



EUROPEAN CENTRAL BANK



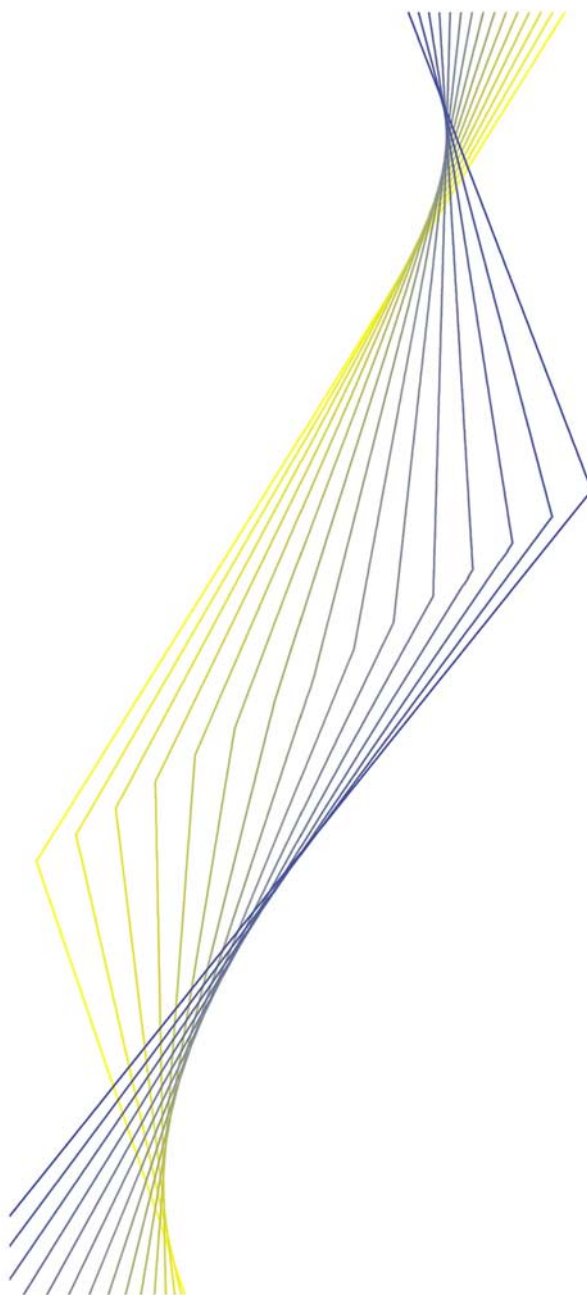
DEVELOPMENTS IN BANKS' LIQUIDITY PROFILE AND MANAGEMENT

May 2002





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Address	Kaiserstrasse 29 D-60311 Frankfurt am Main Germany
Postal address	Postfach 16 03 19 D-60066 Frankfurt am Main Germany
Telephone	+49 69 1344 0
Internet	http://www.ecb.int
Fax	+49 69 1344 6000
Telex	411 144 ecb d

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The following country abbreviations are used in the report:

BE	Belgium
DK	Denmark
DE	Germany
GR	Greece
ES	Spain
FR	France
IE	Ireland
IT	Italy
LU	Luxembourg
NL	Netherlands
AT	Austria
PT	Portugal
FI	Finland
SE	Sweden
UK	United Kingdom

Executive summary

The liquidity risk of European banks is influenced by structural and business cycle factors. Disintermediation, technological developments and market globalisation all pose considerable challenges for the way in which banks manage their liquidity. There have also been concerns in several European countries that deposit collection was not be able to keep up with strong loan growth and that banks therefore had to rely more on credit-sensitive market financing and wholesale depositors. Some developments in the financial infrastructure may have led to an increased risk of operational problems spilling over into liquidity risk. On the other hand, the integration, deepening and better liquidity of the money markets, the introduction of new payment technologies and of financial innovations have improved banks' ability to manage liquidity risk. Although these factors mean that the nature of liquidity risk and the environment in which liquidity risk has to be managed have changed significantly over recent years, it is difficult to say whether liquidity risk has actually increased or decreased. Significantly, any wholesale liquidity problem would, in an RTGS environment, be likely to manifest itself intraday in the payments system.

Significant developments requiring particular attention include the following: (i) the growing importance of intraday liquidity; (ii) the increased reliance on wholesale market financing and securitised borrowing; (iii) the development of instruments with a contingent liquidity effect that is difficult to assess; (iv) improved liquidity access under normal conditions, but possibly higher liquidity risk in certain stress situations; (v) the development of new quantitative techniques to assess liquidity risk, and (vi) the growing importance of liquidity management at group level. These developments have a number of important implications, notably a change in the nature of typical liquidity crises, which are now less likely to resemble traditional models of a bank run by retail depositors.

The report further investigates how European banks organise their liquidity management and how they monitor liquidity risk. It finds that no generally accepted method of accurately measuring liquidity risk has yet emerged in the banking community. Some of the largest market players are in the process of developing liquidity-at-risk models, but these models are still in the development phase and are not yet ready for full regulatory use.

The report concludes with addressing implications of the main findings.

1 Introduction

This report – prepared by the Banking Supervision Committee of the European System of Central Banks - gives a structural analysis of how the EU banking system's liquidity position has evolved over recent years and explains how European banks organise their liquidity management. In particular, the analysis focuses on:

- recent changes in banks' liquidity profile and their determinants, including the impact of Economic and Monetary Union (EMU);
- the way in which banks manage their liquidity position;
- the interaction between bank liquidity and market liquidity; and
- the implications of such developments for banks, supervisors and financial stability.

The analysis does not, in principle, involve detailed discussions of systemic liquidity risk, monetary policy, payment systems, intraday and overnight liquidity management, emergency liquidity assistance and supervisory approaches to bank liquidity, although issues relating to these areas are raised where appropriate.

The report's topic was considered to be relevant, especially as banks' liquidity risk is influenced by factors such as disintermediation (success of mutual funds, insurance products, direct investments in shares and bond), technological developments (TARGET, CLS, electronic markets), the globalisation of financial markets and the introduction of the euro. In a number of countries, there have been concerns that deposit collection was not able to keep up with rapid loan growth and that banks had therefore to rely more on expensive and volatile market financing. Events such as the Swedish banking crisis, Y2K, LTCM and both the Asian and Russian crises have increased awareness of the importance of liquidity. Rating agencies are attaching more importance to this issue and the supervisory community has recently published sound practices on how banks should manage their liquidity risk.¹

The report is divided into four main sections: Section 2 deals with the concept of liquidity – distinguishing between funding and market liquidity – and investigates the role of banks as liquidity transformers and liquidity insurers. Section 3 looks at the major structural factors influencing bank liquidity, encompassing both a static and a dynamic analysis. Section 4 discusses how banks manage their liquidity profile and covers issues such as the organisation of liquidity management and the way in which liquidity risk is monitored and managed. Section 5 addresses the implications relating to the developments identified.

¹ Basel Committee on Banking Supervision (2000), Comptroller of the Currency (2001). The OCC press release reads: "The new OCC handbook notes that liquidity risk is a greater concern and management challenge for banks today than in the past. Increased competition for consumer deposits, a wider array of wholesale and capital market funding products, and technological advances have resulted in structural changes in how banks are funded and how they manage their liquidity risk ...".

2 The concept of liquidity

The liquidity issue is at the core of banking. Credit institutions typically transform short-term, liquid liabilities into long-term, illiquid assets. In so doing, banks allow customers to smooth out their consumption and investment patterns, which increases the overall welfare level of society. In providing this important economic function, banks protect their customers against liquidity problems, but – at the same time – become exposed to such risks themselves. In an extreme case, such liquidity problems can manifest themselves in runs, even on sound banks, when customers withdraw their deposits on a massive scale. Furthermore, an individual liquidity problem can quickly spread to the whole banking sector, resulting in a real bank panic. Informational asymmetries and the principle of “first come, first served” in the repayment of deposits at par are important factors in such bank runs and panics. Devices – in particular, deposit insurance, reserve requirements and access to central bank liquidity – have been put in place to mitigate these risks.² One of the main arguments of this report is that this traditional picture of a liquidity crisis is somewhat outdated, especially for the largest banks.

The role of banks as liquidity providers may also explain why lending and deposit-taking operations continue to be combined in one and the same institution. “Narrow banking”, whereby lending and deposit-taking are separated and performed by different types of institution, is still seldom found in practice. Finance literature would suggest that both sides of a bank’s balance sheet show the same basic function, i.e. the provision of liquidity. Some of the literature sources point to natural synergies between the two sides, to the extent that both require banks to hold large volumes of liquid assets: if deposit withdrawals and loan commitment takedowns are imperfectly correlated, the two activities can share any dead-weight costs of holding these liquid assets.³ Other literature points to the incentive created by demand deposits for a bank to continue providing liquidity to borrowers until loans mature: as the total face value of the loans cannot be recovered, early loan liquidation may result in possible losses for depositors and, in turn, in a bank run disintermediating the bank altogether.⁴

Liquidity is traditionally defined as the ability of credit institutions to fund increases in assets and meet obligations as they become due.⁵ However, this definition does not completely capture the stochastic dimension of liquidity. This dimension is important, for example, where there is an unexpected utilisation of credit lines, unforeseen deposit withdrawals, untimely loan redemption and/or interest payments (“asset side” risk), a liquidity need resulting from asset price developments (margin calls, haircuts), or failed or delayed payments by sellers of credit risk protection.⁶ Ideally, banks would like to calculate a measure of vulnerability to such liquidity risks by considering a range of possible

² A classical theoretical model in finance literature that models the situation described in this paragraph is that developed by D.W. Diamond and Ph.H. Dybvig (1983).

