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Exam Prep

SchweserNotes[™]

Liquidity and Treasury Risk
Measurement and Management



PART II BOOK 4

KAPLAN[®] SCHWESER

Book 4: Liquidity and Treasury Risk Measurement and Management

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FRM Part II



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CONTENTS

Readings and Learning Objectives

STUDY SESSION 10—LIQUIDITY RISK MANAGEMENT

READING 59

Liquidity Risk

Exam Focus

Module 59.1: Trading Liquidity Risk

Module 59.2: Funding Liquidity Risk

Module 59.3: Liquidity Black Holes and Positive Feedback Trading

Key Concepts

Answer Key for Module Quizzes

READING 60

Liquidity and Leverage

Exam Focus

Module 60.1: Sources of Liquidity Risk, Liquidity Transformation, and Systematic Funding

Module 60.2: The Collateral Market and Leverage

Module 60.3: Funding and Transactions, Liquidity Risk, and Transactions Cost

Key Concepts

Answer Key for Module Quizzes

READING 61

Early Warning Indicators

Exam Focus

Module 61.1: Early Warning Indicators for Liquidity Risk Management

Key Concepts

Answer Key for Module Quizzes

READING 62

The Investment Function in Financial-Services Management

Exam Focus

Module 62.1: Money Market and Capital Market Instruments

Module 62.2: Investment Security Selection and Risks

Module 62.3: Investment Maturity Strategies and Maturity Management Tools

Key Concepts

Answer Key for Module Quizzes

READING 63

Liquidity and Reserves Management: Strategies and Policies

Exam Focus

Module 63.1: Net Liquidity and Strategies

Module 63.2: Bank Liquidity Needs

Module 63.3: Legal Reserves and Sources of Reserves

Key Concepts

Answer Key for Module Quizzes

READING 64

Intraday Liquidity Risk Management

Exam Focus

Module 64.1: Uses and Sources of Intraday Liquidity

Module 64.2: Managing and Measuring Intraday Liquidity Risk

Key Concepts

Answer Key for Module Quizzes

READING 65

Monitoring Liquidity

Exam Focus

Module 65.1: Cash Flow Types and Liquidity Options

Module 65.2: Liquidity Risks, Cash Flows, and Capacity

Module 65.3: Managing Assets for Liquidity

Key Concepts

Answer Key for Module Quizzes

STUDY SESSION 11—STRESS TESTING, CONTINGENCY PLANNING, DEPOSIT SERVICES, AND NONDEPOSIT LIABILITIES

READING 66

The Failure Mechanics of Dealer Banks

Exam Focus

Module 66.1: Functions of Dealer Banks

Module 66.2: Liquidity Concerns for Dealer Banks and Risk Policy Measures

Key Concepts

Answer Key for Module Quizzes

READING 67

Liquidity Stress Testing

Exam Focus

Module 67.1: Types of Liquidity and Contingent Liquidity

Module 67.2: Liquidity Stress Test Design Issues

Key Concepts

Answer Key for Module Quizzes

READING 68

Liquidity Risk Reporting and Stress Testing

Exam Focus

Module 68.1: Liquidity Risk Reports

Module 68.2: Liquidity Stress Tests

Key Concepts

Answer Key for Module Quizzes

READING 69

Contingency Funding Planning

Exam Focus

Module 69.1: Contingency Funding Planning

Module 69.2: Components of a Contingency Funding Plan

Key Concepts

Answer Key for Module Quizzes

READING 70

Managing and Pricing Deposit Services

Exam Focus

Module 70.1: Transaction and Nontransaction Deposit Types

Module 70.2: Methods of Pricing Deposits

Module 70.3: Challenges to Offering Deposit Accounts

Key Concepts

Answer Key for Module Quizzes

READING 71

Managing Nondeposit Liabilities

Exam Focus

Module 71.1: Nondeposit Liabilities and Available Funds Gap

Module 71.2: Choice and Cost of Nondeposit Sources of Funds

Key Concepts

Answer Key for Module Quizzes

STUDY SESSION 12—REPOS, LIQUIDITY TRANSFER, AND INTEREST RATE RISK MANAGEMENT

READING 72

Repurchase Agreements and Financing

Exam Focus

Module 72.1: Mechanics of Repos, Repo Motivations, and Counterparty and Liquidity Risk

Module 72.2: The Credit Crisis, Collateral, and Special Spreads

Key Concepts

Answer Key for Module Quizzes

READING 73

Liquidity Transfer Pricing: A Guide to Better Practice

Exam Focus

Module 73.1: Best Practices and Challenges for Liquidity Transfer Pricing

Module 73.2: Approaches for Liquidity Transfer Pricing and Contingent

Liquidity Risk Pricing

Key Concepts

Answer Key for Module Quizzes

READING 74

The US Dollar Shortage in Global Banking and the International Policy Response

Exam Focus

Module 74.1: Global Bank Balance Sheets and Vulnerabilities

Module 74.2: U.S. Dollar Shortage and International Policy Response

Key Concepts

Answer Key for Module Quizzes

READING 75

Covered Interest Parity Lost: Understanding the Cross-Currency Basis

Exam Focus

Module 75.1: Covered Interest Parity Violations

Key Concepts

Answer Key for Module Quizzes

READING 76

Risk Management for Changing Interest Rates: Asset-Liability Management and Duration Techniques

Exam Focus

Module 76.1: Interest-Sensitive Gap Management

Module 76.2: Duration Gap Management

Key Concepts

Answer Key for Module Quizzes

READING 77

Illiquid Assets

Exam Focus

Module 77.1: Illiquid Markets, Market Imperfections, Biases, and Unsmoothing

Module 77.2: Illiquidity Risk Premiums and Portfolio Allocation to Illiquid Assets

Key Concepts

Answer Key for Module Quizzes

Formulas

Index

READINGS AND LEARNING OBJECTIVES

STUDY SESSION 10

59. Liquidity Risk

John C. Hull, *Risk Management and Financial Institutions, 5th Edition* (Hoboken, NJ: John Wiley & Sons, 2018). Chapter 24.

After completing this reading, you should be able to:

- explain and calculate liquidity trading risk via cost of liquidation and liquidity-adjusted VaR (LVAR).
- identify liquidity funding risk, funding sources, and lessons learned from real cases: Northern Rock, Ashanti Goldfields, and Metallgesellschaft.
- evaluate Basel III liquidity risk ratios and BIS principles for sound liquidity risk management.
- explain liquidity black holes and identify the causes of positive feedback trading.

60. Liquidity and Leverage

Allan Malz, *Financial Risk Management: Models, History, and Institutions* (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 12.

After completing this reading, you should be able to:

- differentiate between sources of liquidity risk and describe specific challenges faced by different types of financial institutions in managing liquidity risk.
- summarize the asset-liability management process at a fractional reserve bank, including the process of liquidity transformation.
- compare transactions used in the collateral market and explain risks that can arise through collateral market transactions.
- describe the relationship between leverage and a firm's return profile (including the leverage effect) and distinguish the impact of different types of transactions on a firm's leverage and balance sheet.
- distinguish methods to measure and manage funding liquidity risk and transactions liquidity risk.
- calculate the expected transactions cost and the spread risk factor for a transaction and calculate the liquidity adjustment to VaR for a position to be liquidated over a number of trading days.
- discuss interactions between different types of liquidity risk and explain how liquidity risk events can increase systemic risk.

61. Early Warning Indicators

Shyam Venkat, Stephen Baird, *Liquidity Risk Management: A Practitioner's Perspective* (Hoboken, NJ: John Wiley & Sons, 2016). Chapter 6.

After completing this reading, you should be able to:

- evaluate the characteristics of sound Early Warning Indicators (EWI) measures.
- identify EWI guidelines from banking regulators and supervisors (OCC, BCBS, Federal Reserve).
- discuss the applications of EWIs in the context of the liquidity risk management process.

62. The Investment Function in Financial-Services Management

Peter Rose, Sylvia Hudgins, *Bank Management & Financial Services, 9th Edition* (New York, NY: McGraw-Hill, 2013). Chapter 10.

After completing this reading, you should be able to:

- compare various money market and capital market instruments and discuss their advantages and disadvantages.
- identify and discuss various factors that affect the choice of investment securities by a bank.

- c. apply investment maturity strategies and maturity management tools based on the yield curve and duration.

63. Liquidity and Reserves Management: Strategies and Policies

Peter Rose, Sylvia Hudgins, *Bank Management & Financial Services, 9th Edition* (New York, NY: McGraw-Hill, 2013). Chapter 11.

After completing this reading, you should be able to:

- a. calculate a bank's net liquidity position and explain factors that affect the supply and demand of liquidity at a bank.
- b. compare strategies that a bank can use to meet demands for additional liquidity.
- c. estimate a bank's liquidity needs through three methods (sources and uses of funds, structure of funds, and liquidity indicators).
- d. summarize the process taken by a US bank to calculate its legal reserves.
- e. differentiate between factors that affect the choice among alternate sources of reserves.

64. Intraday Liquidity Risk Management

Shyam Venkat, Stephen Baird, *Liquidity Risk Management: A Practitioner's Perspective* (Hoboken, NJ: John Wiley & Sons, 2016). Chapter 4.

After completing this reading, you should be able to:

- a. identify and explain the uses and sources of intraday liquidity.
- b. discuss the governance structure of intraday liquidity risk management.
- c. differentiate between methods for tracking intraday flows and monitoring risk levels.

65. Monitoring Liquidity

Antonio Castagna, Francesco Fede, *Measuring and Managing Liquidity Risk* (United Kingdom, John Wiley & Sons, 2013). Chapter 6.

After completing this reading, you should be able to:

- a. distinguish between deterministic and stochastic cash flows and provide examples of each.
- b. describe and provide examples of liquidity options and explain the impact of liquidity options on a bank's liquidity position and its liquidity management process.
- c. describe and apply the concepts of liquidity risk, funding cost risk, liquidity generation capacity, expected liquidity, and cash flow at risk.
- d. interpret the term structure of expected cash flows and cumulative cash flows.
- e. discuss the impact of available asset transactions on cash flows and liquidity generation capacity.

STUDY SESSION 11

66. The Failure Mechanics of Dealer Banks

Darrell Duffie, 2010. "The Failure Mechanics of Dealer Banks," *Journal of Economic Perspectives* 24:1, 51-72.

After completing this reading, you should be able to:

- a. compare and contrast the major lines of business in which dealer banks operate and the risk factors they face in each line of business.
- b. identify situations that can cause a liquidity crisis at a dealer bank and explain responses that can mitigate these risks.
- c. assess policy measures that can alleviate firm-specific and systemic risks related to large dealer banks.

67. Liquidity Stress Testing

Shyam Venkat, Stephen Baird, *Liquidity Risk Management: A Practitioner's Perspective* (Hoboken, NJ: John Wiley & Sons, 2016). Chapter 3.

After completing this reading, you should be able to:

- a. differentiate between various types of liquidity, including funding, operational, strategic, contingent, and restricted liquidity.
- b. estimate contingent liquidity via the liquid asset buffer.
- c. discuss liquidity stress test design issues such as scope, scenario development, assumptions, outputs, governance, and integration with other risk models.

68. Liquidity Risk Reporting and Stress Testing

Moorad Choudhry, *The Principles of Banking* (Singapore: John Wiley & Sons, 2012). Chapter 14.

After completing this reading, you should be able to:

- a. identify best practices for the reporting of a bank's liquidity position.
- b. compare and interpret different types of liquidity risk reports.
- c. explain the process of reporting a liquidity stress test and interpret a liquidity stress test report.

69. Contingency Funding Planning

Shyam Venkat, Stephen Baird, *Liquidity Risk Management: A Practitioner's Perspective* (Hoboken, NJ: John Wiley & Sons, 2016). Chapter 7.

After completing this reading, you should be able to:

- a. discuss the relationship between contingency funding planning and liquidity stress testing.
- b. evaluate the key design considerations of a sound contingency funding plan.
- c. assess the key components of a contingency funding plan (governance and oversight, scenarios and liquidity gap analysis, contingent actions, monitoring and escalation, and data and reporting).

70. Managing and Pricing Deposit Services

Peter Rose, Sylvia Hudgins, *Bank Management & Financial Services, 9th Edition* (New York, NY: McGraw-Hill, 2013). Chapter 12.

After completing this reading, you should be able to:

- a. differentiate between the various transaction and non-transaction deposit types.
- b. compare the different methods used to determine the pricing of deposits and calculate the price of a deposit account using cost-plus, marginal cost, and conditional pricing formulas.
- c. explain challenges faced by banks that offer deposit accounts, including deposit insurance, disclosures, overdraft protection, and basic (lifeline) banking.

71. Managing Nondeposit Liabilities

Peter Rose, Sylvia Hudgins, *Bank Management & Financial Services, 9th Edition* (New York, NY: McGraw-Hill, 2013). Chapter 13.

After completing this reading, you should be able to:

- a. distinguish between the various sources of non-deposit liabilities at a bank.
- b. describe and calculate the available funds gap.
- c. discuss factors affecting the choice of non-deposit funding sources.
- d. calculate overall cost of funds using both the historical average cost approach and the pooled-funds approach.

STUDY SESSION 12

72. Repurchase Agreements and Financing

Bruce Tuckman and Angel Serrat, *Fixed Income Securities: Tools for Today's Markets, 3rd Edition* (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 12.

After completing this reading, you should be able to:

- a. describe the mechanics of repurchase agreements (repos) and calculate the settlement for a repo transaction.
- b. discuss common motivations for entering into repos, including their use in cash management and liquidity management.

- c. discuss how counterparty risk and liquidity risk can arise through the use of repo transactions.
- d. assess the role of repo transactions in the collapses of Lehman Brothers and Bear Stearns during the 2007–2009 financial crisis.
- e. compare the use of general and special collateral in repo transactions.
- f. identify the characteristics of special spreads and explain the typical behavior of US Treasury special spreads over an auction cycle.
- g. calculate the financing advantage of a bond trading special when used in a repo transaction.

73. Liquidity Transfer Pricing: A Guide to Better Practice

Joel Grant, 2011. “Liquidity Transfer Pricing: A Guide to Better Practice,” Occasional Paper, Financial Stability Board, Bank for International Settlements.

After completing this reading, you should be able to:

- a. discuss the process of liquidity transfer pricing (LTP) and identify best practices for the governance and implementation of an LTP process.
- b. discuss challenges that may arise for banks during the implementation of LTP.
- c. compare the various approaches to liquidity transfer pricing (zero cost, average cost, and matched maturity marginal cost).
- d. describe the contingent liquidity risk pricing process and calculate the cost of contingent liquidity risk.

74. The US Dollar Shortage in Global Banking and the International Policy Response

Patrick McGuire, Gotz von Peter, 2009. “The US Dollar Shortage in Global Banking and the International Policy Response,” BIS Working Papers, Bank for International Settlements.

After completing this reading, you should be able to:

- a. identify the causes of the US dollar shortage during the Great Financial Crisis.
- b. evaluate the importance of assessing maturity/currency mismatch across the balance sheets of consolidated entities.
- c. discuss how central bank swap agreements overcame challenges commonly associated with international lenders of last resort.

75. Covered Interest Parity Lost: Understanding the Cross-Currency Basis

Claudio Borio, Robert McCauley, Patrick McGuire, Vladyslav Sushko, 2016. “Covered Interest Parity Lost: Understanding the Cross-Currency Basis,” BIS Quarterly Review.

After completing this reading, you should be able to:

- a. differentiate between the mechanics of foreign exchange (FX) swaps and cross-currency swaps.
- b. identify key factors that affect the cross-currency swap basis.
- c. assess the causes of covered interest rate parity violations after the financial crisis of 2008.

76. Risk Management for Changing Interest Rates: Asset-Liability Management and Duration Techniques

Peter Rose, Sylvia Hudgins, *Bank Management & Financial Services, 9th Edition* (New York, NY: McGraw-Hill, 2013). Chapter 7.

After completing this reading, you should be able to:

- a. discuss how asset-liability management strategies can help a bank hedge against interest rate risk.
- b. describe interest-sensitive gap management and apply this strategy to maximize a bank’s net interest margin.
- c. describe duration gap management and apply this strategy to protect a bank’s net worth.
- d. discuss the limitations of interest-sensitive gap management and duration gap management.

77. Illiquid Assets

Andrew Ang, *Asset Management: A Systematic Approach to Factor Investing* (New York, NY: Oxford University Press, 2014). Chapter 13.

After completing this reading, you should be able to:

- a. evaluate the characteristics of illiquid markets.
- b. examine the relationship between market imperfections and illiquidity.
- c. assess the impact of biases on reported returns for illiquid assets.
- d. explain the unsmoothing of returns and its properties.
- e. compare illiquidity risk premiums across and within asset categories.
- f. evaluate portfolio choice decisions on the inclusion of illiquid assets.

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Hull, Chapter 24.

READING 59

LIQUIDITY RISK

Study Session 10

EXAM FOCUS

Liquidity is extremely important for a financial institution, as it must be able to meet its cash needs as they come due. Candidates should be familiar with the concept of liquidity, the costs of liquidation, and the risks (including value at risk) associated with trading in normal and stressed markets. Also, be familiar with liquidity funding risk, the primary sources of liquidity for a financial institution, and how real firms have been undone by a lack of appropriate liquidity management practices. Basel III introduced key liquidity risk equations and the Bank for International Settlements (BIS) developed 17 principles associated with liquidity risk management that are critical for the exam. Finally, be familiar with liquidity black holes and how trading strategies, leverage, and regulations can heavily impact liquidity needs.

MODULE 59.1: TRADING LIQUIDITY RISK

LO 59.a: Explain and calculate liquidity trading risk via cost of liquidation and liquidity-adjusted VaR (LVar).

Although both concepts are often mistaken for one another, solvency and liquidity are very different. **Solvency** exists when equity is positive, implying that assets exceed liabilities on the balance sheet. **Liquidity** relates to a company's ability to meet its obligations as they come due. In terms of trading, liquidity relates to the ease in which an investment can be unwound. Investments in large, publicly traded equity securities are highly liquid, whereas noninvestment grade debt and emerging market equity securities tend to have low liquidity.

For any given asset, its sale price is a function of its estimated value (or mid-market price), the speed with which the sale needs to occur, the quantity being sold, and the overall economic environment. Just as real estate markets can shift from buyer's to seller's markets, financial assets are vulnerable to economic shifts which can make all assets more or less liquid depending on the situation.

Large positions are vulnerable to **predatory trading**, which exists when market participants, who are aware of another entity that needs to liquidate a large position,

execute similar trades to profit. A pending large transaction to close out a short position would involve large purchases of shares which other companies can profit from by placing buy orders before the large purchase closeout.

Liquidity requires transparency, and history has shown how investments which lack transparency do not remain liquid for long. In the mid-2000s, portfolios consisting of subprime mortgages and other questionable investments were rampant in the marketplace. Investors lacked an understanding of these investments and the risks involved, and when the credit crisis occurred in 2007, the lack of financial models and information needed to properly value the investments led to significant price declines and an overall lack of liquidity.

For a financial asset with a market maker, there will be both a **bid and offer price**. An asset is sold at the bid price (which is the lower value) and purchased at the offer price (which is the higher value) up to a specified contract size. As the size of the order increases beyond a market maker's size limit, the spread is likely to widen to hedge risk. Even financial assets without market makers have implicit bid-offer spreads.

The dollar bid-offer spread (p) and the proportional bid-offer spread (s) are shown in the following equation, with the **mid-market price** (deemed the fair price) representing the halfway point between the bid and offer.

$$p = \text{offer price} - \text{bid price}$$

$$s = \frac{\text{offer price} - \text{bid price}}{\text{mid-market price}}$$

The cost to execute a trade and liquidate a position is equal to $s \times (\alpha / 2)$, with α as the mid-market or dollar value of the position. The cost to liquidate a book of investments in a normal market, with n representing the number of positions, is equal to:

$$\text{cost of liquidation (normal market)} = \sum_{i=1}^n \frac{s_i \alpha_i}{2}$$

Because larger positions tend to create more liquidity risk due to a widening bid-offer spread, setting size limits to trades, and holding a larger quantity of smaller positions tend to reduce liquidity trading risk.

EXAMPLE: Cost of liquidation

A company has two equity positions. The first is 2 million shares of ABC Company with a bid of \$25.50 and an offer of \$27.00. The second holding is 500,000 shares of XYZ Company with a bid of \$45.00 and an offer of \$46.50.

Calculate the mid-market value of each position, the proportional bid-offer spread, and the cost of liquidation in a normal market.

Answer:

ABC Company:

$$\text{Bid-offer spread} = \$27.00 - \$25.50 = \$1.50$$

$$\text{Mid-market price} = (\$25.50 + \$27.00) / 2 = \$26.25$$

Mid-market value: $\$26.25 \times 2 \text{ million shares} = \$52,500,000$

Proportional bid-offer spread: $\$1.50 / \$26.25 = 0.05714$

XYZ Company:

Bid-offer spread = $\$46.50 - \$45.00 = \$1.50$

Mid-market price = $(\$45.00 + \$46.50) / 2 = \$45.75$

Mid-market value (XYZ): $\$45.75 \times 500,000 \text{ shares} = \$22,875,000$

Proportional bid-offer spread: $\$1.50 / \$45.75 = 0.03279$

Cost of liquidation:

$$[(\$52,500,000 \times 0.05714) / 2] + [(\$22,875,000 \times 0.03279) / 2] = \$1,874,961$$

While the earlier equation can be used to calculate the cost of liquidation in a normal market, a critical calculation is the cost of liquidation in a stressed market. With μ , σ , and γ representing the mean, standard deviation, and the confidence level of the proportional bid-offer spread respectively,

$$\text{cost of liquidation (stressed market)} = \sum_{i=1}^n \frac{(\mu_i + \gamma \sigma_i) \alpha_i}{2}$$

EXAMPLE: Cost of liquidation (continued)

Assume the same information as the previous example. In addition, assume the mean and standard deviation for the bid-offer spread for both securities is \$1.5 and \$2.5, respectively.

Calculate the cost of liquidation at a 95% level of confidence (1.645 z-score for one tail).

Answer:

ABC Company:

Mean, proportional bid-offer spread: $\$1.5 / \$26.25 = 0.05714$

Standard deviation, proportional bid-offer spread: $\$2.5 / \$26.25 = 0.09524$

XYZ Company:

Mean, proportional bid-offer spread: $\$1.5 / \$45.75 = 0.03279$

Standard deviation, proportional bid-offer spread: $\$2.5 / \$45.75 = 0.05464$

Cost of liquidation:

$$\{[\$52,500,000 \times (0.05714 + 1.645 \times 0.09524)] / 2\} + \{[\$22,875,000 \times (0.03279 + 1.645 \times 0.05464)] / 2\} = \$7,015,577$$

Although the earlier equation assumes a normal distribution for bid-offer spreads, this is not always the reality. However, the equation also assumes a strong positive

correlation between investments, which is often the case as a tight liquidity market tends to impact many investments.

Liquidity-adjusted value at risk (LVaR) estimates VaR while taking into account liquidity risk. VaR can be adjusted for the cost of unwinding positions in both normal and stressed markets using the equations derived earlier.

$$\text{liquidity-adjusted VaR (normal market)} = \text{VaR} + \sum_{i=1}^n \frac{s_i \alpha_i}{2}$$

$$\text{liquidity-adjusted VaR (stressed market)} = \text{VaR} + \sum_{i=1}^n \frac{(\mu_i + \gamma \sigma_i) \alpha_i}{2}$$



PROFESSOR'S NOTE

We add the confidence parameter times the volatility of the spread to the mean of the spread since the liquidity adjustment increases the value at risk. Also, notice that the confidence parameter (or z-score) used for the uncertainty of the spread is labeled differently. The confidence parameter, in this case, is a value to be determined.

Traders are often faced with decisions on the speed to which they unwind their positions. A quick unwind will reduce the risk of the mid-market price moving against them, but increases the risk associated with a widening spread. A slow unwind increases market risk, but decreases the risk associated with widening spreads.

