



Canadian
Institute
of Actuaries

Institut
canadien
des actuaires

Educational Note

Liquidity Risk Measurement

Document 626

ARCHIVED

This document was archived April 11, 2023



EDUCATIONAL NOTE

LIQUIDITY RISK MEASUREMENT

ARCHIVED

**SUBCOMMITTEE ON LIQUIDITY RISK MEASUREMENT
COMMITTEE ON INVESTMENT PRACTICE**

MARCH 1996

Cette note est disponible en français



MEMORANDUM

To: All Members Practising in the Insurance Area
From: R.J. Sharkey, Chairperson
Committee on Investment Practice
Date: March 29, 1996
Subject: Educational Note on Liquidity Risk Measurement

The attached educational note is being distributed to members to increase their understanding of the importance of liquidity risk management. The paper provides a useful approach to measuring the degree of liquidity risk to which the insurance company is exposed.

While the approach outlined is fairly tactical, it can be broadened to cover longer term issues facing the company.

Questions regarding the paper can be addressed to me at my *Yearbook* address.

RJS

TABLE OF CONTENTS

1.	PURPOSE AND SCOPE	4
2.	DEFINITIONS	4
3.	LIQUIDITY RISK MANAGEMENT	5
	3.1 STRATEGIC CONSIDERATIONS	5
	3.2 OPERATIONAL CONSIDERATIONS	5
	3.3 REGULATORY REQUIREMENTS	5
4.	LIQUIDITY RISK MEASUREMENT	6
	4.1 METHODOLOGY	6
	4.2 LIQUIDITY RATIO	6
	4.3 SCENARIOS	6
	4.4 TIME HORIZON	7
	4.5. DEMAND LIABILITIES	7
	4.5.1 Individual Insurance	7
	4.5.1.1 Cash Surrender Value	7
	4.5.1.2 Amounts on Deposit	8
	4.5.2 Single Premium Deferred Annuities (SPDA)	8
	4.5.3 Group Pension	8
	4.5.3 Annuities	9
	4.5.3.1 Life Contingent Annuities	9
	4.5.3.2 RRIF	9
	4.5.4 Group Life and Health	9
	4.5.5 Other Liabilities	9
	4.5.6 Projected Demand Liability	10
	4.6 LIQUID ASSETS	10
	4.6.1 Cash	10
	4.6.2 Short-Term Investments	11
	4.6.3 Public Funds	11
	4.6.4 Stocks	11
	4.6.4.1 Common Stocks	11
	4.6.4.1 Preferred Stocks	12
	4.6.5 Residential Mortgages	12
	4.6.6 Other Asset Types	12
	4.6.7 Borrowings/Financing	12
5.	RESULTS	13
	APPENDIX A	14

EDUCATIONAL NOTE ON LIQUIDITY RISK MEASUREMENT

1. PURPOSE AND SCOPE

This paper addresses the liquidity risk issues facing a life insurance company. While the material predominantly focusses on Canadian issues, the U.S. environment is also recognized.

The purpose is to outline a tactical approach for monitoring and testing the extent of liquidity resources available to, and required, by a life insurance company.

While the main focus of the paper is liquidity risk measurement, the management process required to prudently manage liquidity will also be briefly addressed. From a measurement point of view, the financial forecasts of the various sources and uses of cash, over specific time periods, will identify if and when there may be liquidity concerns. By looking at these forecasts through adverse scenarios, management is able to measure the magnitude of the issues and take corrective action if the results fall outside the targets set in a liquidity risk management policy.

As the key measure, this paper introduces the concept of a liquidity ratio. This ratio measures a company's exposure to liquidity risk over a specified time frame. It quantifies the amount of liquid assets available to the corporation to support potential demand for cash.

An overall liquidity risk management framework is proposed to address the strategic and operational liquidity issues. From a strategic point of view, a liquidity risk management policy, approved by the board of directors, should be in place that sets out the desired liquidity level, having taken into account the balance between the cost of liquidity on one hand and competitiveness in terms of price, ratings and corporate solidity on the other hand. The role of management should be clearly outlined with an overall crisis plan in place.

Liquidity issues in segregated funds, R&C companies and pension plans, while not specifically addressed here, have many similarities to the concepts outlined.

