4		

II.5.2 What are your assumptions regarding the cash outflow from retail deposits, interbank deposits and investors?

	Cash outflow (% of actual value)			*Which method(s) do you apply to derive the respective assumptions (e.g. expert judgment, statistical analysis of available time series)?*
	IS 1	*IS 2*	*IS 3*	
Retail depositors				
Interbank deposits				
Investors				
Others, please specify:				

II.5.3 Please rank the following six categories within each scenario according to your reliance on funding sources in the idiosyncratic scenarios (1 = most important to 6 = least important)

	IS 1	*IS 2*	*IS 3*
Credit lines			
Interbank market			
Central bank			
If applicable, group transfers			
Sale of liquid assets (e.g. loans)			
Other, please specify:			

II.6 Scenario review

II.6.1 How often have you significantly adjusted your liquidity stress scenarios over the last five years?

Please indicate the date when the last significant adjustments took place:

What were the triggers for these adjustments?

II.6.2 In general, do you need board approval for significant adjustments to your liquidity stress test scenarios?

☐ *yes* ☐ *no*

II.7 Measurement approach of liquidity stress tests

II.7.1 What type of measurement approach for your liquidity position do you adopt?

Please consider following definitions for the different measurement approaches

Cash flow gap analysis:	Forecast of (known or estimated) cash flow mismatch positions (both on- and off-balance sheet positions) for various time horizons to determine the sufficiency of resources.
Cash flow Maturity Mismatch:	Measuring liquidity through the difference or mismatch between inflows and outflows in various maturity bands (often cumulated across maturity bands).
Other cash flow gap analysis:	E.g. Expected and Dynamic Cash Liquidity, Expected and Dynamic Liquidity at Risk

Liquidity stock approach: Defining a minimum stock of eligible liquid assets that has to be hold at all times (typically expressed as a percentage of short-term liabilities).

Balance-sheet Maturity Mismatch: Measuring liquidity through the difference or mismatch between assets and liabilities in various maturity bands.

Liquidity ratios: Ratios used to derive a bank's liquidity position by measuring items from corporate balance sheet, income statement, and statement of cash flows for a determination of the sufficiency of resources.

- Current liability ratio: Comparison of current liabilities with total liabilities, equity or total assets.
- Working capital ratio: Working capital divided through total assets.
- Liquidity coverage ratio: Comparison of bank's liquid assets to average daily operating expenses in order to obtain the number of days a bank can continue meeting expenses using only current resources.

	Y/N	*Please describe briefly:*
Cash-flow gap analysis		
Cash flow Maturity Mismatch		
Other cash flow analysis, please specify:		
Liquidity stock approach		
Balance-sheet Maturity Mismatch		
Mixture of cash-flow and stock approach		
Liquidity ratios		
Current liability ratio		
Working capital ratio		
Liquidity coverage ratio		
Other liquidity ratios, please specify:		
Other, please specify:		

II.7.2 List five main strengths and weaknesses of your measurement approach(es):

	Strengths
1	
2	
3	
4	
5	

	Weaknesses
1	
2	
3	
4	
5	

II.8 Liquidity risk tolerance of bank

II.8.1 Does your bank quantify its liquidity risk tolerance?

☐ *yes* ☐ *no*

II.8.2 If yes, what is the measure (e.g. a survival time under liquidity stress or the maximum probability that your bank will face serious liquidity problems over the next quarter)? What is your bank's risk tolerance under this measure?

II.8.3 If you don't quantify your liquidity risk tolerance, what is the reason? How does your bank define its liquidity risk tolerance?

II.9 Behavioural aspects in stress tests

II.9.1 Please mark which behavioural aspects were of particular relevance to your bank in the recent market turmoil and if they were adequately included into your stress tests.

	Relevant to your bank	*Adequately included*
Liquidity hoarding by other market participants	☐	☐
Investors' unwillingness to lend because of uncertainty regarding your banks' solvency and liquidity	☐	☐
Second round effects, leading to a drying up of market liquidity	☐	☐
Other, please specify:		
	☐	☐
	☐	☐

II.9.2 How do you integrate the above mentioned behavioural aspects in your stress testing exercises?

