AFIN8003 Week 9 - Liquidity Risk

Banking and Financial Intermediation

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1 Liquidity Risk

1.1 Introduction

Liquidity risk is a normal aspect of everyday management of a financial institution (FI).

- Depository institutions (DIs) are more exposed to liquidity risk than others
- In extreme cases liquidity risk can threaten the solvency of an FI
- The Global Financial Crisis commencing in 2008 was, in part, due to liquidity risk
- Liquidity risk may result from asset side or liability side

We focus on the risk exposure of DIs.

1.2 Causes of liquidity risk

Liquidity risk can arise on both sides of the balance sheet: the asset side as well as the liability side

- Liability side
  - Depositors and other claim holders decide to cash in their financial claims immediately
    - The DI has to borrow additional funds or sell assets
  - DI need to be able to predict the distribution of **net deposit drains**
    - The difference between deposit withdrawals and deposit additions on any specific normal banking day
- Asset side
  - Risk from OBS loan commitments and other credit lines
  - Change of the value of investment securities portfolios due to unexpected changes of interest rates
  - Problems associated with 'quick' asset sales/fire-sales
    - High costs for turning illiquid assets into cash
    - Low sales price; in worst case, fire-sale price

2 Liquidity risk at depository institutions

2.1 Liability-side liquidity risk

- A DI's balance sheet typically features a large amount of short-term liabilities funding relatively long-term assets.
  - Short-term liabilities: demand deposits, other transaction accounts, etc.
  - Long-term assets: mortgages, C&I loans, etc.
- Demand deposit accounts, money market deposit accounts (MMDAs), and other transaction accounts allow holders to demand immediate repayment of the face value in cash.
  - For example, a DI with 20% of its liabilities in demand deposits, MMDAs, and other transaction accounts must be ready to liquidate assets to cover that amount on any banking day.

> **Note**
>
> As of June 2021, U.S. commercial banks had total deposits representing 82.19% of total liabilities and capital.
> - Cash assets accounted for only 15.45% of total assets.

For CBA, cash and liquid assets account for 9.3% of total assets.

	Note	Group 30 Jun 23 $M	Group 30 Jun 22 $M	Bank 30 Jun 23 $M	Bank 30 Jun 22 $M
Assets					
Cash and liquid assets	5.1	**116,619**	161,154	**108,367**	150,974
Receivables from financial institutions	5.2	**6,079**	6,845	**5,422**	6,071
Assets at fair value through Income Statement	5.3	**67,627**	25,315	**67,641**	25,249
Derivative assets	5.4	**23,945**	35,736	**25,585**	37,774
Investment securities:					
At amortised cost	5.5	**2,032**	3,217	**2,032**	3,217
At fair value through Other Comprehensive Income	5.5	**84,072**	79,086	**77,232**	72,191
Assets held for sale	11.3	**5**	1,322	**5**	28
Loans and other receivables	3.1	**926,082**	878,854	**816,140**	773,042
Shares in and loans to controlled entities	11.2	**–**	–	**54,636**	56,719
Property, plant and equipment	6.1	**4,950**	4,887	**3,549**	3,627
Investments in associates and joint ventures	11.1	**2,848**	2,801	**1,430**	1,407
Intangible assets	6.2	**7,393**	6,899	**4,340**	3,883
Deferred tax assets	2.5	**3,811**	3,173	**3,640**	3,069
Other assets	6.3	**7,382**	5,971	**6,799**	5,387
Total assets		**1,252,845**	1,215,260	**1,176,818**	1,142,638

Figure 1: Excerpt of CBA's 2023 balance sheet - assets

For CBA, deposits and other public borrowings account for 73.25% of total liabilities.