2. DEFINITIONS

Three interrelated concepts are referred to in this paper:

Liquidity risk – is the inability to meet financial commitments, as they fall due, through ongoing cash flow or asset sale at fair market value.

Market risk – is the potential loss when the sale of an asset is required to fund the cash demand. The loss could arise from the deterioration in value of an asset due to changes in interest rates, market, credit quality or for any other reason.

Liquidation risk – is the potential loss when the sale of an asset is urgently required which may result in the proceeds being below fair market value. The loss is the difference between the “fire sale price” and “fair market value.”

3. LIQUIDITY RISK MANAGEMENT

Liquidity risk management is addressed, first, through strategic and operational considerations. Ideally, these would both be covered in a comprehensive liquidity risk management policy document.

3.1 Strategic Considerations

The management responsibilities include setting guidelines, monitoring the position relative to these guidelines, and taking action to manage the overall balance sheet to prevent a liquidity shortfall.

The strategic framework must create the corporate target for liquidity risk. This includes the extent to which the corporation wishes to be protected from a liquidity crisis. Constraints could be imposed on short-term borrowings or asset mix to ensure the company is adequately protected. These various limitations recognize the balance between protection on a going-concern basis, protection in the event of a crisis and the cost of liquidity in terms of either yield give-up on assets or product features, such as higher surrender charges.

Consideration should be given to rating agencies. These organizations examine many aspects of an insurance company, including liquidity. The corporation should have an understanding of rating agency expectations in this area.

The strategy would also address the internal organizational level at which liquidity will be managed: total company or at a lower level such as legal entity or segment.

An overall contingency plan could be developed outlining the actions various areas such as customer service, public relations, field force management, investment and product administration will take in the face of an event that could trigger a liquidity crisis.

3.2 Operational Considerations

Once a strategy is set, a number of functional areas are involved in its implementation.

The asset/liability management function must work closely with the cash management function to define the short- and medium-term cash needs, the possible impacts of various scenarios on liquidity, and determine actions required to address any issues.

Linkages to dynamic capital adequacy testing and other financial planning activities can be quite useful to uncover how longer term trends in business and asset mix may impact liquidity in the future.

Product design teams should be aware of the possible liquidity implications of various product features. For example, a product allowing cashout on demand at book value will behave quite differently, under certain conditions, than a product allowing cashout at market value.

Customer service, distribution and product administration must work together to ensure the prudent enforcement of the various product features that impact liquidity.

3.3 Regulatory Requirements

It is expected that, over the next few years, regulatory guidelines will be more fully developed. CompCorp has published, in draft form, liquidity risk management guidelines. The insurance industry will need to put in place the management process to meet those guidelines. They are similar in content and form to the CDIC guidelines on liquidity risk management which were developed for banks and trust companies. These draft guidelines may not be sufficient for a prudent management process in a life insurance company.

4. LIQUIDITY RISK MEASUREMENT

4.1 Methodology

The liquidity ratio is the basis for liquidity risk measurement. The ratio defines the relationship between liquid assets (see Section 4.6) and the potential demand for cash called the “projected demand liabilities” (see Section 4.5.6) under a variety of scenarios.

The liquidity ratio is studied over various scenarios and time horizons to ensure that a full range of possible outcomes are identified. Action can then be considered if the liquidity ratio falls outside of the target set out in the liquidity risk management policy document.

Depending on specific company circumstances, this analysis could be done at different frequencies. Going-concern analysis could be done monthly while adverse scenarios might be analyzed quarterly. Long-term trends, on the other hand, could be done yearly, possibly as part of the strategic planning process and/or dynamic capital adequacy testing.

4.2 Liquidity Ratio

The **liquidity ratio** is **liquid assets/projected demand liabilities**, where liquid assets and demand liabilities will be defined in detail in later sections. Projected demand liabilities are the amount of liability withdrawals expected for a specific scenario and product within the time period being tested. Thus, they equal the summation of each demand liability times the probability of surrender for the scenario.

4.3 Scenarios

The going-concern cash-flow forecast forms the basis of the analysis. The expected cash flow is then tested under various adverse conditions. While there are a wide range of scenarios that could be tested, for practical reasons, the analysis may be limited to three scenarios – high, stress, and panic.