The following equations exist to evaluate the decisions faced by a trader:

$$\text{total costs related to bid-offer spread} = \sum_{i=1}^n q_i \frac{p(q_i)}{2}$$

$$\text{variance of the change in value of the position} = \sum_{i=1}^n \sigma^2 x_i^2$$

$$\text{trader's objective (to minimize VaR)} = \sqrt{\sum_{i=1}^n \sigma^2 x_i^2} + \sum_{i=1}^n q_i \frac{p(q_i)}{2}$$

where:

n = number of days over which to liquidate the position

q = number of units traded in one day

p = bid-offer spread in dollars

x = size of trader's position after one day

i = a specific day

An alternative measure of liquidity is the trading volume per day. The higher the volume of trading, the higher the liquidity of the asset. In 2002, an economist named Yakov Amihud proposed a liquidity equation comparing the absolute value of the daily return to the daily dollar volume over a specific time period. Amihud's research showed that expected return was inversely related to liquidity, such that lower liquidity resulted in higher expected returns.¹



MODULE QUIZ 59.1

1. Rigues Bank owns 5 million shares of a stock with a bid price of \$10.50 and an offer price of \$12.75. The cost of liquidation in normal market conditions is closest to:
A. \$2.813 million.

- B. \$5.625 million.
- C. \$6.228 million.
- D. \$11.250 million.

MODULE 59.2: FUNDING LIQUIDITY RISK

LO 59.b: Identify liquidity funding risk, funding sources, and lessons learned from real cases: Northern Rock, Ashanti Goldfields, and Metallgesellschaft.

Liquidity funding risk is a measure of a firm's ability to meet its cash needs as they come due. This risk can stem from weak financial performance, liquidity stresses resulting in hesitant investors, and funding decisions which often result in mismatches where short-term instruments are used to fund longer-term requirements. The ability of a firm to predict when cash is needed is critical, as some cash obligations are very predictable (e.g., coupon payments on bond issuances) and others are harder to forecast (e.g., customer withdrawals).

A financial institution has the following six primary sources of liquidity:

- *Cash and treasuries.* In exchange for relatively low returns, cash holdings and investments in safe instruments like U.S. and U.K. treasury securities offer significant liquidity. An institution has to balance its investments between those that offer high liquidity and low returns with those that offer lower liquidity but provide a higher return.
- *Retail and wholesale deposits.* Both wholesale and retail deposits tend to be somewhat unstable, as customers can easily transfer funds between financial institutions by comparing interest rates. In addition, tight liquidity environments tend to affect the entire market as opposed to just individual institutions.
- *Trading book liquidation.* In the event that an institution needs to raise cash, it can liquidate a portion of its trading book. The success of this strategy depends on how liquid the book is, especially in stressed (rather than normal) market conditions.
- *Securitization.* The *originate to distribute* model led to banks taking illiquid assets and securitizing them (pooling debts owed to an institution and selling their cash flows as securities to investors). The success of this strategy rapidly dissipated in late 2007 because of the subprime mortgage crisis.
- *Borrowing ability.* Stressed market conditions create more risk aversion, which results in higher interest rates and shorter maturities associated with the borrowings. Lines of credit can be set up to help mitigate the risks associated with obtaining funding in stressed market conditions.
- *Central bank borrowings.* In the event a commercial bank needs funding support, the "lenders of last resort" (e.g., European Central Bank, the Bank of England, and the Federal Reserve in the United States) can be called upon to provide money. The cost is the collateral provided by borrowers, the relatively high interest rate, and the haircut which reduces the amount lent below the collateral provided. The other challenge is the negative signal that borrowing from a central bank sends to

the marketplace, which is why any borrowings from the central bank are kept as quiet as possible.

Case Studies

Northern Rock: A British bank which was heavily involved in mortgage lending. The bank used short-term debt instruments for funding, which became highly problematic when investors were resistant to lend to banks after the subprime mortgage crisis of 2007–2009. In September of that year, Northern Rock went to the Bank of England for funding and borrowed £3 billion from the Tripartite Authority. Once the BBC broke the news of the emergency request for funding, a massive bank run led to £2 billion in customer withdrawals over the next week. Deposit guarantees by the British government and Bank of England slowed the run but emergency borrowing continued, reaching £25 billion within six months. The end result was a change in bank management and the bank itself was nationalized. A more conservative assessment of funding accessibility may have helped mitigate the risk the bank took on before the 2007–2009 financial crisis.

Ashanti Goldfields: A gold mining company in West Africa which sold gold forwards to protect shareholders from potential declines in gold prices. In the fall of 1999, 15 central banks in Europe announced that they would limit gold sales for five years. With a forecasted supply reduction for gold, demand jumped and prices rose over 25%. The short positions in gold forwards led to margin calls that could not be met, as well as significant losses leading to restructuring of hedge positions, the sale of a mine, and equity dilution. While the underlying asset (gold) did increase in value, the illiquidity of the asset itself was misaligned with the immediate need for margin calls to be met in cash.

Metallgesellschaft (MG): A German industrial conglomerate which sold a significant amount of 5–10-year fixed-price supply contracts on heating oil and gasoline to customers at above market prices. The company used long positions in short-term futures contracts to hedge the supply contracts. With oil prices subsequently falling, the futures positions required margin calls that led to a cash drain on the company. Because of management and banker concerns regarding the cash outflows from the positions, the company dropped its fixed-price contracts and closed out its hedge positions, leading to a loss of over \$1.3 billion. Similar to Ashanti Goldfields, immediate cash outflows for margin calls were misaligned with cash inflows from illiquid investments.

Reserve requirements are often put in place, which require banks to maintain a specific percentage of its transaction deposits either in their vault or with the central bank. While the United States has a reserve requirement of 10%, other countries may have different requirements (e.g., the UK has no reserve requirement). The higher the reserve percentage, the bigger the negative impact on the country's money supply.

Liquidity Risk Ratios

LO 59.c: Evaluate Basel III liquidity risk ratios and BIS principles for sound liquidity risk management.

Liquidity risk requirements introduced by Basel III include the liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR).

Liquidity Coverage Ratio (LCR):

$$\frac{\text{high-quality liquid assets}}{\text{net cash outflows in a stressed 30-day period}} \geq 100\%$$

The 30-day period in the LCR represents a period of significant stress which includes a 100% loss of wholesale funding, line of credit drawdowns, a partial loss on deposits, a downgrade of three notches on credit ratings, and higher haircuts on secured funding.

Net Stable Funding Ratio (NSFR):

$$\frac{\text{amount of stable funding}}{\text{required amount of stable funding}} \geq 100\%$$

The amount of stable funding is derived by applying an available stable funding factor to each category of funding. The required amount of stable funding looks at assets and off-balance sheet items that require funding.

BIS principles, developed as a result of the 2007–2009 liquidity crisis, speak to how banks need to manage liquidity. The 17 principles are described as follows:

Fundamental principle for liquidity risk management and supervision:

- A comprehensive liquidity risk management framework must be in place to maintain a sufficient level of liquidity, which will include enough high quality, unencumbered liquid assets to protect the bank from high stress events. Supervisors are responsible for ensuring that the bank's liquidity position is sufficient and that the framework is adequate and functioning as expected.

Liquidity risk management governance:

- A bank's liquidity risk tolerance should be aligned with its role in the financial system and its business strategy.
- Strategies, policies, and practices developed to manage liquidity risk should be in line with the bank's risk tolerance. Senior management should continuously manage liquidity and report to the bank's board of directors. The board should approve these strategies, policies, and practices at least annually and has responsibility for ensuring that senior management is effectively managing liquidity risk.
- For all significant business activities, liquidity costs, benefits, and risks should be incorporated into the new product approval process, internal pricing, and performance measurement.

Liquidity risk measurement and management:

- A sound framework for projecting cash flows should be included in the overall process for capturing and managing liquidity risk.
- Liquidity risk exposures and funding needs should be controlled and actively monitored across business lines, legal entities, and currencies.

- A bank should effectively diversify its funding sources, maintain strong relationships with its fund providers and the overall funding markets, evaluate its capacity to raise funds quickly, and keep a pulse on the factors which impact its fund raising capacity.
- Under normal and stressed market conditions, a bank should be able to meet settlement and payment obligations based on its management of risks and intraday liquidity positions.
- Active management of collateral positions is required, including the differentiation of encumbered versus unencumbered assets, the physical location where assets are held, and the legal entity which holds the assets.
- Stress tests should be conducted regularly to identify where liquidity strain may exist and to make sure that current liquidity exposures align with established risk tolerances. Outcomes from stress tests should be used to adjust liquidity risk management strategies, policies, and positions.
- A formal contingency funding plan (CFP) should be in place which articulates how liquidity shortfalls will be met in emergency situations. A regularly tested and updated CFP should articulate clear responsibilities and outline policies which address managing liquidity in various stress environments.
- A bank should have an identified portfolio of high quality, unencumbered liquid assets which are available without any regulatory, legal, or operational impediments in a range of stressed scenarios.

Disclosure:

- Market participants should be able to assess a bank's liquidity position and the strength of its liquidity risk management framework based on regular, public disclosures.

Supervisory responsibilities:

- Supervisors should comprehensively assess a bank's liquidity position and its liquidity risk management framework.
- Market information, internal reports, and prudential reports should be used by supervisors as supplements to their regular assessments of liquidity positions and the risk management framework.
- Intervention may be needed to address deficiencies in a bank's liquidity position and its risk management processes.
- Regular communication with public authorities and other supervisors is needed, with increased information sharing during stressed market conditions.



MODULE QUIZ 59.2

1. Which of the following statements accurately reflects liquidity management for a financial institution?
 - A. Investments in Treasury securities help a bank increase its risk and return profile.
 - B. Stability in retail deposits over the years has enhanced bank liquidity.
 - C. Central bank borrowings are relatively cheap ways for banks to stay afloat.
 - D. Stressed markets can limit the effectiveness of trading book liquidation strategies.
2. Which of the following factors must be taken into account in the net cash outflows in a 30-day period component of the liquidity coverage ratio (LCR) as required by Basel III?

- A. Complete losses on deposits.
- B. Partial losses of wholesale funding.
- C. Larger haircuts on secured funding.
- D. Two notch reductions in credit ratings.

MODULE 59.3: LIQUIDITY BLACK HOLES AND POSITIVE FEEDBACK TRADING

LO 59.d: Explain liquidity black holes and identify the causes of positive feedback trading.

Liquidity black holes occur when a market exhibits dried up liquidity because of everyone wanting to take the same side of a transaction (e.g., everyone wants to buy or everyone wants to sell). Also known as a *crowded exit*, a frequent occurrence is when price declines lead to investors wanting to sell. As the sell-off occurs, liquidity disappears and investors are only able to sell at prices far below the assets' implicit values.

Trader behavior drives liquidity in financial markets. Traders are categorized as either **positive feedback traders**, who buy when prices rise and sell when they fall, or **negative feedback traders**, who buy when prices fall and sell when they rise. When a market is considered liquid, there is a strong balance of buyers and sellers and negative feedback traders are the dominant group, as buying during price declines and selling during price increases will keep prices relatively stable.

The opposite situation occurs when positive feedback traders dominate, as further purchases when prices rise and further sales as prices decline tend to destabilize the market and create illiquidity. Reasons for positive feedback trading include the following:

- Stop loss rules limit losses for traders by triggering sales whenever an asset's price falls below a specific level.
- Trend trading occurs when traders buy as the asset's price trends higher and sell as the asset's price trends lower. Breakout trading is similar and occurs as the price of an asset moves outside of a specific range.
- Predatory trading occurs when traders who become aware of large, upcoming sales of an asset take short positions to profit from the inevitable price declines.
- A short call (put) option position can be hedged by buying (selling) the underlying after a price increase (decrease). Large short positions held by financial institutions represent a potential risk to market liquidity in the event the hedges described here are executed. Contrast this with dynamic hedging, which involves long positions in calls or puts and hedging via sales after price increases and purchases after price decreases (negative feedback trading).
- A long position in an option is sometimes created synthetically by hedging a short position in the same option. The stock market crash of 1987 was an example of the illiquidity issues created by a positive feedback trading situation. Trading rules (i.e., portfolio insurance) were established which were structured to create

synthetic put options on portfolios worth over \$60 billion. The rules involved buying equities (and futures) when the market increased and selling equities (or index futures) when the market decreased. A steady decline occurred over the course of three days, with much of the 10% decline occurring on a Friday afternoon. The trading models dictated that \$12 billion should have been sold, but with only enough time to sell \$4 billion by the Friday market close, on Monday, October 19, massive sales in this space along with a massive sell-off in the broader market helped cause what is known as *Black Monday*.

- Margin calls occur when investors who are leveraged are required to provide additional collateral as a result of their positions moving unfavorably. When calls cannot be met, investors have to close out positions, which only accentuates the current trend in the underlying asset prices.
- Long Term Capital Management (LTCM) was a U.S. hedge fund firm whose failure in 1998 led to a massive bailout by Wall Street banks looking to prevent a massive and wide-scale economic collapse. LTCM took short positions in liquid bonds and long positions in illiquid bonds, looking to profit from prices moving together. The Russian default led to the price spread widening and the firm, already highly leveraged, could not meet margin calls and was forced to close out their positions (further widening the spread).

Leveraging occurs when more borrowing exists throughout the economy. Banks with excess liquidity extend credit more readily to individuals, investors, and companies. This leads to higher demand for assets (financial and nonfinancial) and price increases. As these assets are often used for collateral, the value of this collateral increases and therefore facilitates additional borrowing. The exact opposite situation is **deleveraging**, which occurs when banks do not have sufficient liquidity and therefore tighten lending. In this scenario, a reduced demand for assets leads to falling prices, falling collateral values, and further reduced borrowing.

Significant rise in the U.S. equity prices in the mid-1990s raised the question of whether the underlying fundamentals fully supported such growth. *Irrational exuberance* was a term coined by Federal Reserve Board chair Alan Greenspan in reference to the stock market at the time, with the concern that reinforcing processes like large asset purchases increasing prices, exhibiting profitability, and attracting more investors who push the prices even higher, can ultimately hide the level of risk inherent in these positions. A similar event occurred in the U.S. housing market in the mid-2000s, as massive year over year price increases led to everybody wanting to participate in the housing market, pushing prices higher until the bubble burst.

Although regulations and uniformity of regulation enforcement globally is beneficial in many ways, liquidity black holes can develop as banks respond similarly to external events. It is important that regulations be applied differently to different types of institutions, as banks have different time horizons and risk profiles than pension funds and life insurance companies. Applying regulations differently creates diversity, which is needed to avoid liquidity black holes as trades should not all have to be executed in the same way at the same time for all financial institutions.



MODULE QUIZ 59.3

1. A highly liquid market tends to result from situations where:

- A. Stop loss rules take effect as prices decline.
- B. Negative feedback traders sell shares as prices rise.
- C. Positive feedback traders purchase shares as prices rise.
- D. Breakout trading occurs because of prices moving outside of a range.

KEY CONCEPTS

LO 59.a

Liquidity relates to a company's ability to make payments in cash as the payments come due. In terms of trading, liquidity relates to the ease in which an investment can be unwound. For any given asset, its sale price is a by-product of its estimated value (or mid-market price), the speed at which the sale needs to occur, the quantity being sold, and the overall economic environment.

For a financial asset with a market maker, there will be both a bid and an offer price. An asset is sold at the bid price (which is the lower value) and purchased at the offer price (which is the higher value), up to a specific contract size. The mid-market price represents the halfway point between the bid and the offer.

Liquidity-adjusted value at risk (LVaR) is a means of estimating VaR while taking into account liquidity risk. VaR can be adjusted for the cost of unwinding positions in both normal and stressed markets.

Traders are often faced with decisions on the speed to which they unwind their positions. A quick unwind will reduce the risk of the mid-market price moving against them, but increase the risk associated with a widening spread. A slow unwind increases market risk, but decreases the risk associated with widening spreads.

An alternative measure of liquidity is the trading volume per day. The higher the volume of trading, the higher the liquidity of the asset.

LO 59.b

Liquidity funding risk is a measure of a firm's ability to meet its cash needs as they come due. This risk can stem from weak financial performance, liquidity stresses resulting in hesitant investors, and funding decisions which often result in mismatches where short-term instruments are used to fund longer-term requirements. The ability of a firm to predict when cash is needed is critical.

A financial institution has six primary sources of liquidity:

- Cash and treasuries
- Retail and wholesale deposits
- Trading book liquidations
- Securitization
- Borrowing ability
- Central bank borrowings

Case studies such as Northern Rock, Ashanti Goldfields, and Metallgesellschaft illustrate the importance of managing liquidity and funding sources and aligning cash inflows with cash needs.

Reserve requirements are often put in place, which require banks to maintain a specific percentage of its transaction deposits either in their vault or with the central bank. The higher the reserve percentage, the bigger the negative impact on the country's money supply.

LO 59.c

Liquidity risk requirements introduced by Basel III include the liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR).

Liquidity Coverage Ratio:

$$\frac{\text{high-quality liquid assets}}{\text{net cash outflows in a stressed 30-day period}} \geq 100\%$$

Net Stable Funding Ratio:

$$\frac{\text{amount of stable funding}}{\text{required amount of stable funding}} \geq 100\%$$

BIS principles, developed as a result of the 2007 liquidity crisis, speak to how banks need to manage liquidity. The 17 principles cover fundamental principles for risk management and supervision, risk management governance, risk measurement and management, disclosure, and supervisory responsibilities.

LO 59.d

Liquidity black holes occur when a market exhibits dried up liquidity due to everyone wanting to take the same side of a transaction. Positive feedback traders buy when prices rise and sell when they fall. Negative feedback traders buy when prices fall and sell when they rise. When a market is considered liquid, there is a strong balance of buyers and sellers and negative feedback traders are the dominant group. The opposite situation occurs when positive feedback traders dominate, as further purchases when prices rise and further sales as prices decline tend to destabilize the market and create illiquidity. Reasons for positive feedback trading include the following: stop loss rules limit losses, trend and breakout trading, predatory trading, hedges on large short-option positions, synthetic trading rules, and unmet margin calls on large hedge positions.

Leveraging occurs when more borrowing exists throughout the economy as banks are looser with extending credit. Deleveraging occurs when banks do not have liquidity and are therefore tighter with extending credit.

It is important that regulations be applied differently to different types of institutions, as banks have different time horizons and risk profiles than pension funds and life insurance companies.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 59.1

1. **B** For the stock owned by Rigues, the mid-market value is the middle point between the bid and offer price multiplied by the number of shares: $\$11.625 \times 5 \text{ million}$

shares = \$58,125,000.

The proportional bid-offer spread is equal to the difference between the bid and offer prices divided by the mid-market value: $\$2.25 / \$11.625 = 0.193548$

The cost of liquidation is therefore $\$58,125,000 \times (0.193548 / 2) = \$5,625,000$. (LO 59.a)

Module Quiz 59.2

1. **D** Stressed markets create liquidity challenges, and trading book liquidations that may be effective in normal market conditions may be heavily compromised in stressed market conditions. Treasury investments reduce risk, but that comes with lower expected return. Retail deposits have become less stable, as investors can easily move their funds across banks as they search for higher interest rates. Central bank borrowings are costly, as they come with a high interest rate, a haircut, and a potentially negative signal to the market. (LO 59.b)
2. **C** Higher haircuts on secured funding is one of the components that needs to be taken into account in the LCR calculation, along with partial losses on deposits, 100% losses on wholesale funding, line of credit drawdowns, and three notch reductions in credit ratings. (LO 59.c)

Module Quiz 59.3

1. **B** Negative feedback traders who sell shares as prices rise will help to create liquidity and price stability in the market. Stop loss rules as prices decline will only accentuate the decline, reducing liquidity. Positive feedback traders who purchase more shares as prices rise and breakout trading strategies which build on the trend as prices move outside of a range also contribute to illiquidity. (LO 59.d)

¹ Yakov Amihud, "Illiquidity and Stock Returns: Cross Section and Time-Series Effects," *Journal of Financial Markets* 5 (2002): 31–56.

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Malz, Chapter 12.

READING 60

LIQUIDITY AND LEVERAGE

Study Session 10

EXAM FOCUS

This reading analyzes the effects of liquidity and leverage on firm risk. For the exam, understand the distinction between transactions liquidity and funding liquidity, and the role banks play in providing liquidity. Also, be able to calculate a firm's leverage ratio and the leverage effect, and know how to construct the economic balance sheet given trades such as buying stock on margin, selling stock short, and taking positions in derivatives. Finally, be able to explain tightness, depth, and resiliency as they relate to liquidity risk.

MODULE 60.1: SOURCES OF LIQUIDITY RISK, LIQUIDITY TRANSFORMATION, AND SYSTEMATIC FUNDING

Sources of Liquidity Risk

LO 60.a: Differentiate between sources of liquidity risk and describe specific challenges faced by different types of financial institutions in managing liquidity risk.

LO 60.g: Discuss interactions between different types of liquidity risk and explain how liquidity risk events can increase systemic risk.

Liquidity is defined in many ways in financial markets. In general, an asset is liquid if it is “close to cash.” This means that the asset can be sold quickly, cheaply, and without moving the price “too much.” A market is liquid if positions can be unwound quickly, cheaply (i.e., at low transactions costs), and without undue price deterioration.

Liquidity has two essential properties, which relate to two essential forms of risk. **Transactions liquidity** deals with financial assets and financial markets. **Funding liquidity** is related to an individual's or firm's creditworthiness. Risks associated with liquidity include:

- **Transactions (or market) liquidity risk** is the risk that the act of buying or selling an asset will result in an adverse price move.

- **Funding liquidity risk** or **balance sheet risk** results when a borrower's credit position is either deteriorating or is perceived by market participants to be deteriorating. It also occurs when the market as a whole deteriorates. Under these conditions, creditors may withdraw credit or change the terms of credit (e.g., increase the required collateral for the loan). The position may, as a result, be unprofitable or may need to be unwound. Balance sheet risks are higher when borrowers fund longer term assets with shorter term liabilities. This is called a **maturity mismatch**. Maturity mismatching is often profitable for firms because short-term investors bear less risk and have a lower required rate of return. This means that short-term debt financing contributes less to the overall cost of capital of a borrowing firm. The incentive to maturity mismatch is even greater when the yield curve is upward sloping. However, funding long-term assets with short-term financing exposes the borrower to **rollover risk** (sometimes called cliff risk), the risk that the debt cannot be refinanced or can only be refinanced at escalating rates.
- **Systemic risk** is the risk that the overall financial system is impaired due to severe financial stress. With this risk, credit allocation is impaired across the financial system.

Risks associated with liquidity are interrelated and can exacerbate problems. For example, if collateral requirements are increased, a counterparty may be forced to unwind a position early and at a potential loss. In this case, the increase in funding liquidity risk increases the transactions liquidity risk.

An important connection between funding and transactions liquidity is leverage. An investor with a long position may be forced to sell an asset if future funding for the asset dries up. This in turn would reduce the number of potential asset holders, leading to a reduction in asset valuation. It may be the case that this decline in price is temporary, however, the length of the depressed asset price could be long enough to adversely impact the solvency of the investor who initially purchased the asset. A rapid deleveraging of assets could lead to a "debt-deflation crisis."

Transactions liquidity could also impair funding liquidity. For example, if a hedge fund is facing redemptions, it is forced to raise cash by selling assets and therefore must decide which assets to sell first. Selling highly liquid assets will lead to fewer adverse price impacts, but will leave the hedge fund with a more illiquid portfolio. On the other hand, selling highly illiquid assets will increase realized losses, which may put additional pressure on the portfolio from a funding liquidity standpoint.

The level of economy-wide liquidity directly impacts the level of systemic risk. When market conditions deteriorate, liquidity tends to become constrained just when investors need it the most. Liquidity risk events could potentially become systemic risk events through disruptions in payment, clearing, and settlement systems. Severe stress to the financial system would impact market participants simultaneously, suggesting that the illiquidity or insolvency of one counterparty may have a domino effect on other market participants throughout the system.

Liquidity Transformation by Banks

LO 60.b: Summarize the asset-liability management process at a fractional reserve bank, including the process of liquidity transformation.

Commercial bank assets are typically longer-term and less liquid than bank liabilities (e.g., deposits). Wholesale funding (i.e., non-deposit sources of funding like commercial paper, bonds, and so on) is generally longer term but deposits are “sticky.” Depositors generally change banks only if impelled to by a move or some other extenuating circumstance. Deposits make up approximately 60% of bank liabilities in the United States.