³ Kashyap, A.K., Rajan, R., and Stein, J.C. (2000).

⁴ Diamond, D.W., and Rajan, R.G (1999, b). The reason why a bank would consider liquidating a loan before maturity is that, as a relationship lender, it is able to realise a higher liquidation value than outsiders such as depositors. In other words, the bank might want to extract an economic rent from depositors.

⁵ Basel Committee on Banking Supervision (2000), paragraph 1.

⁶ For example, in the context of a credit default swap acquired by a protection buyer. In that respect, the willingness to pay (and thus for the protection buyer to receive liquidity) may be different depending on the counterparty of the credit default swap. See Rule D (2001), p. 134.

outcomes and their probabilities. Liquidity-at-risk models, which are now being developed, and scenario analysis are tools to tackle these sort of questions. Moreover, in stress scenarios, the underlying probabilities may well be different and a stress test approach might also be appropriate.

There are two distinct but interrelated dimensions of bank liquidity: funding or cash liquidity, (the ability to borrow in the market) and asset or market liquidity, (the ability to sell or to unwind asset positions). Both concepts are closely related, but not identical. For example, a leveraged institution that is not willing or able to sell its asset positions in time will need to ensure appropriate funding liquidity. Likewise, an institution that is not able to get the necessary funding might want to sell or pledge assets, which will be considerably more difficult for illiquid assets. The mutual interaction of funding and asset liquidity means that they tend to reinforce each other. However, this mutual dependency could weaken markets under adverse circumstances since disruptions affecting one dimension can quickly spread to the other. Institutions that tend to finance their market-making activities through leveraged positions, for instance, or market participants with low cushions of cash, could give way to distress selling, thereby undermining the liquidity of the whole market.

Banks should be able to assess the maturity profile of their assets and liabilities and the associated returns and costs. In doing so, they can also determine what liquid assets to hold to meet a desired threshold for maturity mismatch. However, this is not enough because liquidity also has a stochastic dimension. Banks need to assess the likelihood of more liabilities having to be repaid than new liabilities being generated to replace them (funding liquidity risk) and/or they will be unable to sell or unwind their positions to meet short-term obligations (asset liquidity risk). This is why one should think about normal and stress times separately since the probability of shifts in the marketability of different asset classes and the maturity structure of liabilities may be different.

Under normal circumstances, liquidity management is primarily a matter of a cost/benefit trade-off as a credit institution will always be able to finance itself as long as it is willing to pay the prevailing market price or by selling/pledging assets. Likewise, a bank may hold a stock of high-quality liquid assets to provide liquidity insurance (“liquidity warehouse”), but such assets are generally associated with lower returns. However, in the event of an individual bank crisis, the bank’s access to liquidity may be severely restricted because counterparties may be unwilling to provide funds, even against high-quality collateral or at high prices. In a general market crisis, it may even be impossible for a bank to mobilise its assets on the market.

Liquidity risk is closely related to other dimensions of a bank’s financial structure, such as the interest rate risk, foreign exchange risk, profitability and solvency. The interest rate risk resulting from mismatches in maturity or interest rate reset dates can manifest itself in refinancing (or reinvestment risk) and market value risk.⁷ But by acting as a risk-bearing maturity and liquidity transformer, the bank can also earn a return and this therefore directly relates to its profitability. Holding more liquid

⁷ Refinancing risk: the risk that the cost of rolling over funds will rise above the return being earned on the assets. Reinvestment risk: the risk that the return being earned on the assets falls below the cost of funds. Market value risk: the risk that the market value of a bank’s assets falls (increases) by a greater (smaller) amount than its liabilities.

assets or better matching the cash-flow profile of assets and liabilities will reduce the liquidity risk, but also bank profitability. The relationship works equally in the opposite direction: impaired loans will impact both profitability and liquidity, as expected cash inflows do not materialise. Furthermore, there is a relationship to solvency. Greater bank capital reduces liquidity creation by the bank but enables it to survive more often and to avoid distress.⁸ A solvent bank should not normally experience funding problems with customers willing to roll over their deposits. However, as the solvency of an institution becomes more uncertain, the liquidity becomes more of an issue. Moreover, solvency may be difficult to ascertain, especially in a crisis situation, which would call for liquidity regulation as a sort of insurance.⁹ These illustrations show the close interaction between different risk areas which are difficult to disentangle in practice.

3 Structural factors influencing bank liquidity

The extent to which a banking system or individual credit institution can be considered more or less liquid will be influenced by a number of internal and external factors, e.g. the structure of the financial system, the regulatory environment, or the business model chosen by the bank. Over recent years, there have been a number of important changes in these factors, which have, in turn, affected bank liquidity. However, the European banking sector seems divided over whether liquidity risk has actually increased, decreased or remained stable over the past years as a result of these changes. A careful conclusion could therefore be that the environment in which banks manage their liquidity has changed significantly and that banks which are not able to cope with these changes are potentially more at risk.

3.1 Characteristics of the financial system

The structure and growing importance of financial markets is an important element. Many EU countries have a significant government bond market, for example, which is reflected in the significance of these securities in banks' liquidity position (e.g. BE, DK, GR, ES, IT and SE). At the same time, there is a shift away from this liquidity source, because of the reduction of the public deficit and debt. Government bonds can be used as collateral in interbank repo transactions and are eligible assets for refinancing operations with the central bank. Some countries have a significant market in mortgage bonds (e.g. DK, DE and SE) or certificates of deposits (e.g. FI), which can likewise be used as collateral to obtain central bank financing.

Because of the growing competition of alternative investment opportunities, bank deposits are often not able to keep up with loan growth. Banks have therefore to rely increasingly on more volatile market funding, such as debt securities and interbank loans, to finance their traditional loan business. For example the period June 1998-June 2001, the loan deposit ratio of the euro area banks increased from 117% to 123%. In the same period, banks' debt securities expressed as a percentage of their

⁸ Diamond, D.W., and Rajan, R.G. (1999 a).

⁹ Clementi, D. (2001).

deposit base jumped from 39% to 43%; for interbank funding, the ratio increased from 83% to 88%. However, one has to differentiate according to the type of bank. For example, local banks may still be able to fund their loan business through deposits, while large commercial banks may have to increase their money and capital market financing. In parallel, there is a growing share in some countries of funding through non-residents and/or in non-domestic currency as well as through the issuance of non-traditional securities such as mortgage bonds, preferred shares, convertible bonds and subordinated debt. Increased market funding has an impact on banks' profitability, as such financing is more expensive than relying on retail deposits. It may also imply that a typical liquidity crisis may not resemble anymore the traditional image of a bank-run by retail depositors.

An ever growing segment of the interbank market is occupied by repo activity. This market has developed swiftly, inter alia because repos are used by the Eurosystem and other central banks as the main instrument to conduct open market operations for monetary policy purposes. Since repos are similar to collateralised lending, they permit a reduction in counterparty risk and benefit from reduced capital requirements. The possible macro-effects and policy issues arising as a result of an increased use of collateral in wholesale markets have already been investigated by the Committee on the Global Financial System (CGFS).¹⁰ From a micro-prudential perspective, national authorities should make sure that banks' collateral management develops in parallel with the growth of securitised borrowing and lending.

Box 1: The European repo market

The repo market is an important and ever growing segment of the money market, but despite its size and economic importance, basic information about market structure is surprisingly limited. This can be traced back to the over-the-counter (OTC) nature of the market.¹¹ According to an ESCB market survey,¹² the repo market contributed 37% of all activity in the cash market in 2000, up from 32% on the previous year. Capital adequacy reasons (reducing counterparty risk) are an important factor in this development. Repo transactions are OTC transactions, mostly with domestic counterparties, in euro, at a fixed rate, for a short-term period (often \leq one month) and on the basis of collateral issued by central governments. The top ten banks account for about 64% of the business, the top 20 for 88% and the top 30 for 97%, which shows a high market concentration. The Herfindahl index, however, is 0.05, which points to a very healthy degree of competition.¹³

Cross-border transactions and non-government collateral (e.g. *Pfandbriefe*) are of increasing importance, which could lead to more risky collateral replacing less risky collateral.¹⁴ A number of factors explain why the market is still predominantly national in nature: complications with settlements between national and international central securities depositories, lack of central netting and counterparty facilities, differences in investor attitude and tax treatment, different trading systems, absence of harmonised accounting and netting rules, lack of standardised documentation.¹⁵ Initiatives are under way to meet a number of these concerns, such as the

¹⁰ Committee on the Global Financial System (2001 and 1999). Points that were highlighted by the CGFS are: the strong growth of collateralised transactions, which outpaces the growth of collateral with low credit and liquidity risk (especially cash and government securities); the increased linkages between markets, although operational and legal differences continue to exist; the possible change in market dynamics (especially under stress); increased concentration in collateralised markets; the reduction in the pool of assets available to a firm's general creditors; and the limited disclosure of collateral-related information.

¹¹ Canoy, M., et al. (2001), pp. 108-110.

¹² European Central Bank (July 2001).

¹³ European market survey by the International Securities Market Association (2001).

¹⁴ Canoy, M., et al. (2001), p. 126.