Rule of thumb (individual appreciation) ☐
Scalar variable (qualitative to quantitative transformation) ☐
Other, please describe briefly: ☐

II.10 Reputational risk in liquidity stress testing

Please tick, which of the following reputational risks were identified as relevant ones before the market turmoil. Please also indicate, how serious your bank was affected by those reputational risks in recent events (1 = no impact, 4 = high impact). Will these reputational risks receive more attention in future within your bank (e.g. by altering the design of liquidity promises, substitution with other funding sources, ...)?

"Liquidity promise" is defined as a credit line granted to your bank by a counterparty and the pre-commitment is legally binding.

	Was risk identified as a relevant risk before recent events?	*How serious was your bank affected?* 1 2 3 4	*Which reputational risks will receive more attention in the future?*
Reputational risk from calling upon available liquidity promises of counterparties	☐	☐ ☐ ☐ ☐	☐
Reputational risk from using central bank standing facilities because of stigma attached to them	☐	☐ ☐ ☐ ☐	☐
Need to provide funding to third parties in order to avoid reputational risk even if not obliged to (e.g. to SIVs)	☐	☐ ☐ ☐ ☐	☐
Others, please specify:			
	☐	☐ ☐ ☐ ☐	☐
	☐	☐ ☐ ☐ ☐	☐

II.11 Disclosure Policy of stress testing

II.11.1 Does your bank disclose the results of its liquidity stress tests to one of the following audiences?

	Regularly	*Upon request*	*Not foreseen*
Top refinancing counterparties	☐	☐	☐
All important refinancing counterparties	☐	☐	☐
General public (e.g. annual report, 20-F form)	☐	☐	☐
Rating agencies	☐	☐	☐
Others, please specify			
	☐	☐	☐
	☐	☐	☐

II.11.2 The disclosure of liquidity stress test results is quite rare. What do you consider to be potential reasons for that from your banks' point of view?

	Strongly agree	*Agree*	*Disagree*	Strongly disagree
Results can not be interpreted without detailed understanding of the scenarios and the considerations underlying them	☐	☐	☐	☐
Lack of comparability across banks	☐	☐	☐	☐
Disclosure would not enhance market discipline	☐	☐	☐	☐
Our bank does not see value added in disclosing liquidity stress test results	☐	☐	☐	☐
Others, please specify				
	☐	☐	☐	☐
	☐	☐	☐	☐

II.12 Standardization of liquidity stress tests

Note: Standardization refers in the following questions to specific concerted rounds of liquidity stress tests, e.g. for supervisory purposes, without affecting your bank's routine liquidity stress tests for internal purposes.

II.12.1 How would your rank (1 most important to 5 least important) the benefits for your bank of standardization of liquidity stress tests?

	Rank
Benchmarking exercise	☐
Learning effect	☐
Knowledge transfer	☐
Other, please specify	
	☐
	☐

II.12.2 Would standardization of the following liquidity stress test elements help to improve comparability among banks?

	Yes	*No*
Standardisation of the scenarios in liquidity stress test	☐	☐
Standardisation of the scope of liquidity stress tests (with respect to the on- and off-balance sheet item to be included)	☐	☐
Standardisation of the output metrics	☐	☐
Standardisation of the time horizon	☐	☐

II.12.3 Given standardisation of liquidity stress tests, would disclosure requirements foster market discipline in liquidity risk management?

☐ *yes* ☐ *no*

II.13 Barriers to cross-border transfer of liquidity within liquidity stress tests

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		*Impact on liquidity stress test results*			*Relevance to your banking group during recent turmoil*			*Warrants further elaboration in future liquidity stress tests*	
	Yes	*No*	*High*	*Low*	*None*	*High*	*Low*	*None*	*Yes*	*No*
Local supervisory liquidity requirements										
LE limits to intra-group exposures										
Transferability of collateral across borders										
Central bank frameworks (e.g. eligibility of cross-border collateral)										
Operational hurdles (e.g. delayed settlement, time to cash collateral)										
Time zone mismatch										
Others, please specify:										

II.14 Future developments of bank's liquidity stress testing

II.14.1 Do you plan to introduce joint stress tests which account for stress scenarios of credit risk, market risk, and liquidity risk at the same time?

