

## LIQUIDITY RISK –

*New Lessons and Old Lessons*

## TABLE OF CONTENTS

2	Introduction
3	Measuring Liquidity Risk
12	Managing Liquidity Risk
14	Standby Liquidity Reserve
14	Syndication, Sales and Securitization
14	Tactics for Liability Diversification
17	Other Liability Management Tactics
19	Conclusion

## INTRODUCTION

*The flight to quality that began in 2007 reminded many banks of the importance of liquidity risk management.*

While maintaining ample liquidity for significant stresses is a costly proposition, there is a balance to be struck between short-term earnings and long-term survival.

The crisis also reminded us that liquidity risk is a consequential risk. However, this time, none of the usual suspects such as credit and trading losses triggered the liquidity stresses. Instead, liquidity problems resulted from the belated recognition of risk in mortgage-backed securities which led to a massive flight to quality and, for some banks, the need to fund off-balance sheet commitments. While the initial cause of both problems was excessive exuberance in US residential mortgage underwriting, problems quickly spread.

## I. MEASURING LIQUIDITY RISK

In today's complex product market, some banks have far more complex liquidity risks than others. Smaller, conservatively-run banks tend to make greater use of relatively reliable core deposits and less use of potentially volatile short-term market instruments. Conversely, larger banks and smaller banks with aggressive funding strategies have recently made greater and more aggressive use of funding from other banks and the capital markets for their funding needs, including brokered CDs and complex securitizations – such as asset-backed commercial paper (ABCP) and collateralized debt obligations (CDOs).

This has put a much greater emphasis on contingent and market liquidity risk, two of the three specific types of liquidity risk defined in Table 1.

### Exhibit 1: Liquidity risk comprises three specific types of risk

1. **Mismatch or structural liquidity risk.** The liquidity risk in the bank's current balance sheet structure due to maturity transformation in the cash flows of individual positions.
2. **Contingency liquidity risk.** The risk that future events may require a significantly larger amount of cash than the bank's projections allow. This can arise due to unusual deviations of timing of cash flows (term liquidity risk), e.g., non-contractual prolongation of loans, or unexpected draws on committed loan facilities (call liquidity risk).
3. **Market liquidity risk.** The risk that the bank is unable to sell assets at or near fair value (discounted cash flow), due to market disruption or the loss of the bank's reputation.

Many commentators described the 2007-08 market turbulence as 'exceptional,' but this does not let banks off the hook. The history of banking is littered with examples of how unparalleled events expose poor liquidity management, from the US savings & loans crisis in the 1980s, to the run on Continental Illinois in 1984, to the long-term capital management drama in 1998.

It is true, however, that banks cannot afford to hold enough excess liquidity in normal market conditions to survive every worst-case scenario. Instead, they have to:

- 1) 'Buy' reasonable amounts of liquidity insurance through taking a prospective stance on liquidity requirements, e.g., diversifying funding sources or extending the stickiness or maturity of deposits in line with future bank needs
- 2) Maintain a reserve of unencumbered, marketable assets to buy time in the case of funding disruption
- 3) Build the capability to spot elevated risk levels so that the bank can take remedial action promptly, while remedies are still available

As we'll explain in the rest of this paper, this means turning away from traditional 'retrospective' approaches to measuring liquidity risk, and turning towards newer, 'prospective' approaches that include sophisticated cash flow forecasts, quantification of liquidity reserves in terms of 'survival horizons,' and early warning systems based on key risk indicators (KRIs). The bank must then apply these prospective measurement approaches to the management of liquidity risk, while avoiding a number of common pitfalls.

### **TURNING AWAY FROM TRADITIONAL APPROACHES**

Traditional approaches to liquidity risk measurement rely on balance sheet ratios such as loan-to-deposit ratios. These ratios have proved to be inadequate.

First, because they use historical accounting data, they are retrospective. They tell us what the risk was but not what it might be. Second, few of the traditional ratios incorporate off-balance sheet commitments. Most banks have seen a huge growth in the volume of these commitments and therefore in the associated liquidity risk. Third, traditional ratios fail to capture the temporal dimension of liquidity risk: a funding exposure 90 or 180 days from now does not pose the same risk as a similarly sized funding exposure tomorrow.

On top of these problems, there are a number of traps for the unwary when measuring liquidity risk:

1. Perhaps the most common mistake is to consider that cash on hand, or cash on deposit with other banks, is a liquid asset. That would only be true if our aim was to liquidate the bank – something we are trying to avoid! Cash and bank deposits held for clearings are, accordingly, illiquid, fixed assets in the eyes of the liquidity risk manager.
2. The second common mistake is to exclude the effect on cash flows of off-balance sheet commitments that are not contractually binding. Liquidity risk is a particular danger in banking because it can arise simply from the perception that a financial institution will not have sufficient cash to meet its obligations, at one or more future periods in time. The management of perceptions during a funding crisis is therefore at least as important as the management of cash. Accordingly, making new loans and funding non-legally binding commitments is essential (in the early stages of a funding disruption, at least).
3. Using the bank's loan-to-deposit ratio to assess liquidity is a third error: not all loan assets are illiquid, not all other assets are liquid, and not all deposits will leave the bank in the event of a funding crisis.