¹⁵ European Central Bank (July, 2001), Deutsche Bank (2000), Giovannini Group (1999).

development of a Master Agreement sponsored by the European Banking Federation in co-operation with the European Savings Banks,¹⁶ an EC Directive that would create a simplified legal framework for collateral¹⁷ and proposals for the establishment of a single pan-European central counterparty.¹⁸

According to the EU rules on annual accounts for banks, the assets transferred in a repo transaction continue to appear in the transferor's balance sheet and the purchase price received by the transferor has to be shown as an amount owed to the transferee (debt). In addition, the value of the assets transferred has to be disclosed in a note in the transferor's accounts. The transferee is not entitled to show the assets transferred in his balance sheet; the purchase price paid by the transferee has to be shown in his balance sheet as an amount owed by the transferor (claim).¹⁹

We are not aware of any figures indicating the extent to which banks' securities portfolios are actually used as collateral in repo transactions. However, a rough estimate can be made for collateral used in central bank credit operations, both for monetary policy and payment system operations.²⁰ According to ECB figures, by the end of 2000, the total amount of marketable assets eligible as Eurosystem collateral was EUR 6.3 trillion. About one-third (around EUR 2 trillion) was estimated to be held by credit institutions in the euro area. The average total amount of collateral used by Eurosystem counterparties was estimated at EUR 622 billion (currently now about EUR 690 billion). The ratio between encumbered securities and securities that could potentially be used by banks for central bank credit operations is therefore approximately 30%.

By comparison, corporate and retail loans still remain illiquid although techniques such as loan sales and securitisation continue to develop: the Loan Market Association (LMA), for example, has recently developed guidelines on loan transfers with the aim of facilitating active loan management and enhancing liquidity in the loan markets. According to the LMA, secondary loan activity in the Euromarkets has increased rapidly, from USD 20 billion in 1997 to USD 35 billion in 2000.²¹ Securitisation in Europe reached USD 84 billion for the year 2000 and is expected to grow to USD 100 billion in 2001,²² with a further increase of 20% in 2002. Reportedly, securitisation is motivated mainly by solvency considerations (capital relief, removal of impaired assets), rather than by liquidity ones.

Given the increasing importance of financial markets in large companies' financing and the subsequent decline of banks as a funding source, it could be argued that banks have also become less important as liquidity providers. However, even in the market-based financial system of the United States, banks act as an important backup source of liquidity, insulating many large companies from market shocks.²³ A recent example of this are the telecommunications companies, which were forced to revert to short-term bank loans when their long-term market financing became too expensive. Investment banks that cannot offer loan products are reportedly losing business to integrated banking

¹⁶ Banking Federation of the European Union et al. (2001).

¹⁷ European Commission (March 2001).

¹⁸ European Securities Forum (2000).

¹⁹ Article 8 (4) of Directive 86/635/EEC of 8 December 1986 on the annual accounts and consolidated accounts of banks and other financial institutions.

²⁰ Figures quoted are from European Central Bank (April 2001).

²¹ Loan Market Association (2001).

²² Thomson Financial (2001). The large majority of transactions relate to residential mortgages. Figures do not include the growing portion of unfunded securitisations (through derivatives), which is estimated to be USD 38 billion for the year 2000.

²³ Saldenberg, M.R., and Strahan, Ph. E. (1999). Issuers of commercial paper are vulnerable to rate increases when their paper matures and they wish to refinance. To protect themselves, companies routinely secure a commercial paper backup line of credit with a bank. This role of banks as liquidity insurers can be traced back to the Penn Central financial crisis in the United States (1970). Because of the default of the Penn Central Transportation Company on its outstanding commercial paper, other large companies experienced difficulties in refinancing their commercial paper as it matured. In response, commercial paper issuers began establishing backup lines of credit with banks. The practice is stimulated by the credit agencies' requirement to obtain such lines in order for the commercial paper to get a rating.

groups. Commercial banks, on the other hand, are using their lending capabilities to break into investment banking.²⁴ Reportedly, institutional investors such as pension funds and insurance companies are also entering the liquidity market by providing back-up lines for corporate commercial paper (CP) programmes.²⁵

Comprehensive information on the development of loan commitments is very hard to come by in Europe. However, anecdotal evidence shows that this activity is increasing in a number of countries. For a sample of major UK banks, for example, loan commitments increased from around one-fifth of their aggregate balance sheet in 1995 to nearly one-third in 2000. Such loan commitments can be given in the context of capital market operations (e.g. back-up lines or standby facilities) or securitisation operations. The UK supervisor requires wholesale banks to reserve a level of liquidity against commitments made, while retail banks are expected to monitor their contingent obligations. However, the situation may vary strongly from country to country, depending, *inter alia*, on the importance of investment banking activities in the national banking system. In BE, for example, backup facilities provided for the placement of bond and equity issues amount to no more than 0.3% of banks' balance sheets and the evolution seems to depend very much on capital market sentiment.

The growth of contingent funding is linked to the earlier mentioned increased opportunities for especially large companies to tap the market directly, using backup facilities as a safety net in case of adverse market conditions. International capital rules may be another factor in the development of contingent financing. As a result, banks may no longer always be lenders of first resort, but they typically remain lenders of second resort.²⁶ However, the assumption of such a role makes banks' liquidity planning much more challenging as draw-downs are determined by a number of factors that are difficult to assess.²⁷ Moreover, it might also increase banks' credit risk as firms will typically tap such lines when market conditions or their individual credit situation develop unfavourably. An adequate pricing and management of the risks involved is therefore important.

The structure of the banking sector is also an important factor. In the UK, for example, there is a "tiered system" under which in practice only a limited number of banks have settlement accounts with the Bank of England. Also, although entry barriers are low, only a subset of banks are seen to be dealers and counterparties in the Bank of England's open market operations and these banks and securities dealers are required to distribute the liquidity provided by the Bank. In the euro area, the largest banks are seen to carry out the function of cross-border liquidity redistribution acting thereby as "money centre" banks for the integrated market as a whole, while smaller institutions still mainly operate with their domestic counterparts (see Section 3.2). In the United States, banks sometimes rely

²⁴ Morris, J. (2001).

²⁵ Lin, A. (2001). Since issuers of commercial paper seldom use their liquidity lines, face many restrictions on their use, and would draw for short periods anyway, institutional investors may see such lines as a way to gain incremental return for little risk.

²⁶ Clementi, D. (2001).

²⁷ For example, the credit rating of the issuer and general market conditions. The assessment may also be complicated by conditions that restrict the use of such lines (e.g. only in the case of a market-wide disruption and/or only when the issuer meets certain covenants) or exclude the use (e.g. "material adverse changes" (MAC) clauses). If multiple customers drawn on their liquidity lines at the same time (e.g. in the case of a general market disruption), the bank could be confronted with an unexpectedly high cash drain.

on “brokered deposits”.²⁸ Such deposits usually exhibit high volatility and often carry high interest rates. The use of brokered deposits by problem banks has often been associated with abuses and has contributed to failures. They can represent consistent and heavy borrowings by institutions that have only a limited access to the borrowed funds market, to support unsound an expansion of the loan and investment portfolios.²⁹ Brokered deposits, however, are of significance in virtually none of the EU countries. But in the UK, such deposits have always been a significant factor, because of the prevalence of many foreign firms active in the wholesale market. No special treatment is afforded to banks that have a high degree of funding from this source. In BE, IE and NL, the phenomenon exists, but is in practice limited or does not pose any particular liquidity concerns.

Concentration in the national banking industry as a result of mergers and acquisitions has led to the need to reorganise liquidity management. It has also reduced the number of counterparties and increased the average deal size and settlement and counterparty risk. For example, the number of bidders in the Eurosystem open market operations has declined over time, although factors other than increased concentration also play a role, such as the switch from the fixed to the variable rate tender and the increased efficiency of the interbank market. With fewer market players, there is a higher potential for contagion, but this development is mitigated by the fact that a large proportion of interbank transactions are conducted on a cross-border basis and in a broader and deeper market. Larger institutions also have better and wider access to refinancing possibilities, which has a beneficial effect on their funding cost. A number of European banks have expanded significantly abroad. For funding purposes, this implies that some of them had to rely increasingly on liabilities from non-residents and capital market instruments such as preferred shares and subordinated debt.

With the increasing importance of large banking groups and financial conglomerates, intra-group liquidity management also comes more to the forefront with techniques such as centralised liquidity management, cash-pooling and netting. It seems that until now international supervisory forums have paid relatively little attention to this development. However, anecdotal evidence would suggest that such groups use intra-group liquidity first, and only seek external funding in a second stage. Long-term strategic funding can be centralised in one entity in order to reduce funding costs, with operational liquidity management remaining the responsibility of the different entities. Sometimes, the different group entities provide liquidity support to each other, for example through credit lines, the provision of securities as collateral (e.g. from the group’s insurance company to the group’s bank), or the recycling of deposit surpluses to entities with deposit shortages.

The increasing use of a risk-return framework – probably as a result of the growing importance of shareholder value in banking – implies that liquidity spreads will be more easily passed on to customers. It may also restrict access to certain liquidity facilities which have existed in the past.

²⁸ Deposits that are obtained from or through the mediation or assistance of a deposit broker.

²⁹ In the United States, the FDIC Act limits the use of brokered deposits. An undercapitalised institution may not accept, renew or roll over any brokered deposits. An adequately capitalised institution may not accept, renew or roll over any brokered deposits unless the institution has applied for and been granted a waiver by the FDIC. Only a well-capitalised institution is allowed to use such deposits without restrictions.