☐ *yes* ☐ *no*

If you already have joint stress tests in place, do you work on elaborating those?

☐ *yes* ☐ *no*

II.14.2 Do you include P&L and capital effects (.g. higher refinancing costs) next to cash-flow effects in your scenarios?

Before recent events: ☐ *yes* ☐ *no* *In future stress tests:* ☐ *yes* ☐ *no*

II.14.3 What other areas of your liquidity stress testing will you improve or introduce in the next 1-2 years? Please describe the most relevant projects shortly.

III. QUESTIONS ON CONTINGENCY FUNDING PLANS

III.1 Breadth and coverage of Contingency Funding Plans (CFP)

III.1.1 Does your bank have a contingency funding plan (CFP) in place?

☐ *no* ☐ *yes*

III.1.2 At which organisational level is the CFP set?

☐ *group level* ☐ *entity level* ☐ *both group and entity level separately*

III.2 Activation and alarm / escalation levels of CFP

III.2.1 Please describe briefly the triggers for activating your CFP regarding 1) the sort of triggers and 2) upon what levels of the triggers the CFP will be activated.

III.2.2 What circumstances (e.g. reputational risk) / types of shocks would prevent you from activating your CFP, even though the triggers are in place?

III.2.3 Who is responsible for the monitoring of the triggers for the activation? Who is responsible for activating your CFP?

III.2.4 In the current market turmoil, on which stage was your CFP activated?

☐ *not activated* ☐ *early stage* ☐ *medium stage* ☐ *"latest stage"*

As a common rule, CFPs describe different "alarm" levels or "escalation" levels according to the deterioration of the bank's liquidity capacity. For each of those "alarm/escalation" levels measures are determined that are to be undertaken once the respective level has been reached.

III.2.5 Of how many of such "alarm/escalation" levels does your CFP consist of?

☐

III.2.6 Please describe briefly for each of your "alarm/escalation" levels separately 1) what type of funding, 2) what cash reducing activities and 3) what measures to protect the franchise are foreseen in the respective "alarm/escalation" level.

III.2.7 Please describe briefly the triggers for entering the next "alarm/escalation" level for each of the "alarm/escalation" level.

III.2.8 According to your CFP, who is responsible for monitoring the triggers for entering the next "alarm/escalation" level? Who is responsible for the decision of entering the next "alarm/escalation" level?

III.2.9 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?

☐ *1* ☐ *2* ☐ *3* ☐ *4*

III.3 Sources of liquidity in CFP

Which of the following sources of liquidity are included in your CFP (please tick when accessible, otherwise leave blank)? Please mark also to what degree those sources were accessible for your bank in the market turmoil (1 = not accessible to 4 = fully accessible). Based on your experiences in the market turmoil, will the individual liquidity source receive more, less or the same weight in your future CFPs?

"Liquidity promise" is defined as a credit line granted to your bank by a counterparty and the pre-commitment is legally binding.

	Included in your CFP? (tick, if yes)	*Degree of accessibility (1=none, 4= full)*				*What weight will the source receive in your future CFPs?*		
		1	*2*	*3*	*4*	*More*	*Equal*	*Less*
Asset sales	☐	☐	☐	☐	☐	☐	☐	☐
Securitization issuances	☐	☐	☐	☐	☐	☐	☐	☐
Bond issuances	☐	☐	☐	☐	☐	☐	☐	☐
Intra-group liquidity facilities	☐	☐	☐	☐	☐	☐	☐	☐
Inter-banking market facilities	☐	☐	☐	☐	☐	☐	☐	☐
Central banks facilities	☐	☐	☐	☐	☐	☐	☐	☐
Liquidity promises	☐	☐	☐	☐	☐	☐	☐	☐
Liquidity saving measures	☐	☐	☐	☐	☐	☐	☐	☐
Other, please specify:								
	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐

III.4 CFP tests

Some banks test their CFPs regarding its feasibility, for example, regarding the people involved in the CFP chain (do systems work to get people on the phone, are all necessary phone numbers available, who is communicating, …) or regarding operational difficulties (e.g. in some banks asset managers are instructed to sell assets that are only somewhat liquid in order to see what hurdles / prices they have to face.