The various scenarios should reflect both the external and internal environments facing the company today and in the future. The degree of adversity of the scenarios tested depends on a number of factors.

Here is a list of considerations which a company should review in determining its own exposure to a liquidity shortfall.

External Circumstances

- What is the state of the economy and expectations for interest rates?
- What are the likely downgrades or upgrades by rating agencies of the provinces or the country?
- What is the strength of the industry?
- What is the level of consumer confidence in the insurance industry?
- What is the level of consumer confidence in the company?

If the answers to these questions would point to more than normal cash outflow, the scenarios tested should be more adverse (i.e., higher liability withdrawals).

Internal Circumstances

- How tight is the cash management process?
- What is the predictability of business mix and cash flows?
- Are the corporate owners willing to provide additional liquidity in a worst-case scenario?
- How strong is the company in terms of balance sheet, earnings and image?
- Are profitability results as expected by rating agencies and other stakeholders?

- Are there potential rating downgrades for the company?
- How sophisticated is the distribution force and the customer base?
- How strong is the relationship between the customer and the company?
- Does one distributor control a large portion of the business?
- Do the contracts allow some waiting period before the payment of cash surrender values?
- How strong is the public relations department?
- How well matched are the assets to the liabilities?
- Does the company enforce all the surrender charges, market value adjustments and waiting periods?
- Are these product features effective?
- Do the products include market value adjustments and surrender penalties?

If the answers to these questions tend to be negative, the scenarios tested should be more adverse.

At least a less severe stress and an extreme panic scenarios should be analyzed. Combining these with adverse economic conditions, such as declining stock and real estate markets, will add substantial value.

A stress scenario could be triggered by any one of a number of factors such as a ratings downgrade of the industry, the loss of a large client or distribution channel, or a significant change in the market that causes a product to lose its attractiveness and the existing in-force block to leave. A stress scenario should result in higher than normal withdrawals either across all businesses or concentrated in significant product lines.

The panic scenario is intended to cover a "run on the bank." Withdrawals should be set at a level that reflects anticipated policyholder reaction to a complete loss of confidence in the financial institution.

A third scenario could be added which would reflect normal business but with somewhat more conservative assumptions as to sales or cash outflow.

4.4 Time Horizon

The liquidity ratio should be examined over time, as well as under various scenarios. The forecasts should be done over a number of time periods such as one month, three months and one year. From time to time, longer time horizons should also be studied, possibly through the dynamic capital adequacy testing process. The combination of time horizons and severity of the scenarios will define the range of possible outcomes for the liquidity ratio. This will determine what action, if any, might be considered.

4.5. Demand Liabilities

To determine the amount of liquidity required, an analysis of the demand liabilities is necessary. Liabilities are considered demand liabilities if the customer can contractually withdraw cash on demand within the time horizon tested.

While each company needs to consider its own circumstances, the following sections will outline the major risk factors for the more common products. For each product, we examine the key characteristics that will create a risk, such as embedded options, contingent maturities or degree of sophistication of the policyholders.

4.5.1 Individual Insurance

4.5.1.1 Cash Surrender Value

The demand liability for life insurance is represented by the cash surrender value of the policies in force, net of any cash surrender charges and policy loans.

For some life insurance contracts there are no explicit charges. The cash value payable is independent of current interest rates, unlike the market value of the assets. Therefore, the liquidity ratio will tend to vary under different interest rate environments because the market value of the assets will change while the surrender value of the liabilities will not.

Universal life contracts that include explicit surrender penalties may tend to deter surrenders.

4.5.1.2 Amounts on Deposit

These are common in respect of participating insurance contracts, where dividends and other policyholder benefits are left on deposit with the company and credited either a short-term interest rate or a portfolio rate. These are also considered demand liabilities but because of their small average size tend to be fairly stable.

4.5.2 Single Premium Deferred Annuities (SPDA)

SPDAs are also generally considered demand liabilities. To determine the amount at risk and the likelihood of the surrender, the surrender value should be calculated. This is the account value less any surrender charges and market value adjustments.

Some products do not allow withdrawals prior to maturity and, therefore, present lower liquidity risk if the cash flows are well matched and the company's practice has been to deny requests for surrenders in accordance with the contract.