On a more general note, growing competition in banking (because of deregulation and new entrants), easier access to information and greater transparency (e.g. because of the internet), as well as growing investor sophistication have made bank customers more yield conscious and yield sensitive. They are therefore more ready to hold additional accounts with banks other than their traditional relationship bank, or to diversify into alternative financial assets such as stocks and bonds. The development of e-banking has also contributed to this trend.

3.2 Introduction of the euro

The introduction of the euro is generally perceived to have had a positive effect on liquidity risk and its management, in particular for large, internationally active banks.

Open market operations, especially main refinancing operations (MROs), and standing facilities (marginal lending and deposit facility) form the operational basis of the new monetary framework in the euro area. Eurosystem lending to counterparties is always made against collateral in order to protect against financial risks. It takes the form either of repurchase agreements (repos) or of pledges of assets, normally deposited in a pool at the central bank. A broad set of counterparties and collateral is accepted. Collateral is split up into two asset categories, “tier one” and “tier two”,³⁰ with the first category accounting for about 90% of the total. Banks’ refinancing possibilities with the central bank have broadened considerably due to the broad set of eligible assets. It also offers opportunities to reduce the cost of collateral, as banks monitor which collateral is most cost-efficient to post. The cross-border use of collateral – now involved in almost 20% of Eurosystem credit operations – is based on the use of the “correspondent central banking model” or the use of links between securities settlement systems.

The Eurosystem’s operational framework seems to effectively satisfy banks’ daily liquidity needs as, for example, evident from the very moderate use of the standing facilities in normal circumstances and the flexible access to these facilities in stress conditions. Moreover, in the very special situations of the events of 11 September 2001 (see Box 3 further in the report), the millennium change-over and the cash change-over, the daily liquidity needs of the euro area banks were met by very moderate recourse to fine-tuning operations and standing facilities, giving further evidence of the efficiency of the euro area interbank market and of the operational framework.

An essential element in implementing the monetary policy is TARGET, an EU-wide real-time gross settlement (RTGS) system used for the settlement of central bank operations and cross-border and domestic interbank and customer transfers. As a result of TARGET, cross-border payments have become easier and overnight positions have reportedly levelled out. Linked to the introduction of the

³⁰ “Tier one” assets consist of marketable debt instruments which fulfil uniform euro area-wide eligibility criteria specified by the ECB. They are predominantly government paper and, to a lesser extent, securities of credit institutions. “Tier two” assets consist of additional assets (marketable and non-marketable) which are of particular importance for national financial markets and banking systems. They are predominantly corporate securities. Collateral eligible for monetary policy operations can also be used as collateral for intraday credit within TARGET. Reportedly, the collateral is used mainly for intraday credit purposes, rather than for monetary policy operations, see European Central Bank (February 2001). There are some distinct geographical patterns in the distribution of the collateral, e.g. “Tier one” is predominantly concentrated in DE, FR and IT and “tier two” in FR and NL.

RTGS system is the increasing importance of managing liquidity on an intraday basis. In stress conditions, wholesale liquidity pressures (higher outflows, on average reduced roll-overs, lower inflows) would manifest themselves in a greater demand for RTGS-eligible collateral, underlining the importance for banks to hold some eligible assets over and above their normal daily needs. This may be strengthened further with the forthcoming introduction of the CLS project (see Box 2).

Box 2: Continuous Linked Settlement Bank (CLS Bank)³¹

CLS Bank is the industry's response, represented by a group of major forex trading banks (G20), to the authorities' concerns about the development of foreign exchange (forex) settlement or "Herstatt" risk. Forex settlement risk exists because the two currency legs in a forex trade are generally separated, for example because of time-zone differences or differences in the technical infrastructure. Due to this separation, a bank usually pays one leg of the transaction without simultaneously receiving the other leg, which leaves the bank exposed to a possible failure of the counterparty to deliver.

CLS Services Ltd, the holding company of CLS Bank, was founded in 1997 and counts about 70 of the world's leading financial institutions among its shareholders. In 1999, CLS Bank was chartered by the Federal Reserve System. The Bank will provide forex settlement services on a payment-versus-payment (PVP) basis, thus largely reducing forex settlement risk. After several delays, CLS Bank is now scheduled to become operational in mid - 2002. In the first phase, seven currencies (AUS, CAD, CHF, EUR, GBP, JPY, and USD) are scheduled to be eligible for settlement.

There are several forms of participation in CLS Bank's system. *Settlement members* will have a single multi-currency account with CLS Bank; they will be able to submit instructions for settlement and receive information on the status of the instructions. *Nostro agents* make and receive payments on behalf of a settlement member in currencies where the settlement member has no central bank account or cannot provide sufficient liquidity to ensure settlement. Fulfilling settlement obligations remains the duty of the settlement member but the nostro agent has a critical operational role. Such institutions may constitute a concentration risk since most nostro agents are also expected to be settlement members. *User members* will not have a CLS Bank account and will instead have to settle their transactions via a settlement member. *Third parties* will only have access to the system by having settlement members or user members submitting instructions on their behalf. Third party banks may, in turn, offer fourth party services in order to protect their corresponding banking franchise.

Apart from reducing forex settlement risk, CLS Bank is expected to have a major impact on the way banks manage their risk and interact with each other. Intraday liquidity and collateral will become more important since payments to CLS Bank have to be made by a specific time. There are speculations that a market for intraday liquidity may develop with prices being calculated on an intraday basis. Banks involved in CLS Bank will have to exercise real-time global multi-currency liquidity management. Given the sizeable investments and organisational requirements for settlement members and nostro agents, consolidation in payment services providers is likely to occur. Liquidity management is expected to become a competitive instrument for banks, especially in the "settlement member to third party" market, as innovative corporate treasury services are being developed. The introduction of CLS Bank could be an opportunity for corporates and banks to re-examine and rationalise their banking relationships. Correspondent banking services are expected to be strongly affected, as CLS Bank will trigger a demand for real-time, highly specialised services. This could lead to a further concentration of the business. A two tier forex market could also emerge as banks not involved in CLS Bank may have to trade currencies at less competitive rates which incorporate the forex settlement risk. Some concerns have been voiced about the consequences of CLS for smaller currencies (as the largest currency and largest balance is paid out first) and about possible liquidity pressures as a result of imbalances between trades through CLS and outside CLS.³²

Liquidity management has become much easier because of the reduction in the number of currencies and in currency risk. Major banks have responded by concentrating their liquidity management of euro in one centre ("liquidity hub"). This makes it easier to co-ordinate funding flows, to enhance transparency and to allow pre-netting in the group. On the other hand, operational risk may have

³¹ More information on CLS Bank and the operational and liquidity risks involved can be found in Sveriges Riksbank (2001).

³² Sveriges Riksbank (2001), pp. 89-90.

increased (e.g. higher vulnerability to technical failures, fraud, natural disasters), which should be duly recognised in banks' risk management systems and contingency plans. For smaller, domestically active institutions, the liquidity management system has not fundamentally changed.³³

Monetary Union has also had a major impact on the correspondent banking activity³⁴ as the number of correspondent banking accounts has been reduced drastically and operational procedures have become more streamlined. Scale and efficiency are now crucial factors in the provision of correspondent banking services, so that business is now concentrated on a number of major players. This development has clear benefits for banks' treasury management and may continue further with the cash changeover and the introduction of CLS Bank (see Box 2).

Financial markets have become more integrated, deeper and more liquid, as shown, *inter alia*, by the development of new reference rates (e.g. the EONIA and the EURIBOR), the harmonisation of EU sovereign issues, availability of large volumes on the money market (although for a limited maturity spectrum), and increased average deal size. Banks' funding resources, securities portfolio and counterparty risks have become more diversified.

The closer integration of financial markets in the euro area also bears risks. Liquidity difficulties are potentially more easily transmitted from one institution to another (contagion risk), and from one country to another, as more than half of all interbank money market trade is now conducted on a cross-border basis. However, not every EU bank is transacting with all other EU banks. Instead, a *de facto* tiered structure in the interbank market seems to have developed with the UK, DE, and to a lesser extent FR, playing an important role in the cross-border interbank activity. There is relatively little other interbank trading across countries, with the exception of some regional trading (e.g. among Nordic countries). The pattern that emerges is therefore one of large, internationally active banks located in these three centres transacting with major banks in the other countries. Small banks, on the other hand, trade predominantly with their large domestic counterparts. International counterparties reportedly tend to pay more attention to the individual rating situation of a bank than domestic banks did. A liquidity regime adapted to the central role of core market participants in the further distribution of liquidity across the banking system might be warranted.

3.3 Regulation

Regulation – such as regulatory liquidity ratios, the presence of a deposit insurance scheme, tax and reinvestment rules, and minimum reserve requirements – has an impact on the liquidity features of a banking system.

³³ More detailed information on the impact of the introduction of the euro on banks' treasury management can be found in European Central Bank (July 2001), p. 25.

³⁴ Correspondent banking is an arrangement under which one bank provides payment services and other services to another bank. Payments through correspondents are often executed through reciprocal accounts (*nostro* and *vostro* accounts), to which standing credit lines may be attached.