III.4.1 How often do you perform such CFP test?

☐ *never* ☐ *ad hoc* ☐ *routinely, every* ____month(s)

III.4.2 Please describe briefly the CFP testing procedure of your bank.

III.4.3 Who is responsible for those CFP tests?

III.5 Communication in CFP

III.5.1 Is external communication formally covered in CFP? What does it say?

III.5.2 How does communication to markets / clients differ from communication to supervisors and central banks?

III.6 Operational problems

With regard to your experiences in the recent market turmoil, which of the following operational problems are the most relevant ones for your bank? Please rank them from 1 = not very relevant to 4 = very relevant. Will any of those operational problems receive more attention from your bank (e.g. by testing or by setting up more detailed procedures)?

	Relevance for your bank 1 2 3 4	*Will receive more attention in future*
Insufficient legal arrangements		
Insufficient operational arrangements		
Too few counterparty relationships		
Limited experience (e.g. regarding rarely or not yet used instruments)		
Others, please specify:		

III.7 Future projects for CFP

III.7.1 What other lessons have you learnt during recent market turmoil regarding the implementation / set up / feasibility of your CFP (e.g. information

III.7.2 What specific projects are foreseen in your bank regarding a further elaboration / improvement of your CFP?

Annex 2: results of PCA analysis

Chart 1/PCA analysis – mapping of Luxembourg banks by business activity

Eigen values **Matrix trace = 11,00**

Axis	Eigen value	% explained	% cumulated
1	2.588979	23.54%	23.54%
2	2.344702	21.32%	44.85%
3	1.280892	11.64%	56.50%
4	1.243374	11.30%	67.80%
5	1.094535	9.95%	77.75%
6	0.837831	7.62%	85.37%
7	0.664452	6.04%	91.41%
8	0.353395	3.21%	94.62%
9	0.247536	2.25%	96.87%
10	0.224672	2.04%	98.91%
11	0.119632	1.09%	100.00%
Tot.	11	-	-

Factor Loadings [Communality Estimates]

Attributes	Axis_1		Axis_2	
	Corr.	% (Tot. %)	Corr.	% (Tot. %)
LU retail	0.8303	*69 % (69 %)*	0.08	*1 % (70 %)*
Private banking	0.3067	*9 % (9 %)*	-0.7219	*52 % (62 %)*
Mortgage	0.828	*69 % (69 %)*	0.2178	*5 % (73 %)*
Corporate finance	0.1515	*2 % (2 %)*	-0.4855	*24 % (26 %)*
Trading and sales	0.3728	*14 % (14 %)*	-0.7345	*54 % (68 %)*
Asset Management	0.0163	*0 % (0 %)*	-0.4585	*21 % (21 %)*
Securities portfolio	0.3051	*9 % (9 %)*	0.2563	*7 % (16 %)*
Payment and settl.	0.5379	*29 % (29 %)*	-0.2442	*6 % (35 %)*
Agency (Inv. Services)	-0.2246	*5 % (5 %)*	-0.3967	*16 % (21 %)*
Bank assurance	0.6941	*48 % (48 %)*	0.2216	*5 % (53 %)*
Issuance	0.2074	*4 % (4 %)*	0.6728	*45 % (50 %)*
Var. Expl.	2.589	*24 % (24 %)*	2.3447	*21 % (45 %)*