Banks only expect a fraction of deposits and other liabilities to be redeemed at any point in time. As a result, they do not hold all the deposits in liquid assets, but make loans with deposits instead. For example, a bank might take in \$100 of deposits, hold \$10 for redemptions, and lend the remaining \$90. This is known as a **fractional-reserve bank** and the process of using deposits to finance loans is known as **asset-liability management (ALM)**.

The bulk of banks in history have been fractional-reserve banks. The alternative to a fractional-reserve system is one in which the bank uses owners’ money (i.e., equity) or money raised in capital markets to make loans, and keeps in reserve cash or highly liquid assets equal to its deposits.

If withdrawals are greater than the bank’s reserves, the bank is forced into a **suspension of convertibility**. This means the bank will not be able to, as expected by depositors, convert deposits immediately into cash. In the extreme, there may even be a **run on the bank**. In the case of a bank run, depositors who are concerned about bank liquidity may attempt to get money out of the bank before other depositors and lenders. While rollover risk associated with other short-term financing is less extreme than bank runs, it does increase the fragility of banks. Higher capital reduces bank fragility.

Frozen commercial paper markets in the wake of the Lehman Brothers failure illustrated the fragility of bank funding. Commercial funding couldn’t be placed and thus fell dramatically after the Lehman bankruptcy. It became nearly impossible to roll over longer term paper and very short-term paper rose to account for approximately 90% of the market. The Federal Reserve stepped in after the Lehman bankruptcy and created the Commercial Paper Funding Facility (CPFF) and the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF).

Structured Credit Products and Off-Balance Sheet Vehicles

Structured credit products, such as asset-based securities (ABSs) and mortgage-backed securities (MBSs), match investor funding needs with pooled assets. Because these products are maturity matched, they are not subject to funding liquidity issues. However, investor financing for structured credit products can create liquidity risk when investors rely on short-term financing. This type of financing was one of the main drivers of the 2007 to 2009 subprime crisis and the increase in leverage in the financial system leading up to the crisis. Two types of short-term financing include: (1)

securities leading (i.e., applying structured credit products as collateral to short-term loans), and (2) off-balance sheet vehicles.

Special-purpose vehicles (SPVs) serve as off-balance sheet vehicles by issuing secured debt in the form of asset-backed commercial paper (ABCP). **ABCP conduits** finance purchases of assets, such as securities and loans, with ABCP. They receive liquidity and credit support via credit guarantees. **Structured investment vehicles (SIVs)** differ slightly from ABCP conduits because they do not receive full liquidity and credit support.

Prior to the subprime crisis, both ABCP conduits and SIVs profited from the spread between funding costs and asset yields. The assets held by these vehicles typically had longer maturities than the ABCP that fund the assets. In addition to maturity transformation, these vehicles also provided liquidity transformation. This was accomplished by creating ABCP that was more liquid and had shorter terms than the assets held in the conduit and SIV. However, despite being off-balance sheet, which permitted firms to hold less capital, these vehicles did not entirely transfer risk. As a result, they still contributed to the leverage issues and fragility of the financial system during the subprime crisis.

Systematic Funding Liquidity Risk

Systematic funding risks were apparent in many market sectors during the subprime mortgage crisis. As loans become shorter term, lenders and borrowers are exposed to greater liquidity risks. Borrowers must be able to refinance in order to repay short-term loans. The risk is systematic in that it affects borrowers and lenders at the same time.

Liquidity issues arose during the financial crisis of 2007–2009 for a variety of investment strategies including:

- **Leveraged buyouts (LBOs).** Leveraged loans became the dominate type of syndicated bank loans as LBOs and private equity grew before the crisis. Leveraged loans accounted for a large part of collateralized loan obligations (CLOs) and collateralized debt obligations (CDOs), which provided funding for LBOs. During the subprime mortgage crisis, LBO deals fell apart as funding dried up. Some loans, called “hung loans,” had not been distributed to investors and demand dried up. Banks incurred significant losses as prices fell sharply.
- **Merger arbitrage hedge funds.** Hedge funds engaged in merger arbitrage experienced losses in the early stages of the subprime mortgage crisis. After a merger is announced, the target’s stock price typically increases and the acquirer’s price sometimes declines due to increased debt. The merger arbitrage strategy exploits the difference between the current and announced acquisition prices. Hedge funds experienced large losses as mergers were abandoned when financing dried up.
- **Convertible arbitrage hedge funds.** Convertible arbitrage strategies rely on leverage to enhance returns. Credit is extended by broker-dealers. When financing becomes unavailable due to market conditions, as experienced in the 2007–2009 financial crisis, convertible bond values drop precipitously. The funding liquidity problem was compounded by redemptions (i.e., a market liquidity problem). Also,

because there is a limited clientele investing in convertible bonds, when the clientele develops a dislike for the product due to deteriorating market conditions, it is difficult to sell the assets without large price declines. The gap between convertible bond prices and replicating portfolios widened dramatically during the financial crisis, but it still did not bring arbitrage capital into the market.

The broader point is that investment strategies, such as merger arbitrage, convertible arbitrage, and leveraged buyouts, are not only exposed to idiosyncratic risks, but also to systematic risks (i.e., systematic funding risks in this case). The risks are soft risks because they are difficult to relate to a particular series of asset returns. Instead, analysts must examine data on credit and liquidity spreads as well as quantitative and anecdotal data on the availability of credit in the market to understand the probability of a liquidity freeze.

Money market mutual fund (MMMF) investors can write checks and make electronic bank transfers. Like banks, MMMFs are obligated to repay investors/depositors on demand. In general, underlying MMMF assets are high credit quality instruments with short maturities (e.g., a few weeks to a few months). However, the values of the underlying assets in the fund, despite their relative safety, are subject to change. As such, redemptions may be limited if asset values fall. The liabilities of MMMFs are, therefore, more liquid than their investments, similar to banks.

MMMFs use a form of accounting called the amortized cost method, under the Securities and Exchange Commission's (SEC) Rule 2a-7. This means that MMMF assets do not have to be marked-to-market each day, as required for other types of mutual funds. The reason behind the difference is that extremely short-term securities are not likely to revalue based on changes in interest rates and credit spreads. MMMFs set a notional value of each share equal to \$1.00. However, credit write-downs cannot be disregarded and it is possible for net asset values (NAVs) to fall below \$1.00. This is known as **breaking the buck**.

Liquidity risk can also cause NAVs to fall below \$1.00. MMMFs, like depository institutions, are subject to runs. If a large proportion of investors try to redeem shares in adverse market conditions, the fund may be forced to sell money market paper at a loss. This can potentially result in write-downs and breaking the buck.



MODULE QUIZ 60.1

1. Jackson Grimes, a trader for Glenn Funds, works on the repurchase agreement (repo) desk at his firm. Markets have been highly volatile but Glenn Funds has a large capital base and is sound. Grimes reports to the CEO that in the last month, the firm Glenn Funds borrows from has been consistently increasing collateral requirements to roll over repos. From the perspective of Glenn Funds, this represents:
 - A. systematic risk.
 - B. transactions liquidity risk.
 - C. balance sheet risk.
 - D. maturity transformation risk.
2. Chris Clayton, an analyst for a private equity fund, noticed that merger arbitrage strategies at several hedge funds experienced large losses in late 2007 to early 2008. These losses were likely due to:
 - A. abandoned merger plans due to a lack of available financing.

- B. target prices falling precipitously due to stock market corrections.
 - C. acquirers filing for bankruptcy as the subprime mortgage crisis unfolded.
 - D. idiosyncratic risks surrounding the merger arbitrage strategy.
3. With respect to the valuation of money market mutual fund (MMMF) assets, funds:
- A. are not required to mark-to-market the underlying assets daily.
 - B. must reflect changes in the values of underlying assets that are the result of changes in credit risks but may ignore value changes that are the result of changes in interest rates.
 - C. will set the notional values of each of the underlying assets equal to \$1.00.
 - D. are not allowed to invest in any asset with a rating below AAA because asset values must not fluctuate outside of a 10% range around the historical value in order to keep the notional value equal to \$1.00.

MODULE 60.2: THE COLLATERAL MARKET AND LEVERAGE

Economics of the Collateral Market

LO 60.c: Compare transactions used in the collateral market and explain risks that can arise through collateral market transactions.

Collateral markets have two important purposes. First, they enhance the ability of firms to borrow money. Cash is only one type of asset that is borrowed. Securities are also borrowed in collateral markets. Second, collateral markets make it possible to establish short positions in securities.

Firms with excess cash are more willing to lend at a low rate of interest if the loan is secured by collateral. Securities are used as collateral for secured loans. Collateralized loans can be short term or longer term. Overnight loans are often extended automatically. The full value of the securities is not lent in a collateralized loan. The difference is called a **haircut**. For example, a lender may be willing to lend \$95 against \$100 of collateral.

Collateral values fluctuate and most collateralized borrowing arrangements require that variation margin be paid to make up the difference (called **remargining**). Variation margin is the additional funds a broker requests so that the initial margin requirement keeps up with losses. The haircut ensures that the value of the collateral can fall by a certain percentage (i.e., 5% in the previous example) and still leave the loan fully collateralized. The variation margin protects the lender.

Collateralized loans are used to finance securities or other assets or trades. The securities pledged to one firm are often loaned or pledged again, hence the collateral circulates. This process is known as **rehypothecation** or **repledging**.

The role of collateral has expanded in contemporary finance, hand-in-hand with the development of securitization. Securitization creates securities that can be pledged as collateral for credit. Securitized assets generate cash flows, may appreciate in value, and can be used as collateral for other transactions.

Life insurance companies own large portfolios of high-quality assets. They may use these assets for collateralized loans to borrow at low rates and reinvest at higher rates. Hedge funds pledge securities to finance portfolios at rates cheaper than unsecured loans.

Markets for collateral take the following forms:

- **Margin loans.** Margin loans are used to finance security transactions. The margin loan is collateralized by the security and is often provided by the broker intermediating the trade. The broker maintains custody of the securities in a street name account (i.e., securities are registered in the name of the broker rather than the owner). This structure makes it easier to seize and sell securities to meet margin calls. An added advantage to the broker is that securities in street name accounts can be used for other purposes, such as lending to other customers for short sales. In practice, the broker uses the customer's collateral to borrow money in the money market to provide margin loans to customers. The margin loan to the broker is collateralized by the repledged customer collateral. The Federal Reserve's Regulation T sets the initial margin requirement for securities purchases at 50%. **Cross-margin agreements** are used to establish the net margin position of investors with portfolios of long and short positions. In general, cross margin involves transferring excess margin in one account to another account with insufficient margin, resulting in lower overall margin for the investor.
- **Repurchase agreements or repos.** Repurchase agreements, also known as repos and RPs, are another form of collateralized short-term loans. They involve the sale of a security at a forward price agreed upon today. The interest on the loan is implied from the difference between spot and forward prices of the securities. While traditionally collateral had little or no credit risk (collateral was usually Treasury bills), today acceptable collateral encompasses whole loans, high-yield bonds, and structured credit products. Repos allow banks and other firms to finance inventories of structured credit products and allow for high investment grade ratings for senior tranches of asset-backed securities (ABSs) and collateralized debt obligations (CDOs).
- **Securities lending.** Securities lending involves the loan of securities to another party in exchange for a fee, called a **rebate**. The lender of the securities continues to receive the dividends and interest cash flows from the securities. Lenders of securities are often hedge funds or other large institutional investors of equities. Securities are held in street name accounts to make them available for lending to traders who want to short stocks. Fixed income securities lending typically involves the loan of Treasury securities for cash. The cash is invested in a higher risk bonds and the investor's objective is to earn the spread between the two.
- **Total return swaps.** In a total return swap (TRS), one party pays a fixed fee in exchange for the total return (both income and capital gains) on a reference asset, typically a stock. The advantage is that the party paying the fee can earn the return from the underlying asset without owning the asset. The party providing the return (such as a hedge fund) is, in essence, short the asset.



Securities lending, like repurchase agreements, are often structured as sales of securities, not loans of securities, so the holder of the collateral can rehypothecate the securities, or even sell them in a timely fashion if the loan is not repaid.

Leverage Ratio and Leverage Effect

LO 60.d: Describe the relationship between leverage and a firm's return profile (including the leverage effect) and distinguish the impact of different types of transactions on a firm's leverage and balance sheet.

A firm's **leverage ratio** is equal to its assets divided by equity (total assets / equity). That is:

$$L = \frac{A}{E} = \frac{(E + D)}{E} = 1 + \frac{D}{E}$$

For an all-equity financed firm, the ratio is equal to 1.0, its lowest possible value. As debt increases, the leverage ratio (i.e., multiplier) increases. For example, a firm with \$100 of assets financed with \$50 debt and \$50 equity has a leverage ratio equal to 2.0 (= \$100 / \$50).

Return on equity (ROE) is higher as leverage increases, as long as the firm's return on assets (ROA) exceeds the cost of borrowing funds. This is called the **leverage effect**. The leverage effect can be expressed as:

$$r_E = Lr_A - (L - 1)r_D$$

where:

r_A = return on assets

r_E = return on equity

r_D = cost of debt

L = leverage ratio

It may help to think of this formula in words as follows:

$$\text{ROE} = (\text{leverage ratio} \times \text{ROA}) - [(\text{leverage ratio} - 1) \times \text{cost of debt}]$$

For a firm with a zero cost of debt, return on equity is magnified by the leverage factor; however, debt is not free. Thus, return on equity (ROE) increases with leverage, but the cost of borrowing, because there is more debt, also increases. The $L - 1$ factor multiplies the cost of debt by the proportion of the balance sheet financed with debt. For example, with a leverage ratio of 2, 50% of the balance sheet is financed with debt and 50% with equity. So for every \$2 of assets, \$1 comes from shareholders and \$1 comes from borrowed funds. We multiply the cost of debt by 1 in this case. If the leverage ratio is 4, 25% is financed with equity and 75% is financed with debt. Thus, for every \$4 of assets, \$1 is equity and \$3 is borrowed funds. In the formula, we multiply the cost of debt by 3. The higher the leverage factor, the bigger the multiplier but also the higher the debt costs. Leverage amplifies gains but also magnifies losses. That is why leverage is often referred to as a double-edged sword.

The effect of increasing leverage is expressed as:

$$\partial r_E / \partial L = r_A - r_D$$

where:

∂r_E = change in retained earnings

∂L = change in the leverage ratio

This formula implies that, given a change in the leverage ratio, ROE changes by the difference between ROA and the cost of debt.

The equity in the denominator of the leverage ratio depends on the entity. If it is a bank, it may be the book value of the firm. It might also be calculated using the market value of the firm. The net asset value (NAV) of a fund is the appropriate denominator for a hedge fund. The NAV reflects the current value of the investors' capital in the fund.

EXAMPLE: Computing firm ROE (total assets = \$2)

Martin, Inc., a U.S. manufacturing company, has an ROA equal to 5%, total assets equal to \$2, and equity financing equal to \$1. The firm's cost of debt is 2%. **Calculate** the firm's ROE.

Answer:

$$r_E = Lr_A - (L - 1)r_D$$

$$r_E = [(2 / 1) \times 5\%] - [(2 - 1) \times 2\%] = 8\%$$

EXAMPLE: Computing firm ROE (total asset = \$4)

Martin, Inc., a U.S. manufacturing company, has an ROA equal to 5%, total assets equal to \$4, and equity financing equal to \$1. The firm's cost of debt is 2%. **Calculate** the firm's ROE.

Answer:

$$r_E = Lr_A - (L - 1)r_D$$

$$r_E = [(4 / 1) \times 5\%] - [(4 - 1) \times 2\%] = 14\%$$

Given a cost of debt of 2%, increasing the leverage factor from 2 to 4 increased the firm's ROE from 8% to 14%.

Leverage is also influenced by the firm's hurdle rate (i.e., required ROE). For example, assume a firm's hurdle rate (i.e., ROE) is 10%, ROA equals 6%, and its cost of debt equals 2%. The firm will choose a leverage ratio of 2.0. That is:

$$ROE = (2 \times 6\%) - (1 \times 2\%) = 10\%$$

Margin Loans and Leverage

Purchasing stock on margin or issuing bonds are examples of using leverage explicitly to increase returns. However, there are other transactions that have implicit leverage. It is important to understand the **embedded leverage** in short positions and derivatives,

such as options and swaps. By constructing economic balance sheets for investors and/or firms, it is possible to measure the implicit leverage of these transactions.

When considering margin loans, the stock purchased with the margin loan is collateral for the loan. The haircut (h) is the borrower's equity and $1 - h$ is loaned against the market value of the collateral. The leverage is calculated as $1 / h$. The Federal Reserve requires that an investor put up a minimum of 50% equity (i.e., $h = 50\%$) in a stock purchase using borrowed funds.

First, assume that a firm has \$100 cash invested by the owners (i.e., no borrowed funds). The balance sheet in this case is:

Assets		Liabilities and Equity	
		Debt	\$0
<u>Cash</u>	<u>\$100</u>	<u>Equity</u>	<u>\$100</u>
Total assets	\$100	TL and OE	\$100

If the firm uses the cash to purchase stock, the balance sheet is:

Assets		Liabilities and Equity	
		Debt	\$0
<u>Stock</u>	<u>\$100</u>	<u>Equity</u>	<u>\$100</u>
Total assets	\$100	TL and OE	\$100

Thus, the leverage ratio is equal to 1 (i.e., \$100 / \$100 or 1.0 / 1.0).

Assume instead that the firm uses 50% borrowed funds and invests 50% (i.e., $h = 50\%$) equity to buy shares of stock. Immediately following the trade, the margin account balance sheet has 50% equity and a \$50 margin loan from the broker. That is:

Assets		Liabilities and Equity	
		Margin loan	\$50
<u>Stock</u>	<u>\$100</u>	<u>Equity</u>	<u>\$50</u>
Total assets	\$100	TL and OE	\$100

The full economic balance sheet as a result of the borrowed funds (remember, owners put in \$100 of equity initially so the firm now has \$100 of stock and \$50 of cash) is:

Assets		Liabilities and Equity	
Cash	\$50	Margin loan	\$50
<u>Stock</u>	<u>\$100</u>	<u>Equity</u>	<u>\$100</u>
Total assets	\$150	TL and OE	\$150

Thus, the leverage ratio has increased to 1.5 (i.e., \$150 / \$100 or 1 / 0.667). Note that the broker retains custody of the stock to use as collateral for the loan.

Short Positions and Leverage

In a short trade, the investor borrows the shares of stock and sells them. The transaction lengthens the balance sheet because the cash generated from the short sale along with the value of the borrowed securities appear on the balance sheet.

Assume the firm borrows \$100 of stock and sells it short. The firm has an asset equal to the proceeds from selling the stock and a liability equal to the value of the borrowed shares. However, the firm cannot use the cash for other investments as it is collateral. It ensures that the stock can be repurchased and returned to the lender. It is in a segregated short account. In the event that the stock price increases rather than decreases, the firm must also put \$50 in a margin account.

Immediately following the trade, the margin account and short account has \$50 equity and a \$50 margin loan from the broker.

Assets		Liabilities and Equity	
\$150 due from broker:			
Margin	\$50	Borrowed stock	\$100
<u>Short sale proceeds</u>	<u>\$100</u>	<u>Equity</u>	<u>\$50</u>
Total assets	\$150	TL and OE	\$150

The firm's full economic balance sheet given the short sale is:

Assets		Liabilities and Equity	
Cash	\$50	Borrowed stock	\$100
<u>Due from broker</u>	<u>\$150</u>	<u>Equity</u>	<u>\$100</u>
Total assets	\$200	TL and OE	\$200

Thus, the leverage ratio has increased to 2.0 (i.e., \$200 / \$100 or 1 / 0.50). The leverage is higher in this case than in the previous margin example because the full value of the stock is borrowed in a short transaction. Leverage is inherent in the short position but is a choice in the long position. The firm only borrows 50% of the balance of the stock in the long position.

If the short position plays a hedging role in the portfolio, the position will reduce market risk. This means that leverage will overstate the overall risk because it ignores the potential risk reducing benefits of the short positions. As such, a distinction must be made between gross and net leverage. **Gross leverage** is the value of all the assets, including cash generated by short sales, divided by capital. **Net leverage** is the ratio of the difference between the long and short positions divided by capital.

Derivatives and Leverage

Derivatives allow an investor to gain exposure to an asset or risk factor without actually buying or selling the asset. Derivatives also allow investors to increase leverage. Although derivatives are generally off-balance sheet, they should be included on the economic balance sheet as they affect an investor's returns. Derivatives are synthetic long and short positions. To estimate the economic balance sheet, find the **cash-equivalent market value** for each type of derivative. Derivatives include:

- **Futures, forward contracts, and swap contracts.** These contracts are linear and symmetric to the underlying asset price. The amount of the underlying instrument represented by the derivative is set at the initiation of the contract so values can be represented on the economic balance sheet by the market value of the underlying asset. These contracts have zero net present values (NPVs) at initiation.
- **Option contracts.** These contracts have a non-linear relationship to the underlying asset price. The amount of the underlying represented by the option changes over time. The value can be fixed at any single point in time by the option delta. Thus, on the economic balance sheet, the cash equivalent market values can be represented by the delta equivalents rather than the market values of the underlying assets. These contracts do not have zero NPVs at initiation because the value is decomposed into an **intrinsic value** (which may be zero) and a **time value** (which is likely not zero).

In this next example, the counterparty is assumed to be the prime broker or broker-dealer executing the positions. This means that margin will be assessed by a single broker on a portfolio basis.

First, assume the firm enters a 1-month currency forward contract and is short \$100 against the euro and the 1-month forward exchange rate is \$1.25 per euro. The balance sheet is:

Assets		Liabilities and Equity	
\$100 equivalent of €80 bank deposit		Broker loan	\$100

Now, assume the firm buys a 3-month at-the-money call option on a stock index with an underlying index value of \$100. The call's delta is currently 50%. The transaction is equivalent to using a \$50 broker loan to buy \$50 of the stock index. That is:

Assets		Liabilities and Equity	
\$50 long index position	\$50	Broker loan	\$50

Next, assume the firm enters a short equity position via a total return swap (TRS). The firm pays the total return on \$100 of ABC stock and the cost of borrowing the ABC stock (i.e., the short rebate). This is equivalent to taking a short position in ABC. Assuming the market price of ABC is \$100, we have:

Assets		Liabilities and Equity	
\$100 due from broker (proceeds from short sale)	\$100	Borrowed ABC stock	\$100

Finally, assume the firm adds short protection on company XYZ via a 5-year credit default swap (CDS) with a notional value of \$100. This position is equivalent to a long position in a par-value 5-year floating rate note (FRN) financed with a term loan.

The firm's combined economic balance sheet that includes all of the derivatives positions is:

Assets		Liabilities and Equity	
Cash	\$50	Short-term broker loan	\$150
Due from broker	\$150		
\$50 margin			
\$100 short sale proceeds		Term loan	\$100
Equivalent of €80 bank deposit	\$100	Borrowed ABC stock	\$100
Long equity index	\$50		
<u>XYZ FRN</u>	<u>\$100</u>	<u>Equity</u>	<u>\$100</u>
Total assets	\$450	TL and OE	\$450

The firm has increased its leverage to 3.5 in its long positions. The long positions combined with the short position (the ABC TRS) means the firm has gained economic exposure to securities valued at \$450 using \$50 of cash.

Notice that computing leverage is complex when derivatives are used. Also, correctly interpreting leverage is important since risk may be mitigated if short positions are used to hedge. For example, currency and interest rate risks can be hedged accurately. However, the positions are of the same magnitude as the underlying assets. If the positions are carried on the economic balance sheet, leverage will be overstated and other material risks in the portfolio may be ignored.



MODULE QUIZ 60.2

1. Charleston Funds intends to use leverage to increase the returns on a convertible arbitrage strategy. The return on assets (ROA) of the strategy is 8%. The fund has \$1,000 invested in the strategy and will finance the investment with 75% borrowed funds. The cost of borrowing is 4%. The return on equity (ROE) is closest to:
 - A. 4%.
 - B. 32%.
 - C. 20%.
 - D. 12%.
2. Assume a broker provides a margin loan to a U.S. hedge fund that puts up the minimum equity amount required by the Federal Reserve. If the hedge fund wants to take a \$250,000 equity position, determine the margin loan amount and the leverage ratio of this position.
 - A. Margin loan = \$125,000; leverage ratio = 1.0.
 - B. Margin loan = \$125,000; leverage ratio = 2.0.
 - C. Margin loan = \$250,000; leverage ratio = 0.0.
 - D. Margin loan = \$250,000; leverage ratio = 1.0.