## FLYING TOO CLOSE TO THE SUN

In trying to build more sophisticated approaches, some banks have recently fallen into the measurement cul-de-sac of applying stochastic analysis to quantify liquidity risk. Typically, these banks use Value-at-Risk (VaR) measures based on historical data to examine the volatility of cash flow from assets and liabilities.

For example, banks can evaluate the changes in savings account balances over a period, e.g., five or ten years, to forecast the maximum cash out-flow that might be expected with a given confidence level such as 98%.

Stochastic analysis is very seductive, but dangerous. It seems to bring precision to the forecasting process but is misguided. Many bank's statistical tool kits do a poor job of capturing the risk arising from low probability events. Looking at cash out-flows in the tail of a distribution will not tell a bank anything very useful about cash out-flows in a future funding crisis because the data in such a distribution does not include any observations from funding crises. The bank should be more interested in the impact of some potential structural change, either in the market or in its own balance sheet.

In a fortunate coincidence, Nassim Taleb, in his new book, *The Black Swan*, gave risk managers a timely reminder of this old problem: no amount of observations of white swans will ever permit an observer to predict the appearance of a black swan. Except for budgeting, liquidity risk managers are looking for black swans.

## BUILDING BEST PRACTICE LIQUIDITY RISK MEASUREMENT

By contrast, we can think of best practice liquidity risk measurement as a stool supported by three measurement legs:

- Multi-period cash flow projections for sets of deterministic forecasts. The sets include multiple scenarios and multiple stress levels
- Quantification of the bank's liquidity reserve, i.e., the unencumbered, marketable assets that can be used to buy time in the event of a funding problem
- KRIs and trends relating to them, e.g., measures of liability concentrations and maturity profiles

These three legs all support the reporting function at the top of the stool, which in turn should reflect the needs of various users. Risk managers require reports that allow them to dig down into the details of what might be causing a liquidity risk, so that they can work out how to manage or mitigate the risk. Senior executives and non-executive directors, on the other hand, need reports that flag up and summarize risk exposures clearly.

Let us look at each of the three legs in more detail.

## CASH FLOW FORECASTS

Cash flow forecasts start with a base case that reflects the bank's standard business projections, e.g., the bank's budget. Large banks and banks that depend upon capital markets funding usually forecast the first projected week in daily time buckets, the rest of the first month in three weekly time buckets, and then monthly time buckets for the rest of the year. Smaller banks and banks primarily funded by retail deposits often simply use monthly buckets.

Each cash flow forecast is driven by the bank's contractual cash in-flows and out-flows due in each time period, as well as by estimates of behavior-driven cash flows. The bank's business tactics often help to shape behavior-driven cash flows. For example, the bank may be promoting a deposit product and will therefore expect to bring in large amounts of new deposits. The bank's expectations about how counterparties will act are also important, e.g., some portion of time deposit holders can be expected to roll over their funds at maturity.

Exhibit 2, on the following page, presents one illustrative cash flow analysis. In this analysis, we've shown all of the customer-driven cash flows first, allowing us to create a customer-driven cash flow subtotal. These cash flows, together with non-discretionary treasury cash flows – such as the cash out-flow for borrowings that mature – represent the deficit that must be offset and therefore the sum of funds that the bank requires. Presented in this way, the funds generated to offset the deficit (e.g., new borrowings, asset sales) will not act to mask the underlying risk.

The base case, or normal course of business, projection should be supplemented by forecasts for other scenarios and stress levels. For example, a bank may model a scenario in which credit or trading losses lead to reduced counterparty confidence. One forecast under that scenario might represent the effect of a mild problem, another the effect of a serious problem, and another a worst-case problem.

This, in a nutshell, is liquidity stress testing. However, liquidity risk managers face various challenges when they try to create useful multi-period, multi-scenario, multi-stress level forecasts.

The first problem is how to source the historical data that shapes cash flow assumptions in each stressed forecast.

The problem here is that both markets and bank balance sheets change, especially after a crisis. For example, liquidity risk managers might look at how their banks were affected by the disruption in the capital markets during autumn 1998. While this will offer some insight, the bank's 2007 balance sheet were quite different to that of 1998. Likewise, data from the credit crunch during 2007-08 may not seem very relevant by 2009.