Liabilities					
Deposits and other public borrowings	4.1	**864,995**	857,586	**786,267**	783,701
Payables to financial institutions	5.2	**21,910**	26,052	**21,266**	25,321
Liabilities at fair value through Income Statement	4.2	**40,103**	7,271	**39,148**	6,097
Derivative liabilities	5.4	**25,347**	33,899	**26,728**	35,002
Due to controlled entities		**–**	–	**42,586**	41,433
Current tax liabilities		**671**	263	**442**	75
Deferred tax liabilities	2.5	**138**	150	**64**	82
Liabilities held for sale	11.3	**–**	1,183	**–**	–
Provisions	7.1	**3,013**	3,636	**2,818**	3,370
Term funding from central banks	4.4	**54,220**	54,807	**49,637**	51,137
Debt issues	4.3	**122,267**	116,902	**95,893**	89,940
Bills payable and other liabilities	7.2	**15,578**	12,656	**14,932**	12,347
		1,148,242	1,114,405	**1,079,781**	1,048,505
Loan capital	8.2	**32,598**	28,017	**32,587**	28,009
Total liabilities		**1,180,840**	1,142,422	**1,112,368**	1,076,514

Figure 2: Excerpt of CBA's 2023 balance sheet - liabilities

It's not that bad.

- Normally, only a small proportion of its deposits will be withdrawn on any given day.
- Further, deposit withdrawals may in part be offset by the inflow of new deposits[1] (and the DI's income).

Most demand deposits are relatively "stable", acting as consumer **core deposits** on a daily basis.

- **Core deposits** are those deposits that provide a DI with a long-term funding source.

[1] Large inflow of deposits may also cause issues if the DI cannot find sufficiently attractive investments.

The DI manager must monitor and predict the *net deposit drains* on any given normal banking day.

- Beyond predictable daily seasonality in deposit flows, other seasonal variations exist.
- Many of these seasonal variations are somewhat predictable.
- Retail DIs often experience above-average deposit outflows around the end of the year and in the summer (due to Christmas and the vacation season).
- Rural DIs may experience a deposit inflow–outflow cycle aligned with the local agricultural cycle.
  - During the planting and growing season, deposits tend to fall.
  - During the harvest season, deposits tend to rise as crops are sold.