MODULE 60.3: FUNDING AND TRANSACTIONS, LIQUIDITY RISK, AND TRANSACTIONS COST

Sources of Transactions Liquidity Risk

LO 60.e: Distinguish methods to measure and manage funding liquidity risk and transactions liquidity risk.

An asset is liquid if it resembles money. That is, it can be exchanged for goods or services quickly and at a certain value. However, assets have to be liquidated in order to buy goods and services because we do not have a barter economy.

Transactions liquidity implies that an asset can be bought or sold without moving its price. However, large transactions may move an asset's price because they create a short-term imbalance between supply and demand. Transactions liquidity risk is fundamentally related to the costs of searching for a counterparty, the institutions required to assist in that search, and the costs of inducing a counterparty to hold a position.

In order to understand transactions liquidity risk, it is important to understand market microstructure fundamentals. These fundamentals are:

- **Trade processing costs.** The first cost is associated with finding a counterparty in a timely fashion. In addition, processing costs, clearing costs, and the costs of settling trades must also be considered. These costs do not typically increase liquidity risk except in circumstances, either natural or man-made, where the trading infrastructure is affected.
- **Inventory management.** Dealers provide trade immediacy to market participants. The dealer must hold long or short inventories of assets and must be compensated by price concessions. This risk is a volatility exposure.
- **Adverse selection.** There are informed and uninformed traders. Dealers must differentiate between liquidity or noise traders and information traders. Information traders know if the price is wrong. Dealers do not know which of the two are attempting to trade and thus must be compensated for this lemons risk through the bid-ask spread. The spread is wider if the dealer believes he is trading with someone who knows more than he does. However, the dealer does have more information about the flow of trading activity (i.e., is there a surge in either buy or sell orders).
- **Differences of opinion.** It is more difficult to find a counterparty when market participants agree (e.g., the global financial crisis where counterparties were afraid to trade with banks because everyone agreed there were serious problems) than when they disagree. Investors generally disagree about the correct or true price on an asset and about how to interpret new information about specific assets.

These fundamentals differ across different types of market organizations. For example, in a quote-driven system, common in over-the-counter (OTC) markets, market makers are expected to publicly post 2-way prices or quotes and to buy or sell at those prices within identified transaction size limits. In contrast, order-driven systems, typically found on organized exchanges, are more similar to competitive auction models. Typically the best bids and offers are matched throughout the trading session.

Liquidity risks are introduced when bid-ask spreads fluctuate, when the trader's own actions impact the equilibrium price of the asset (called **adverse price impact**) and when the price of an asset deteriorates in the time it takes a trade to get done (called **slippage**).

In general, regulators have focused more on credit and market risks and less on liquidity risk. Liquidity risk is difficult to measure. However, since the financial crisis, more attention is being paid to measuring liquidity risks in a firm.

Transactions Cost

LO 60.f: Calculate the expected transactions cost and the spread risk factor for a transaction and calculate the liquidity adjustment to VaR for a position to be liquidated over a number of trading days.

Assuming that daily changes in the bid-ask spread are normally distributed, the 99% confidence interval on the transactions cost in dollars is:

$$+/- P \times \frac{1}{2}(s + 2.33\sigma_s)$$

where:

P = an estimate of the next day asset midprice, usually set to P , the most recent price observation

s = expected or typical bid-ask spread calculated as: (ask price – bid price) / midprice

σ_s = sample standard deviation of the spread

This confidence interval estimates the expected transactions costs in dollar terms. The $\frac{1}{2}(s + 2.33\sigma_s)$ component is referred to as the 99% **spread risk factor**.

EXAMPLE: Computing transactions cost

Brieton, Inc., recently traded at an ask price of \$100 and a bid price of \$99. The sample standard deviation of the spread is 0.0002. **Calculate** the expected transactions cost and the 99% spread risk factor for a transaction.

Answer:

$$\text{midprice} = (100 + 99) / 2 = 99.50$$

$$s = (100 - 99) / 99.5 = 0.01005$$

$$\text{transactions cost} = 99.50 \times \frac{1}{2}[0.01005 + 2.33(0.0002)] = \$0.523$$

$$\text{spread risk factor} = \frac{1}{2}[0.01005 + 2.33(0.0002)] = 0.005258$$

Note that in this example, we use the current midprice as the estimate for the next day asset midprice.

Adjusting VaR for Position Liquidity

Liquidity-adjusted value at risk (LVaR) is a tool used to measure the risk of adverse price impact. The trader will often liquidate the position over a period of days in order to ensure an orderly liquidation of the position.



PROFESSOR'S NOTE

The calculation of liquidity-adjusted VaR was shown in Reading 59. Here we discuss how VaR may be overstated when adjusting for different time horizons

(via the square root of time rule). The reason is because this adjustment does not account for the liquidation of positions over the time period of analysis.

Adjusting VaR for liquidity requires an estimate of the number of days it will take to liquidate a position. The number of trading days is typically denoted T . Assuming the position can be divided into equal parts across the number of trading days and liquidated at the end of each trading day, a trader would face a 1-day holding period on the entire position, a 2-day holding period on a fraction $(T - 1) / T$ of the position, a 3-day holding period on a fraction $(T - 2) / T$ of the position, and so on. The 1-day position VaR adjusted by the square root of time is estimated for a given position as:

$$VaR_t \times \sqrt{T}$$

However, this formula overstates VaR for positions that are liquidated over time because it assumes that the whole position is held for T days. To adjust for the fact that the position could be liquidated over a period of days, the following formula can be used:

$$VaR_t \times \sqrt{\frac{(1 + T)(1 + 2T)}{6T}}$$

For example, if the position can be liquidated in four trading days ($T = 4$), the adjustment to the overnight VaR of the position is 1.3693, which means we should increase VaR by 37%. This is greater than the initial 1-day VaR, but less than the 1-day VaR adjusted by the square root of T .

Measuring Market Liquidity

Factors such as tightness, depth, and resiliency are characteristics used to measure market liquidity.

- **Tightness** (or **width**) refers to the cost of a round-trip transaction, measured by the bid-ask spread and brokers' commissions. The narrower the spread, the tighter it is. The tighter it is, the greater the liquidity.
- **Depth** describes how large an order must be to move the price adversely. In other words, can the market absorb the sale? The market can likely absorb a sale by an individual investor without an adverse price impact. However, if a large institution sells, it will likely adversely impact the price.
- **Resiliency** refers to the length of time it takes lumpy orders to move the market away from the equilibrium price. In other words, what is the ability of the market to bounce back from temporary incorrect prices?

Both depth and resiliency affect how quickly a market participant can execute a transaction.

Funding Liquidity Risk Management

Redemption requests, especially in times of market stress, may require hedge fund managers to unwind positions rapidly, exposing the fund to transactions liquidity risk. If this happens to many funds at once, fire sales may result. Hedge funds manage liquidity via:

- **Cash.** Cash can be held in money market accounts or Treasury bills and unencumbered liquidity. Cash is not wholly without risk, however, because money market funds may suspend redemptions in times of stress or crisis, and broker balances are at risk if the broker fails.
- **Unpledged assets.** Unpledged assets, also called assets in the box, are assets not currently being used as collateral. They are often held with a broker. Price volatility of the assets affects their liquidity. Only Treasury securities, and more specifically Treasury bills, may be used as collateral during a financial crisis. Even government agency securities were not sufficient collateral during the 2007–2009 financial crisis. Unpledged assets can be sold, rather than pledged, to generate liquidity. However, in times of market stress, asset prices are often significantly depressed.
- **Unused borrowing capacity.** This is not an unfettered source of liquidity as unused borrowing capacity can be revoked by counterparties by raising haircuts or declining to accept pledged assets as collateral when it is time to rollover the loan. These loans are typically very short term and credit can, as it did during the 2007–2009 financial crisis, disappear quickly.

During the crisis, a systemic risk event, hedge funds that had not experienced large losses still faced a liquidity crisis as investors, seeking liquidity themselves, issued redemption requests.



MODULE QUIZ 60.3

1. Brett Doninger recently placed an order to sell a stock when the market price was \$42.12. The market was volatile and, by the time Doninger's broker sold the stock, the price had fallen to \$41.88. In the market, this phenomenon is known as:
 - A. adverse selection.
 - B. transactional imbalance.
 - C. slippage.
 - D. the spread risk factor.

KEY CONCEPTS

LO 60.a

Liquidity has two essential properties, which relate to two essential forms of risk. Transactions liquidity deals with financial assets and financial markets and is related to the ability to sell an asset quickly, cheaply, and without moving the price too much. Funding liquidity is related to individual's or firm's creditworthiness.

Systematic funding risks were apparent in many market sectors during the subprime mortgage crisis. Liquidity issues arose during the 2007–2009 financial crisis for a variety of investment strategies.

Money market mutual funds (MMMFs) have net assets (NAVs) equal to \$1.00. However, credit write-downs can result in net asset values falling below \$1.00. This is known as breaking the buck. Liquidity risk can also cause NAVs to fall below \$1.00.

LO 60.b

Banks only expect a fraction of deposits and other liabilities to be redeemed at any point in time. As a result, they do not hold all deposits in liquid assets, but make loans

with deposits instead. This is known as a fractional-reserve bank and the process of using deposits to finance loans is known as asset-liability management (ALM).

LO 60.c

Collateral markets enhance the ability of firms to borrow money. They also make it possible to establish short positions in securities. Cash and securities may be borrowed in the market for collateral.

Firms with excess cash are more willing to lend at a low rate of interest if the loan is secured by collateral. The full value of the securities is not lent. The difference is called a haircut.

Collateralized loans are used to finance securities or other assets or trades. The securities pledged to one firm are often loaned or pledged again, hence the collateral circulates. This process is known as rehypothecation or rep pledging.

LO 60.d

A firm's leverage ratio is equal to its assets divided by equity. That is:

$$L = \frac{A}{E} = \frac{(E + D)}{E} = 1 + \frac{D}{E}$$

Return on equity (ROE) is higher as leverage increases, as long as the firm's return on assets (ROA) exceeds the cost of borrowing funds. This is called the leverage effect. The leverage effect can be expressed as:

$$r_E = Lr_A - (L - 1)r_D$$

There is embedded leverage in short positions and derivatives such as options and swaps. Economics balance sheets can be constructed to help investors and/or firms measure the implicit leverage of these transactions.

LO 60.e

Transactions liquidity implies that an asset can be bought or sold without moving its price. Transactions liquidity risk is fundamentally related to the costs of searching for a counterparty, the institutions required to assist in that search, and the costs of inducing a counterparty to hold a position.

To understand transactions liquidity risk, one must understand market microstructure fundamentals. Trade processing costs, inventory management, adverse selection (i.e., dealing with informed versus uninformed traders), and differences of opinions regarding asset prices affect transactions liquidity.

Factors such as tightness, depth, and resiliency are characteristics used to measure market liquidity. Tightness (or width) refers to the cost of a round-trip transaction, measured by the bid-ask spread and brokers' commissions. Depth describes how large an order must be to move the price adversely. Resiliency refers to the length of time it takes lumpy orders to move the market away from the equilibrium price.

Hedge funds manage liquidity via cash, unpledged assets, and unused borrowing capacity. In times of market stress, redemption requests may require hedge fund managers to unwind positions rapidly, exposing the fund to transactions liquidity risk. If this happens to many funds at once, fire sales may result.

LO 60.f

Assuming that daily changes in the bid-ask spread are normally distributed, the 99% confidence interval on the transactions cost in dollars is:

$$+/- P \times \frac{1}{2}(s + 2.33\sigma_s)$$

The spread risk factor is equal to $\frac{1}{2}(s + 2.33\sigma_s)$.

Liquidity-adjusted VaR is a tool used to measure the risk of adverse price impact. Traders will often liquidate positions over a period of days in order to ensure an orderly liquidation of the position.

LO 60.g

Risks associated with liquidity are interrelated and can exacerbate problems. For example, an increase in funding liquidity risk can lead to an increase in transactions liquidity risk. Also, severe stress to the financial system from a liquidity risk event would impact market participants simultaneously, suggesting that the illiquidity or insolvency of one counterparty may impact other market participants.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 60.1

1. **C** Funding liquidity risk or balance sheet risk results when a borrower's credit position is either deteriorating or is perceived by market participants to be deteriorating. It also occurs when the market as a whole deteriorates. Under these conditions, creditors may withdraw credit or change the terms of credit. In this case, the lender is increasing the haircut and is thus changing the terms of credit. Glenn Fund's creditworthiness does not actually have to decline for a lender to withdraw credit or change the terms of credit. (LO 60.a)
2. **A** Systematic funding risks were apparent in many market sectors during the subprime mortgage crisis. Hedge funds engaged in merger arbitrage experienced losses in the early stages of the subprime mortgage crisis. After a merger is announced, the target's stock price typically increases and the acquirer's price sometimes declines due to increased debt. The merger arbitrage strategy exploits the difference between the current and announced acquisition prices. Hedge funds experienced large losses as mergers were abandoned when financing dried up. (LO 60.a)
3. **A** MMMFs use a form of accounting called the amortized cost method, under the Securities and Exchange Commission's (SEC) Rule 2a-7. This means that MMMF assets do not have to be marked-to-market each day, as required for other types of mutual funds. However, the values of the underlying assets in the fund, despite their relative safety, are subject to change. As such, redemptions may be limited if asset values fall. (LO 60.c)

Module Quiz 60.2

1. **C** $\text{debt} = \$1,000 \times 0.75 = \750

leverage ratio = total assets / equity

leverage ratio = $\$1,000 / \$250 = 4$

$$r_E = Lr_A - (L - 1)r_D$$

where:

r_A = return on assets

r_E = return on equity

r_D = cost of debt

L = leverage ratio

return on equity = $4(8\%) - [(4 - 1)(4\%)] = 32\% - 12\% = 20\%$

(LO 60.d)

2. **B** The Federal Reserve requires an initial margin of 50% (i.e., haircut is 50%).

Therefore, the margin loan will be \$125,000 ($= \$250,000 \times 50\%$). The leverage ratio is equal to total assets divided by equity. Therefore, the hedge fund's leverage ratio is 2.0 ($= \$250,000 / \$125,000$). (LO 60.d)

Module Quiz 60.3

1. **C** Liquidity risks are introduced when bid-ask spreads fluctuate, when the trader's own actions impact the equilibrium price of the asset (called adverse price impact), and when the price of an asset deteriorates in the time it takes a trade to get done. When the price deteriorates in the time it takes to get a trade done, it is called slippage. (LO 60.e)

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Venkat and Baird, Chapter 6.

READING 61

EARLY WARNING INDICATORS

Study Session 10

EXAM FOCUS

Early warning indicators (EWIs) are a crucial part of liquidity risk management (LRM). This reading discusses the desirable traits of EWIs and how EWIs can be applied in an LRM context. For the exam, know the characteristics of sound EWIs and be able to discuss the applications and guidelines related to EWIs.

MODULE 61.1: EARLY WARNING INDICATORS FOR LIQUIDITY RISK MANAGEMENT

EWI Characteristics

LO 61.a: Evaluate the characteristics of sound Early Warning Indicators (EWI) measures.

Within the context of liquidity risk management (LRM), **early warning indicators (EWIs)** are analogous to warning lights on a car dashboard. EWIs are changes in key metrics (qualitative or quantitative) that could signal a pending liquidity problem; they can vary in severity and priority.

For example, consider three possibilities arising from EWIs:

- Indication of urgent problem requiring action now.
- Indication of potential problem that may require future action.
- Indication to perform further analysis to determine if there is a problem and if any action is required.

The main objective of EWIs is to get management to acknowledge the situation and promote the necessary dialogue and actions, together with documentation of these items.

Framework

The EWI framework looks at measures, escalation, reporting, integrated systems, and thresholds. To move effectively from measures to escalation, timely reporting is required together with integrated systems and appropriate thresholds.

Measures

It is important to have a future-oriented perspective of liquidity risk exposures. Both balance sheet and off-balance sheet items should be evaluated. Analysis should involve normal and stressed states and consider several different time periods. Ultimately, the measures should be able to forecast future cash flows and liquidity positions.

EWIs should contain both internal and external measures. Internal measures focus specifically on the bank's balance sheet while external measures look at macroeconomic factors. An effective EWI should be able to detect an internal stress event prior to it becoming apparent publicly.

EWIs should also be leading and granular. Leading indicators provide warning signals before the event occurs; they are much more effective than lagging indicators that provide signals after an event occurs. A granular indicator is more sharp and would not go unnoticed despite the amount of "noise" or distracting detail that may exist within a given data set. For example, information on decreases in general bank deposits would be an EWI, but information on decreases in bank deposits of a certain group of clients makes for an even more effective EWI. Overall, leading and granular EWIs provide more time to respond to negative events and to understand sources of liquidity risk.

Normal and Stressed States

EWIs should be utilized in normal operating states to provide warning of any potential future worsening of a bank's financial position. At the same time, examining hypothetical (but plausible) stressed states can help the bank determine whether it has sufficient liquid resources to handle a stress situation. Stress testing can also uncover some systemic risks that would otherwise prove to be disastrous if not mitigated immediately upon detection.

Different Time Horizons

EWIs should consider different time horizons, given that the bank likely has assets and liabilities of differing durations, for example. Time horizons such as hourly, daily, weekly, and monthly would likely serve as effective early warnings due to their shorter durations.

EWI Applications

LO 61.c: Discuss the applications of EWIs in the context of the liquidity risk management process.

Escalation

EWIs are useful in potentially escalating an issue to relevant management personnel and applying appropriate remedies, depending on the severity of the issue. If EWIs can

be included within a clear escalation plan, it is only then that the EWIs may have a positive effect on LRM.

Reporting

Timely (e.g., daily) EWI reporting allows for sufficient time to react to negative events. Banks that are involved with significant amounts of trading activity may find intraday (e.g., hourly) reporting to be even more effective.

Overall, reporting of EWIs must be sufficiently broad to cover a full range of relevant matters; however, it must be sufficiently focused to cover what is most important.

Integrated Systems

Having an integrated data processing system allows for more consistent and accurate reporting of measures when data is entered from multiple sources. That will provide liquidity risk managers with useful internal EWI information that could be used in conjunction with external measures.

Thresholds

EWI thresholds could utilize the “green, amber, and red” stoplight approach, with green requiring no further action, amber requiring additional follow up, and red requiring immediate attention to remedy a serious problem. From an analytical perspective, the transition from green to amber should be carefully calibrated to ensure that potential problems do not continue undetected or that there are too many unnecessary alerts

Past data is the frequent source of information to compute the EWI’s standard deviation and to calibrate its thresholds. The time period in question must be long enough (e.g., one year) to provide reliable results, yet it should incorporate recent events to account for the current economic conditions. Thresholds should be backtested in case recalibration is required.

Industry Practices

Banks and other financial institutions have been creating and using EWI dashboards on a more frequent basis in recent years. The primary reason for doing so has been to facilitate supervisory duties, although part of the reason is to also improve risk reporting.

EWI Guidelines

LO 61.b: Identify EWI guidelines from banking regulators and supervisors (OCC, BCBS, Federal Reserve).

EWI supervisory guidelines have been established by the Office of the Comptroller of the Currency (OCC), the Basel Committee on Banking Supervision (BCBS), and the Federal Reserve.

OCC (2012) Guidelines

- EWIs should exist for securities and derivatives with embedded options (e.g., callable debt) to indicate when those options are likely to be exercised and/or any contingent liabilities associated with the embedded options.
- EWIs should provide advance notice of a possible negative event to give the bank enough time to prepare. Examples of EWIs include:
 - Reduced financing to be provided by lenders.
 - More stringent requirements to issue long-term debt.
 - Forthcoming regulatory changes.
 - Capital, asset quality, management, earnings, liquidity, and sensitivity (CAMELS) rating downgrades.
 - Spread increases on fixed income and swap products.
 - Falling stock prices.
 - Higher borrowing rates in normal market conditions.
 - Reduced deposits by portfolio managers and funds.
 - Higher margins required.

BCBS (2008) Guidelines

- Banks need to have indicators available to signal deterioration of liquidity or increased need for funding.
- EWIs are quantitative or qualitative and include:
 - Very sharp increase in assets.
 - More concentrated assets or liabilities.
 - More currency mismatches.
 - Lower liability durations.
 - Frequent occurrences of breaches or near breaches of limits.

BCBS (2012) Guidelines

- Examples of intraday liquidity indicators include:
 - Daily maximum liquidity.
 - Intraday liquidity availability.
 - Total intraday payments, including the timing of them.
 - Key obligations (e.g., time-sensitive).
 - Amount of payments made for financial institution customers.
 - Intraday lines of credit provided to financial institution customers.

Federal Reserve (Supervision and Regulation [SR] 10-6) Guidelines

- Use EWIs and event triggers to identify possible constraints on liquidity. The EWIs should be consistent to the firm's liquidity risk profile.
- Advance notice of potential problems allows the firm more time to prepare and allows them a way to relay the information to relevant internal or external parties.
- Examples of EWIs include:

- Bad publicity surrounding specific assets held by the firm.
- Possible worsening of the firm's balance sheet (e.g., decreased assets, increased liabilities).
- Increasing spreads for fixed income and swap products.



MODULE QUIZ 61.1

1. Which component of the early warning indicator (EWI) framework represents the ultimate desired outcome when measures suggest a potential liquidity problem?
 - A. Escalation.
 - B. Integrated systems.
 - C. Protection.
 - D. Reporting.
2. Which of the following statements regarding early warning indicator (EWIs) is correct?
 - A. The more granular the indicator, the more accurate it is.
 - B. To be effective, EWIs must be tied to a definitive escalation plan.
 - C. EWIs should focus on external metrics over internal metrics because the former are generally more reliable.
 - D. Lagging indicators are less prone to error than leading indicators, therefore, they are potentially more useful to liquidity risk managers.
3. Which supervisory guideline for early warning indicators (EWIs) focuses on intraday liquidity monitoring indicators?
 - A. BCBS (2008).
 - B. BCBS (2012).
 - C. OCC (2012).
 - D. SR 10-6.
4. Which supervisory guideline for early warning indicators (EWIs) includes a specific provision on EWIs that deals with embedded options?
 - A. BCBS (2008).
 - B. BCBS (2012).
 - C. OCC (2012).
 - D. SR 10-6.

KEY CONCEPTS

LO 61.a

Within the context of liquidity risk management (LRM), early warning indicators (EWIs) are analogous to warning lights on a dashboard. EWIs are changes in key metrics (qualitative or quantitative) that could signal a pending liquidity problem; they can vary in severity and priority.

It is important to have a future-oriented perspective of liquidity risk exposures. EWIs should contain both internal and external measures. EWIs should also be leading and granular. EWIs should be utilized to provide warning of any potential future worsening of a bank's financial position and to determine whether it has sufficient liquid resources to handle a stress situation. Finally, EWIs should consider different time horizons.

LO 61.b

EWI supervisory guidelines have been established by the Office of the Comptroller of the Currency (OCC), the Basel Committee on Banking Supervision (BCBS), and the

Federal Reserve.

OCC (2012)

- EWIs should exist for securities and derivatives with embedded options (e.g., callable debt) to indicate when those options are likely to be exercised and/or there are any contingent liabilities associated with the embedded options.
- EWIs should provide advance notice of a possible negative event to give the bank enough time to prepare.

BCBS (2008)

- Banks need to have indicators available to signal deterioration of liquidity or increased need for funding.

BCBS (2012)

- Focus on intraday liquidity indicators.

Federal Reserve (SR 10-6)

- Use EWIs and event triggers to identify possible constraints on liquidity. The EWIs should be consistent to the firm's liquidity risk profile.
- Advance notice of potential problems allows the firm more time to prepare and allows the firm a way to relay the information to relevant internal or external parties.

LO 61.c

EWIs are useful in potentially escalating an issue to relevant management personnel and applying appropriate remedies, depending on the severity of the issue.