## Exhibit 2

**OCEAN BANK**  
**Liquidity Cash Flow Projection**  
**Bank Specific Scenario at Stress Level 2 (Orange)**

	Monthly Rate of Increase or Decrease	Opening Balance	Day 1	Day 2	Day 3	Day 4	Day 5	Week 2	Week 3	Week 4
<b>Customer Driven</b>										
<b>ASSETS</b>										
<b>Personal Loans</b>										
Personal Loans (Contractual)			29	17	20	16	21	119	138	170
Personal Loans Prepayment Estimate	1.67%		1	1	1	1	1	28	28	28
New Loans	4.00%		(36)	(36)	(36)	(36)	(36)	(270)	(270)	(270)
Net Installment Loans		27,000	(7)	(19)	(16)	(19)	(15)	(123)	(104)	(72)
Personal Line of Credit Payments (Contractual)			3	3	3	3	3	15	15	15
Personal Line of Credit Prepayment Estimate	0.93%		0	0	0	0	0	11	11	11
Personal Line of Credit Advances	5.00%		(32)	(32)	(32)	(32)	(32)	(238)	(238)	(238)
New Loans	1.75%		(11)	(11)	(11)	(11)	(11)	(83)	(83)	(83)
Net Personal Line		19,000	(40)	(40)	(40)	(40)	(40)	(295)	(295)	(295)
Mortgage Payments (Contractual)			12	61	5	5	5	47	50	74
Mortgage Prepayment Estimate	1.15%		0	0	0	0	0	17	17	17
New Loans	2.65%		(21)	(21)	(21)	(21)	(21)	(159)	(159)	(159)
Net Mortgage Loans		24,000	(9)	40	(16)	(16)	(16)	(95)	(92)	(68)
<b>Corporate Loans</b>										
Payments (Contractual)			59	75	438	321	126	922	2,189	2,557
Estimated Prepayments	1.36%		3	13	4	22	76	67	49	1,101
New Loans and Rollovers	6.25%		(427)	(427)	(427)	(427)	(427)	(3,203)	(3,203)	(3,203)
Net Corporate Loans - Fixed		205,000	(365)	(339)	15	(84)	(225)	(2,215)	(965)	454
<b>Corporate Lines of Credit</b>										
Optional Pay downs	6.00%		4	4	4	4	4	218	218	218
Advances	16.00%		(10)	(10)	(10)	(10)	(10)	(580)	(580)	(580)
New Loans	0.50%		(10)	(10)	(10)	(10)	(10)	(73)	(73)	(73)
Net Commercial - Lines of Credit		58,000	(16)	(16)	(16)	(16)	(16)	(435)	(435)	(435)
<b>LIABILITIES</b>										
<b>Sight Deposits</b>										
Current Accounts	-2.00%	30,548	(20)	(20)	(20)	(20)	(20)	(153)	(153)	(153)
Savings Accounts	-2.00%	61,433	(41)	(41)	(41)	(41)	(41)	(307)	(307)	(307)
Money Market linked Savings	-2.00%	78,342	(52)	(52)	(52)	(52)	(52)	(392)	(392)	(392)
<b>Term Deposits</b>										
Insured CDs - Maturing (Contractual)	-2.00%		(68)	(68)	(68)	(68)	(68)	(509)	(509)	(509)
Insured CDs - New	0.50%		17	17	17	17	17	127	127	127
Net CDs under \$100,000		101,786	(51)	(51)	(51)	(51)	(51)	(382)	(382)	(382)
Uninsured CDs - Maturing (Contractual)	-2.00%		(32)	(32)	(32)	(32)	(32)	(242)	(242)	(242)
Uninsured CDs - New	0.50%		8	8	8	8	8	60	60	60
Net CDs >= \$100,000		48,380	(24)	(24)	(24)	(24)	(24)	(181)	(181)	(181)
Net Income (cash basis)			17	17	18	13	13	100	100	100
<b>TOTAL CUSTOMER DRIVEN</b>			<b>(608)</b>	<b>(545)</b>	<b>(244)</b>	<b>(350)</b>	<b>(487)</b>	<b>(4,477)</b>	<b>(3,205)</b>	<b>(1,730)</b>
<b>Treasury Non-Discretionary Cash Flows</b>										
Proceeds from O/N Funds sold				n/a	n/a	n/a	n/a	n/a	n/a	n/a
Investment Securities Maturing			1,190	3,000	2,500	-	1,040	15,000	-	1,000
Investment Securities Pay downs & Calls			1,944	2,132	1,754	1,723	1,827	1,881	1,631	1,602
Brokered Deposits Maturing (Contractual)			(79)	(10)	(111)	(3,767)	(45)	(310)	(200)	(575)
Repayment of O/N Borrowings		25,000	(25,000)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Other Borrowings Maturing (Contractual)		75,000	-	(3,000)	-	-	-	(25,000)	-	-
Central Bank Borrowings Maturing										
<b>Subtotal Treasury Non-Discretionary Cash Flows</b>			<b>(21,945)</b>	<b>2,122</b>	<b>4,143</b>	<b>(2,044)</b>	<b>2,822</b>	<b>(8,429)</b>	<b>1,431</b>	<b>2,027</b>
<b>DEFICIT THAT MUST BE OFFSET (MCO)</b>			<b>(22,553)</b>	<b>1,577</b>	<b>3,899</b>	<b>(2,394)</b>	<b>2,335</b>	<b>(12,906)</b>	<b>(1,774)</b>	<b>297</b>

The assumptions made when conducting scenario-based stress cash flow forecasts therefore require a great deal of thought. They must be appropriate for the institution and have a sound logical and quantitative foundation. Most importantly, they must be appropriate for the given scenario and stress level. For example, in the widespread capital markets disruption of autumn 1998, only the safest assets were marketable. However, in the case of a bank-specific funding event, banks can rely on being able to market a much larger group of asset types.

It is also important that banks focus on materiality. The main drivers of the bank's risk exposure will be a loss of funding (i.e., liabilities), particularly from uninsured, unsecured counterparties, and an increase in funding requirements for off-balance sheet commitments.

In some stress scenarios, it is very likely that off-balance sheet commitments will be drawn upon – a lesson that some banks had to learn again. In a scenario based on credit quality deterioration, the bank must also take into account a reduction in cash flows from defaulting loans.