2.2 Net deposit drains

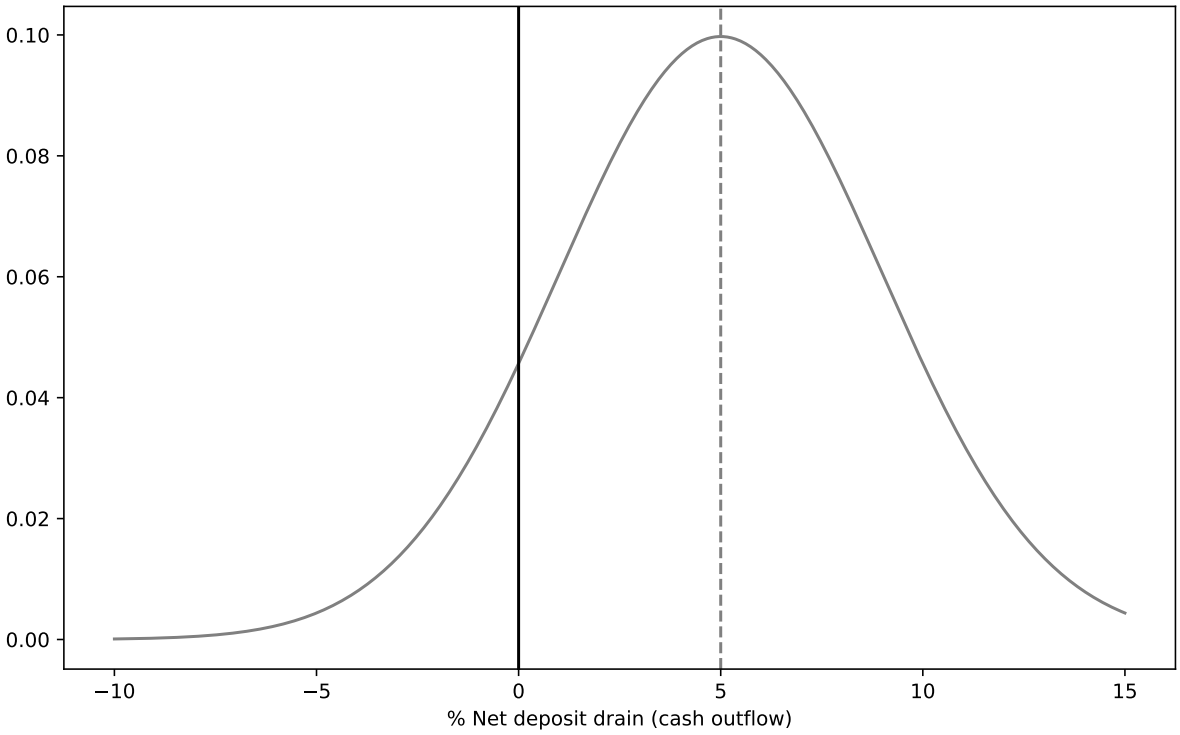

Figure 3: A hypothetical distribution of net deposit drains

Consider a probability distribution of net deposit drains that is assumed to be strongly peaked at the 5 percent net deposit withdrawal level, as shown in Figure 3.

- This DI expects approximately 5 percent of its net deposit funds to be withdrawn on any given day with the highest probability.
- A *positive* net drain on deposits, so its new deposit funds and other cash flows are expected to be insufficient to offset deposit withdrawals.

As a result, the liability side of the DI's balance sheet is **contracting**.

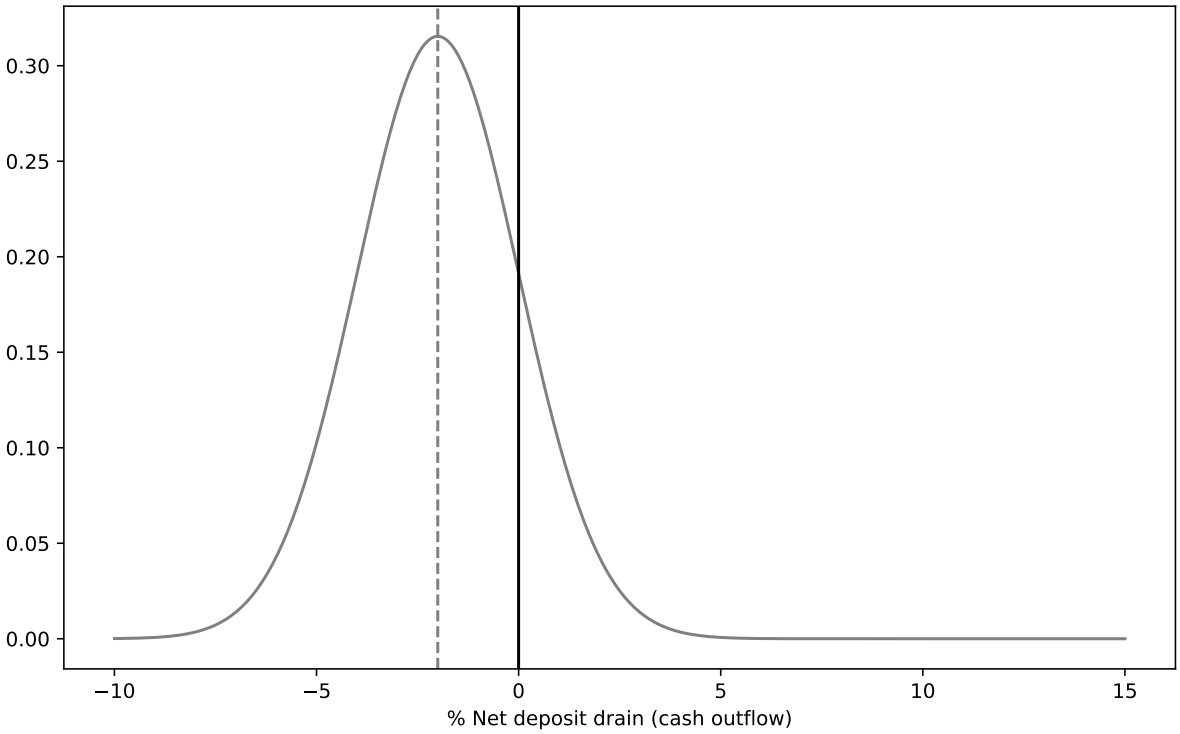

Figure 4: Another hypothetical distribution of net deposit drains

Consider another probability distribution of net deposit drains that is assumed to be strongly peaked at the -2 percent net deposit withdrawal level, as shown in Figure 4.