Timely (e.g., daily) EWI reporting allows for sufficient time to react to negative events.

Having an integrated data processing system allows for more consistent and accurate reporting of measures when data is entered from multiple sources.

EWI thresholds could utilize the “green, amber, and red” stoplight approach, with green requiring no further action, amber requiring additional follow up, and red requiring immediate attention to remedy a serious problem.

Banks and other financial institutions have been creating and using EWI dashboards on a more frequent basis in recent years.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 61.1

1. **A** Measures are an important starting point in a strong EWI framework; however, it is even more important to ensure that the measures can be tied to eventual escalation (to appropriate personnel) of the problem. (LO 61.a)
2. **B** EWIs can have a positive impact on liquidity risk management when they are tied to a clear escalation plan.

Increased granularity of an indicator does not mean greater accuracy. It simply means the indicator is sharper and will not go unnoticed despite the distraction of voluminous amounts of data.

EWIs should strike a reasonable balance between external and internal metrics. There is no evidence to suggest external metrics are more reliable than internal metrics.

Compared to leading indicators, lagging indicators are less useful because they report on events that have already happened. (LO 61.a)

3. **B** Under BCBS (2012), examples of intraday liquidity indicators include:

- Daily maximum liquidity.
- Intraday liquidity availability.
- Total intraday payments, including the timing of them.
- Key obligations (e.g., time-sensitive).
- Amount of payments made for financial institution customers.
- Intraday lines of credit provided to financial institution customers.

(LO 61.b)

4. **C** Under OCC (2012), a bank that holds securities and derivatives with embedded options should have EWIs to indicate when those options are likely to be exercised and/or any contingent liabilities associated with the embedded options. (LO 61.b)

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Rose and Hudgins, Chapter 10.

READING 62

THE INVESTMENT FUNCTION IN FINANCIAL-SERVICES MANAGEMENT

Study Session 10

EXAM FOCUS

This reading begins by looking at the various types of investments, including money market and capital market assets, and investments that were more recently introduced. These instruments differ not only by maturity but by liquidity, return, cash flows, and use as collateral. For the exam, ensure that you understand not only their definitions but also why each security is desirable to investors and what their key disadvantages are. Also, be able to discuss the factors that affect a bank's choice of investment securities, including yield to maturity, tax exposure, and various risks (e.g., interest rate, credit, liquidity). Finally, understand the key investment maturity strategies for consideration by investment firms and managers and the two main maturity management tools (yield curve and duration).

MODULE 62.1: MONEY MARKET AND CAPITAL MARKET INSTRUMENTS

LO 62.a: Compare various money market and capital market instruments and discuss their advantages and disadvantages.

Banks and depository institutions invest a significant portion of their asset portfolios in investment securities, which are often managed by investment officers and can make up between one-third and one-fifth of the asset portfolio. Investment securities can be short term or longer term, and can range from Treasury bills and commercial paper to notes, bonds, and asset-backed securities. These securities can have important roles in an institution's investment portfolio, including income stabilization, hedging the risk of loans, adding diversification and liquidity, providing tax benefits by reducing tax exposure, and making the balance sheet appear stronger. Investments can also be referred to as the **crossroads account** because they stand in between (are in the crossroads of) borrowing and lending. When cash is low, investments can be sold to

generate cash, and when there is excess cash, it can be invested in securities. Investment securities can also be used as collateral in borrowing.

Investment securities have different characteristics when it comes to risks, yields, inflation sensitivity, sensitivity to economic conditions, and political decisions. A basic classification of securities is by maturity. Securities with a maturity of one year or less are classified as **money market instruments**, and are typically characterized by low risk and low yield. Securities with a maturity of greater than one year are classified as **capital market instruments**, and are characterized by higher risk and higher yield.

Money Market Investments

- **Treasury bills (T-bills).** T-bills are short-term securities maturing within one year and issued by the U.S. federal government through weekly and monthly auctions. Because these securities carry the full backing and faith of the U.S. federal government including its taxing power, they are considered one of the safest investment vehicles. Because of their short maturities and low risk, their yield is also very low. T-bills are zero-coupon securities and are issued at a discount and mature at par. The difference between the discounted issue price and par value at maturity is its return. T-bills can be used as collateral and their return is calculated based on the bank discount method. Their primary advantage is safety, liquidity, and use as collateral.
- **Treasury notes (T-notes) and Treasury bonds (T-bonds).** Treasury notes and bonds are coupon-bearing securities also issued by the U.S. federal government and therefore carry its full faith and backing. T-notes at issuance have maturities up to 10 years, and T-bonds have maturities greater than 10 years. When these securities have one year or less to their maturity, they are classified as short-term (money market) securities. Their primary advantages are safety, secondary market liquidity, and use as collateral; however, their returns are typically above the return of T-bills. They also offer the potential for capital gains.
- **Federal agency securities.** Agency securities are issued by agencies that are owned or sponsored by the U.S. federal government. They include the Federal National Mortgage Association (Fannie Mae), the Federal Home Loan Mortgage Corporation (Freddie Mac), the Farm Credit System, and the Federal Land Banks. While these securities do not directly have a U.S. federal government guarantee, support is implied under the assumption that Congress would rescue these agencies if they were in distress. Their primary advantage is safety and relatively good liquidity, while offering higher return potential than securities issued directly by the U.S. federal government. Interest income on these securities is typically fully taxable.
- **Certificates of Deposit (CDs).** CDs are issued by depository institutions (i.e., banks) for fixed terms. They are attractive to issuing institutions because they are a source of funds. Investors prefer CDs for their relatively low risk and low initial investment (as low as \$500) while offering a higher yield than T-bills. They also benefit from federal insurance up to \$250,000. *Consumer-oriented CDs* are typically issued in smaller denominations of \$500 to \$100,000, while *business-oriented CDs* are issued with denominations over \$100,000.

- **International Eurocurrency deposits.** Eurocurrency deposits are uninsured time deposits with a fixed maturity of 30, 60, or 90 days. They are issued by large banks but the market is concentrated in London. While they are low-risk investments, they are attractive to investors because they offer a yield advantage relative to time deposits issued by local banks. Their disadvantage is volatility in interest rates and income that is taxable.
- **Bankers' acceptances.** Bankers' acceptances are short-term investments primarily used in trade credit (also called trade finance) transactions, whereby a financial firm—typically a bank—guarantees the payment of a customer for an export/import transaction. The bank receives a fee for the guarantee and becomes the primary obligor for the transaction (in other words, in exchange for the fee the bank will pay the customer's debt if the customer is unable to do so). Bankers' acceptances are pure discount instruments, issued at a discount and maturing at par value. Bankers' acceptances have an active market for secondary trading. They offer higher yields than T-bills but lower than Eurocurrency deposits, and qualifying bankers' acceptances are eligible for discounting (borrowing) at the Federal Reserve Bank. To qualify, they must be denominated in U.S. dollars with a maturity of six months or less and must relate to the export/import of goods or storage of marketable securities. Their primary disadvantages are lack of availability for certain maturities and income that is taxable.
- **Commercial paper.** Commercial paper is issued by large corporations for short-term maturities—typically 90-days or less in the United States. They are issued at a discount and mature at par value and as a result their income is taxable. They are attractive to both small financial firms and money market funds, and to large international firms and financial firms (mainly in Europe and Japan).
- **Short-term municipal obligations.** Two common types of short-term municipal obligations include *tax-anticipation notes* (TANs) and *revenue-anticipation notes* (RANs). The repayment by an issuer of TANs is supported by anticipated future tax revenue, while the repayment of RANs is supported by future revenues from revenue-generating municipal projects, including toll roads or bridges. Investors find these notes attractive in part because interest earned on these municipal notes is exempt from U.S. federal income taxes. In addition, several states and municipalities in the United States have faced financial problems over the last decade, reducing the quality of these notes. As a result, their attractiveness has declined in recent years.

Capital Market Investments

- **Treasury notes and bonds.** As we noted, T-notes and T-bonds are coupon-bearing securities issued by the U.S. federal government and carry the government's full faith and backing. T-notes at issuance have maturities up to 10 years, and T-bonds have maturities greater than 10 years and can range in denominations from \$1,000 to \$1 million. They are attractive to investors for their safety and secondary market liquidity and use as collateral, while their returns are typically above the returns of T-bills. They also offer the potential for capital gains. Their main disadvantage is price risk from higher price volatility, and liquidity risk for some notes and bonds with less liquid secondary trading.

- **Municipal notes and bonds.** These securities are issued by states and local governments, including cities and municipalities. Investors find them attractive in part because interest earned on these municipal securities is exempt from U.S. federal income taxes. However, they are less liquid instruments and are subject to capital gains taxes, except when the price appreciation is due to a movement to par value for a discounted note or bond. Investors can purchase these instruments through competitive bids or from investment dealers. There are two categories of municipal bonds: (1) general obligation (GO) bonds and (2) revenue bonds. GO bonds are backed by the full faith of the issuing government and are paid from general revenues, including taxes. Revenue bonds are typically issued to finance revenue projects, including toll roads and bridges, and repayment of the bonds is financed from revenue from these projects including tolls. U.S. banks can deal in and underwrite both GO bonds and revenue bonds (since 1999 for the latter).
- **Corporate notes and bonds.** Corporate notes at issuance have maturities up to five years, and corporate bonds have maturities greater than five years. There are several varieties of these debt securities, including debentures or those secured by mortgages. Insurance companies and pension funds find these securities particularly attractive because of their higher yields than government-issued debt instruments. However, higher yields imply higher risk, with yields widening relative to government debt securities during economic downturns.

More Recently Developed Investment Instruments

Several new investment securities have been developed in the last few decades, including structured notes, securitized assets, and stripped securities.

- **Structured notes.** Structured notes have existed since the 1990s. They are created by security dealers from pools of federal agency securities with yields that can be reset based on changes in a reference rate, including the U.S. Treasury bond rate. These securities could also have a *cap rate* above which investment returns cannot move, or a *floor rate* below which investment returns cannot drop. Coupons can be adjustable when rates change, or could have a *step-up* provision for additional coupon yield. These provisions are attractive to investors because they provide higher yields; however, these notes are more complex with the potential for larger losses.
- **Securitized assets.** Securitized assets are created from a pool of underlying loans of uniform quality and type. The underlying loans can range from mortgages and government-insured home loans to credit card loans. One of the most popular forms is mortgage-back securitized assets. Securitized assets remain popular with investors because of their higher yields than government security yields, relative scarcity, strong liquidity and marketability, and guarantees from government agencies or private institutions (i.e., banks or insurance companies). Nevertheless, following the 2007–2009 financial crisis which exposed significant weaknesses in their structure, they have lost some of their popularity. Securitized assets include the following:
 - **Pass-through securities.** These are created from pools of mortgages that the issuing entity transfers from its balance sheet to a trustee and issues securities backed by these mortgages. Principal and interest payments on the mortgages

are “passed through” to investors. Depending on the mortgage types, repayment of principal and interest may be guaranteed for a fee by federal agencies including Fannie Mae or Ginnie Mae. Fees are typically small at just a few basis points (remember, 1 basis point is 1/100th of 1%). Both Fannie Mae and Ginnie Mae may be directly involved in the creation of mortgage pass-through securities, although Ginnie Mae only securitizes pass-through securities created from government-insured home loans, while Fannie Mae aids in the securitization of both government-insured and conventional (noninsured) mortgages. Both agencies may add their own guarantees. Government-insured mortgages may be sheltered from default if the Federal Housing and Veterans Administration ensures that the pooled loans are repaid even if the home is abandoned by the homeowner.

- **Collateralized mortgage obligations (CMOs).** CMOs were developed in the early 1980s by Freddie Mac. They are pass-through securities that are also divided in segments called *tranches*. Each tranche represents a different level of risk with different coupon levels. CMOs can be created either from securitizing mortgage loans or pass-through securities.
- **Real estate mortgage conduits (REMICs).** REMICs are another form of securitized investments. These instruments also segment cash flows from mortgage loans or mortgage-backed securities into multiple maturity classes, primarily to reduce cash flow uncertainty. The primary risk faced by investors is *prepayment risk*, the risk that borrowers may default on their mortgages or pay them off early as interest rates change.
- **Mortgage-backed bonds (MBBs).** MBBs are also created from a pool of underlying mortgages; however, unlike pass-throughs and CMOs, these mortgages remain on the issuer’s balance sheet. The issuer will, however, segregate them from other assets. A trustee who acts on behalf of bondholders ensures adequate tracking of loans, and periodically verifies that loan values exceed bond values.
- **Stripped securities.** Stripped securities are hybrid investments that offer a claim either against the principal or interest payments on a bond. They are called *stripped* because dealers “strip” the individual cash flows of a bond into separate investments, creating **principal-only (PO)** and **interest-only (IO) securities**. Each IO or PO is issued at a discount and matures at par, and are therefore zero-coupon securities. They are attractive to investors because they hedge against changes in interest rates. The most common debt obligations to strip are U.S. Treasury notes and bonds and mortgage-backed securities. IOs are less sensitive to changes in interest rates than regular bonds, whereas POs are more sensitive.



MODULE QUIZ 62.1

1. Which of the following characteristics is not an advantage of Treasury bills?
 - A. They have stable market prices.
 - B. They can serve as collateral for borrowers.
 - C. They have higher yields than agency securities.
 - D. They are backed by the taxing power of the federal government.
2. Which of the following instruments is most common in trade finance transactions?
 - A. Commercial paper.

- B. Bankers' acceptances.
- C. Tax-anticipation notes.
- D. Certificates of deposit.

MODULE 62.2: INVESTMENT SECURITY SELECTION AND RISKS

LO 62.b: Identify and discuss various factors that affect the choice of investment securities by a bank.

Investment securities make up about a fifth of total bank assets, although this ratio varies. Smaller banks tend to hold a larger proportion of investments than larger banks. Investments are largely concentrated in a small number of security types. Dominant among these are U.S. federal government debt or agency-guaranteed debt, and in particular mortgage-backed securities, which account for more than half of all U.S. bank investment holdings. Other important holdings include state and local government debt and nongovernment asset-backed securities. Banks' investment holdings of private sector securities, including corporate notes and bonds, commercial paper, and equities are less dominant. Banks typically hold investment securities for resale to finance investment opportunities, make loans, or to cover customer withdrawals, and therefore largely designate these assets as trading securities.

Small banks in particular favor less risky government securities. These banks have high-risk loans on their balance sheet which they balance with low-risk investments. Large banks, on the other hand, have greater tolerance for risk. As a result, they maintain a larger share of riskier investment securities, including foreign securities and private debt and equity, to generate higher yields.

There are several factors that impact banks' choice of trading an investment security. These factors include expected rate of return, tax exposure, interest rate risk, credit risk, business risk, liquidity risk, call risk, prepayment risk, inflation risk, and pledging requirements.

Expected Rate of Return

For most investment securities (except equities), the **yield to maturity (YTM)** is the best determination of expected return, and factors in principal and interest payments and any capital gains or losses. For securities sold prior to maturity or those that do not have a maturity, the **holding period yield (HPY)** is the best way to determine return. Recall that the YTM calculates the rate of return on a security that would equate the present value of future cash flows with its market price. The computed YTM should be compared with the YTM of other securities to determine investment opportunities. Similarly, the HPY is the rate of return that equates its purchase price with the expected future cash flows up until it is sold.

Tax Exposure

Because of their higher tax exposure, banks typically look at the after-tax returns of securities rather than before-tax returns. Before-tax returns are more important for tax-exempt institutions like credit unions and mutual funds. Banks in the highest tax brackets often favor tax-exempt state and municipal bonds and notes.

- *Taxable versus tax-exempt bonds:* Banks will need to determine which investments offer the highest yield relative to other investments. However, because municipal bonds are tax exempt, their returns need to be compared to other investments on an after-tax basis.

EXAMPLE: Comparing bond yields

Suppose that a bank is considering purchasing either an AA-rated corporate bond with a YTM of 6%, or an AA-rated municipal bond with a YTM of 4.4%. The corporate marginal tax rate is 35%. **Compare** the two bond yields on an after-tax gross YTM basis, and **determine** which bond is more attractive to the bank.

Answer:

After-tax gross YTM:

Corporate AA bond: $6\% \times (1 - 0.35) = 3.9\%$

Municipal AA bond: $4.4\% \times (1 - 0) = 4.4\%$ (no tax implication since it is tax exempt)

Therefore, the municipal bond is more attractive, given its higher after-tax yield.

Banks can also calculate the **tax-equivalent yield (TEY)** which would then compare investments on a before-tax gross basis. In our earlier example, the TEY would be $4.4\% / (1 - 0.35) = 6.8\%$.

- *Tax reforms and bank-qualified bonds:* Since the Tax Reform Act of 1986, banks have significantly decreased their holdings of municipal debt given: (1) lower tax advantages, (2) lower corporate tax rates, and (3) a decline in available tax-exempt bonds. To qualify for a tax advantage—where a bank can deduct 80% of the interest incurred to fund the bond purchase—the bond must be issued by smaller municipalities issuing \$10 million or less in public securities annually. These bonds are referred to as **bank-qualified bonds**. In addition, the highest corporate tax bracket has declined from 46% prior to the tax reform to 35% for mid/larger corporations and 34% for the rest. Furthermore, laws including Congressional restrictions on bond issuances have reduced the number of local governments that qualify for a tax exemption.

We can also calculate the after-tax return on municipal bonds by calculating the additional return generated by the tax advantage:

net after-tax return = nominal after-tax municipal bond return – interest expense incurred to buy the bond + tax advantage

tax advantage = marginal bank tax rate \times ratio of interest expense that qualifies for a tax deduction \times interest expense incurred to fund the bond purchase

EXAMPLE: Calculating the net after-tax return from municipal bonds

Suppose that a bank purchases a municipal bond with a 6% gross nominal rate of return. The bank's borrowing cost to purchase the bond is 5%, and the bank is in the top income tax bracket of 35%. The bond is a bank-qualified bond, and 80% of the interest expense is tax deductible. **Calculate** the net after-tax return on the bond.

Answer:

$$\text{net after-tax return} = 6\% - 5\% + (0.35 \times 0.80 \times 5\%) = 2.4\%$$

- *Tax swapping*: Lending institutions which experience years of high loan revenues may engage in tax swapping. This strategy allows the lender to sell lower-yielding investment securities at a loss to reduce current taxable income, and concurrently purchase new higher-yielding securities to generate higher future income. The strategy is particularly attractive to lending institutions in the highest tax bracket with significant loan revenues. However, there are limits to the use of tax swapping. One key consideration in whether to use this strategy is the amount of tax-exempt income the institution can use.
- *Portfolio shifting*: The portfolio shifting strategy allows lending institutions to sell securities at a loss to offset significant loan income to reduce its tax liability. The institution could also shift new, higher-yielding securities for older, lower-yielding securities whose yield is below market levels. The disadvantage of this strategy is that it could result in significant short-term losses, but could generate long-term gains.

Interest Rate Risk

Changes in **interest rate risk** not only impact portfolio values, but also impact demand for loanable funds. Rising interest rates increase demand for loanable funds by institutions, while falling rates increase demand for borrowing by consumers. In general, interest rate risk refers to changes in investment or portfolio value and returns due to movement in interest rates. Institutions can hedge this risk through derivatives including interest rate swaps.

Credit Risk

Credit risk broadly refers to the risk that an entity will be unable to make scheduled principal or interest payments, or may default on their obligations. Credit rating agencies measure credit risk by assigning credit ratings to rated entities, including institutions and state and municipal governments. Credit ratings are important because they measure the relative credit quality of rated entities. The risk of default or nonpayment has led to restrictions for institutional investors such as pension funds to hold investment grade securities only. These are securities that have a credit rating of *BBB* or *Baa*¹ or higher. When securities drop to *BB-* or *Ba* rating category, institutions can no longer hold these investments. Rating agencies also include modifiers within letter grade categories, including + and - modifiers or 1, 2, and 3 numerical modifiers, where + and 1 indicates the high end of the letter grade category.

The financial crisis of 2007–2009 resulted in a significant number of defaults on investment grade entities, which exposed credit rating agencies to legal and reputational risk.

Lending institutions can protect against default risk primarily through derivatives, including credit swaps and credit options which protect the yield on investment securities. For example, credit options on a bond allow the option buyer to receive a payoff if the bond issuer defaults.

Business Risk

The risk that the economy of the market area served by a financial institution weakens, leading to declining sales and a weaker financial position, is called **business risk**. Institutions often protect against business risk through geographical diversification of their portfolio. For example, an institution serving the western U.S. market may include bonds and other securities issued by entities located outside the western market.

Liquidity Risk

Liquidity risk refers to the risk that an institution is unable to sell a security quickly and at a reasonable price, leading to potential losses. As a result, the *breadth* and *depth* of the security's resale market is an important factor in security purchase decisions. However, there is a trade-off between liquidity and yield. Securities with the strongest liquidity include T-bills, T-bonds, and T-notes, but these securities also have the lowest yield relative to other investments. Therefore, a portfolio manager who purchases these securities for their superior liquidity will lower the overall return of the portfolio.

Call Risk

When interest rates decline, issuers of callable bonds have the right to call (repurchase) these bonds from investors at a predetermined price. This risk is known as **call risk**. When investors receive the cash from the called back bonds, they must now reinvest the proceeds at lower prevailing market interest rates, reducing investment returns. Investors can mitigate against this risk by avoiding callable bonds altogether, or by buying callable bonds which have greater deferment (i.e., the initial period following bond issuance when the bond cannot be called).

Prepayment Risk

Prepayment risk arises from investors not receiving all of the expected cash flows on investments. Cash flows on mortgage-backed securities come from principal and interest payments. However, mortgage loan refinancings by borrowers when interest rates fall lead to investors replacing existing assets at lower yields. In addition, borrowers may be unable to meet their scheduled mortgage payments, leading to defaults.

The speed at which mortgages or loans are prepaid depends on the level and path of interest rates (shape of the yield curve), economic conditions, age of loans, and seasonal factors (e.g., most homes are bought and sold in the spring). Investment officers want to be able to predict prepayments. For example, they can look to the prepayment model by the **Public Securities Association (PSA)** to assess prepayments. The model

assumes that a typical insured mortgage will prepay 0.2% of principal on a home mortgage loan in the first month, and then prepayment will increase by 0.2% each month for the first 30 months, at which point it will level off at 6%. A mortgage portfolio that is estimated to have 100% PSA is assumed to meet this prepayment speed.

While prepayments when interest rates fall are generally unfavorable for the investing institution because it now needs to reinvest funds at a lower rate, it could also have beneficial effects. This is because when cash is received at an earlier period than expected, institutions can then use these cash proceeds for other profitable projects.

Inflation Risk

Inflation is the persistent rise in the price of goods and services, which can erode the value of a shareholder's investment in a financial institution (its net worth). It also makes these goods and services more expensive relative to the interest and principal payments received by institutions. This risk is known as **inflation risk**. A security that explicitly protects against inflation risk is the U.S. Treasury Department's Treasury Inflation-Protected Securities (TIPS), which exist in maturities of 5, 10, and 30 years. The principal of a TIPS is adjusted for movements in inflation, which means that the semiannual coupon payments fluctuate as the principal changes. TIPS tend to be especially popular when inflation rises, although in recent years they have lost some of their popularity, given overall low inflation and the rise of other inflation protection securities.

Pledging Requirements

Depository institutions in the United States cannot accept federal, state, or local governments' deposits without posting collateral acceptable to these governments. These **pledging requirements** differ significantly by state, although acceptable collateral for pledging needs to be of sufficiently high credit quality—typically federal and municipal securities. Pledging securities for collateral is also used in repurchase agreements.



MODULE QUIZ 62.2

1. A bank recently purchased a municipal bond with a 5.5% nominal rate of return. To finance the purchase, the bank borrowed funds at a cost of 4.7%. The bank's marginal income tax rate is 34%. The bond is a bank-qualified bond, and 80% of the interest expense is tax deductible. The net after-tax return on the bond is closest to:
 - A. 0.80%.
 - B. 2.08%.
 - C. 2.40%.
 - D. 4.56%.
2. An investment firm that is prohibited from holding speculative grade securities would have to sell a security when its rating changes from:
 - A. AAA to AA.
 - B. BBB to BB.
 - C. BB to B.
 - D. B to CCC.