Chart 2/PCA analysis – LU banks vs. EU peer banks by business activity

Eigen values **Matrix trace = 9,00**

Axis	Eigen value	% explained	% cumulated
1	2.812574	31.25%	31.25%
2	1.311914	14.58%	45.83%
3	0.937219	10.41%	56.24%
4	0.923364	10.26%	66.50%
5	0.867123	9.63%	76.14%
6	0.682063	7.58%	83.71%
7	0.620585	6.90%	90.61%
8	0.42603	4.73%	95.34%
9	0.419129	4.66%	100.00%
Tot.	9	-	-

Factor Loadings [Communality Estimates]

Attributes	Axis_1		Axis_2	
	Corr.	% (Tot. %)	Corr.	% (Tot. %)
Corporate finance	0.5959	*36 % (36 %)*	0.3377	*11 % (47 %)*
Trading and sales	0.7223	*52 % (52 %)*	-0.1831	*3 % (56 %)*
Retail banking	0.4925	*24 % (24 %)*	0.178	*3 % (27 %)*
Mortgage banking	0.5472	*30 % (30 %)*	0.2335	*5 % (35 %)*
Payment and settl.	0.5484	*30 % (30 %)*	0.0132	*0 % (30 %)*
Asset management	0.5826	*34 % (34 %)*	-0.4945	*24 % (58 %)*
Agency services	0.2439	*6 % (6 %)*	-0.7338	*54 % (60 %)*
Bank-assurance	0.6954	*48 % (48 %)*	-0.1001	*1 % (49 %)*
Others	-0.4591	*21 % (21 %)*	-0.5338	*28 % (50 %)*
Var. Expl.	2.8126	*31 % (31 %)*	1.3119	*15 % (46 %)*

Chart 4/PCA analysis – LST scenarios by main assumptions and markets affected

Eigen values **Matrix trace = 14,00**

Axis	Eigen value	% explained	% cumulated
1	2.658708	18.99%	18.99%
2	1.803995	12.89%	31.88%
3	1.678721	11.99%	43.87%
4	1.476773	10.55%	54.42%
5	1.290402	9.22%	63.63%
6	1.049796	7.50%	71.13%
7	0.942036	6.73%	77.86%
8	0.841597	6.01%	83.87%
9	0.661981	4.73%	88.60%
10	0.623335	4.45%	93.05%
11	0.361333	2.58%	95.63%
12	0.280888	2.01%	97.64%
13	0.226515	1.62%	99.26%
14	0.10392	0.74%	100.00%
Tot.	14	-	-

Factor Loadings [Communality Estimates]

Attributes	**Axis_1**		**Axis_2**	
	Corr.	% (Tot. %)	Corr.	% (Tot. %)
general liq squeeze	0.1198	*1 % (1 %)*	-0.0822	*1 % (2 %)*
economic crisis	0.4887	*24 % (24 %)*	-0.0886	*1 % (25 %)*
financial markets crash	0.2892	*8 % (8 %)*	-0.1395	*2 % (10 %)*
downgrade	-0.0953	*1 % (1 %)*	0.76	*58 % (59 %)*
rumors	-0.0147	*0 % (0 %)*	-0.5546	*31 % (31 %)*
internal/operational crisis	-0.3222	*10 % (10 %)*	-0.1429	*2 % (12 %)*
Retail	0.1438	*2 % (2 %)*	0.1039	*1 % (3 %)*
Repo	0.7617	*58 % (58 %)*	-0.1748	*3 % (61 %)*
Unsec IB	0.3202	*10 % (10 %)*	0.5894	*35 % (45 %)*
Bond	0.6843	*47 % (47 %)*	-0.1235	*2 % (48 %)*
Securitiz	0.5146	*26 % (26 %)*	0.0358	*0 % (27 %)*
Institut	-0.2056	*4 % (4 %)*	0.4986	*25 % (29 %)*
Cbanks	0.2883	*8 % (8 %)*	0.4477	*20 % (28 %)*
off bal	0.8043	*65 % (65 %)*	0.1004	*1 % (66 %)*
Var. Expl.	2.6587	*19 % (19 %)*	1.804	*13 % (32 %)*