- A *negative* net drain on deposits, so its new deposit funds and other cash flows are expected to be larger than deposit withdrawals.

As a result, this DI is expected to grow with an **expanding** balance sheet.

2.3 Managing net deposit drains

Generally a drain on deposits at DIs can be managed by

- purchased liquidity management
- stored liquidity management

Traditionally, DIs have relied on stored liquidity management. Today, most DIs rely on purchased liquidity management.

> **Note**
>
> We will discuss in greater detail liquidity management in next week.

2.4 Purchased liquidity management

- A DI manager seeking to *purchase liquidity* turns to markets for purchased funds.
- Options include the cash market and the repurchase agreement markets, which are interbank markets for short-term loans.
- Alternatively, the DI manager could:
  - Issue additional wholesale certificates of deposit.

  - Sell notes and bonds.
- Borrowed funds (at market rates) are likely to be at higher rates than interest paid on deposits.

Panel A: Balance sheet immediately before and after deposit drain

	Assets	Deposits	Borrowed funds	Other liabilities	Total Liabilities
Before the drain	100	70	10	20	100
After the drain	100	65	10	20	95

Panel B: Adjusting to a deposit drain through purchased liquidity management

	Assets	Deposits	Borrowed funds	Other liabilities	Total Liabilities
After liquidity management	100	65	15	20	100

- Purchased liquidity management allows DIs to maintain their overall balance sheet size
- A liability-side adjustment to the balance sheet to cover a deposit drain

2.5 Stored liquidity management

- A DI manager could also *liquidate* some of its assets, utilizing its stored liquidity.
- Traditionally, U.S. DIs hold cash reserves at the Federal Reserve and in their vaults to meet liquidity needs.
- The Federal Reserve sets minimum reserve requirements for banks' cash reserves.
- Despite these requirements, DIs often hold cash reserves above the minimum to manage liquidity drains.

> **Note**
>
> - In U.S., the Fed reduced the reserve requirement to 0, effective March 26, 2020.
> - In Australia, the RBA does not impose formal reserve requirements.

Panel A: Balance sheet immediately before deposit drain

	Assets	Liabilities	
Cash	9	Deposits	70
		Borrowed funds	10
Other asset	91	Other liabilities	20
Total	100	Total	100

Panel B: Adjusting to a deposit drain through stored liquidity management

	Assets	Liabilities	
Cash	4	Deposits	65
		Borrowed funds	10
Other assets	91	Other liabilities	20

	Assets	Liabilities	
Total	95	Total	95

- Size of balance sheet decreases
- DIs tend to prudently hold low-rate excess reserve assets to meet liquidity drains

2.6 Asset-side liquidity risk

This far we have discussed the liability-side liquidity risk due to net deposit drains.

On the asset side, liquidity problems can arise due to

- loan requests
- the exercise by borrowers of their loan commitments and other credit lines! (e.g., at the onset of COVID-19)

See for example Acharya et al. (2024).

Balance Sheet Immediately Before and After Exercise

(a) Before Exercise

	Amount		Amount
Cash	12	Deposits	100
Other assets	138	Borrowed funds	20
		Other liabilities	5
		Equity	25
Total	150	Total	150

(b) After Exercise

	Amount		Amount
Cash	12	Deposits	100
Other assets	143	Borrowed funds	20
		Other liabilities	5
		Equity	25
Total	155	Total	150

Adjusting the Balance Sheet to a Loan Commitment Exercise

(a) Purchased Liquidity Management

	Amount		Amount
Cash	12	Deposits	100
Other assets	143	Borrowed funds	25
Other liabilities	5	Other liabilities	5
		Equity	25
Total	155	Total	155

(b) Stored Liquidity Management

	Amount		Amount
Cash	7	Deposits	100
Other assets	143	Borrowed funds	20
		Other liabilities	5
		Equity	25
Total	150	Total	150

2.7 Asset-side liquidity risk (investment portfolio)

Another type of asset-side liquidity risk arises from the investment portfolio.