MODULE 62.3: INVESTMENT MATURITY STRATEGIES AND MATURITY MANAGEMENT TOOLS

LO 62.c: Apply investment maturity strategies and maturity management tools based on the yield curve and duration.

Investment Maturity Strategies

The maturity of investments held is an important consideration for financial institutions. Institutions look at whether short- or long-term maturities are more appropriate, and what the distribution of maturities should be. For example, an institution could invest evenly across all maturities within a maturity spectrum, or it could put greater weight on short-term (or long-term) investments. A factor in these considerations is institutions' expectation of the level of interest rates. There are several important investment maturity strategies.

Ladder (Spaced-Maturity) Policy

This strategy involves investing an equal portion of securities in each maturity interval up until the maximum maturity desired. For example, if an institution chooses a maximum maturity of five years, it would invest 20% of investments in one-, two-, three-, four-, and five-year maturities. Although the ladder approach does not maximize investment income, it is popular among smaller institutions because it does not require significant expertise and is easy to carry out. In addition, as investments in each interval mature, cash is freed up which can then be used for potential investment opportunities.

Front-End Load Maturity Approach

Investment firms could decide to invest a portion of the funds not needed for loans or reserves in short-term investments. For example, a firm could decide to invest 100% of its available funds in securities with maturities of two years or less. This strategy results in significant liquidity.

Back-End Load Maturity Approach

Under the back-end load strategy, firms could invest a portion of the funds not needed for loans or reserves in long-term investments. For example, a firm could decide to invest 100% of its available funds in securities with maturities in the 7- to 10-year range. However, this strategy may require significant borrowing to meet short-term liquidity requirements.

Barbell Strategy

The barbell strategy is essentially a combination of the front-end and back-end load strategies and is favored by smaller institutions. Under this approach, institutions invest most of their funds in both a short-maturity portfolio and a long-maturity portfolio, with relatively few investments in intermediate maturities. The short-term

portfolio generates liquidity, while the long-term portfolio produces higher investment returns.

Rate Expectations Approach

Under this approach, investment decisions rely significantly on an institution's forecasts of interest rate movements and economic trend. Because it requires institutions to use sophisticated forecasting, it is more suitable for larger firms. Given that interest rates and investment securities such as bonds move in opposite directions, rising interest rates would cause these asset prices to decline. As a result, if an institution anticipates rising interest rates, it would shift the portfolio toward shorter maturity assets. Similarly, an institution's expectation of falling interest rates would cause it to extend the investment portfolio to longer maturity investments to maximize gains.

Shifting the portfolio to shorter or longer maturity assets requires significant trades in the portfolio, which can lead to significant taxable gains or losses. Managers generally prefer to undertake trades when: (1) effective tax management strategies can raise returns, (2) they can lock in higher yields when interest rates fall, (3) trades improve the overall asset quality, and (4) moving to higher quality assets does not compromise investment returns.

Maturity Management Tools

The two primary maturity management tools are the **yield curve** and **duration**.

The Yield Curve

Interest Rate Forecasts

The yield curve is a point in time indication of the various securities yields that differ by maturity only. An upward sloping yield curve indicates that longer maturity investments have higher yields. Yield curves could also slope downward indicating declining yields with longer maturities, or be horizontal (flat) implying that all maturities have identical yields (note that yields and interest rates are often used synonymously).

Investment officers look at the shape of the yield curve to make predictions about future interest rate movements. For example, a downward sloping yield curve indicates expectations of declining short-term interest rates. Shifting to long-term investments in this scenario could result in significant capital gains. Conversely, investment officers also look at the shape of the yield curve as trade indicators. For example, a security whose yield is below the yield curve indicates its yield is too low (price is too high) and therefore signals a sell opportunity. If the security yield is above the yield curve, it indicates a buy opportunity.

Risk-Return Trade-Offs

The yield curve also represents a trade-off between higher return and higher risk. Investors and investment officers can pick up additional return by switching to longer-term investments (generating higher yield under an upward sloping yield curve scenario), but recognize that this comes at the cost of higher risk. For example, if the yield on the three-year bond is 3% and the yield on the seven-year bond is 3.8%, the investor who switches from the three-year to the seven-year bond will pick up an additional 80 basis points (0.8%) in yield. However, the investor must be willing to accept the higher risk of the longer-term bond, including the potential for greater capital loss if the interest rate rose.

Carry Trade

The **carry trade** describes a scenario where investors borrow at lower short-term rates to invest in higher-yielding longer-term securities. As long as the return on the investment securities, net of taxes and any fees, is higher than the borrowing cost, the investor earns a positive return. This return is called the **carry return**.

Riding the Yield Curve

When yield curves have significant positive slopes, it can create opportunities where a securities price spikes significantly shortly prior to maturity. Investors can sell these securities to generate gains, and reinvest the proceeds to purchase longer term securities. This strategy is called **riding the yield curve** and will result in positive returns as long as the shape of the yield curve doesn't change.

Duration

Yield curve strategies are popular but they have limitations. The shape of the yield curve, including its slope and steepness, can change, which could adversely affect portfolio values. In addition, the yield curve does not give information about the timing and amount of future cash flows.

This information is available from duration. Duration is an indicator of an investment's interest rate sensitivity, meaning the expected change in an investment's price due to changes in interest rates. It is the present value-weighted measure of maturity of a security or a portfolio of securities. Duration can also be seen as the average amount of time an investor would have to wait to receive all of an investment's cash flows.

The duration formula measures an investment's price change when interest rates change, and therefore provides important information about the relationship between a security's price and interest rates.

$$-\text{duration} \times \frac{\text{change in interest rate}}{1 + \text{initial interest rate} \times (1/m)}$$

where:

m = number of times the investment pays interest (coupon) in a year

Portfolio Immunization With Duration

Portfolio immunization is a strategy to protect (i.e., immunize) a portfolio's return from changes in interest rates, regardless of which direction interest rates move. To immunize a portfolio, the duration of the investment or portfolio must be equal to the length of the investor's planned holding period for the investment or portfolio. Immunization balances the two opposing effects of interest rate changes on prices and reinvestment return. When interest rates increase, investment prices fall but reinvestment return increases; when interest rates fall, investment prices increase and reinvestment return falls. Immunization helps balance these two risks, so that interest rate changes would not impact the total portfolio return.



MODULE QUIZ 62.3

1. Which of the following investment maturity strategies would most likely reduce income fluctuation in the medium and long term, while generating sufficient ongoing liquidity for potential investment opportunities?
 - A. Ladder.
 - B. Barbell.
 - C. Back-end load.
 - D. Front-end load.

KEY CONCEPTS

LO 62.a

Investment securities fulfill important roles by providing income, generating cash through sales, and serving as collateral in borrowing. Investment securities differ by their yields, inflation sensitivity, and their sensitivity to economic conditions and political decisions.

Money market instruments are securities with a maturity of one year or less and have low risk and low yield. Capital market instruments are securities with a maturity of greater than one year and have higher risk and higher yield.

Money market instruments, largely by increasing yield and risk, include the following instruments:

- Treasury bills (T-bills).
- Short-term Treasury notes and bonds (T-notes and T-bonds).
- Federal agency securities.
- Certificates of deposit (CDs).
- International Eurocurrency deposits.
- Bankers' acceptances.
- Commercial paper.
- Short-term municipal obligations.

Capital market investments, largely by increasing yield and risk, include the following instruments:

- Treasury notes and bonds.
- Municipal notes and bonds.

- Corporate notes and bonds.

Other securities that have been more recently developed include structured notes, securitized assets (pass-through securities, collateralized mortgage obligations [CMOs], real estate mortgage investment conduits, mortgage-backed bonds [MBBs]), and stripped securities (including principal-only [PO] and interest-only [IO] securities).

LO 62.b

Investment securities held by banks are largely concentrated U.S. federal government debt or agency-guaranteed debt, and in particular mortgage-backed securities. Banks hold investment securities for resale to finance investments, extend loans, and to cover customer withdrawals.

Small banks prefer less risky government securities to balance their higher-risk loans. Large banks have greater risk tolerance to generate higher yields, with larger holdings of foreign securities, private debt, and equity.

Factors that affect a bank's choice of investment securities include:

- Expected rate of return, including the yield to maturity (YTM) and the holding period yield (HPY).
- Tax exposure (including taxable versus tax-exempt bonds, the tax-equivalent yield, bank-qualified bonds, tax swapping tool, and portfolio shifting).
- Interest rate risk.
- Credit risk.
- Business risk.
- Liquidity risk.
- Call risk.
- Prepayment risk.
- Inflation risk.
- Pledging requirements.

LO 62.c

There are several important investment maturity strategies for consideration by investment firms and managers:

- Ladder (spaced-maturity) policy, which involves investing an equal portion of securities in each maturity interval. This strategy requires little expertise and is easy to implement, and frees up cash for new opportunities, but it doesn't maximize investment income.
- Front-end load maturity approach, which invests a portion of the funds not needed for loans or reserves in short-term investments.
- Back-end load maturity approach, which invests funds in long-term investments.
- Barbell strategy, which combines the front-end and back-end load strategies by investing funds in both a short-maturity portfolio and a long-maturity portfolio.
- Rate expectations approach, which relies significantly on an institution's forecasts of interest rate movements and economic trends.

In addition, there are two main maturity management tools:

- *Yield curve.* Investment firms and managers look at the shape of the yield curve to make predictions about future interest rate movements. A downward sloping yield curve indicates expectations of declining short-term interest rates. The carry trade entails investors borrowing at lower short-term rates and investing the proceeds in higher-yielding longer-term securities. Riding the yield curve allows investors to sell securities whose prices have spiked significantly shortly before maturity.
- *Duration.* Provides important information about the relationship between a security's price and interest rates. It is the present value-weights of maturity of a security or a portfolio. When investors adjust the duration of the investment or portfolio so that it is equal to the length of the investor's planned holding period for the investment or portfolio, the portfolio is immunized against interest rate risk (price risk and reinvestment risk).

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 62.1

1. **C** Treasury bills are very liquid short-term instruments backed by the taxing power of the federal government. They are liquid with stable prices and can be used as collateral for borrowing. They are considered safer investments than agency securities, and therefore have lower yields. (LO 62.a)
2. **B** Bankers' acceptances are short-term investments in which a financial firm like a bank guarantees the payment of a customer for an export/import transaction. These transactions are primarily used in trade credit (also called trade finance) deals. (LO 62.a)

Module Quiz 62.2

1. **B** The after-tax return on municipal bonds can be calculated as:

$$\text{net after-tax return} = \text{nominal after-tax municipal bond return} - \text{interest expense incurred to buy the bond} + \text{tax advantage}$$

$$\text{tax advantage} = \text{marginal bank tax rate} \times \text{ratio of interest expense that qualifies for a tax deduction} \times \text{interest expense incurred to fund the bond purchase}$$

$$\text{net after-tax return} = (5.5\% - 4.7\%) + (0.34 \times 0.80 \times 4.7\%) = 2.08\% \text{ (LO 62.b)}$$
2. **B** Investment firms like pension funds may be prohibited from holding speculative (noninvestment grade) securities. These securities are rated BB or below (Ba on a Moody's scale). Firms can only hold securities rated BBB or above (Baa on a Moody's scale).

The choices BB to B and B to CCC are incorrect because the investment firm would be prohibited from holding securities that are rated BB or B, so even if these securities' ratings deteriorate further, they are ineligible investments. If a security's rating drops from AAA to AA, it is still eligible for investment by the firm. (LO 62.b)

Module Quiz 62.3

1. **A** The ladder strategy involves investing an equal portion of securities in each maturity segment up until the maximum maturity desired. As investments in each interval mature, they free up cash which can then be used to take advantage of potential investment opportunities.

The other strategies either don't provide ongoing liquidity or do not reduce income fluctuation in the medium or long term. (LO 62.c)

¹ BBB refers to the ratings scale by Standard and Poor's and Fitch, while Baa refers to Moody's.

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Rose and Hudgins, Chapter 11.

READING 63

LIQUIDITY AND RESERVES MANAGEMENT: STRATEGIES AND POLICIES

Study Session 10

EXAM FOCUS

Liquidity speaks to an institution's ability to meet its cash needs via access to low cost, immediately spendable funds. The net liquidity position of an institution is a critical calculation, as it balances the demand for, and supply of, liquidity. For the exam, be familiar with the different strategies that a bank can use to meet liquidity demands, including assets, liability, and balanced strategies. Also, be familiar with the highly unique approaches used to estimate liquidity needs which offer different perspectives and options for evaluating desired liquidity positions. Finally, understand how to calculate the amount of legal reserves needed, the factors which influence legal reserves, and the factors that weigh into choosing between the different sources available to meet reserve needs.

MODULE 63.1: NET LIQUIDITY AND STRATEGIES

LO 63.a: Calculate a bank's net liquidity position and explain factors that affect the supply and demand of liquidity at a bank.

Liquidity represents a financial institution's access to funds which at a low cost are immediately spendable and available exactly when those funds are needed. It is extremely critical for all financial institutions that liquidity is ensured at all times, as a lack of liquidity can send a negative signal of financial difficulty and erode public confidence.

Demands for spendable funds generally arise from two primary sources: credit requests from customers (such as existing credit line draws and loan requests) and customers withdrawing money from their accounts. Payoffs of borrowings, cash dividend payments, and income tax payments also represent demands for spendable funds. Supply sources for spendable funds include new customer deposits, customer loan

repayments, asset sales, money market borrowings, and fee income from nondeposit services.

A firm's **net liquidity position** is the difference between supplies of liquidity into the firm and demands for liquidity from the firm:

$$\text{net liquidity position (L)} = \text{supplies of liquidity} - \text{demands for liquidity}$$

where:

supplies of liquidity = incoming deposits (inflows) + customer loan
repayments + asset sales + revenue from nondeposit
services + money market borrowings

demands for liquidity = deposit withdrawals (outflows) + borrowing
repayments + dividend payments + loan requests +
other operating expenses

If demand exceeds supply, $L < 0$, the firm has a liquidity deficit, and additional funds must be raised. If supply exceeds demand, $L > 0$, the firm has a liquidity surplus, and the excess funds should be invested to cover future liquidity needs. The reality is that demand and supply are rarely aligned, thereby resulting in perpetual movements from liquidity deficit to liquidity surplus positions. In addition, funding sources that enhance the firm's liquidity position typically offer very low returns, forcing a firm to balance liquidity with profitability.

Timing is a major factor in liquidity management, as some needs are immediate (such as when a bank has issued certificates of deposits [CDs] coming due and customers want their money to be put elsewhere) while other needs are longer-term where a financial institution can access funds from a wider range of sources. When customers face liquidity problems, these often trickle down to the institutions that supply them with liquidity. Institutions face costs in managing liquidity, including time and money transaction costs incurred in finding liquid funding sources, interest costs on borrowed funds, and opportunity costs associated with liquidating assets to fund liquidity needs.

Liquidity problems stem from a variety of reasons. From the perspective of a financial institution, maturity imbalances exist between short-term borrowings (which imply that the institution needs to meet its liabilities in the near-term) and long-term lending (meaning that it will receive payments from its customers over a longer period of time). Interest rate risk (associated with rates that may change) and availability risk (associated with liquid funds not available when needed) are two risks that are prevalent due to this mismatch. Shifting market interest rates impact customer demands for deposits and loans. Interest rates also impact the market value of assets the firm may have to sell in order to generate new funds. In addition to the pressure of maintaining public confidence in the institution, liquidity managers need to communicate regularly with their largest customers to ensure that they are ready should a large withdrawal or credit line draw be forthcoming.

LO 63.b: Compare strategies that a bank can use to meet demands for additional liquidity.

At a high level, strategies for managing liquidity needs fall into three categories: asset liquidity management, liability management, or a balanced approach, which is a hybrid

of asset and liability strategies.

Asset Liquidity Management

The **asset conversion** strategy, often used by smaller financial institutions, involves maintaining liquidity through liquid assets such as a cash and marketable securities. Assets are simply converted into cash as needed to meet liquidity demands. A **liquid asset** has a ready market (quickly convertible into cash), a relatively stable price (the sale will not significantly impact the price), and is reversible (principal can be recovered with little risk of loss). Typical liquid assets include Treasury bills (direct obligations of U.S. or foreign governments), CDs, municipal bonds, interbank deposits, repurchase agreements (liquid security purchases), Eurocurrency loans, federal funds loans, and federal agency securities.

From a cost standpoint, the asset conversion strategy presents opportunity costs in the form of lost earnings on assets which are sold to create liquidity. In that vein, assets with the lowest profit potential should be the ones which are sold first, even though these assets tend to boost the strength of a firm's balance sheet. Transaction costs play a role as well, along with the risk of having to sell assets in a declining market. Liquid assets also carry lower returns, with a firm perpetually balancing safety with profit potential.

Liability (Borrowed Liquidity) Management

The **liability management** (purchased liquidity) strategy, often used by larger institutions, entails borrowing funds to cover anticipated liquidity demands. The advantages to this strategy include the ability to borrow funds only when needed, to leave asset portfolios unaltered (relative to the asset conversion strategy), and to adjust the offered interest rate up or down depending on the amount of funds needed. Typical sources of borrowed liquidity include jumbo negotiable CDs (\$100,000+), repurchase agreements (liquid security sales), Eurocurrency issuances, federal funds borrowings, central bank discount window borrowings, and advances from Federal Home Loan Banks.

Due to interest rate volatility, uncertain borrowing costs, and fluctuations in credit availability, borrowing liquidity is a risky strategy.

Balanced Liquidity Management

The majority of financial institutions use both asset and liability management strategies. A **balanced liquidity management** strategy involves meeting liquidity demands in part through assets such as marketable securities which can sell quickly if needed and in part through advance arrangements for lines of credit from suppliers. As always, time management and anticipation of upcoming short-term and long-term liquidity needs is critical to success.



MODULE QUIZ 63.1

1. Genny Richards is the liquidity manager for Legend Bank. In evaluating the bank's net liquidity position, Richards anticipates the following amounts:

Line Item	Amount
Asset sales	\$1,325,000
Deposit withdrawals	\$1,015,000
Dividend payments	\$470,000
Incoming deposits	\$2,500,000
Loan requests	\$845,000
Nondeposit services revenue	\$950,000

Legend Bank's net liquidity position is closest to:

- A. \$2,330,000.
 - B. \$2,445,000.
 - C. \$3,385,000.
 - D. \$3,405,000.
2. A bank utilizing the liability management strategy is most likely to use which of the following sources of liquidity?
- A. U.S. Treasury securities.
 - B. Federal agency securities.
 - C. Repurchase agreement sales.
 - D. Municipal bond investments.

MODULE 63.2: BANK LIQUIDITY NEEDS

LO 63.c: Estimate a bank's liquidity needs through three methods (sources and uses of funds, structure of funds, and liquidity indicators).

Liquidity managers are tasked by financial institutions with managing all of the issues described thus far. Liquidity must be managed continuously, as both deficits (where funds must be raised quickly to meet needs) and surpluses (because of the opportunity cost associated with not having funds invested) can be problematic. Liquidity managers must be kept abreast of all activities within the entity that involve using and supplying funds. They should know well in advance when large amounts of funds will be added to or withdrawn from customer accounts. In addition, they should work to ensure that liquidity management still remains a priority, even in the face of the main priority of maximizing returns through supplying services and providing loans.

Liquidity reserves typically include a planned component based on reserves needed from the latest forecast and a protective component, which is an extra cushion of reserves above and beyond the planned component and based on recent forecasted liquidity needs. In order to estimate liquidity requirements, there are four primary approaches: the sources and uses of funds approach, the structure of funds approach, the liquidity indicator approach, and the market signals (discipline) approach.

Sources and Uses of Funds Approach

The **sources and uses method** is predicated on the reality that liquidity changes based on deposits and loans; deposit increases drive liquidity higher, while loan increases drive liquidity lower. A **liquidity gap** exists when there is a mismatch

between sources and uses of funds. A positive liquidity gap or surplus exists when sources exceed uses, while a negative liquidity gap or deficit exists when uses exceed sources.

The sources and uses approach involves several key steps, including forecasting deposits and loans for a given period, estimating the changes in deposits and loans for that period, and estimating the net liquid funds' deficit or surplus based on estimated changes in deposits and loans. A bank may estimate changes in total deposits by aggregating projected factors such as personal income growth, money supply growth, the rate of inflation, increases in retail sales, and yields on money market deposits. Estimated changes in total loans may be projected based on economic growth, quarterly corporate earnings, the differential between the prime loan rate and CD or commercial paper (CP) rate, and factors that influence deposits such as money supply growth and the inflation rate. The estimated liquidity surplus (+) or deficit (–) for the upcoming period is therefore equal to the estimated change in deposits subtracted by the estimated change in loans.

An alternative approach for estimating deposits and loans is to separate growth into three components: a trend component based on a 10-plus-year period, a seasonal component, and a cyclical component driven by the health of the overall economy. Figure 63.1 represents forecasted deposits for four weeks in March, while Figure 63.2 represents forecasted loans over the same period. Figure 63.3 forecasts liquidity surpluses and deficits using data from the first two figures.

Figure 63.1: Deposit Forecast

Time Period	Trend Component	Seasonal Component	Cyclical Component	Estimated Total
March, Wk. 1	\$450	+22	–8	\$464
March, Wk. 2	\$454	+9	–6	\$457
March, Wk. 3	\$458	–14	–12	\$432
March, Wk. 4	\$462	–85	–15	\$362

Figure 63.2: Loan Forecast

Time Period	Trend Component	Seasonal Component	Cyclical Component	Estimated Total
March, Wk. 1	\$380	+3	–10	\$373
March, Wk. 2	\$382	+5	–13	\$374
March, Wk. 3	\$384	–10	–7	\$367
March, Wk. 4	\$386	–15	–10	\$361

Figure 63.3: Estimated Liquidity Surplus (Deficit)

Time Period	Estimated Total (Deposits)	Estimated Total (Loans)	Estimated Change (Deposits)	Estimated Change (Loans)	Estimated Liquidity Surplus (+) or Deficit (-)
March, Wk. 1	\$464	\$373	\$___	\$___	\$___
March, Wk. 2	\$457	\$374	-7	+1	-8
March, Wk. 3	\$432	\$367	-25	-7	-18
March, Wk. 4	\$362	\$361	-70	-6	-64

Structure of Funds Approach

The **structure of funds method** divides sources of funds such as deposits into three categories based on the likelihood that they are withdrawn and no longer available to the firm. Once the categories are defined, liquid funds must be set aside based on a predetermined operating rule for each category.

The categories include:

- *Volatile (hot money) liabilities.* Deposits and borrowed funds with high interest rate sensitivity and a high likelihood of being withdrawn within the period.
- *Vulnerable funds.* Customer deposits where a large portion is likely to be withdrawn in the period.
- *Core deposits (liabilities) and stable funds.* Unlikely to have much, if any, withdrawn.

The liability liquidity reserve is by-product of the percentage in reserves that the bank would like to maintain for each category. For example, if the percentages applied to the earlier three categories are 90%, 25%, and 10% respectively, the total liability liquidity reserve will be equal to:

liability liquidity reserve =

$$\begin{aligned}
 & [0.90 \times (\text{hot money deposits and nondeposit funds} - \text{legal reserves held})] \\
 & + [0.25 (\text{vulnerable deposits and nondeposit funds} - \text{legal reserves held})] \\
 & + [0.10 (\text{stable deposits and nondeposit funds} - \text{legal reserves held})]
 \end{aligned}$$



PROFESSOR'S NOTE

The percentages used for each of the three categories (e.g., 90%, 25%, and 10%) varies by institution. You don't need to memorize this—it will be provided on the exam.

On the loan side, an institution must be in a position to deliver on all good loans, which are those that are for customers who meet loan standards and have legitimate credit needs. Because loans often lead to other forms of business for the institution, management is best served by incorporating potential future loans into the previous equation as follows (assuming the desire is to fully meet borrowing capacity):

total liquidity requirement =

$$\begin{aligned} & [0.90 \times (\text{hot money deposits and nondeposit funds} - \text{legal reserves held})] \\ & + [0.25 (\text{vulnerable deposits and nondeposit funds} - \text{legal reserves held})] \\ & + [0.10 (\text{stable deposits and nondeposit funds} - \text{legal reserves held})] \\ & + [1.00 \times (\text{potential loans outstanding} - \text{actual loans outstanding})] \end{aligned}$$

EXAMPLE: Structure of funds approach

Jartens Bank has the following deposit and nondeposit liabilities broken down into three categories:

Hot money: \$13 million

Vulnerable funds: \$18 million

Core funds: \$65 million

Legal reserves are 2.5% and desired reserve percentages for the earlier categories are 90%, 25%, and 10% respectively. Actual loans are \$85 million with the potential to reach \$100 million.