With any product with a market value adjustment designed to replicate the market value of the assets supporting it, the liquidity risk is not compounded by the market risk, especially when there is a close matching of the expected cash flows. In this case, the book-to-market value relationship of the assets would be similar to the book-to-market value relationship of the liabilities surrendered.

For products where the surrender value is the market value, care should be taken to consider whether an increase in surrender activity might occur when the surrender value is greater than the book value simply from the customer's perception of value.

The contract should also be considered, and, in particular, clauses dealing with the waiting period allowed for the company to honour surrender requests. This time can be used to communicate with the customer to retain the business and provide time to sell assets and raise liquidity. Past company practice is a key consideration.

Special attention should be given to products offering a declining surrender charge. The policyholder will behave quite differently once the surrender charge disappears or becomes less than the potential opportunity of reinvesting the proceeds at new money rates.

4.5.3 Group Pension

Group pension products present liquidity risk for the same reasons as individual SPDAs, but there are special considerations for the following reasons:

- greater sophistication of the customers, employers and plan sponsors;
- the contract's design may be more complex creating a stronger relationship with the carrier and/or longer time frame to cash out;
- customers are typically influenced by knowledgeable consultants and brokers;
- larger average account balances involved with each surrender resulting in concentration risk;
- contracts may be individually negotiated, including surrender values, making it more difficult to evaluate the overall exposure;

- plan sponsors are more likely to react to “bad news” to honour their fiduciary responsibilities;
- for defined contribution contracts, there will be some variation in the mix between segregated funds and guaranteed interest funds requiring additional liquidity in the guaranteed funds to allow for mix shifts;
- book value cashouts are allowed in certain circumstances;
- investment-only contracts will behave differently than full service arrangements.

4.5.3 Annuities

4.5.3.1 Life Contingent Annuities

Term certain annuities and life contingent annuities, including settlement annuities, are typically noncashable and, therefore, are not included as demand liabilities.

A small portion of the market is represented by cashable annuities with a market value adjustment. Such annuities should be included in demand liabilities.

4.5.3.2 RRIF

RRIFs are typically cashable with a market value adjustment. Often, these contracts also allow for changes in payment pattern within certain constraints. These features will be important in determining the potential cash-flow variability.

4.5.4 Group Life and Health

The liquidity risk in the group business is one of an ongoing nature caused by cash-flow unpredictability. However, there are still special considerations that must be taken into account in a worst-case scenario.

There typically will be amounts on deposits and surplus positions which should be considered demand liabilities. Depending on the cases, these amounts may tend to be cashed out in large amounts, and, in a crisis situation, quickly.

Another consideration is incurred but not reported claims (IBNR). In a crisis situation, the IBNR will decline rapidly and require additional cash flow since premium income will not likely be present to meet this cash demand.

Long-term disability represents a significant asset accumulation pool. However, these benefits are locked-in, and, therefore, not considered demand liabilities.

4.5.5 Other Liabilities

Each company will face its own set of challenges and should review its liquidity exposure.

Here are some other examples which may be specific to an insurer:

- Mortgage-backed securities or mortgage sale – Is there a commitment to buy back the mortgages at renewal? If so, sufficient cash must be on hand to execute the repurchase.
- Miscellaneous guarantees – Are there liquidity guarantee arrangements with other companies, subsidiaries or sister companies?
- Committed liquidity facilities – Are there any commitments made to third parties?
- Other – There may be other significant commitments such as repurchase agreements (repos), commercial paper repayments and accounts payable.
- Reinsurance arrangements present unique liquidity risk considerations.

4.5.6 Projected Demand Liability

As mentioned above, the demand liability should be adjusted to reflect the likelihood of the cash outflow.

It is unlikely that all policyholders will withdraw all of the demand liabilities at the same time. Even in the case of a failure, a certain percentage of the business will remain on the books and be sold at a later date as a block. Therefore, the demand liabilities should be reduced by a certain percentage reflecting the propensity of policyholders to cash out. This calculation defines the projected demand liabilities.

This table is **for illustration only** and shows possible ratios of projected demand liabilities to demand liabilities for various blocks of business. The target ratio will depend on the corporation's overall business mix. Some rating agencies will also have target ratios which could be taken into account.