- Rising interest rates reduce the value of investment portfolios.
- Liquidity in a particular market could deteriorate because no one wants to buy.

Technological development is claimed to have improved the liquidity of financial markets. But given the **herding** hebaviour in the market, liquidity could still dry up and investment securities only sold at fire-sale prices.

- The FI must fund the loss in value on the balance sheet such that loan requests and deposit withdrawals can be met.
- The result is increased liquidity risk for the FI.

Balance Sheet Immediately Before and After Drop in Investment Portfolio Value

(a) Before Drop in Value

	Amount		Amount
Cash	12	Deposits	100
Investment portfolio	50	Borrowed funds	20
Other assets	88	Other liabilities	5
		Equity	25
Total	150	Total	150

(b) After Drop in Value

	Amount		Amount
Cash	12	Deposits	100
Investment portfolio	45	Borrowed funds	20
Other assets	88	Other liabilities	5
		Equity	20
Total	145	Total	145

Adjusting the Balance Sheet for a Drop in Investment Portfolio Value

(a) Purchased Liquidity Management

	Amount		Amount
Cash	12	Deposits	105
Investment portfolio	50	Borrowed funds	20
Other assets	88	Other liabilities	5
		Equity	20
Total	150	Total	150

(b) Stored Liquidity Management

	Amount		Amount
Cash	7	Deposits	100
Investment portfolio	50	Borrowed funds	20
Other assets	88	Other liabilities	5
		Equity	20
Total	145	Total	145

2.8 Measuring a DI's liquidity risk exposure

1. Financing gap and the financing requirement.

- **Financing gap** is the difference between a DI's average loans and average (core) deposits:

$$\text{Financing gap} = \text{Average loans} - \text{Average deposits}$$

A positive financing gap implies that the DI must fund it using its cash and liquid assets and/or borrowing funds in the money market. Therefore,

$$\text{Financing gap} = -\text{Liquid assets} + \text{Borrowerd funds}$$

We thus have the following relationship:

$$\text{Financing gap} + \text{Liquid assets} = \text{Financing requirement (borrowed funds)}$$

2. Peer group ratio comparison

Comparison of certain key ratios and balance sheet features of the DI with similar DIs, for example,

- Loans to deposits
- Loans to assets
- Core deposits to total assets
- (Unused) loan commitments to assets

3. Liquidity index

Developed by Jim Pierce at the Federal Reserve, **liquidity index** measures the potential losses an FI could suffer from a sudden or fire-sale disposal of assets compared with the amount it would receive at a fair market value established under normal market (sale) conditions.

$$I = \sum_{i=1}^{N} \left(W_i \times \frac{P_i}{P_i^*} \right)$$

where

- W_i is the percentage of each asset in the FI's portfolio
- P_i is the immediate sale price
- P_i^* is the fair market price

The liquidity index should lie between 0 and 1.

2.9 Liquidity risk measures

- During the financial crisis, many DIs struggled to maintain adequate liquidity.
- Central banks had to provide extraordinary levels of liquidity assistance to sustain the financial system.
- Despite this support, some DIs failed or were forced into mergers.
- In response, the BIS's Basel Committee on Banking Supervision introduced two new regulatory standards for liquidity risk supervision:
  - **Liquidity Coverage Ratio (LCR):**
    - Came into effect on January 1, 2015.
    - Gradually implemented, reaching full compliance on January 1, 2019.
  - **Net Stable Funding Ratio (NSFR):**
    - Became a minimum standard on January 1, 2018.
- These rules apply to:
  - Large, internationally active banking organizations with $250 billion or more in total consolidated assets.
  - Organizations with $10 billion or more in total on-balance-sheet foreign exposure.
  - Consolidated subsidiary depository institutions with $10 billion or more in total assets.