Assuming the bank wishes to be able to meet all good loans, **calculate** the total liquidity requirement.

Answer:

total liquidity requirement =

$$\begin{aligned} & [0.90 \times (\$13 \text{ million} - 0.025 \times \$13 \text{ million})] \\ & + [0.25 \times (\$18 \text{ million} - 0.025 \times \$18 \text{ million})] \\ & + [0.10 \times (\$65 \text{ million} - 0.025 \times \$65 \text{ million})] \\ & + [1.00 \times (\$100 \text{ million} - \$85 \text{ million})] = \$37,132,500 \end{aligned}$$

A liquidity manager may refine the structure of funds approach by defining scenarios (e.g., best case, worst case, most likely case) and assigning probabilities for each scenario. In the best possible liquidity position scenario, deposit growth reaches peak levels and loan demand falls below expectations, creating a liquidity surplus. In the worst possible liquidity position scenario, deposit growth is at a low point and well below management expectations, while loan demand exceeds management expectations and is at an all-time high relative to historical track records; this scenario creates a significant liquidity deficit. Although the likely outcome is somewhere in between, creating scenarios and assigning probabilities to them allows the liquidity manager to create a weighted average liquidity requirement using the following equation:

$$\text{expected liquidity requirement} = \sum (\text{probability of each unique outcome} \times \text{estimated liquidity surplus / deficit for each outcome})$$

EXAMPLE: Expected liquidity requirement

Mary Richards is the liquidity manager for Kent Bank. She forecasts the following scenarios for deposits and loans for next week.

Possible Outcomes	Estimated Deposit Volume	Estimated Loan Volume	Estimated Liquidity Surplus/ Deficit	Probability
Best possible	\$90 million	\$62 million	+\$28 million	20%
Worst possible	\$75 million	\$85 million	−\$10 million	25%
Most likely	\$84 million	\$78 million	+\$6 million	55%

Calculate the expected liquidity requirement.

Answer:

estimated liquidity requirement =

$$[0.20 \times (+\$28 \text{ million})] + [0.25 \times (-\$10 \text{ million})] + [0.55 \times (+\$6 \text{ million})] = +\$6.4 \text{ million}$$

Liquidity Indicator Approach

Liquidity indicators are ratios that institutions use to estimate liquidity needs based on industry averages and experience. The following ratios are most often used for this purpose, with the change in each ratio from one period to the next being more critical than the relative levels of each ratio.

Ratios where a higher output means more liquidity:

- **Cash position indicator:** (cash + deposits due from depository institutions) / total assets.
- **Liquid securities indicator:** U.S. government securities / total assets.
- **Core deposit ratio:** Core deposits / total assets. Core deposits are total deposits less those over \$100,000.
- **Hot money ratio:** Money market (short-term) assets / volatile liabilities. Money market assets are cash, monies due from deposits at other institutions, short-term securities holdings, reverse repo agreements, and federal funds loans. Volatile liabilities are large CDs, Eurocurrency deposits, repo agreements, and federal funds borrowings.
- **Net federal funds and repurchase agreements position:** (Federal funds sold and reverse repo agreements – federal funds purchased and repo agreements) / total assets.

Ratios where a higher value means more illiquidity:

- **Capacity ratio:** Net loans and leases / total assets.
- **Loan commitments ratio:** Unused loan commitments / total assets. Unused loan commitments represent promises of credit made by lenders to customers up a specific amount over a specific period of time.
- **Pledged securities ratio:** Pledged securities / total securities holdings.

- **Deposit composition ratio:** Demand deposits / time deposits. Demand deposits fluctuate significantly while time deposits have fixed maturities and typically assess penalties for early withdrawal.
- **Deposit brokerage index:** Brokered deposits / total deposits. Brokered deposits are funds placed by securities brokers for their customers which are interest sensitive and may be withdrawn quickly.

Indicators which focus on liquid assets are focusing on *stored liquidity*, while the remainder focus on liabilities and future commitments (essentially, *purchased liquidity*). Stored liquidity ratios tend to decline during periods of significant loan demand and increase when activity is sluggish. Purchased liquidity ratios will increase when credit demands accelerate and decrease when the economy is sluggish.

Market Signals/Discipline Approach

The **discipline of the financial marketplace** approach is essentially a method where a sufficient liquidity position is only gauged by market signals indicating whether or not that level has been reached.

The following market signals are useful in deploying this approach:

- Public confidence.
- Institution's stock price performance.
- Loss sales of assets (frequency of asset sales and losses on sales).
- Risk premiums on CDs and borrowings (interest rates paid relative to similar institutions).
- Central bank borrowings (frequency and size of borrowings).
- Commitments to credit customers (ability to meet loan requests if criteria are met or the inability to do so due to liquidity pressures).



MODULE QUIZ 63.2

1. Which of the following indicators would create concern for a liquidity manager looking to stabilize liquidity and create confidence in the bank's position?
 - A. An increasing hot money ratio.
 - B. An increasing deposit composition ratio.
 - C. Increases in reverse repurchase agreements.
 - D. An excess of federal funds sold over federal funds purchased.

MODULE 63.3: LEGAL RESERVES AND SOURCES OF RESERVES

LO 63.d: Summarize the process taken by a US bank to calculate its legal reserves.

The **money position manager** for a financial institution is tasked with managing its liquidity position and ensuring that it maintains a sufficient level of **legal reserves**, which are assets required by law and central banking regulations for a specific time

period. For large commercial and savings banks, credit unions, savings and loan associations, and foreign bank branches and agencies with offerings in the United States, the United States requires legal reserves be held as vault cash and deposits held in reserves at the regional Federal Reserve Bank if vault cash is insufficient. Bound institutions have to deposit amounts at the regional Fed bank, whereas nonbound institutions have enough in vault cash to not have to deposit funds at the regional bank.

The current system of accounting for legal reserves is called **Lagged Reserve Accounting (LRA)**. This system includes a **reserve computation period** which represents a two-week period of time from a Tuesday of one week to a Monday two weeks later from which data on daily average deposit amounts and other reservable liabilities is collected. Also from that period, the daily average amount of vault cash is calculated. The money position manager must maintain the required legal reserve on deposit with the regional Federal Reserve Bank, less daily average vault cash, over the reserve maintenance period stretching from a Thursday of one week to a Wednesday two weeks later. The **reserve maintenance period** begins 30 days after the beginning of the reserve computation period, per the following timeline:

- Day 1 (Tu.) – Day 14 (M): reserve computation period
- Day 15 (Tu.) – Day 30 (W): planning period for money position managers
- Day 31 (Th.) – Day 44 (W): reserve maintenance period

The volume and mix of an institution's deposits and the particular time period in question dictate the amount of money to be held in reserve. Transaction deposits had a reserve requirement in 2010 of 3% of end-of-day daily average amounts for a two-week period for deposit totals between \$10.7 million and \$58.8 million; the requirement was 10% on amounts above \$58.8 million (called the reserve tranche and adjusted annually based on the annual deposit growth rate).

Total required legal reserves is calculated using the following equation:

total required legal reserves =

(transaction deposit reserve requirement × daily average amount of net transaction deposits for the computation period) + (nontransaction reservable liabilities' reserve requirement × daily average amount of nontransaction deposits for the computation period)

Excess reserves occur when legal reserves (the daily average holding amount) exceed the calculated required reserves. If a reserve deficit (legal reserves fall short of the calculated required reserve amount) occurs, an institution typically must cover it by acquiring additional legal reserves. Small deficits may be allowed to carry over as long as an excess occurs in the next period.

EXAMPLE: Legal reserve requirement

Legal reserve requirements applicable to Ridgeland Bank based on net transaction deposits are as follows: 0% on deposits up to \$10.7 million, 3% on deposits between \$10.7 and \$58.8 million, and 10% on deposits exceeding \$58.8 million.

Net transaction deposits for the bank averaged \$145 million over the reserve computation period, and Ridgeland averaged \$7.25 million in vault cash over the

same period.

Calculate the additional legal reserves that Ridgeland Bank must raise.

Answer:

The average required legal reserve level is equal to: $(0\% \times \$10.7 \text{ million}) + [3\% \times (\$58.8 \text{ million} - \$10.7 \text{ million})] + [10\% \times (\$145 \text{ million} - \$58.8 \text{ million})] = \10.063 million . The additional amount to raise is equal to $\$10.063 \text{ million} - \$7.25 \text{ million} = \$2.813 \text{ million}$.

A **clearing balance** is a reserve that a bank chooses to keep with the Fed to cover any debit items or checks that may be drawn against them. If a bank in the United States wishes to use the Fed's check-clearing facilities, it must keep a minimum-size clearing balance at the district Federal Reserve Bank. A minimum daily average amount must be kept over a two-week period (similar to the requirements for legal reserves). Amounts falling below the minimum daily average amount result in deficits which must be cleared, while excesses can be used as a safety cushion for potential legal reserve deficits. Interest earned on clearing balances can be used as credits to offset the costs of Fed services.

The balances in legal reserves are a by-product of factors which are both controllable and noncontrollable. Draft and check volume per day, coin and currency shipments between each bank and the central bank vault, government security activity, and borrowing/lending of federal funds are primary factors which drive balances. A primary driver for the overall decline in legal reserves is the sweep account. **Sweep accounts** move customers deposits out of low-yield accounts into higher-yielding accounts which preserve the customers' ability to write checks, make payments, and withdraw funds. Sweep accounts consist of both retail sweeps (for individuals/families) and business sweeps. The goal for managing legal reserves is to have no excess reserves but also no deficit large enough to result in a penalty (in the United States, being within 4% of the daily average reserve level prevents penalties). To manage excess reserves, an institution will either sell federal funds to other institutions, purchase securities with the excess funds, or issue new loans. Deficits will be managed by purchasing federal funds or borrowing from the district Fed, with anticipated longer-term deficits resulting in assets sales or a reduction in lending activity.

The **federal funds market** is a fairly volatile, although relatively cheap, source of funds when a money position manager has a need to cover a large reserve deficit. The volatility stems from the fact that the effective interest rate literally changes by the minute, although the rate tends to be relatively close to the target Fed Funds rate. This market is not the only source for covering reserve deficits, as other options include selling liquid securities, drawing on balances held at other institutions, using repurchase agreements, borrowing in the Eurocurrency market, and selling time deposits. While smaller institutions often have reserve surpluses, larger institutions tend to have reserve deficits.

LO 63.e: Differentiate between factors that affect the choice among alternate sources of reserves.

As noted earlier, there are several sources of reserves that a money position manager can choose from in funding a reserve deficit. The factors that drive the decision as to which source to use are:

- *Need duration.* The central bank discount window or federal funds market is preferred for short-term deficit needs, while longer shortages are often covered by longer-term borrowing or asset sales.
- *Need immediacy.* Urgent needs to cover deficits will typically require overnight loans from the federal funds market or central bank loans from the discount window, whereas nonimmediate needs can come from asset sales or deposit sales.
- *Costs and risks of alternative fund sources.* Costs and availability change constantly, with the liquidity manager having to constantly stay aware of changes in order to choose the cheapest source of reliable funds.
- *Liquid fund market access.* Institutions must choose from sources they can access quickly.
- *Outlook for monetary policy changes from the central bank.* Monetary policy drives the money supply, which impacts interest rates.
- *Outlook for interest rates.* Fund sources with the lowest expected interest rates are ideal, with managers having to forecast potential interest rate changes in the future.
- *Liquidity source rules and regulations.* Each liquidity source has its own set of rules and regulations that users must follow. Also critical is an understanding of availability, as some sources like the Eurocurrency market and federal funds market are only available during the trading day.



MODULE QUIZ 63.3

1. Tuesday, May 5, is the start of the reserve computation period for Lakeland Bank. Monday, May 18, represents the:
 - A. First day of the planning period.
 - B. First day of the reserve maintenance period.
 - C. Last day of the reserve maintenance period.
 - D. Last day of the reserve computation period.
2. Which of the following statements is correct in regards to reserve sources?
 - A. Long-term asset sales are typically used to cover immediate needs.
 - B. Monetary policy and interest rate movements are relatively independent.
 - C. The federal funds market is available anytime a bank has an immediate cash need.
 - D. Deficits which must be covered relatively quickly are often funded through the central bank discount window.

KEY CONCEPTS

LO 63.a

Liquidity represents a financial institution's access to funds, which (at a low cost) are immediately spendable, and available exactly when those funds are needed. A firm's net liquidity position is the difference between supplies of liquidity into the firm and demands for liquidity from the firm.

$$\text{net liquidity position (L)} = \text{supplies of liquidity} - \text{demands for liquidity}$$

If demand exceeds supply, $L < 0$, the firm has a liquidity deficit, and additional funds must be raised. If supply exceeds demand, $L > 0$, the firm has a liquidity surplus, and the excess funds should be invested to cover future liquidity needs.

Institutions face costs in managing liquidity, including time and money transaction costs incurred in finding liquid funding sources, interest costs on borrowed funds, and opportunity costs associated with liquidating assets to fund liquidity needs.

Liquidity problems stem from a variety of reasons. Maturity imbalances between short-term borrowing and long-term lending, interest rate risk impacting both customer deposits and asset values, availability risk, and early knowledge of significant customer activity are all forces which impact liquidity.

LO 63.b

At a high level, strategies for managing liquidity needs fall into three categories: asset liquidity management, liability management, or a balanced approach, which is a hybrid of asset and liability strategies.

The asset conversion strategy involves maintaining liquidity by converting assets into cash as needed to meet liquidity demands. Typical liquid assets include Treasury bills, CDs, municipal bonds, interbank deposits, repurchase agreements, Eurocurrency loans, federal funds loans, and federal agency securities.

The liability management entails borrowing funds to cover anticipated liquidity demands. Typical sources of borrowed liquidity include jumbo negotiable CDs (\$100,000+), repurchase agreements, Eurocurrency issuances, federal funds borrowings, central bank discount window borrowings, and advances from Federal Home Loan Banks.

A balanced liquidity management strategy involves meeting liquidity demands in part through assets such as marketable securities which can be sold quickly if needed and in part through advance arrangements for lines of credit from suppliers.

LO 63.c

To estimate liquidity requirements, there are four primary approaches: the sources and uses of funds approach, the structure of funds approach, the liquidity indicator approach, and the market signals (discipline) approach.

The sources and uses method is based on liquidity changes due to deposits and loans. Deposit increases drive liquidity higher, while loan increases drive liquidity lower. A positive liquidity gap or surplus exists when sources exceed uses, while a negative liquidity gap or deficit exists when uses exceed sources.

The structure of funds method divides sources of funds such as deposits into three categories (volatile/hot money liabilities, vulnerable funds, and core deposit liabilities) based on the likelihood that they will be withdrawn and no longer available to the firm. Once the categories are defined, liquid funds must be set aside based on a predetermined operating rule for each category. The liability liquidity reserve is by-product of the percentage in reserves that the bank would like to maintain for each category. Management is best served by incorporating potential future loans into the reserve equation as well. A liquidity manager may refine the structure of funds approach by defining best, most likely, and worst case liquidity scenarios and assigning

probabilities for each scenario. The expected liquidity requirement is then the sum of the probability of each unique outcome multiplied by the estimated liquidity surplus/deficit for each outcome.

Liquidity indicators are ratios which institutions use to estimate liquidity needs based on industry averages and experience. Ratios where a higher value indicate higher liquidity include the cash position indicator, liquid securities indicator, core deposit ratio, hot money ratio, and net federal funds and repurchase agreements position. Ratios where a higher value indicates lower liquidity include the capacity ratio, loan commitments ratio, pledged securities ratio, deposit composition ratio, and deposit brokerage index. Indicators which focus on liquid assets are focusing on *stored liquidity*, while the remainder focus on liabilities and future commitments (*purchased liquidity*).

The discipline of the financial marketplace approach is essentially a method where a sufficient liquidity position is only gauged by market signals indicating whether or not that level has been reached. Market signals applicable to this approach include: public confidence, institution's stock price performance, lost sales of assets, risk premiums on borrowings, central bank borrowings, and commitments to credit customers.

LO 63.d

The money position manager for a financial institution is tasked with managing its liquidity position and ensuring that it maintains a sufficient level of legal reserves, which are assets required by law and central banking regulations for a specific time period. The current system of accounting for legal reserves includes a reserve computation period and a reserve maintenance period which begins 30 days after the beginning of the reserve computation period.

Total required legal reserves is calculated using the following equation:

total required legal reserves =

(transaction deposit reserve requirement × daily average amount of net transaction deposits for the computation period) + (nontransaction reservable liabilities' reserve requirement × daily average amount of nontransaction deposits for the computation period)

Excess reserves occur when legal reserves (the daily average holding amount) exceed the calculated required reserves, while a deficit occurs when legal reserves fall short of the calculated required reserve amount. The goal for managing legal reserves is to have no excess reserves but also no deficit large enough to result in a penalty. A clearing balance is a reserve that a bank chooses to keep with the Fed to cover any debit items or checks that may be drawn against them.

The federal funds market is a fairly volatile, although relatively cheap, source of funds when a money position manager has a need to cover a large reserve deficit. Other options for covering deficits include selling liquid securities, drawing on balances held at other institutions, using repurchase agreements, borrowing in the Eurocurrency market, and selling time deposits.

LO 63.e

There are several sources of reserves that a money position manager can choose from in funding a reserve deficit. The factors that drive the decision as to which source to

use include need duration, need immediacy, the costs and risks of alternative funding sources, access to liquid fund markets, outlooks for monetary policy and interest rate changes, and rules and regulations tied to each liquidity source.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 63.1

1. **B** The net liquidity position is equal to the difference between the supplies of liquidity and the demand for liquidity. Supplies include asset sales (\$1,325,000), incoming deposits (\$2,500,000), and nondeposit services revenue (\$950,000). Demands include deposit withdrawals (\$1,015,000), dividend payments (\$470,000), and loan requests (\$845,000). The net liquidity position is therefore equal to: $(\$1,325,000 + \$2,500,000 + \$950,000) - (\$1,015,000 + \$470,000 + \$845,000) = \$2,445,000$. (LO 63.a)
2. **C** Of the choices given, only repurchase agreement sales (sales of liquid securities) would be a component of a liability (borrowed liquidity) management strategy. U.S. Treasury securities, federal agency securities, and municipal bond investments are all components of an asset liquidity management strategy. (LO 63.b)

Module Quiz 63.2

1. **B** The deposit composition ratio compares demand deposits to time deposits. An increasing ratio means that more deposits are demand (relative to time). Demand deposits are more volatile, as they fluctuate based on customer activity. Time deposits are more stable in that they have set maturities and penalties for early withdrawal. Higher demand deposits create a greater liquidity concern. An increasing hot money ratio, increases in reverse repo agreements, and an excess of federal funds sold over federal funds purchased will all improve liquidity positions. (LO 63.c)

Module Quiz 63.3

1. **D** If Tuesday, May 5, is the first day of the 14-day reserve computation period, the last day will be Monday, May 18. The planning period will be from Tuesday, May 19, to Wednesday, June 3, with the reserve maintenance period then spanning from Thursday, June 4, to Wednesday, June 17. (LO 63.d)
2. **D** Deficits that are of a more immediate nature are often funded through the central bank discount window. Long-term asset sales are typically used to cover longer-term (nonimmediate) deficits. Monetary policy and interest rate movements are highly related, as monetary policy impacts the money supply which in turn impacts interest rates. The federal funds market is only available during the trading day. (LO 63.e)

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Venkat and Baird, Chapter 4.

READING 64

INTRADAY LIQUIDITY RISK MANAGEMENT

Study Session 10

EXAM FOCUS

This reading examines intraday liquidity and begins with the basics on the uses and sources of intraday liquidity. It then discusses the governance structure of intraday liquidity risk management. It concludes by differentiating between the methods for tracking intraday flows and monitoring risk levels. For the exam, focus on the uses and sources of intraday liquidity as well as the metrics involved in tracking intraday flows and monitoring risk.

MODULE 64.1: USES AND SOURCES OF INTRADAY LIQUIDITY

LO 64.a: Identify and explain the uses and sources of intraday liquidity.

Uses of Intraday Liquidity

The uses of intraday liquidity are as follows:

Outgoing Wire Transfers

- Could be made for the bank itself (about one or two days lead time) or for its clients (often unpredictable).
- The most significant use of intraday liquidity.
- Payments occur throughout the day with a steady pattern.
- The outgoing payments must be carefully monitored to ensure that the intraday overdraft stays within the intraday credit limit because controls often exist that do not allow any exception. In that regard, outgoing payments can be slightly delayed or controlled until sufficient incoming receipts reduce the intraday overdraft.

Settlements at Payment Clearing and Settlement (PCS) Systems

- PCS systems often settle once daily (near the end of the business day), with a net inflow or outflow of funds.
- Forecasting amounts is challenging for same-day settlements but is easier for multi-day settlements.

Funding of Nostro Accounts

- Banks often have correspondent bank accounts in foreign countries (for transactions in that foreign country), known as *nostro accounts*.
- Depending on the activity going on in the nostro account for the day, there may be a net inflow or outflow of cash.
- Forecasting amounts is easier for settlements of securities and more difficult for client activities.

Collateral Pledging

- Specific client and bank transactions will require collateral to be pledged (e.g., margin trading).
- Acquiring that collateral results in a cash outflow.
- Forecasting amounts relies on trading volume and daily price change data.

Asset Purchases/Funding

- Banks need funds to cover investment portfolio securities purchases, fixed asset purchases, and client loans (e.g., draws on credit lines or new loans).
- The securities and fixed asset purchases are easier to forecast, but the client loans are more challenging.

Sources of Intraday Liquidity

The sources of intraday liquidity are as follows:

Cash Balances

- Includes amounts held in the central bank and amounts held in correspondent banks.
- Cash balances impacted by the bank's operations are easier to forecast than those impacted by client activities.

Incoming Funds Flow

- Banks receive payment inflows and financial market utilities (FMUs) settlements; the most significant source of intraday liquidity.
- Inflows may occur instantaneously or in batches.

Intraday Credit

- Central banks offer a significant source of intraday credit to banks; the overdraft is temporary during the day and is negated by the end of the business day.
- In some cases, interest is explicitly charged and in other cases, very high quality collateral must be pledged.

Liquid Assets

- Near-cash items include money market instruments, time deposits, and government securities with maturities of one year or less.

Overnight Borrowings

- Such borrowings are different from intraday credit in that they are paid back only on the next day.
- Overnight borrowings are a cost-benefit decision between having too much liquidity versus having insufficient liquidity to complete a given day's transactions.

Other Term Funding

- An extension of overnight borrowing for longer periods of time such as a week or even a month.
- More of a supplemental/occasional source of funds for intraday liquidity rather than the usual source.

Summary

Banks must be able to deal with the large amounts of cash inflows and outflows from many sources within the bank. The overall objective is to adhere to the intraday credit limits.

However, there are three key problems:

- Cash flows may be extremely volatile on a daily basis with very sudden inflows and/or outflows.
- Macroeconomic factors such as daily volatility of securities' prices lead to cash outflows to finance sudden margin calls. Or, the direct implementation of monetary policy by the central bank would impact market liquidity and ultimately, the bank's liquidity in terms of inflows/outflows of intraday funds.
- Real-time balances are often not available and that makes it difficult to accurately assess how much cash there is at a given moment as well as determining how much cash will be needed for the rest of the day.



MODULE QUIZ 64.1

1. A new bank treasurer is attempting to obtain a better understanding of the bank's daily cash inflows and outflows. Which of the following transactions is the most significant use of intraday liquidity?
 - A. Asset purchases/funding.
 - B. Funding of nostro accounts.
 - C. Outgoing wire transfers.
 - D. Settlements at payment, clearing, and settlement (PCS) systems.
2. A bank treasurer is attempting to minimize liquidity funding costs. Which of the following sources of liquidity is most likely to have the greatest explicit financial cost?
 - A. Cash balances.
 - B. Incoming funds flow.
 - C. Intraday credit.
 - D. Liquid assets.
3. Which of the following factors is least likely to increase a bank treasurer's challenge in managing cash in order to stay within its intraday credit limits?