Chart 5/PCA analysis – LU banks vs. EU peer banks by market-wide LST scenarios

Eigen values **Matrix trace = 14,00**

Axis	Eigen value	% explained	% cumulated
1	2.640297	18.86%	18.86%
2	1.780852	12.72%	31.58%
3	1.298705	9.28%	40.86%
4	1.140455	8.15%	49.00%
5	1.004671	7.18%	56.18%
6	0.975334	6.97%	63.15%
7	0.918432	6.56%	69.71%
8	0.876775	6.26%	75.97%
9	0.778638	5.56%	81.53%
10	0.731268	5.22%	86.75%
11	0.604267	4.32%	91.07%
12	0.473255	3.38%	94.45%
13	0.43694	3.12%	97.57%
14	0.340111	2.43%	100.00%
Tot.	14	-	-

Factor Loadings [Communality Estimates]

Attributes	Axis_1		Axis_2	
	Corr.	% (Tot. %)	Corr.	% (Tot. %)
Retail	0.0009	*0 % (0 %)*	-0.3609	*13 % (13 %)*
Repo	0.5635	*32 % (32 %)*	-0.3517	*12 % (44 %)*
CD/CP	0.6852	*47 % (47 %)*	-0.0039	*0 % (47 %)*
FX swap	0.2844	*8 % (8 %)*	-0.3173	*10 % (18 %)*
Unsec IB	0.5183	*27 % (27 %)*	-0.2594	*7 % (34 %)*
Bond	0.7591	*58 % (58 %)*	0.0232	*0 % (58 %)*
Cov Bond	0.5991	*36 % (36 %)*	0.1579	*2 % (38 %)*
Securitiz	0.3832	*15 % (15 %)*	0.6808	*46 % (61 %)*
other kfm	-0.2374	*6 % (6 %)*	-0.0122	*0 % (6 %)*
Institut	0.1063	*1 % (1 %)*	-0.4874	*24 % (25 %)*
Cbanks	0.1169	*1 % (1 %)*	-0.4769	*23 % (24 %)*
off bal	0.4763	*23 % (23 %)*	-0.0822	*1 % (23 %)*
warehouse	0.2161	*5 % (5 %)*	0.5586	*31 % (36 %)*
struct credit	0.2586	*7 % (7 %)*	0.2932	*9 % (15 %)*
Var. Expl.	2.6403	*19 % (19 %)*	1.7809	*13 % (32 %)*

Chart 6/PCA analysis – LU banks vs. EU banks, comparison by idiosyncratic LST scenarios

Eigen values **Matrix trace = 7,00**

Axis	Eigen value	% explained	% cumulated
1	1.852148	26.46%	26.46%
2	1.549595	22.14%	48.60%
3	1.129257	16.13%	64.73%
4	1.016143	14.52%	79.24%
5	0.914886	13.07%	92.31%
6	0.488193	6.97%	99.29%
7	0.049778	0.71%	100.00%
Tot.	7	-	-

Factor Loadings [Communality Estimates]

Attributes	Axis_1		Axis_2	
	Corr.	% (Tot. %)	Corr.	% (Tot. %)
other assumptions	-0.0326	*0 % (0 %)*	-0.8861	*79 % (79 %)*
rumors/bad media coverage	0.7584	*58 % (58 %)*	0.5271	*28 % (85 %)*
downgrade	-0.7498	*56 % (56 %)*	0.2644	*7 % (63 %)*
Retail	0.2693	*7 % (7 %)*	0.3013	*9 % (16 %)*
Unsec IB	-0.6212	*39 % (39 %)*	0.3258	*11 % (49 %)*
Institut	-0.4426	*20 % (20 %)*	0.3899	*15 % (35 %)*
other	-0.2436	*6 % (6 %)*	-0.2602	*7 % (13 %)*
Var. Expl.	1.8521	*26 % (26 %)*	1.5496	*22 % (49 %)*

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