3.3.1 Supervisory requirements

Bank supervisors in eight of the 15 EU Member States (i.e. DK, DE, FR, IE, LU, NL, AT and UK) impose quantitative liquidity requirements, whereas the authorities in the remaining countries monitor the liquidity position on the basis of non-binding observation ratios and/or impose qualitative requirements. Funding concentration in BE and the UK is monitored by means of observation ratios. In NL additional liquidity requirements are imposed in case of funding concentration and IE even imposes funding concentration limits. The quantitative liquidity requirements differ widely from country to country. There is probably more supervisory convergence on the qualitative side as sound practices on liquidity management have been developed by the Basel Committee on Banking Supervision.

In response to structural developments in the market, a number of authorities are now in the process of reviewing their liquidity approach. The UK is currently in the process of revising its liquidity policy for all types of firms under its supervision. Although still in the development stage, it is envisaged that the regime will be based on a combination of system and control requirements and a quantitative regulatory framework. The section on systems and controls will set out standards for the identification, measurement, monitoring and control of liquidity risk. Specific aspects will include, inter alia, the responsibilities of a firm's governing body and senior management, the setting of limits and requirements which augment the quantitative regulatory framework, such as the need for firms to perform stress and scenario testing and to have in place contingency funding plans.

On the quantitative side, the aim is to have a single framework for banks, building societies and securities firms, within which quantitative limits on the extent of liquidity risk that a firm may incur can be set. It is planned that the framework will be based on a liquidity-gap method, with overall limits set in the short time-bands. It will provide incentives for currency liquidity matching. Within the framework, there will be a range of possible approaches available to firms, with qualifying conditions for each related to a firm's liquidity risk management. One aim will be to encourage higher risk management standards. For the most sophisticated firms, the possibility of an approach based on firms' internal liquidity-risk models is being explored. The framework is also to be designed to take adequate account of the different roles which different types of firms play, for example, in the provision of liquidity to other parts of the financial system.

In response to developments of its banking sector's liquidity position, PT very recently introduced a new regulation on liquidity. The monitoring of banks' liquidity position is carried out both on an individual and on a consolidated (group-wide) basis. In that respect, the Banco de Portugal receives regular reports concerning both the current and prospective liquidity profiles of financial groups. The assumptions concerning the effective residual maturity of some types of assets and liabilities with no defined contractual maturity have been tightened by the supervisor. An appropriate level for the liquidity ratio ("target" observation ratio) is defined, taking into account the overall situation of the individual credit institution. Elements that are considered are the funding concentration (e.g. the share of the ten major depositors in total deposits; the share of the five biggest counterparties in total

resources) and the structure of assets and liabilities (e.g. ratio between liquid assets and resources from foreign credit institutions; ratio between stable resources and total loans).

De Nederlandsche Bank is also revising its liquidity requirements. Under the new test, the liquidity of the banks' domestic operations is no longer the main focus for the minimum requirements, as has hitherto been the case. Instead, liquidity will, in principle, be tested at the group level, i.e. including foreign subsidiaries and branches. Off-balance-sheet items will also be taken into account, and the test horizon will be shortened from one year to one month. Since liquidity requirements have not yet been harmonised internationally, Dutch banks abroad will continue to be faced with other requirements set by local supervisors. In order to contain the attendant administrative burden where possible, foreign subsidiaries under adequate local supervision may be exempted from the new returns. In 2002, the supervisor and the banking system will gain experience with the new system, which will come into effect in 2003.

In LU, the supervisor is currently conducting a survey on liquidity management with the aim of assessing how banks are managing liquidity, of identifying best practices and sound standards, and of providing a further basis for discussion with the banking industry. Swedish authorities have recently published new liquidity guidelines and specific on-site liquidity inspections have been introduced.

Changes in supervisory liquidity requirements do affect banks' liquidity profile. When the supervisory authority in DE changed its liquidity requirements (2000), this resulted in a new composition of banks' portfolio of highly liquid assets as well as other short-term investments immediately convertible into cash. On the banks' liabilities side, there was a structural shift in the refinancing business from term to special sight deposits (e.g. credit card or money market accounts). In designing new products, banks are seen to take into account the possible impact on prudential liquidity ratios. Following the introduction of the "sterling stock regime" in the UK, one of the liquidity requirements imposed by the Financial Services Authority (FSA), firms were observed to substantially increase their holdings of sterling certificates of deposit (CDs).

Some major banks are developing their own methodology in the hope that supervisors would recognise it in the future so that it could replace regulatory liquidity ratios. In the UK, the FSA already has the possibility of granting a concession to banks with significant retail deposits to include such deposits in the regulatory ratio using an in-house "behavioural" maturity analysis.

In the absence of a consensus on how exactly to measure liquidity risk, the supervisory rules can provide a common benchmark. A number of smaller banks, for example, do not use any in-house liquidity ratios, but rather the supervisory ratios. Supervisory ratios may even inspire banks in the development of own indicators.

It should be recalled that in the present European supervisory framework, the host country retains responsibility, in co-operation with the home country, for the supervision of the liquidity of branches

of EEA credit institutions.³⁵ In the euro area context, such a rule has indeed become less relevant and the European Commission has therefore plans to propose a modification of the relevant directive so as to apply the general rule of “home country control” in this area as well. However, some Member States have already concluded arrangements that will discharge their responsibilities as host supervisors through the supervision exercised by the home supervisor when both home and host supervisors are satisfied that the firms in question have effective policies in place for the management of their liquidity at the group level.

Apart from the specific European context, it is the home country that is responsible in practice for the liquidity supervision of foreign branches. This is because liquidity is often managed centrally, which makes it difficult to analyse the position of branches in isolation from the rest of bank. Some European authorities may require that a branch is transformed into a subsidiary if they are not satisfied with the way it manages its liquidity. Requesting “letters of comfort”, a moral but not legally binding guarantee from the parent company, is another supervisory technique to make a parent company take up responsibility for its foreign establishments.

Finally, it should be pointed out that supervisory rules which are not primarily aimed at tackling liquidity risk, such as capital adequacy rules, can have an indirect effect on banks’ liquidity position. An important element in the proposed new capital accord is that, under the supervisory review process (“pillar 2”), banks and supervisors will have to address liquidity risk explicitly in their capital assessment. This may lead to an increased attention by banks and supervisors to liquidity risk since, under the present capital regulation, and unlike credit risk and market risk, liquidity risk is not subject to any capital requirements.

3.3.2 Deposit guarantee scheme

Deposits that benefit from the protection of a deposit guarantee scheme are less risk-sensitive and therefore more stable and reliable as a funding source. On the other hand, the higher the protection, the more one would expect customers willing to shift deposits to high-yielding, but possibly more risky, accounts, since their deposits are guaranteed anyway. This may result in customers being more sensitive to yield differentials, thus increasing the volatility of bank deposits and increasing liquidity risk.

Under normal conditions, the impact of the guarantee system seems to be limited, also because the EU Directive on deposit guarantee schemes prohibits advertising the extent of coverage.³⁶ The very few “topping-up” arrangements that currently exist in the EEA point to the same conclusion.³⁷ Likewise,

³⁵ Article 14 (2) of Directive 89/646/EEC of 15 December 1989 (“Second Banking Directive”). This directive has been integrated in the Directive 2000/12/EC of 20 March 2000 relating to the taking up and pursuit of the business of credit institutions (Article 27).

³⁶ Directive 94/14/EC of 30 May 1994 on deposit-guarantee schemes.

³⁷ Article 2 (2) of the Directive (“topping-up” clause) stipulates that host Member States with a guarantee above the minimum must ensure that their guarantee schemes can offer a supplementary guarantee to those foreign EU branches that request this. This enables a foreign branch with a lower guarantee than that prevailing in its host state to complement its home guarantee up to the level and scope of that given in its host country. According to a recent report by the European Commission, only five topping-up agreements (one in DK and four in the UK) have been concluded (European Commission, 2001).

after the abolishment of the export prohibition clause,³⁸ no particular changes of deposit flows to branches with higher coverage levels could be identified. However, in the case of financial difficulties of a particular bank or banking system, the relevance of deposit coverage may become a far more important element in customer behaviour.

According to the Directive, Member States should have a coverage of at least EUR 20,000, from which certain deposits and depositors may be excluded (e.g. deposits in currencies other than those of EU Member States or deposits held by non-retail customers). Coverage in the EU ranges from the minimum of EUR 20,000 (in most of the countries) to a maximum of more than EUR 100,000 (in Italy).

3.3.3 Tax legislation

The differences in the tax treatment of financial products will influence their relative attractiveness for customers and therefore their significance as a funding source. In IT, for example, there was a gradual substitution of medium and long-term certificates of deposit by bank bonds that was affected by changes in the taxation of interest income.

In particular, the favourable tax treatment of certain retail deposit products may contribute to the stability of these deposits. A number of EU countries offer such beneficial tax treatment. The risk, however, is that this stable source of funding could suddenly become more volatile when the beneficiary tax treatment ceases to exist, although other factors (e.g. the availability of similar financial products and the sophistication of customers) also come into play.

3.3.4 Minimum reserve requirements

With the introduction of the new monetary framework in the euro area, credit institutions have to hold remunerated balances on their current accounts with the NCBs (“minimum reserves”). The level of these minimum reserves is determined on the basis of the banks’ liabilities. Some liabilities are subject to a reserve requirement, while others are de facto exempted.³⁹ In this new framework, the competitive disadvantage related to different national rules on minimum reserve requirements has disappeared in the euro area. The averaging mechanism, which allows credit institutions to run daily liquidity deficits or surpluses as long as the requirement at the end of the reserve maintenance period is met, makes the minimum reserves also a useful liquidity management tool.