Other apparent sources of risk are likely to be immaterial. Modeling the impact of changes in rate spreads or loan prepayments on cash flows is intellectually interesting. But will it really make much difference to the bank's risk exposure under stress scenarios?

It is often a good idea to model contractually committed cash flows separately from cash flows affected by behavioral assumptions. This makes it easy to identify the portions of cash flow projections where the measured risk is primarily driven by assumptions.

It is also best to model non-discretionary cash flows separately from cash flows resulting from assumed new borrowings, assumed loan sales and assumed securities sales. In this way, the planned remedial actions will not mask the underlying risk exposures.

Finally, banks must not forget to forecast the need to fund non-contractually binding loan commitments as well as new loans in mild stress scenarios. Confidence management is critical in liquidity risk management.

### **QUANTIFYING THE LIQUIDITY RESERVE**

Experience shows that access to new borrowings, even under committed facilities, can quickly evaporate during a funding crisis. Maintaining a prudential cushion in the form of a liquidity reserve, therefore, may be the single most critical aspect of liquidity risk management. But what exactly is a liquidity reserve and how can we measure it?

## WHAT ARE WE MEASURING?

A liquidity reserve is an aggregation of assets that can be readily and reliably sold in the event of a liquidity problem. Determining which attributes make an asset 'readily and reliably saleable' is a complex problem. In a nutshell, criteria should include the size of the position the bank holds relative to the volume traded; the amount of market activity in that type of asset; the credit quality of the asset; prevailing interest rate levels; the term of the asset; and general market conditions.

On one point, we must be clear: the quantity of assets that the bank can consider liquid is very scenario dependent. For example, the quantity of assets defined as liquid in the bank's projections for normal capital markets should always be higher than the quantity of assets considered as liquid in projections for abnormal capital markets.

Exhibit 3 shows how an illustrative bank might evaluate its liquidity reserve in the case of a bank-specific scenario and for a particular stress level.

**Exhibit 3: Evaluation of the Standby Liquidity Reserve - Bank Specific Scenario at Stress Level 2**

	Prepayment or Growth Rate	Opening Balance	Day 1	Day 2	Day 3	Day 4	Day 5	Week 2	Week 3	Week 4
<b>Standby Liquidity Reserve</b>										
<b>Required Change in Standby Liquidity Reserve</b>										
Unpledged, AFS, Treasuries										
Unpledged, AFS, not CDO, AAA and AA			8,404	(1,577)	(3,899)	2,394	(2,335)	12,906	1,774	(297)
Unpledged, AFS, MBS			5,143							
Unpledged, AFS, AAA and AA, CMBS, CLO, CDO										
Unpledged, AFS, A			9,006							
<b>Total Change in Cash Flow for the Period</b>			-	-	-	-	-	-	-	-
<b>Standby Liquidity Reserve</b>										
<b>Balance at the Beginning of the Period</b>										
Unpledged, AFS, Treasuries		1,989	1,989	1,989	1,989	1,989	1,989	1,989	1,989	1,989
Unpledged, AFS, not CDO, AAA and AA		21,863	13,459	15,306	18,935	16,541	18			
Unpledged, AFS, MBS		5,143	-	-	-	-	-	-	-	-
Unpledged, AFS, AAA and AA, CMBS, CLO, CDO		-								
Unpledged, AFS, A		9,006								
Unpledged Municipal Bonds		9,006	-	-	-	-	-	-	-	-
<b>Total Beginning of Period Reserve</b>		<b>47,007</b>	<b>15,448</b>	<b>17,025</b>	<b>20,924</b>	<b>18,530</b>	<b>20,865</b>	<b>7,960</b>	<b>6,185</b>	<b>6,483</b>
<b>Change in Reserve</b>			<b>31,559</b>	<b>(1,577)</b>	<b>(3,899)</b>	<b>2,394</b>	<b>(2,335)</b>	<b>12,906</b>	<b>1,774</b>	<b>(297)</b>

## WHAT METRIC SHOULD WE USE?

It is perfectly acceptable to quantify the bank's liquidity reserve in currency units, e.g., to forecast that the bank will have X dollars or Y euros available in a specific scenario at a specific stress level. However, this does not provide managers with much insight into the sufficiency of the reserve.

Some banks, therefore, prefer to quantify their liquidity reserve in time units. For each scenario, at each stress level, they compare the amount of any net funding requirement to the amount of liquid assets. The comparison tells them how long a survival horizon they have.

**Exhibit 4: Summary of Liquid Asset Holdings (actual and limit value units are months)**

		<b>Months</b>
<b>Ordinary Course of Business</b>		
	Actual	>12
	Required Minimum	12
<b>Bank Specific</b>		
Stress 1:	Actual	>12
	Required Minimum	12
Stress 2:	Actual	3.6
	Required Minimum	3
Stress 3:	Actual	TBD
	Required Minimum	3*
<b>Systemic</b>		
Stress 1:	Actual	>12
	Required Minimum	12
Stress 2:	Actual	1.8
	Required Minimum	3
Stress 3:	Actual	TBD
	Required Minimum	3*
<p>Grey background for actual values that are within 10% of the minimum guidance level  Blue background for actual values more than 10% above the minimum guidance level</p>		
<p>* After adjustments for remedial actions (e.g. borrowing from FRB)</p>		

For example, in the normal course of business forecasts, the net funding requirement is typically trivial or zero so the survival horizon is longer than the time horizon selected for the forecast. On the other hand, a stress forecast made at the same bank on the same day might suggest the bank has only enough liquid assets to survive for a few weeks. Senior managers can then evaluate whether they are comfortable with the length of the survival period under those particular stress conditions. Exhibit 4 shows how such a report might look.