2.10 Liquidity Coverage Ratio (LCR)

- The **Liquidity Coverage Ratio (LCR)** is designed to ensure that a DI maintains sufficient **high-quality liquid assets (HQLA)**.
- These HQLA must be easily convertible to cash to meet liquidity needs over a 30-day period.
- The LCR is based on an "acute liquidity stress scenario" defined by supervisors.
  - The scenario includes both institution-specific and systemic shocks.
  - It reflects actual conditions experienced during the global financial crisis.
- The purpose of maintaining the LCR is to ensure that DIs can survive severe liquidity stress for at least 30 days.
- The LCR is reported to DI supervisors on a monthly basis.

$$\text{Minimum LCR} = \frac{\text{Stock of HQLAs}}{\text{Total net cash outflows over next 30 calendar days}} \geq 100\%$$

The stock of HQLAs is defined as follows:

- Liquid assets in the stock must remain liquid in times of stress (i.e., convertible into cash at little loss of value and can be used at the central bank discount window as collateral).
- Liquid assets in the stock must be "unencumbered", i.e., free of legal, regulatory, contractual, or other restrictions on the ability of the bank to liquidate, sell, transfer, or assign the asset.
- Liquid assets in the stock are divided into level 1 and level 2. Level 1 amount has no cap, and level 2 amount is capped at 40 percent of the stock.
  - Level 1 assets are limited to:
    - Cash, central bank reserves, marketable securities representing claims on or guaranteed by sovereigns, central banks, public sector entities (PSE), and some supranational institutions (e.g., BIS, IMF, ECB, multilateral development banks).[2]
  - Level 2A assets (15% haircut):
    - Eligible marketable securities representing claims on or guaranteed by sovereigns, central banks, PSEs, or multilateral development banks.
    - Eligible corporate debt securities and covered bonds.
  - Level 2B assets:
    - Eligible residential mortgage backed securities (25% haircut).
    - Eligible corporate debt securities and equities (50% haircut).

[2]There're more restrictions.

The total net cash outflows is defined as:

$$\text{Total net cash outflows over next 30 calendar days} = Out - \min(In, 75\% \times Out)$$

where

- Out is total expected cash outflows
- In is total expected cash inflows

Cash inflows and outflows are computed based on the type of assets/liabilities and associated draw-down factors.

> **Note**
>
> For a detailed calculation of cash outflows and inflows, refer to textbook Saunders, Cornett, and Erhemjamts (2023) or to the suggested readings.

2.11 Liquidity Coverage Ratio (LCR): example

Consider the following balance sheet (in million of dollars) of a bank. Calculate the bank's LCR.

- Assume that the cash inflows over the next 30 days from the bank's assets are \$5 million.

Assets	\$	**Liquidity Level**	**Liabilities and Equity**	\$	**Run-Off Factor**
Cash	5	Level 1	Stable retail deposits	95	3%
Deposits at the Fed	15	Level 1	Less Stable retail deposits	40	10
Treasury securities	100	Level 1	Unsecured wholesale funding from:		
GNMA securities	75	Level 2A	- Stable small business deposits	100	5
Loans to A-rated corporations	110	Level 2A	- Less Stable small business deposits	80	10
Loans to B-rated corporations	85	Level 2B	- Nonfinancial corporates	50	75
Premises	20		Equity	45	
Total	410		**Total**	410	

The LCR is calculated as follows:

First, calculate the amount of HQLA.

- Level 1 assets is $5 + 15 + 100 = 120$ million

Before adjustment for capps,

- Level 2A assets is $(75 + 110) \times (1 - 15\%) = 157.25$ million[3]
- Level 2B assets is $85 \times (1 - 50\%) = 42.5$ million[4]

However, Level 2 assets is capped at 40% of HQLA!