	Stress	Panic
Life insurance with no surrender penalties	25%	50%
Life insurance with surrender penalties	15%	40%
Amounts on deposit	25%	75%
Group pension	50%	75%
Group employer surplus/IBNR	100%	100%
Ind'l savings and RRIF with MV adjustments	50%	100%
Ind'l savings with no surrender penalties	75%	100%
LTD/Payout annuities	0%	0%

4.6 Liquid Assets

Sources of liquidity include the ongoing net cash flow of the company as well as liquid assets. To assess the value of the source of liquidity, only the realizable market value of the asset is relevant. Book, cost or statutory book values are irrelevant. Also, the analysis must include the time frame required to realize the value in cash net of expenses (i.e., to sell the asset and close the transaction).

In this paper, liquid assets are defined as assets that can be sold within the time horizon analyzed. Most of the assets discussed here also have a market risk. This means that selling the assets may result in the realization of gains and losses. In other words, the market value and the book value of the assets will be different.

4.6.1 Cash Flow

The first line of defense in managing liquidity risk is the management of cash flow. A thorough understanding of the ongoing cash-flow items and how they may be impacted by various internal and external factors is necessary, with special attention to premium persistency and policy loans, both on a going-concern basis and in a worst-case scenario.

A detailed example of a cash-flow worksheet is shown in Appendix A.

Positive cash flows are considered assets for liquidity ratio calculation purposes.

4.6.2 Short-Term Investments

Short-term assets, such as T-Bills, are used as a source of liquidity because they do not involve significant credit risk if highly rated and also have relatively low market risk. They can, therefore, be readily transformed into cash, within a day, without incurring significant gains or losses. The supply and demand of high quality short-term T-Bills issued by governments are quite large, and, therefore, are a safe source of liquidity.

To determine the amount of short-term assets that should be held on an ongoing basis, an analysis of historical corporate cash-flow fluctuations is one consideration. This, combined with ongoing cash-flow forecasts, will give a good indication of the minimum amount of short-term assets that should be held. Other special circumstances, such as the amount of commercial paper and repo, will also impact the need for short-term assets.

4.6.3 Public Bonds

Another ready source of liquidity is the public bond portfolio. To be considered liquid, certain quality and term requirements must be met. Investment grade public bonds are more liquid than noninvestment grade.

Some of the considerations would be:

- 1) Credit quality of the issuer – Government bonds would be more liquid than corporate bonds. This general statement could vary depending on the size of the market, the country of issue and the secondary market opportunity for the specific issue.
- 2) Term to “maturity” – The market size will vary by term. Typically, one- to five-year bonds are more marketable than longer term bonds. Strip bonds are less marketable than regular coupon bonds. Longer term bonds represent a higher degree of market risk.
- 3) Ownership restrictions – Trying to dispose of a block while the other large potential purchasers are “full up” on the issue already, for credit reasons, may make it difficult to sell.

Bond sales settlement in Canada and the U.S. are on a three-day basis. Therefore, highly liquid bonds can be transformed into cash within three days. Less liquid bonds may take longer to find buyers and some liquidation risk may be present.

Mortgage-backed securities are considered liquid. The cash flow of a CMO or a U.S. MBS portfolio can be quite unpredictable and the market risk significant. Care should be taken in projecting repayments, or assessing the value of MBS and CMOs in a stress situation.

4.6.4 Stocks

4.6.4.1 Common Stocks

In general, common stocks listed on the major international exchanges are liquid. The market value of a common stock portfolio can change quite rapidly.

The size of the market for a specific stock in relation to the company's position in that stock should be considered in assessing the risk. The realizable amount will depend on the buy/sell situation, again giving rise to liquidation risk. The expenses incurred to execute the trade should also be reflected.

Common stocks which are owned by a majority shareholder may not be as well known to the general market as more widely held stocks. Those stocks may take longer to sell with a greater liquidation premium.

4.6.4.1 Preferred Stocks

Preferred stocks should generally be considered less liquid than common stocks because the demand is fairly limited. The more highly rated issues are usually more liquid. However, lower rated issues have to be looked at on an issue-by-issue basis based on the following criteria:

- 1) Credit quality of issuer – The higher the rating, less time will be required to transform into cash.
- 2) Structure of the particular issue – e.g., a “split-share structure” or a rate reset preferred (auction preferred) can reduce liquidity, especially if that particular structure becomes unpopular in the market.
- 3) Tax environment – Preferred stocks are desirable corporate investments in periods of high earnings as part of a tax minimization strategy. They will, therefore, be easier to sell in periods of high corporate earnings.