4 Banks’ liquidity management

There are a number of dimensions in the way banks concretely manage their liquidity risk, such as where it is exactly performed in the organisation, how liquidity is measured and monitored, what

³⁸ Article 2 (1) of the Directive (“export prohibition” clause) stipulates that, until the end of 1999, the level and scope of deposit protection for a branch established in another Member State could not be higher than that offered by the corresponding guarantee scheme of the host Member State (European Commission, 1999).

³⁹ Mainly deposits and debt securities with a maturity of up to two years are subject to the minimum reserve requirement, while those with a maturity of more than two years have a required reserve ratio of 0%. Repo operations are also subject to a 0% reserve requirement.

measures banks can take to prevent or tackle a liquidity shortage, etc.⁴⁰ Following overview of the banking industry's practices is based on a survey conducted at a number of banks in each EU country.

4.1 Organisation of liquidity management

In any large, internationally active bank, different bodies are involved in liquidity management. The Board of Directors or Executive Committee typically sets the limits and takes final decisions on the general strategy and policy. Recommendations to the Board are made by the Assets and Liabilities Committee (ALCO), or the Risk Management Committee, and compliance of limits is monitored by a Risk Control Department. The Treasury Department is in charge of actual, day-to-day liquidity management, possibly divided up between several operating units. If the institution's funding strategy is considered in a broad sense, the Capital Markets Division may also be involved. In the case of an institution with significant international activity, local or regional Treasuries and ALCOs may also be active. The distinction some banks make between cash liquidity and strategic liquidity may also be reflected in the organisation in that responsibility for the management of short-term and medium-term liquidity risk (e.g. for maturities up to two years) is given to the Treasury Department and that for the management of long-term liquidity risk (e.g. for maturities of more than two years) to the ALM Department.

Liquidity is not always managed at the group level. Sometimes, its management is limited to the institution itself (head office and branches), without including subsidiaries. If there is a liquidity strategy and policy at the group level, management may also exist at the level of each relevant subsidiary; these subsidiaries then follow often the same ALM policies as the group. Co-operative banks typically have a centralised liquidity management in place, with local co-operative banks placing the liquidity they obtain through deposit collection at a central entity. Of particular relevance is the liquidity management of subsidiaries located in emerging countries. Such subsidiaries are often monitored locally, taking into account elements such as currency convertibility, country risk and asset liquidity. Specialised business units (e.g. trading, investment management, payment systems) frequently have a separate liquidity monitoring and management.

As a result of the introduction of the euro, some of the major banks have concentrated their euro liquidity management in one centre ("liquidity hub"). Major banks often manage their international business on a major currency area basis (e.g. USD in New-York, EUR in Frankfurt, JPY in Tokyo).

4.2 Measuring and monitoring liquidity risk

4.2.1 Liquidity risk indicators

A standard set of indicators used by virtually all banks is based on a cash-flow analysis through the calculation of liquidity gaps, (cumulative) cash outflows, etc. Somewhat less frequently used are

⁴⁰ In this respect, it should be noted that the Basel Committee on Banking Supervision has issued a list of sound practices for managing liquidity in banking organisations. See Basel Committee on Banking Supervision (2000).

stock-based indicators and funding concentration indicators. The most advanced banks use a combination of indicators. Some, especially smaller banks, use only the supervisory ratios to monitor their liquidity position, while others use them as a basis for the development of in-house ratios. The most frequently used indicators are:

- cash (out)flows for different maturity buckets (“maturity ladder” or “gap” analysis), possibly differentiated according to the organisational level (e.g. global, regional, local, divisional), market, currency and product; flows that are known as well as can be expected (e.g. on the basis of statistical estimates or scenarios) may be included as well;
- the level of unsecured funding (considered to be a scarce resource);
- the ratio of liquid assets to total assets;
- the ratio of liquid assets to contingent liabilities (e.g. committed facilities, back-up lines for market transactions);
- the ratio of liquid assets to customers’ sight deposits;
- unused capacity in short-term borrowing programmes;
- large depositor concentration;
- the ratio of term liabilities to illiquid assets;
- country exposures (and therefore also individual currency exposures);
- intra-group exposures; and
- compliance with the securities issuance strategy.

Some major banks complement these indicators with partial probabilistic “liquidity at risk” models, but this is still very exceptional.

4.2.2 Treatment of specific elements

A formal liquidity analysis requires the bank to make decisions on how to handle elements such as assets with widely varying liquidity, liabilities with a non-contractual or indeterminate maturity (e.g. sight deposits, certain savings deposits) and loan commitments with a contingent liquidity effect.

Where stocks are concerned, assets are generally categorised on the basis of their degree of liquidity. Haircuts are often used to reflect differences in the degree of liquidity. Some banks apply two or three broad categorisations, such as liquid and illiquid securities, high-grade assets, less liquid assets and securitisable assets, etc.

Liabilities with a non-contractual or indeterminate maturity and loan commitments with a contingent liquidity effect are often included using behavioural analysis based on the historical movement of such liabilities. More sophisticated modelling takes account of phenomena such as interest rate movements and changes in economic conditions. Some banks stated that they no longer model the liquidity characteristics of such liabilities because assumptions in relation to “stickiness”, core/non-core deposits, etc. are deemed to be invariably ad hoc and arbitrary. Models can also be used to assess the potential flows on derivative contracts, although a number of banks felt – in particular, for options – that further research and development was required.

Sometimes banks attempt to distinguish between historical draws on credit lines that are due to individual credit events and those that are due to general market events. They may also seek to differentiate according to customer type (e.g. financial versus non-financial, public sector versus private sector) and tenor (short-term versus long-term). Received loan commitments can be entered in the liquidity analysis for the full amount, although it sometimes happens that committed credit lines granted by other financial institutions are not considered for fear that these commitments would not be honoured in a crisis situation. In stress testing, some banks concentrate on commitments made that do not have predetermined drawing dates because these tend to be drawn in the case of an individual credit event or a general market event.

A behavioural analysis may also be used for sight and savings deposits, but a simpler solution consists of assuming stability or, at the other extreme, considering them as nothing more than overnight liabilities – possibly in combination with scenarios whereby decreases in volume of x% are assumed.

Some banks make several calculations of their liquidity indicator. For example, one calculation might assume that the liabilities in question have no maturity, while another might assume that they will be withdrawn within a fairly short period (e.g. one month) and yet another that all funds will be withdrawn as soon as possible (“legal gap”, worst-case scenario), while still another will use models to arrive at an expected outflow. Sometimes liabilities will be entered into a liquidity analysis at a fixed percentage, probably reflecting their expected or historical “stickiness”.

Because of the difficulties of incorporating the above-mentioned elements into liquidity ratios, some banks may exclude them from the ratio altogether and instead monitor them separately, sometimes in relation to their stock of liquid assets.

4.2.3 Limits

Limits can be defined for going concern as well as stress scenarios. The limits are of course very much tied to the framework used by the bank in its liquidity monitoring (e.g. in terms of the indicator used, the time horizon and the currencies considered). It is not unusual for banks, especially smaller ones, to have no liquidity limits other than those required by existing regulations.

Fairly standard are volume limits (e.g. on the net cash flows in different maturity buckets, or on the level of eligible assets for central bank financing) and ratio limits (e.g. limits on the ratio of liquid assets to total assets, or on the share of the ten largest individual depositors in all unsecured, wholesale liabilities).

In most of the answers banks provided, it was not possible to identify how exactly the institution arrived at certain limit levels. However, some banks mentioned that they do tie their cash flow limits to their stock of liquid assets (e.g. eligible assets for ECB refinancing facilities), for example by imposing a minimum ratio between the two elements. Volume limits for individual maturity buckets are often interrelated: lower for short-term maturities and higher for long-term maturities. If limits are defined for only a few standard buckets, limits for intermediary buckets can be obtained by interpolation.

4.2.4 Time horizon

Most banks use a range of time horizons in their liquidity analyses, instead of just one specific period. A distinction is commonly made between day-to-day operational liquidity (cash management) and longer-term strategic or structural liquidity.

Operational liquidity management typically focuses on periods from one day to between one and three months. The period of one to three months is seen as the critical survival period in the event of a liquidity crisis. Sometimes, one month is quoted because this is the time horizon used to calculate the compulsory central bank reserve requirement or because it is assumed that it would not take any longer than one month to sell liquid assets. Some banks concentrate on the somewhat shorter period of ten trading days (two weeks), assuming that this would be sufficient to solve any liquidity crisis. A period of ten trading days corresponds to the required holding period in regulatory value-at-risk (VaR) calculations of the capital requirements for the market risk.

Strategic liquidity management focuses on periods of up to one year, which coincides with budget and issuance planning. It is uncommon for banks to look further than one year ahead, although some stated that they do perform less detailed analyses for periods of more than a year (e.g. ten years or even 30 years) Longer term imbalances are monitored since they may create short-term imbalances with the passing of time.

4.2.5 Spectrum of currencies

Several approaches are taken with regard to the liquidity management of different currencies.