### **KRIS AND TRIGGERS**

To manage their liquidity efficiently, banks need to be able to recognize promptly any deterioration in funding conditions. The best way to do this is to identify a set of early warning signs typically called 'triggers' or, in more recent discussions, KRIs.

Each bank has to select the set of KRIs that is most relevant to the bank's situation and strategies. A bank primarily funded by insured deposits, for example, has far less need for a risk indicator of liability diversification than does a wholesale funded bank.

## CONSTRUCTING KRIS

In many cases, simple ratios work best. For instance, the bank can report its net funding requirements in terms of cash flow coverage ratios. Here the bank calculates the total forecasted cash in-flows, in a given scenario, at a given stress level, in a single time bucket; this number is then divided by the total forecasted cash out-flows for that scenario, stress level and time bucket. Credit quality can also be indicated by ratios such as loan delinquency and non-performing loan ratios.

KRIs can also be expressed in absolute quantities. For example, spreads are expressed in terms of basis points while liquid assets can be quantified in currency or time units.

## HOW MANY KRIS DO YOU NEED?

No single KRI is sufficient to provide early warning of the onset of abnormal funding conditions, so banks need to tailor a set of KRIs to fit their situation. Exhibit 5 describes seven general examples that relate to bank specific funding events and four examples that relate to systemic funding events.

Each of these examples can drive multiple KRIs. For example, if a bank forecasts potential cash flows for a bank specific scenario at three different stress levels, and uses ten time buckets in each projection, then that single scenario can result in thirty different cash flow quantities. Similarly, the bank is likely to calculate multiple measures of funding concentrations.

**Exhibit 5: General Types of KRIs for Non-Normal Funding Conditions**

	<b>Bank Specific Problem</b>	<b>Systemic Problem</b>
<b>Internal Information</b>	<ul style="list-style-type: none"> <li>• Forecasts indicating unacceptably high net funding needs in upcoming time periods</li> <li>• Forecasts indicating unacceptably low levels of liquid assets in upcoming time periods</li> <li>• Over reliance on short term borrowings</li> <li>• Over reliance on borrowings from very confidence sensitive funds providers</li> <li>• Deteriorating credit quality</li> <li>• Significant opportunity loss</li> </ul>	<ul style="list-style-type: none"> <li>• Forecasts indicating unacceptably high net funding needs in upcoming time periods</li> <li>• Forecasts indicating unacceptably low levels of liquid assets in upcoming time periods</li> </ul>
<b>External Information</b>	<ul style="list-style-type: none"> <li>• Widening spreads, compared to peers, for purchased funds</li> </ul>	<ul style="list-style-type: none"> <li>• Economic leading indicators forecasting a recession</li> <li>• Widening spreads for borrowings of all banks</li> </ul>

As a result, a bank that included all the examples in exhibit 5 might end up calculating dozens of KRIs. At a minimum, a bank's early warning system should measure at least one KRI from each of the four groups defined in exhibit 5. Obviously, more are better and a broader range is better.

Banks should consider two additional factors before deciding how many KRIs are necessary.

The first issue is one of practicality. Which KRIs can be produced automatically from liquidity risk, credit risk or rate risk models? Can others be produced by tweaking automated outputs? Which KRIs are already monitored by other areas of the bank? All of these KRIs will be relatively easy to reproduce for liquidity risk monitoring. Staffing and resources often severely constrain the production of KRIs that require a lot of manual input.

Second, how effective is your management reporting? Does the bank use color coding or summary exception reports so that potential problems stand out clearly from all the clutter? If so, the bank can employ a very large number of KRIs without over loading decision makers with too much information.

## II. MANAGING LIQUIDITY RISK

There is no off-the-peg liquidity risk management strategy that will fit all banks. The nature of a bank's market, balance sheet and business strategies will shape not only its risk appetite, but also its risk management strategies.

That said, every bank's liquidity management strategy has to be able to meet three basic requirements:

1. Ensure the institution's ability to generate or obtain cash or its equivalent in a timely and cost efficient manner so that the bank can meet its obligations
2. Maintain market confidence
3. Ensure that profitable business opportunities can be pursued through all market environments for an extended period of time without liquidating assets at undesirable times, or raising additional unsecured funding on an unreasonable scale

To tailor their strategy, banks can ask:

- What risk scenarios does the bank wish to measure, monitor and manage? Capital markets disruption? Payments system disruption? Bank specific funding crisis?
- What risk exposures concern the bank most? Deposit losses, borrowings, off-balance sheet in-flows, off-balance sheet out-flows?

- What metrics will be used to measure and monitor liquidity risk? Cash flow projections, measures of standby liquidity resources, measures of diversification?
- Under what conditions will liquidity risk be measured and monitored? Short-term or long-term? Probable stress levels or improbable stress levels?
- What criteria and/or limits will be used to determine whether or not the bank's current level of risk exposure is acceptable or unacceptable?
- If the current risk exposure is not acceptable, how will the bank remedy the situation? What kinds of remediation tactic are acceptable?