Considerations outlined in the Public Bond Section also apply to preferred stocks.

4.6.5 Residential Mortgages

A residential mortgage portfolio creates positive cash flow through regular payments of principal and interest, including principal prepayments and nonrenewals at maturity.

In addition, through the development of the mortgage-backed (MBS) and asset-backed securities (ABS) market in Canada, a portion of the residential mortgage portfolio can be considered liquid.

Transforming residential mortgages into cash through MBS or ABS will take longer, possibly as long as six months. Losses and significant expenses, such as CMHC insurance premium, could be incurred.

4.6.6 Other Asset Types

Other asset classes are not typically considered liquid for going-concern management purposes:

- Commercial mortgages
- Private placements
- Real estate
- Subsidiaries
- Nonrated and low rated securities

The securitization markets are quickly expanding and making some of these, previously considered illiquid assets, more and more liquid.

4.6.7 Borrowings/Financing

Bank overdrafts are commonly used to handle daily fluctuations in cash flow.

For immediate cash needs, bond repurchase agreements are also commonly used, but obviously reduce the liquidity of the remaining bond portfolio.

Bank borrowings may be used to handle short-term cash-flow issues of less than 30 days.

It is also possible to issue commercial paper for a 30- to 90-day period. In a crisis situation, it may be difficult to use this as a source of cash. Furthermore, the current outstandings may need to be repaid.

In a crisis situation, most of these sources of cash will not be available.

5. RESULTS

The results of the forecasts can then be summarized and analyzed for each time horizon and scenario. A table similar to the one here may be useful.

Liquidity Ratio

Scenario	Time Horizon			
	1 month	3 months	12 months	Long Term
Stress	x	x	x	x
Panic	x	x	x	x
Alternate scenario #1	x	x	x	x
Other scenarios	x	x	x	x

A comparison of the above table over time will be useful in determining progress toward the target liquidity.

The liquidity ratio should not fall far below 1.00, given a good understanding of liquid assets and projected demand liabilities. If the ratio is far below 1.00, corrective action should be pursued to restore the situation in the appropriate time horizon. If the ratio is above 1.00, the corporation will have sufficient liquidity to meet the potential cash demand over the time horizon and under the environment assumed.

ARCHIVED

APPENDIX A

ABC Insurance Company

Forecasted Cash Flow for the Next Six Months

	Next Week	Week 2 to Week 13	Month 4 to Month 6
Cash Flow From Operations			
Operating Receipts:			
Premium income			
Transfers from segregated funds to guaranteed funds			
Investment income (bond coupons, mortgage interest, real estate rental income, stock dividends, net of receive and pay obligations under swaps)			
Fee income			
Tax and other refunds			
Total Operating Receipts			
Operating Disbursements:			
Policy benefits			
Transfers from guaranteed account to segregated funds			
Maturity payouts (nonrenewal of fixed term liabilities)			
Cash dividends to policyholders			
Expenses (including commissions and payroll)			
Interest expense (commercial paper, debt issues, lines of credit)			
Taxes (including property taxes withheld from mortgagor)			
CompCorp assessments			
Total Operating Disbursements			
Net Operating Cash Flow			
Cash Flow From Investment Activities			
Repayment of Principal			
Regular mortgage principal repayments			
Repayment of mortgage principal at maturity (net of expected mortgage renewals)			
Planned sales of foreclosed real estate			
Bond maturities			

Total Principal Repayment

New Investment Funding Requirements

- New mortgage commitments
- New bond investments
- New real estate investments and cash required to support existing development projects

Total New Investment Funding Requirements

Net Cash Flow from Investment Operations

Cash Flow From Financing Activities

- Dividends to shareholders
- Net new commercial paper issuance
- Net increase in repo activity
- Net new debt and equity issuance
- Draw downs on line of credit

Net Cash Flow from Financing

Total Cash Flow Before Unplanned Asset Sales

ARCHIVED