- All currencies are aggregated, subject to the condition or the underlying assumption that currencies are fungible because of well-functioning and liquid forex markets. However, in the event of a serious dislocation in the transfer mechanism between markets, a credit institution with a balanced overall liquidity position may nevertheless have major imbalances in individual currencies which it is not able to settle.
- All currencies are aggregated and/or a distinction is made between currency classes, often on the basis of their degree of liquidity (e.g. very liquid, liquid, illiquid; freely convertible, non-freely convertible). One important criterion in determining the degree of liquidity is the ability to hedge exposures through currency swaps. A somewhat coarser approach consists of distinguishing between the domestic currency and aggregated foreign currencies. This can probably be attributed to the ease with which central bank funding can be accessed for the domestic currency.⁴¹
- All currencies are aggregated and/or a distinction is made between individual currencies, in which case the focus will, of course, also be determined by the business or funding strategy of the bank. For example, if its business is predominantly in EUR (or local currency), USD and JPY, the focus

⁴¹ Box 3 below detailing the impact of the events of 11 September 2001 on bank liquidity provides an illustration of how the Eurosystem was able to provide adequate liquidity to its banking system in a non-euro area currency (USD). It also shows that, in the event of serious disturbances on the swap market (which links the liquidity in different currencies), central banks may have to step in to act as clearing counterparties between currencies.

will be on these currencies. Some banks that are active in emerging markets make the distinction in their liquidity management between domestic US dollars and local currency because their policy is to fund domestic US dollar/domestic currency loans with domestic US dollar/domestic currency deposits.

4.2.6 Scenario analysis and stress testing

Scenario analysis and stress testing are areas which are being further developed by a number of banks. Some banks said that they did not yet perform scenario analysis and stress testing because of the institution's very comfortable liquidity position which, in their view, made the use of such techniques unnecessary.

Scenario analysis commonly uses interest rate projections. For stress testing, a diverse set of extreme events are considered, some of which are institution-specific, while others are of a more general nature. For example:

- the downgrading of the institution by x notches, possibly distinguishing between a short-term and a long-term rating;
- a withdrawal of customer deposits by x%;
- the inability to refinance all funding, except for core customer deposits;
- the inability to refinance x% of money market/commercial paper funding;
- a one-day fall of x% in a major stock index;
- a significant change in interest rates;
- restrictions on currency convertibility in emerging markets;
- an emerging market crisis on a regional level with potential spill-over effects;
- credit losses;
- operational risk (settlement problems); and
- ad hoc scenario analysis of special events (e.g. Y2K, euro changeover).

Banks that are highly active in emerging countries focus their stress testing on these activities in particular. For example, they will try to assess the impact of an emerging market crisis on non-performing loans, customer deposits, capital market liquidity and other sources of liquidity (e.g. central bank funding).

4.2.7 Economic and market trends

Most banks confirmed that economic and market trends are monitored and fed into the planning and budgeting process, which also covers (among other things) liquidity management. For example, economic trends are reflected in business growth projections which, in turn, drive funding forecasts and decisions relating to the composition of funding. Expectations about future interest rate developments are one important element in the trend monitoring process. The actual timing of funding and investments will be influenced by market conditions, and the bank may decide to steer its desired liquidity profile through internal pricing.

The monitoring of economic and market trends is also used when defining liquidity limits in general, and country and counterparty limits in particular. Economic forecasts may feed into contingency planning through the various scenarios under consideration.

4.3 Measures for avoiding liquidity shortages

Credit institutions can take preventive measures to avoid liquidity shortages by keeping in close contact with investors and counterparties, and by having contingency funding plans in place.

Contacts with fund providers and investors are routinely maintained in the context of correspondent banking activities, wholesale market activities and investor relations programmes. This strategy can range from ensuring that the credit institution in question has a presence on various markets to establishing programmes for accessing new categories of liquidity providers, ensuring a steady turnover of liquid assets or drawdowns of funding lines, and developing good relations with the financial press in order to raise the bank's profile.

Formal liquidity contingency plans do not seem to be a general practice yet, but this does not mean that banks give no consideration to funding possibilities in stressful situations. Many banks pointed to their (alleged) very comfortable liquidity position to justify the absence of a formal plan. For example, they may have a large securities portfolio which can be used for securitised borrowing (either from the central bank or directly from the market) or they may have access to loan commitments or issuance facilities which can be drawn upon in abnormal market conditions. To some extent, however, this may be a "liquidity illusion" insofar as, in a crisis situation, access to previously abundant liquidity may be severely restricted. Moreover, because banks implicitly rely on central bank funding to solve their liquidity problems, "moral hazard" may be that much greater.

Sometimes, banks do not have a general liquidity contingency plan, but draw them up for specific circumstances (e.g. Y2K, the euro changeover). Several banks mentioned that, although they did not yet have a general liquidity contingency plan in place, they were working on developing one.

Major banks often have formal liquidity contingency plans, sometimes as part of a more general emergency plan. These plans consider various potential liquidity crisis scenarios and set out the policy to be implemented for each one, along with possible actions and administrative procedures, for example in terms of intervening bodies, respective responsibilities, reporting and communication requirements, liquidity limits. The scenarios often vary in scope (ranging from a general market crisis to a bank-specific problem) and take account of the speed at which the crisis develops (sudden and unexpected, slower and more foreseeable). Implementation of these plans may be triggered by changes in the spread of the bank's marketable assets, the money market lines at its disposal, its funding costs, rating agency actions, and technical failures.

Banks have a range of possible actions or instruments at their disposal to steer their liquidity positions. The contingency plans may specify under which scenario a particular action is taken. The following table lists the possible actions mentioned with regard to assets and liabilities.

Assets	Liabilities
<p>Liquid assets</p> <ul style="list-style-type: none"> • Participate in central bank operations. • Sell liquid, unencumbered assets. • Park funds raised in liquid securities. • Convert assets into short-dated government securities. <p>Illiquid assets</p> <ul style="list-style-type: none"> • Discontinue acquisition of new loans. • Discontinue purchase of illiquid assets. • Securitise illiquid assets. 	<p>Retail</p> <ul style="list-style-type: none"> • Launch special commercial actions to promote certain customer products (e.g. savings certificates). • Establish a diversified basis of retail customer deposits. <p>Interbank</p> <ul style="list-style-type: none"> • Undertake collateralised borrowing (from central bank or market), possibly in combination with forex swaps to obtain the required currency. • Increase borrowing on the interbank market. • Seek re-confirmation of limits with major/usual lenders on the interbank market. <p>Securities</p> <ul style="list-style-type: none"> • Reduce unsecured interbank funding, e.g. by relying more on CD and CP issuance. • Lengthen maturities of securities (e.g. CP, CDs, medium-term notes (MTN)). • Step up efforts to place securities with new investors or existing customers (e.g. by approaching fund managers or insurance companies). • Continue to make a secondary market in own debt. • Establish programmes for accessing new categories of liquidity provider (e.g. through securitisation, the issuance of hybrid capital). <p>Off-balance sheet</p> <ul style="list-style-type: none"> • Control or block the growth of committed credit lines (either new ones or existing ones that are rolled over). • Use derivatives to ensure that changes in the maturity profile of liabilities do not lead to unwanted changes in market risk.

This table of possible actions is very much linked to the perceived degree of liquidity of the various funding and asset markets. The following table provides an overview of which markets are considered by banks to be the most liquid and illiquid.

Most liquid	Most illiquid
<p>Funding</p> <ul style="list-style-type: none"> • Securitised lending from the central bank. • Repo markets on bonds and T-bills. • Forex swaps market (≤ 1 month). • Unsecured money market (≤ 1 month). • US CP market; Euro-CP market to a lesser extent. • Euro-MTN market. • Senior borrowing 3-5 years. <p>Assets</p> <ul style="list-style-type: none"> • Securities eligible for central bank financing, especially these on the "tier 1" list. • Secondary bond market, especially government bonds and jumbo-mortgage bonds. • Equities in important stock market indices. 	<p>Funding</p> <ul style="list-style-type: none"> • Unsecured money market (> 1 month). • Customer deposit market. • Securitisation operations (cf. work and information required to access market). • Hybrid capital instruments. • Local (non-euro) short-term money market. <p>Assets</p> <ul style="list-style-type: none"> • Local (non-euro) securities market. • Retail loan portfolio. • Corporate securities issued by low-rated entities, or if non-standard (e.g. convertible bonds) or unlisted. • Securities issued by emerging countries. • Participating interests.

Box 3 gives a concrete example of a stress situation, highlighting how euro area banks were confronted with liquidity problems in the aftermath of the terrorist attacks in the United States and how these problems were resolved through co-ordinated central bank action.

Box 3: Impact of the events of 11 September 2001 on bank liquidity

The terrorist attacks on the United States on 11 September 2001 posed a serious test for the smooth distribution of liquidity in the euro area. In the days following the attack, many euro area banks hoarded their liquidity and were unwilling to lend it to the market, as was evident in a high level of overnight rates and the historically high bid-ask spreads, for example. The hoarding tendency may also have reflected a greater risk aversion towards interbank lending. The Eurosystem reacted quickly to these market tensions by injecting additional funds through fine-tuning operations.⁴² Euro area banks did not report any difficulties in extending credit lines when the need arose, nor were they obliged to temporarily reduce any credit lines. There is no evidence of banks having to activate contingency plans because of urgent liquidity problems.

A number of euro area banks, however, did experience difficulties in financing their USD positions as US banks were reluctant to lend USD before they were certain that their own liquidity needs would be satisfied. There may also have been a reluctance to lend to non-US banks. Moreover, although the Federal Reserve System provided ample USD liquidity to the markets through its discount window and open market operations, euro area banks without a US banking licence were not able to directly access that discount window. In order to channel the necessary USD funds to euro area banks and thus avoid a serious disruption of the markets, the ECB and the Federal Reserve Bank of New York concluded a USD/EUR swap agreement. The ECB and NCBs, and then the NCBs and market counterparties, entered into similar swaps. In effect, through this mechanism initiated by the Eurosystem, the Federal Reserve System was able to extend its operations to the whole USD market and not only to the US banking system.