Well-managed institutions analyze their liquidity profile, ratios, net cumulative out-flows, and unencumbered securities on a daily basis for a certain time horizon (ranging from overnight to one year or longer). In most cases, liquidity scenarios over twelve months are highly assumption dependent and their value is not to assess current risk but structural exposure, and how these long-term exposures may need to be restructured.

The bank's short-term funding requirements should be determined with respect to the current generation of new business and trading positions. Long-term funding, meanwhile, should be reviewed in the light of strategic business initiatives (and in the course of the strategic multi-year planning process).

As we mentioned in our discussion about measurement, liquidity managers need to analyze the institution's liquidity profile and funding needs under current market conditions, and under adverse scenarios. The adverse scenarios should be both institution-specific, e.g., downgrade, bank-run, loss of access to the unsecured inter-bank market, and systemic, e.g., LTCM-style crisis, decrease in market value of securities used as liquidity reserve, emerging markets crisis, 9/11, and 2007.

The liquidity manager can then use these analyses to evaluate whether the current and forecasted liquidity profile of the institution is in line with the liquidity strategy defined by the Board.

### **LIQUIDITY RISK MANAGEMENT TACTICS**

Liquidity risk profiles cannot be reshaped as quickly as, say, interest rate risk profiles. There is no derivative market available for hedging liquidity risk. Instead, banks can make use of on-balance sheet instruments such as unsecured funding, commercial paper, repurchase agreements, securitization, medium-term notes (MTN) and bonds.

One apparently easy way to alter a bank's liquidity risk profile is to gain a committed line of credit from another bank. However, liquidity crises are often systemic in nature. In a general crisis, the committed bank might choose to suffer reputation risk instead of incurring credit risk, and therefore find some pretext for denying the drawdown.

The principal tactics for managing bank liquidity risk fall into four categories:

1. Tactics for maintaining a standby liquidity reserve
2. Syndication, sales and securitization
3. Tactics for liability diversification
4. Other liability management tactics

## 1. STANDBY LIQUIDITY RESERVE

The most common way to enhance a standby liquidity reserve is to improve the way the bank manages the collateral that it offers to counterparties:

- Avoid unnecessary over-pledging. Marketable securities are the most reliable source of standby liquidity because they can be sold outright, sold under agreement to repurchase, or pledged to obtain (more stable) secured funding. However, securities already pledged provide no standby liquidity at all: the liquidity from those securities has already been consumed by the bank.
- Monitor pledging over time. Often, banks fail to reduce the amount of pledged collateral after the volume of funds obtained from a secured counterparty declines. Banks can therefore enhance standby liquidity by tightly monitoring the amount of pledged assets and the amount of the liabilities that they secure.
- Manage pledging. The bank should pledge only the least readily salable assets that happen to be acceptable to the counterparty.
- Minimize the amount of marketable securities classified as 'held to maturity.' Held-to-maturity assets can be repo'd without impairing their accounting treatment, but the bank's flexibility is reduced because any outright sale will have accounting consequences.

## 2. SYNDICATION, SALES AND SECURITIZATION

Above and beyond the management of liquid securities, managing bank asset liquidity takes the form of the three 'Ss': syndication, sales and securitization. Given enough time, banks can sell most of their assets, including fixed assets, and securitize or syndicate most of their loans. However, liquidity risk managers need to address three important considerations.

First, banks that do not have recent experience selling, syndicating or securitizing very similar assets need to allow for more time and expense.

Second, banks that sell, securitize or syndicate loans need to be careful not to magnify the average risk of the remaining assets by selling only the highest quality assets. Picking only the low-hanging fruit can leave a very illiquid balance sheet!

Third, banks that model hypothetical, bank-specific crises need to consider that a crisis precipitated by rising loan losses will simultaneously taint the bank's reputation for underwriting, and therefore also impair its ability to sell loans. Even when an individual bank has maintained good underwriting standards, doubts about a whole class of assets, such as sub-prime loans, may emerge and make these assets difficult to sell at a fair price within a short time period.

Here are a number of other points to consider as the bank develops its tactics:

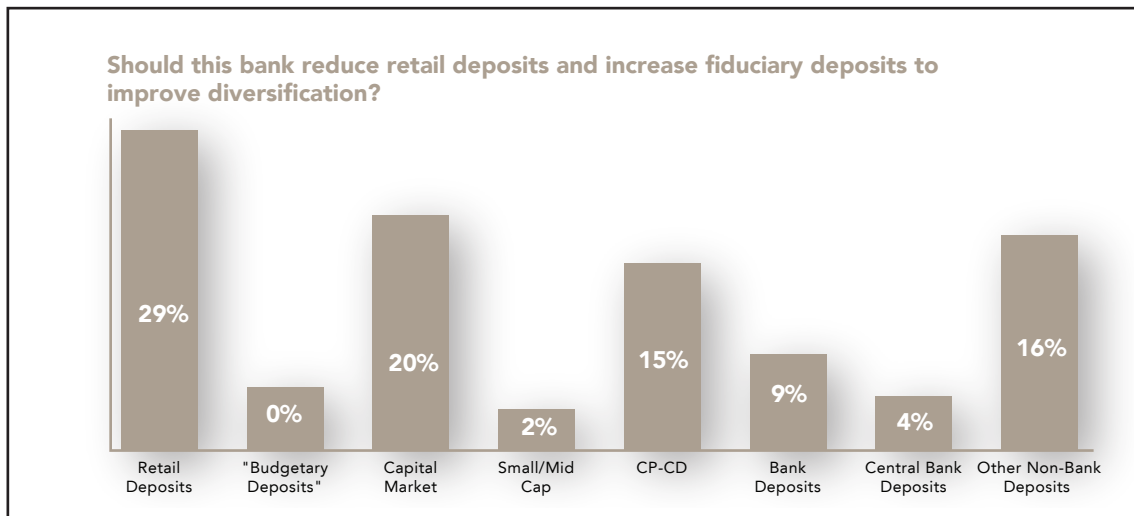
- Amortizing assets generate larger cash flows before maturity than non-amortizing assets. Therefore, a program that increases holdings of amortizing loans and reduces growth in non-amortizing loans can enhance bank liquidity.
- Shorter term investments or loans tend to increase liquidity, e.g., auto loans mature sooner than mortgage loans.
- Asset management strategies such as laddered maturities for investment securities can smooth cash flows over time.
- Either separately or in combination, cash in-flows from asset sales and from borrowings can be timed to fund expected cash out-flows from new loans, deposit withdrawals, maturing liabilities, and all other expected cash out-flows.
- From time to time, perhaps once a year, liquidity risk managers might rank each major asset type held by the bank from most liquid to least liquid, together with the percentage of total assets represented by each asset type. This kind of ranking is only a rough approximation but it can be useful. For example, over the longer term, the bank might try to shift its mix of assets so that more of the banks funds are invested in assets that are high up the ranked list – and fewer funds invested in asset types at the bottom of the list.

### 3. TACTICS FOR LIABILITY DIVERSIFICATION

#### **COUNTERPARTY DIVERSIFICATION**

Diversification is not the panacea it is sometimes held out to be. The most common, and least useful, approach to liability diversification is to diversify the number of counterparty names. For example, a bank with committed, unsecured lines for overnight funding from two other banks might make similar arrangements with five or ten banks.

### Exhibit 6: Diversification of Funding Sources



This is not a particularly reliable tactic. Wholesale funds providers are brutal arbiters of credit quality. One provider may take a day or two longer than its peers before refusing to extend credit, but this hardly represents funding stability.

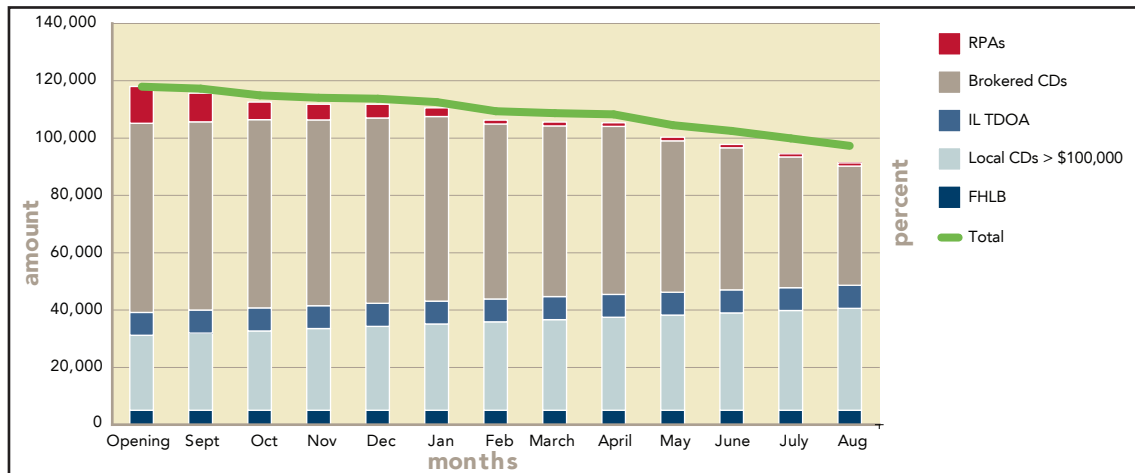
The tactic is not completely worthless, because counterparties can be idiosyncratic. In addition, during payments systems disruptions, such as the problems following 9/11, it can be helpful to have multiple funds providers if they are situated in multiple locations.

However, a more intelligent approach to liability diversification is to diversify by the type – not the name – of counterparty. Even so, liability diversification by counterparty type must be approached with care. Notice that the largest single category of unsecured liabilities shown in our example in exhibit 6 is retail deposits, some 28% of the total. Does this concentration increase the bank's liquidity risk? In fact, it almost certainly reduces risk because retail deposits are generally stickier than other types of liability.

Diversification by counterparty type should ensure that, among the most volatile funding sources, no single counterparty, and no group of similar counterparties, and no single market, constitutes a concentration. At the same time, concentrations of funds obtained from the most stable counterparties, types of counterparties and markets should be encouraged.

It is also useful to monitor the extent of the bank's reliance on the most volatile funding sources. An example is shown in exhibit 7. We can see here that over the next year the example bank comes to depend less and less on wholesale funding. It's important to note that this is a forecast of volatile funding mix, based on cash flows driven from an ALM system. When such forecasts are tied to bank strategies, it is clear what impact the strategy is having on core structural balance sheet positions, and the earnings, value and risk impacts of such structural rebalancing.