- Given that Level 1 assets is 120 million, which should account for at least $1 - 40\% = 60\%$ of HQLA.
- HQLA should be $120/(1-40\%) = 200$ million, which means a maximum of $200 - 120 = 80$ million Level 2 assets.

[3] There is a 15% haircut applied on the value of Level 2A assets.
[4] There is a 50% haircut applied on the value of Level 2B assets.

- The Level 2 assets after haircut is larger than the cap - they will not further increase HQLA.

Therefore, the HQLA is 200 million.

Next, calculate the total net cash outflows over next 30 days.

Cash outflows are:

- Stable retail deposits: $95 \times 0.03 = 2.85$
- Less stable retail deposits: $40 \times 0.1 = 4$
- Stable small business deposits: $100 \times 0.05 = 5$
- Less stable small business deposits: $80 \times 0.1 = 8$
- Nonfinancial corporates: $50 \times 0.75 = 37.5$

Therefore,

- Total cash outflows over next 30 days is 57.35 million.
- Total cash inflows over next 30 days is 5 million (assumed).
- Total net cash outflows over next 30 days is 52.35 million.

Lastly, calculate LCR:

$$\text{LCR} = \frac{\text{Stock of HQLAs}}{\text{Total net cash outflows over next 30 calendar days}} = \frac{200}{52.35} = 382.04\% \geq 100\%$$

2.12 Net Stable Funding Ratio (NSFR)

- The **Net Stable Funding Ratio (NSFR)** focuses on long-term liquidity management on a DI's balance sheet.
- It evaluates liquidity across the entire balance sheet, encouraging the use of stable sources of financing.
- The NSFR requires a minimum amount of stable funding over a one-year time horizon.
  - It aims to limit the reliance on short-term wholesale funding, a significant issue during the financial crisis.
- The NSFR has been reported to DI supervisors quarterly since 2018.

$$\text{NSFR} = \frac{\text{Available amount of stable funding}}{\text{Required amount of stable funding}} \geq 100\%$$

Available stable funding (ASF) includes:

- Bank capital
- Preferred stock with a maturity > 1 year
- Liabilities with maturities > 1 year
- The portion of retail deposits and wholesale deposit expected to stay with bank during a period of idiosyncratic stress

These equity and liabilities are assigned to one of five categories, each with a specific ASF factor.

ASF is calculated as the sum of the weighted amounts.

Required stable funding (RSF) is calculated as the sum of

1. the value of the on-balance-sheet assets multiplied by a specific RSF factor assigned to each particular asset type, and
2. the amount of off-balance-sheet (OBS) activities (or potential liquidity exposure) multiplied by the associated RSF factor.

2.13 Liquidity risk of Australian banks (FY2023)

	CBA	NAB	ANZ	Westpac
Cash Outflows				
Retail And Counterparties Deposits Outflow	37,416	29,947	25,517	29,304
Stable Deposits	12,700	5,843	5,879	7,969
Less Stable Deposits	24,716	24,104	19,638	21,335
Unsecured Wholesale Funding Outflow	82,444	82,299	146,698	76,953
Operational Deposit Outflow	22,219	21,540	22,553	18,631
Non Operational Deposits Outflow	49,236	47,619	111,549	47,073
Unsecured Debt Outflow	10,989	13,140	12,596	11,249
Secured Wholesale Funding Outflow	6,839	10,701	5,405	3,891
Additional Outflow Requirements	26,186	38,693	70,639	30,463
Derivative Expo And Other Collateral Requirement	7,557	8,154	48,206	12,462
Loss of Funding on Debt Products	0	0	0	136
Credit And Liquidity Facilities	18,629	30,539	22,433	17,865
Other Contractual Funding Obligation	0	81	0	4,515
Other Contingent Funding Obligation	10,373	5,219	8,024	4,082
Total Cash Outflow	163,258	166,940	256,283	149,208

	CBA	NAB	ANZ	Westpac
Cash Inflows				
Secured Lending	2,328	3,898	1,549	0
Inflows From Fully Performing Exposures	9,520	11,788	17,190	5,020
Other Cash Inflows	6,753	1,589	36,016	7,988
Total Cash Inflow	18,601	17,275	54,755	13,008