In the aftermath of the events, price and liquidity reactions could also be observed in the equity, bond and other financial markets. The redemption of US-linked mutual funds was also temporarily stopped by euro area banks. The tendency was for a flight to quality, a stock market decline and an atmosphere of uncertainty, as well as some liquidity strains (e.g. in the CP market), which could have had significant implications for banks. Some banks experienced difficulties in finding counterparties for interest rate swaps.

5 Concerns and implications

On the basis of the above analysis, it is difficult to say whether liquidity risk has actually increased or decreased. On the one hand, the integration, deepening and better liquidity of the money markets, the introduction of new payment technologies and of financial innovations have improved banks' ability to manage liquidity risk. On the other hand, the liberalisation and globalisation of the financial markets have raised new concerns of contagion of financial strains. However, there are indications that, while liquidity risk in normal conditions has decreased, it may actually have increased during certain times of stress. It is also clear that the environment in which liquidity has to be managed and the nature of liquidity risk have changed significantly over recent years. Banks that are not able to cope with these changes will potentially be more at risk. This situation also calls for banks regularly to engage in backtesting the behavioural assumptions on which their liquidity analysis is built.

It is sometimes argued that under normal circumstances a healthy and solvent bank will always have access to the funding it needs, e.g. by accessing the interbank market or by using central bank financing, and that liquidity is therefore not a real concern. This view may be reinforced by the very comfortable liquidity position of a bank in a going-concern scenario, e.g. because of its large portfolio

⁴² A non-regular open market operation performed by the Eurosystem, mainly to deal with unexpected liquidity fluctuations in the markets.

of liquid assets or its access to credit lines. Ample market liquidity in normal times may contribute to this feeling of confidence.

In the event of a crisis (either a bank-specific or a general market crisis), however, access to liquidity may be severely restricted if counterparties are unwilling to provide funds, even against high-quality collateral or at high prices. They may also challenge the bank's ability to draw on credit lines, for example by invoking overlooked material adverse-change clauses or by questioning the legal validity of the commitments. In a general market crisis scenario, a bank may find it impossible to mobilise assets on the market, or may only be able to do so by accepting a very large haircut. The events of 1998 showed that liquidity can dry up very quickly in the event of a shock, even on markets that were traditionally considered to be very liquid. So, while liquidity risk may have decreased under normal circumstances, it may in fact have increased during certain periods of stress, due to factors such as the growing interconnection of markets and the consolidation of counterparties. Moreover, it is common that in periods of stress different risk types – such a credit risk, market risk, liquidity risk, operational risk and legal risk – will all be bunched together.

Consequently, banks need to be more aware of this issue. Major banks in particular are already aware of what is at stake and are actively looking for better ways to manage their liquidity risk by, inter alia, implementing the sound practices defined by the Basel Committee on Banking Supervision.

In the area of market risk, the value-at-risk (VaR) concept has become the industry standard, and VaR is now also widely accepted by bank supervisors as a technique for calculating regulatory capital requirements. There is still no such mechanism for liquidity risk, although some of the major banks are working on probabilistic liquidity-at-risk models, with the parallel aim of replacing supervisory liquidity ratios with a set of requirements determined on the basis of such models. However, these still seem to be at an early stage of development. Complicating factors in liquidity modelling are that a normal distribution cannot be assumed for cash flows and that historical data do not adequately capture the stress-dimension of liquidity risk. Some national authorities already accept an embryonic form of modelling, e.g. by allowing the results of a behavioural analysis of certain elements such as sight deposits and savings deposits to be incorporated into the regulatory liquidity ratios. One may want to monitor the further development of liquidity risk measures, which may, at some point in the future, lead to the establishment of an industry standard.

Banks and supervisors should ensure that their liquidity monitoring procedures also take account of elements that have a contingent and difficult-to-assess effect on liquidity, such as derivatives and loan commitments. This will help avoid significant liquidity risk building up unnoticed and prevent banks from accumulating risk without being able to fund it. It is very difficult to incorporate such elements in traditional stock/flow liquidity measures. One way of monitoring and containing the related risks is to emphasise qualitative-organisational requirements and develop scenario analysis and stress testing methods.

Credit institutions increasingly rely on securities to ensure liquidity because they can be sold outright on the market or can be used to secure collateralised borrowing. The growing securities portfolios of

banks and the exponential development of the repo market illustrate this trend. Authorities may therefore want to closely monitor the composition of securities portfolios as government bonds increasingly make way for new asset classes, such as corporate securities, Pfandbrief-style instruments, and agencies' securities. This trend also calls for a better understanding by banks and their supervisors of the micro-financial structure and dynamics of securities markets and how they interact with bank liquidity. For example, mark-to-market valuations, margin requirements and haircuts are such that security price developments are now reflected more quickly in banks' liquidity positions. Attention should be paid to the various aspects of securities market liquidity (e.g. evaporation, duration, concentration, diffusion, self-fulfilling aspects) and linkages between markets (e.g. through leverage, collateral practices, price correlation).

What happened to the Drexel Burnham Lambert Group in the late 1980s and the market for perpetual floating rate notes ("perps") in the mid-1980s are cases in point. As the liquidity of the secondary market for low-grade bonds suddenly deteriorated after a series of events, the Drexel Burnham Lambert Group found it increasingly difficult to manage its liquidity through asset sales or collateralised loans, and this ultimately led to its collapse.⁴³ In our second example, the market for "perps", primarily issued by banks, suddenly collapsed as rumours emerged of an impending change in international banking regulations to avoid double gearing. This caused holders of "perps", believed to be mainly Japanese banks, to drastically reduce their holdings, thus creating liquidity demands that were highly correlated across the investor base.⁴⁴ Meanwhile, the Russia/LTCM crisis of 1998 demonstrated that it is not just relatively minor and segmented markets with a concentrated structure that are subject to abrupt declines in liquidity: market liquidity failure can also take place in markets which are traditionally considered to be among the world's most liquid.⁴⁵

Another manifestation of the increasing importance of securities is the growth of collateralised borrowing and lending, as is evident, for example, from the development of the repo market. From a micro-prudential perspective, banks' collateral risk management needs to keep pace with the strong expansion in the use of collateral and the changes in the business model. It should be noted that the industry has already established some guidelines in this area.⁴⁶ It may also be advisable to require a more detailed disclosure of posted and obtained collateral, since present European rules on this matter are fairly general. Moreover, because the repo market is heavily concentrated on the very short-term segment, banks should not become over-reliant and run the risk of not being able to roll over maturing repos. Extensive pledging of available collateral through repos means that any positive liquidity effect that can be achieved from selling marketable securities in a stress situation is drastically reduced. Pledged securities are often held at custodial banks. The economies of scale involved are such that

⁴³ Allen, F., and Herring, R. (2001). The events that led to a drying-up of liquidity in this market were Drexel's guilty plea and indictment relating to racketeering and fraud charges, Congress' decision that thrift institutions had to sell their holding of low-grade bonds, and the fact that covenants that were expected to protect investors against default risk proved to be ineffectual.

⁴⁴ Fernando, C.S., and Herring, R.J. (2001).

⁴⁵ Davis, E.P. (1999). The author also discusses some other episodes of liquidity risk in debt securities markets and the impact of market liquidity crises for systemic financial stability.

⁴⁶ See, for example, International Swaps and Derivatives Association (1999), Counterparty Risk Management Policy Group (1999).

custodial activity is typically concentrated on a number of large, international players. If one of these major players were to face serious operational difficulties, this could unexpectedly restrict a bank's access to these securities as a liquidity-supporting element. Stress testing should therefore include the scenario where the bank's access to its stock of liquid securities is hampered. In these stress-testing scenarios, banks should not implicitly rely on central bank funding to solve their liquidity problems and institutions that do so as a result of inadequate planning should be penalised. On a more general note, banks should duly recognise in their liquidity contingency planning the possible spill-over effects of operational problems both in key financial infrastructure elements and of core market participants.

In spite of the growth of the repo business, unsecured transactions still dominate the interbank business in Europe. From the point of view of financial stability, the patterns in this activity raise the issue of the emergence of systemically relevant banks at a European level and the impact on liquidity distribution in the euro area if one of these banks were suddenly unable to honour its commitments.

Owing to the increasing reliance on credit-sensitive wholesale fund providers, whether on a secured or unsecured basis, a typical liquidity crisis today would probably be more like the Continental Illinois case in the United States (1984)⁴⁷ or the small banks crisis in the UK (early 1990s)⁴⁸. In both cases, it was the large companies and financial institutions that withdrew their deposits from banks because of a loss of confidence triggered by events such as heavy loan losses. Thus, the traditional image of a liquidity crisis or bank run triggered by retail clients withdrawing their deposits might well be outdated, especially where the largest market players are concerned. Such wholesale bank runs would put pressure on RTGS payment systems, resulting in higher needs for intra-day liquidity. A positive effect of the increasing reliance on wholesale funding is that it offers more scope for market discipline on banks' behaviour.

⁴⁷ See, for example, Swary, L. (1986); Wall, L.D., and Peterson, D.R. (1990).

⁴⁸ Logan, A. (2000).

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