Exhibit 7: Forecasted Trend in Large and Volatile Liability Dependency



### MATURITY DIVERSIFICATION

Managing the time profile of maturing liabilities is vital. Un-matured time deposits and borrowings are one of the most stable sources of funding in the event of a funding problem, and liabilities that do not mature for 90 days or more are the most stable of all.

Of course, extending liability maturities has a cost. Since yield curves are almost always positive (i.e., upward sloping), the interest rate paid for longer term funds is almost always higher than the rate paid for shorter term funds. This cost must be regarded as part of the insurance cost of liquidity management, just like the decision to hold a larger amount of marketable securities. Prudent liquidity risk management demands that banks strike a careful balance between insurance costs and the need for insurance.

Liquidity risk managers usually try to avoid a situation in which an unusually large amount of borrowings mature in any one day or week, in case this coincides with infelicitous market conditions, or a decline in the bank's standing in its funding markets. Maturity concentrations in the next one to three months should therefore receive prompt attention and remedial action.

## 4. OTHER LIABILITY MANAGEMENT TACTICS

Banks can adopt other liability management tactics, however, they have pros and cons:

- Banks that offer security when they borrow money in the funding markets tend to increase the 'stickiness' of their liabilities because their lenders can rely on the collateral the bank has posted. However, securing the bank's borrowings also reduces the amount of standby liquidity reserve available in any future abnormal conditions. It's important to note, also, that securing liabilities increases the effective cost of the funding, lowering its profitability contribution. Few banks take proper care to assess properly the cost of collateral, which would include charge-backs to the business units for "using-up" free collateral.

- Banks may want to avoid liabilities with put options, and/or collateral maintenance requirements, tied to the bank's own creditworthiness.
- Deposit retention programs – sets of marketing tactics designed to increase retail deposits – can significantly enhance liquidity in two ways. Firstly, they reduce the amount of wholesale market funding the bank uses, and secondly they increase the 'stickiness' of the bank's liabilities because they tend to promote relationship-based deposits (as opposed to rate-sensitive deposits). Exhibit 8 lists some of the key considerations when structuring a deposit retention program.
- Market access testing (i.e., monthly borrowing from counterparties that have granted the bank a committed facility) is an important element of liquidity risk management at some banks. This is particularly so for complex banks, banks that are net purchasers of funds, market makers in over-the-counter derivatives markets, and banks that dynamically hedge their positions (and therefore require constant access to financial markets especially in times of market stress). However, because banks usually conduct their market testing under benign market conditions, the sole benefit of the practice is in helping to keep contact information, counterparty communications and procedures up to date. It offers no assurance about the real risk to the bank: that counterparties might not honor contractual commitments under stressed market conditions.

**Exhibit 8: To structure a deposit program properly the bank must consider:**

- 1: Composition of the market-area economic base
- 2: Bank's ability to employ deposits profitably
- 3: Adequacy of current operations (staffing and systems) and the location and size of banking quarters relative to its volume of business
- 4: Degree of competition from banks and nonbank financial institutions, and the programs they have in place to attract deposit customers
- 5: Effects of the national economy and the monetary and fiscal policies of the government on the bank's service area
- 6: Ways to monitor the above factors and adjust the program into the future: the long-term success of any deposit program depends on management making the right adjustments at the earliest possible time

## FOCUS ON STRATEGY, NOT TACTICS

We've looked at a large number of tactics that can be applied to liquidity risk management but it's worth emphasizing that these must all be subsidiary to the bank's big picture strategy. We can sum up this strategy as:

1. Maintain sufficient structural liquidity cushions. Manage forecasted cash in-flows and out-flows in each time bucket, in each scenario and in each stress level.
2. Reduce contingent liquidity risk to the extent practical.
  - Manage potential vulnerabilities such as funding concentrations
  - Focus on the stability, not just the cost, of funding sources
  - Extend liability terms to reduce liquidity risk
3. Maintain the bank's capacity to turn on cash flow waterfalls, from the liquidation of reserves to other remedial actions.
  - Always keep some asset liquidity reserves. This is the insurance cost of liquidity management.
  - Be prepared to enhance liquidity quickly at the first signs that there may be a problem in the future. But recognize that you cannot, and do not want to, hold enough to survive all but the most minor catastrophes.

## CONCLUSION

Traditional "seat-of-the pants" liquidity risk measurement and management works most of the time, for most banks. But regulators around the world may soon come to the conclusion that 'most of the time' is no longer acceptable in the face of the devastating consequences of liquidity events.

However, we should not leap to the conclusion that improving liquidity risk measurement and management is a matter of applying statistical science to better understand risk distributions, as in some other areas of risk management.

Liquidity risk is a structural and contingent risk that is very difficult to analyze statistically. In this area of risk, the past is only a very rough guide to the future. Instead, management of the next liquidity crisis requires putting in place a prudent and forward-looking liquidity risk measurement and management strategy, based on the first principles we have described in this article.

*This article was contributed by Leonard Matz, Liquidity and Interest Rate Risk Consulting, Ambit Risk Management & Compliance*

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