	CBA	NAB	ANZ	Westpac
Liquidity Coverage Ratio (LCR)				
Average High Quality Liquid Assets	189,419	209,561	267,905	181,882
Average Net Cash Outflows	144,657	149,665	201,528	136,200
Average Liquidity Coverage Ratio	131.00	140.00	132.90	134.00
Net Stable Funding Ratio (NSFR)				
Available Stable Funding	860,999	646,508	625,285	707,893
Required Stable Funding	693,453	556,016	537,430	615,341
Net Stable Funding Ratio	124.00	116.00	116.35	115.00

2.14 Liquidity planning

- **Liquidity planning** is crucial for managing liquidity risk and costs, helping with borrowing priorities and minimizing excess reserves.
- Components of a liquidity plan:
  1. Managerial responsibilities: Assign roles during a liquidity crisis and manage public disclosures.
  2. List of fund providers: Identify likely fund withdrawers and patterns, including sensitivity to funding composition changes.
  3. Withdrawal estimates: Assess potential deposit and fund withdrawals over different time horizons and identify funding sources.
  4. Internal limits and asset disposal: Set borrowing limits for subsidiaries and branches, determine acceptable risk premiums, and sequence asset disposals.
- The plan involves key departments like the money desk and Treasury for daily liability funding.

2.15 Liquidity risk, unexpected deposit drains, and bank runs

Major liquidity problems can arise, however, if deposit drains are abnormally large and unexpected, which may occur for a number of reasons, including:

- Concerns about a DI's solvency relative to those of other DIs.
- Failure of a related DI (the contagion effect).
- Sudden changes in investor preferences regarding holding nonbank financial assets (such as T-bills or mutual fund shares) relative to deposits.

In these cases, unexpected deposit drains could trigger a *bank run* that may eventually force a bank into insolvency.

In the worst case, a *bank panic* may occur - systemic or contagious bank run on deposits of banking industry.

2.16 Bank runs, the discount window, and deposit insurance

The two major liquidity risk insulation devices are **deposit insurance** and the **discount window**.

1. Deposit insurance
2. Discount window:
    - A facility provided by central banks where FIs can borrow short-term funds to meet liquidity needs, typically at an interest rate called the "discount rate."
    - During the March 2023 United States bank failures, banks drew $153 billion from the discount window as of 15 March 2023, a new record.

Not without economic costs

- Protection may encourage DIs to increase liquidity risk

3 Liquidity risk at other types of financial institutions

3.1 Life insurance companies

- Life insurance companies hold cash reserves and liquid assets to meet policy cancellations (surrenders) and working capital needs.
- Premium income and returns on investments usually cover policyholder surrenders, with government bonds serving as a liquidity buffer.
- If premium income is insufficient, insurers may sell liquid assets to meet demands.
- A loss of confidence in an insurer can lead to a run, with mass policy surrenders forcing asset liquidations at potentially low prices.
- Forced liquidations can push insurers towards insolvency, similar to banks (DIs).

> **Note**
>
> An example is the case of Equitable Life. Increase in surrenders after it received an adverse legal ruling contributed to its failing. Its 256-year history ended in June 2018, after an 18-year-long winding-down process.

3.2 Property-casualty insurers

- Property–casualty (PC) insurers sell policies insuring against certain contingencies impacting either real property or individuals.
- Large unexpected claims may materialize and exceed the flow of premium income and income returns from assets.
    - For example, natural disasters.

4 Finally...

4.1 Suggested readings

- APRA Explains: Liquidity in banking.
- RBA: The Implementation of Monetary Policy: Domestic Market Operations.
- BIS: LCR - Liquidity Coverage Ratio.
- Acharya, V. V., Engle, R., Jager, M., & Steffen, S. (2024). Why Did Bank Stocks Crash during COVID-19? *The Review of Financial Studies*, 37, 2627–2684.

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