- A. Cash flow volatility.
- B. Credit quality of assets.
- C. Insufficient real-time data.
- D. Securities price volatility.

MODULE 64.2: MANAGING AND MEASURING INTRADAY LIQUIDITY RISK

LO 64.b: Discuss the governance structure of intraday liquidity risk management.

A strong governance structure in managing intraday liquidity risk covers the following four key areas: (1) active risk management, (2) integration with risk governance, (3) risk assessment, and (4) risk measurement and monitoring.

Active Risk Management

Rather than merely viewing intraday liquidity risk as a passive risk that is always a given, a more proactive approach to minimize such a risk is more desirable. For example, settlement and systemic risks are explicitly recognized and classified in the institution's risk appetite.

Integration With Risk Governance

The duties of managing intraday liquidity risk are integrated into the three lines of defense (treasury, corporate risk management, and internal audit). The focus is on corporate risk management throughout the organization (e.g., funding policies and procedures, monitoring risk activities throughout the entire firm, consolidated reporting).

Relevant management personnel are actively involved in making the crucial decisions.

Oversight committees are balanced and have personnel from key areas such as treasury and information technology (IT).

Risk Assessment

The focus here is on settlement risks—the review should focus on risk identification, measurement, and evaluation. Business unit managers and the risk management team would perform an analysis of the internal controls to determine their ability to reduce or minimize settlement risk.

Risk Measurement and Monitoring

Monitoring intraday liquidity risk could be done in two ways: (1) dollar value of intraday credit provided to customers, and (2) dollar value of intraday credit used by the firm.

In terms of credit provided to customers, the development of technology to allow banks to noticeably enhance their capabilities in determining customers' real-time

cash balances will allow banks to chargeback their customers any intraday overdraft charges from the central bank.

In terms of intraday credit use, the intention is to be able to provide a big picture view of all the intraday credit use. However, some of the bank's cash accounts (e.g., held at correspondent banks) might not be able to provide real-time account balances. Also, the ability to consolidate data pertaining to account balances into a single place is limited by the lack of consistency in IT investments across the different banks.

Tracking Intraday Flows and Monitoring Risk Levels

LO 64.c: Differentiate between methods for tracking intraday flows and monitoring risk levels.

Methods for Tracking Intraday Flows

- *Total payments.* Keeping track of data pertaining to all electronic payments made. In further detail, each payment would have data such as the amount, time of transaction, payer, and payee. With all of the data gathered, important metrics such as total payments sent and received, net position in settlement account, and payment volume trends could be monitored.
- *Other cash transactions.* This covers intraday and ending settlement positions for all FMUs in which the bank is involved. Some banks may be involved with securities settlements networks and in that regard, those banks could focus on obtaining account and collateral balances at periodic intervals during the day.
- *Settlement positions.* Data pertaining to a bank's settlement positions with all of its FMUs is crucial to keep and monitor, as the payments have deadlines and are usually of significant amounts. Doing so will ensure proper management of intraday liquidity as well as the bank's overall systemic risk. In addition, it is useful to look for settlement position trends and whether they can be linked to macroeconomic factors, to be able to better anticipate liquidity needs earlier in the day.
- *Time sensitive obligations.* The time sensitivity aspect operates the same as that for settlement positions (e.g., stated time of days). Late settlements (even on the same day) may result in penalties and potentially worse outcomes. As a result, the deadlines need to be carefully monitored.
- *Total intraday credit lines to clients and counterparties.* Awareness of the actual versus potential amounts of credit provided is important to determine the maximum exposure, for example. Also, the bank should maintain statistics on credit use such as normal and high use times and levels.
- *Total bank intraday credit lines available and usage.* The idea here is for the bank to determine and control how much systemic risk it contributes to financial markets. Therefore, the bank must compute how much intraday credit it uses in normal circumstances and compare it to the maximum amount of intraday credit available (committed and uncommitted amounts).

Monitoring Risk Levels

- *Daily maximum intraday liquidity usage.* Assuming transactions for a given day can be obtained after the fact, the metric is calculated by taking the most negative balance of the day and dividing by the credit line limit (committed or uncommitted). Therefore, it does not require the information on a real-time basis. The metric should be calculated for all of the bank's cash accounts and viewed on a combined basis to have a more accurate sense of total intraday liquidity use.
- *Intraday credit relative to Tier 1 capital.* By comparing total intraday credit and unsecured intraday credit, it acknowledges that pledging appropriate collateral does reduce intraday settlement risk. The ratio of unsecured and available (as opposed to used) intraday credit to Tier 1 capital provides a sense of the bank's level of intraday settlement risk, or systemic risk.
- *Client intraday credit usage.* The ratio of the client's highest intraday borrowing amount to the credit line limit. It is computed on an aggregate basis for all of the bank's clients and is an indicator of how much liquidity must be provided to finance the clients' operations. In turn, further analysis can be performed to determine how the client's operations affect how the bank manages its own intraday liquidity. On an individual client basis, a bank can determine which clients are consistently in overdraft positions and whether remedial actions and/or additional charges are necessary.
- *Payment throughput.* Such metrics look at the proportion of outgoing payments and when they occur during the day. Tracking such measures is a good idea because it helps in monitoring payment patterns and to assure that no payments will be late. Also, it would ensure that the bank is in compliance with the FMU's stipulation of making a certain percentage of payments within a deadline. Finally, it would assist the bank in determining its peak payment periods and how it impacts its available intraday liquidity and its intraday credit use. As a measure of how efficiently an FMU is at using intraday credit, a bank could monitor its maximum intraday credit use as a percentage of total transaction amounts with an FMU.



MODULE QUIZ 64.2

1. Which of the following metrics is most appropriate in determining a bank's systemic risk?
 - A. Client intraday credit usage.
 - B. Intraday credit relative to Tier 1 capital.
 - C. Daily maximum intraday liquidity usage.
 - D. Total intraday credit lines to clients and counterparties.
2. In the context of characteristics of an effective governance structure in controlling intraday liquidity within a bank, there is emphasis on expertise in which line of defense?
 - A. Treasury.
 - B. Internal audit.
 - C. Information technology.
 - D. Corporate risk management.

KEY CONCEPTS

Uses of intraday liquidity include:

- Outgoing wire transfers.
- Settlements at Payment Clearing and Settlement (PCS) Systems.
- Funding of nostro accounts.
- Collateral pledging.
- Asset purchases/funding.

Sources of intraday liquidity include:

- Cash balances.
- Incoming funds flow.
- Intraday credit.
- Liquid assets.
- Overnight borrowings.
- Other term funding.

LO 64.b

A strong governance structure in managing intraday liquidity risk covers the following four key areas:

- Active risk management.
- Integration with risk governance.
- Risk assessment.
- Risk measurement and monitoring.

LO 64.c

Methods of tracking intraday flows include:

- Total payments.
- Other cash transactions.
- Settlement positions.
- Time sensitive obligations.
- Total intraday credit lines to clients and counterparties.
- Total bank intraday credit lines available and usage.

Monitoring risk levels include:

- Daily maximum intraday liquidity usage.
- Intraday credit relative to Tier 1 capital.
- Client intraday credit usage.
- Payment throughput.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 64.1

1. **C** Outgoing wire payments (either for customers or for the bank itself) are likely the most significant use of intraday liquidity. (LO 64.a)
2. **C** Intraday credit may require collateral pledging (opportunity cost) with no interest charged or it may require interest payments (explicit cost) for using the line of credit during the day.
Cash balances and liquid assets represent assets owned by the bank so if they are used for financing/liquidity purposes, there is no explicit cost, although there may be implicit or opportunity costs, especially with liquid assets (e.g., interest earned on time deposits or banker's acceptances). There is no explicit financial cost associated with incoming funds flow. (LO 64.a)
3. **B** The credit quality of a bank's assets (e.g., cash balances, liquid assets) is very high and therefore, unlikely to have a negative impact on liquidity. Liquid assets include money market instruments, time deposits, and banker's acceptances, all of which have no or very little default risk.
The other three factors explicitly increase the bank treasurer's challenge in terms of intraday liquidity management. (LO 64.a)

Module Quiz 64.2

1. **B** The ratio of unsecured and available (as opposed to used) intraday credit to Tier 1 capital provides a sense of the bank's level of intraday settlement risk, or systemic risk.
The other metrics are used either to understand intraday cash flows or to monitor risk levels but do not specifically attempt to measure the bank's systemic risk that it contributes to the overall financial markets. (LO 64.c)
2. **D** Ideally, the intraday liquidity risk management framework adopts the standard three lines of defense with emphasis on expertise in the second line of defense, namely corporate risk management.
The other two lines of defense are treasury and internal audit. Information technology is not a line of defense, per se. (LO 64.b)

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Castagna and Fede, Chapter 6.

READING 65

MONITORING LIQUIDITY

Study Session 10

EXAM FOCUS

Liquidity and cash flow management are critically important to the success and survival of a financial institution. For the exam, be familiar with the two dimensions (time and amount) of cash flows and differences between deterministic and stochastic cash flows. An important concept is the liquidity option and the primary impacts these options have on a bank. Liquidity risks, a bank's liquidity generation capacity, and sources of liquidity are all elements of liquidity management that must be understood and maintained in order for a bank to survive. Term structures for both expected cash flows and cumulative expected cash flows must be modeled and perpetually managed in order to ensure solvency. Finally, a bank's term structure of available assets and the impact various transactions have on this structure highlights where it can obtain sources of liquidity.

MODULE 65.1: CASH FLOW TYPES AND LIQUIDITY OPTIONS

Deterministic and Stochastic Cash Flows

LO 65.a: Distinguish between deterministic and stochastic cash flows and provide examples of each.

Cash flows at a point in time can be identified based on two dimensions: time and amount. In terms of time, cash flows can be **deterministic**, which means they occur at known times, or **stochastic**, which means they occur randomly. Similarly, cash flows whose amounts are known are deterministic (and considered *fixed*) while cash flows that have unknown amounts are stochastic. Stochastic amounts are broken out into four categories: credit related (uncertainty due to credit events), behavioral (decisions by bank counterparties and clients drive cash flows), indexed/contingent (market variables drive cash flow amounts), and new business (cash flows driven by new contracts). Figure 65.1 provides examples of the types of cash flows that are deterministic and stochastic as to timing and amount.

Figure 65.1: Deterministic and Stochastic Cash Flows

Cash Flows			Time	
			Deterministic	Stochastic
Amount	Deterministic	Fixed	<ul style="list-style-type: none"> ■ Often related to financial contracts that are fixed and can be both assets and liabilities (bonds, loans, mortgages with fixed rates) ■ Coupons (risk free) on fixed-rate bonds ■ Amortization of fixed-rate mortgage (risk free) 	<ul style="list-style-type: none"> ■ Withdrawals from credit lines (by the bank) ■ One touch option payouts
		Stochastic		
		Credit related		<ul style="list-style-type: none"> ■ Client default → missing cash flows ■ NPV recovery on client default
		Behavioral		<ul style="list-style-type: none"> ■ Deposit prepayments ■ Mortgage prepayments ■ Withdrawals from deposits ■ Credit line withdrawals
		Indexed/contingent (linked to market variables)	<ul style="list-style-type: none"> ■ European option exercise: pay out ■ Floating-rate coupons linked to market rates (risk free) 	<ul style="list-style-type: none"> ■ American option exercise: pay out
		New business	<ul style="list-style-type: none"> ■ Expiring contract renewals ■ Bank issues new debt 	<ul style="list-style-type: none"> ■ New loans ■ New assets ■ New deposits

Liquidity Options

LO 65.b: Describe and provide examples of liquidity options and explain the impact of liquidity options on a bank's liquidity position and its liquidity management process.

A **liquidity option** is the right held by the option holder to give cash to or receive cash from the bank at predetermined times and terms. The need for a surplus of liquidity drives the exercise of the option. Standard financial market options are exercised when profitable and although cash flows after exercise are independent of the exercise decision, they are often positive. The decision to exercise liquidity options is based on cash flows produced after exercise, which may be independent from financial profitability.

A line of credit offered to a customer in which the customer has the right to withdraw funds whenever she wants is an example of a liquidity option sold by the bank. In situations when the customer's credit spread widens and it would cost the customer a higher rate to borrow additional funds, drawing on an existing line of credit with an agreed upon rate may be beneficial. Convenience, even if the spread shrinks, may also be a reason for a customer to draw on their credit line. The ability of a customer to withdraw funds from their savings accounts with minimal to no notice is also a liquidity option offered by the bank. Finally, a customer who prepays a mortgage is typically doing so because interest rates have declined. While the bank is receiving the mortgage balance early (and thereby gaining liquidity), replacing the mortgage will likely be at lower and less advantageous rates.

The exercise of liquidity options has two primary effects on a bank. The first impact is on the balance sheet based on the amount repaid or withdrawn. The second impact is either a positive or negative financial impact, driven by the spread between the initial contract's interest rates, spread, and market values relative to those same metrics at the time the option is exercised. The tools needed to hedge liquidity impacts will either involve cash reserves, liquid assets, and/or easy access to credit lines.



MODULE QUIZ 65.1

1. Each of the following cash flows is stochastic in timing and amount except:
 - A. new debt issued by a bank.
 - B. a bank's recovery on a client default.
 - C. the payout on an American-style call option.
 - D. mortgage prepayments due to interest rate declines.
2. Which of the following statements comparing liquidity to financial options is most accurate?
 - A. Financial options typically produce negative cash flows.
 - B. Financial options align the cash flow decision with profitability.
 - C. Both options are typically only exercised when they are in the money.
 - D. Liquidity options may or may not be financially profitable upon exercise.

MODULE 65.2: LIQUIDITY RISKS, CASH FLOWS, AND CAPACITY

LO 65.d: Interpret the term structure of expected cash flows and cumulative cash flows.

Net cash flows that a bank expects to receive and pay in the future must be monitored in order to manage quantitative liquidity risk. The causes of liquidity risk, which can

involve both positive and negative cash flows, relate to existing and forecasted future contracts arising from ordinary business activity. The sources of liquidity are the factors that can generate positive cash flows to help manage and hedge liquidity risk.

Cumulative expected cash flows consist of both positive and negative cash flows expected to occur over time, as referenced from a specific point in time. For a series of contracts/securities (d_1, d_2, \dots), expected positive and negative cash flows (expected at time t_1 from reference time t_0) are derived using the following formulas:

$$cf_e^+(t_0, t_1) = E \left[\sum_{j=1}^N cf^+(t_0, t_1; d_j) \right]$$

$$cf_e^-(t_0, t_1) = E \left[\sum_{j=1}^N cf^-(t_0, t_1; d_j) \right]$$

At reference time t_0 , cumulative cash flows from date t_a to time t_b are calculated using the following formula:

$$CF(t_0, t_a, t_b) = \sum_{i=a}^b (cf_e^+(t_0, t_i) + cf_e^-(t_0, t_i))$$

The **term structure of expected cash flows (TSECF)**, also known as the maturity ladder, is the collection by date of positive and negative expected cash flows up until the expiration of the contract with the longest maturity (for equation purposes, t_b).

$$TSECF(t_0, t_b) = \{cf_e^+(t_0, t_0), cf_e^-(t_0, t_0), cf_e^+(t_0, t_1), cf_e^-(t_0, t_1), \dots, cf_e^+(t_0, t_b), cf_e^-(t_0, t_b)\}$$

The **term structure of expected cumulated cash flows (TSECCF)** is the collection of cumulative expected cash flows in date order:

$$TSECCF(t_0, t_b) = \{CF(t_0, t_0, t_1), CF(t_0, t_0, t_2), \dots, CF(t_0, t_0, t_b)\}$$

Banks use the TSECCF to not only monitor the cash flow balance on a given date but also how changes in net cash flows affect cash position to date. The balance of cash inflows and outflows can be negative on a specific date, but a positive cash position from previous inflows can help to reduce a net negative position. The key measure for a bank will be the cumulative amount of cash it has available at a given time.

In order to calculate the TSECF and TSECCF for a bank, a balance sheet showing assets, liabilities, and equities is the starting point. Assuming that there are no liquidity options within the deposits and the assets themselves bear no default risk, expiring assets will provide positive cash flow to the bank and expiring liabilities will result in negative cash flows to be paid by the bank. The assets and liabilities should be ordered based on expiration date. It is also important to consider interest payments yielded by the assets and liabilities.

The TSECCF each period is the cumulative balance of cash flows from the expiration of the assets and liabilities themselves, as well as the associated interest impact.

EXAMPLE: TSECCF

At the start of Year 1, King Bank's balance sheet reflects the following balances:

Assets: \$125 million

Liabilities: \$75 million

Equity: \$50 million

At the end of Year 1, assets expire that are worth \$25 million. At the end of Year 2, liabilities expire that are worth \$15 million.

Assuming assets earn an interest rate of 6.00% and liabilities bear an interest rate of 5.00%, **calculate** TSECCF for Years 1 and 2.

Answer:

TSECCF (Year 1): \$25 million (the expiring asset) + \$7.5 million (6.00% interest earned on \$125 million) – \$3.75 million (5.00% interest paid on \$75 million) = \$28.75 million

TSECCF (Year 2): \$28.75 million (from Year 1) + \$6.0 million (6.00% interest earned on \$100 million) – \$15 million (the expiring liability) – \$3.75 million (5.00% interest paid on \$75 million) = \$16.00 million

Key elements of the model to consider include the following:

- Cash flows are often stochastic due to their linkage to market indices.
- Credit models need to consider default risk and correlations that inevitably exist between bank counterparties.
- Behavioral models can be used to adjust cash flows for liquidity options.
- New business cash flows should also be considered, as well as rollovers of maturing liabilities and new bond issuances to fund asset increases.

The Treasury Department goal is to monitor TSECF and TSECCF, with the latter ideally being positive at all times, implying that positive cash flows can cover negative cash flows. Because TSECF forecasts expected values of cash flows, TSECCF only captures expected values as well. Because of the timing of asset and liability maturities, there may be periods of negative cumulated cash flows. A negative balance in TSECCF could be a precursor to insolvency and bankruptcy, which implies it is important to maintain a positive balance.

LO 65.c: Describe and apply the concepts of liquidity risk, funding cost risk, liquidity generation capacity, expected liquidity, and cash flow at risk.

Risk is related to future uncertainty, which can be positive or negative. However, the focus of risk management tends to be on adverse uncertainty. **Quantitative liquidity risk** (which includes both market liquidity risk and funding liquidity risk) for a bank relates to situations in which the bank receives cash flows that are lower than expected in the future, which is problematic when trying to meet future payment obligations. **Market liquidity risk**, which is included as a component of quantitative liquidity risk, occurs when assets cannot be sold quickly at a fair price, resulting in lower than expected cash inflows from the sale.

Funding cost risk (cost of liquidity risk) occurs when a bank has to incur a higher than expected cost (spread between cost over the risk-free rate) in order to receive funds from available liquidity sources. Prior to the economic recession in the United States in 2007, the spread was relatively low reflecting minimal default risk concerns. Rolling over liabilities posed minimal risk due to the consistent, low spread economic environment. Beginning in 2007, raising funds at low spreads became extremely difficult. Volatility increased, available funding declined in the capital markets, and intervention was needed in order to keep this critical banking process functioning.

Liquidity risk, encompassing both the quantitative and cost dimensions, is the amount of economic losses due to the combination of positive and negative cash flows and available cash on a specific date differing from expectations. To summarize, the quantitative dimension relates to the inability to secure funds to meet obligations, thereby requiring asset sales at below fair value. The cost dimension is the ability to raise funds, but only at higher than expected costs (e.g., high interest rates). An additional cost is the opportunity cost, occurring when excess liquidity can only be invested at rates below expectations.

Liquidity generation capacity (LGC) reflects the ability of a bank to generate positive cash flows from its sources of liquidity, beyond those which are contractual. The LGC is the primary tool that a bank uses to manage negative amounts in the term structure of cumulated expected cash flows. LGC comes from two primary sources: balance sheet expansion (using secured or unsecured funding) and balance sheet shrinkage (via asset sales).

- **Balance sheet expansion.** Can occur from issuing new bonds (unrelated to new business or rollovers of existing debt), credit line withdrawals, and borrowings through deposit increases. External factors (clients, institutional counterparties) play a significant role in balance sheet expansion. Liquidity other than balance sheet liquidity (defined in the next bullet) comes from balance sheet expansion.
- **Balance sheet shrinkage.** Can occur from asset sales of liquid and relatively nonliquid securities. External factors do not play a role in balance sheet shrinkage or balance sheet neutral transactions such as repo transactions. Balance sheet liquidity (BSL) comes from existing assets on the balance sheet and is directly linked to balance sheet shrinkage.

LGC can also be delineated between security-linked and security-unlinked liquidity. Security-linked liquidity (essentially BSL) includes secured debt issuances, secured withdrawals from credit lines available via other financial institutions, and asset and repo sales. Security-unlinked liquidity includes unsecured bond issuances, unsecured borrowing from new clients (via new deposits), and unsecured credit line withdrawals.

For the purposes of defining the equations presented following, the three primary source types for liquidity are asset sales (AS), secured funding from repo transactions and using assets as collateral (RP), and unsecured funding from credit line withdrawals and interbank market deposit transactions (USF). AS and RP transactions will reduce the balance sheet, or at best keep it constant. USF transactions expand the balance sheet.

The **term structure of LGC**, known as TSLGC, is the collection of liquidity at a given time that can be generated by sources of liquidity up to a terminal time t_b . The values are all expected values.

$$\text{TSLGC}(t_0, t_b) = \{\text{AS}(t_0, t_1), \text{RP}(t_0, t_1), \text{USF}(t_0, t_1), \dots, \text{AS}(t_0, t_b), \text{RP}(t_0, t_b), \text{USF}(t_0, t_b)\}$$

The **term structure of cumulated LGC**, known as TSCLGC, is the cumulative liquidity that can be generated by sources of liquidity up to a terminal time t_b .

$$\text{TSCLGC}(t_0, t_b) = \left\{ \sum_{i=0}^1 \text{TSLGC}(t_0, t_i), \sum_{i=0}^2 \text{TSLGC}(t_0, t_i), \dots, \sum_{i=0}^b \text{TSLGC}(t_0, t_i) \right\}$$

The TSLGC sources of liquidity come from either the banking or trading books. The banking book contains available for sale (AFS) bonds and other eligible assets that are easily repoed or sold. A repo allows a bank to sell an asset and then buy it back at the expiration of the contract. In essence, it is a collateralized loan that is likely easier to execute than obtaining unsecured funding. For repos and collateralized loans, banks need to consider the size of the haircut. **Haircuts** are reductions in the bond's market value, indicative of the net amount the counterparty is willing to lend the bank. The size of the haircut is driven by the price volatility of the collateral and the default probability of the bond issuer. Also included in the TSLGC calculation are received committed credit lines, which become liabilities when used. Finally, unsecured funding via deposit transactions (through the interbank market) are a potential source of liquidity from the banking book. From the trading book, a bank will have bonds, stocks, and other unencumbered assets that can serve as sources of liquidity.

The **term structure of expected liquidity (TSL_e)** is a measure indicating whether an institution can cover negative cumulated cash flows at a given point in the future. To be solvent at all times, an institution must have a positive TSL. The TSL will include all possible expected cash flows from ordinary business activity, from new business, and from the policies and measures undertaken to manage negative cumulated cash flows. The TSL is a combination of the TSECCF and TSCLGC measures described earlier, such that the formula to calculate it is shown below:

$$\text{TSL}_e(t_0, t_b) = \{\text{TSECCF}(t_0, t_0), \text{TSECCF}(t_0, t_1) + \text{TSCLGC}(t_0, t_1) \dots \text{TSECCF}(t_0, t_b) + \text{TSCLGC}(t_0, t_b)\}$$

EXAMPLE: Term structure of LGC

The following table shows the TSECF and TSCLGC amounts for Years 1–5 for Leland Bank.

Years	TSECF	TSCLGC
1	3.9	0
2	5.8	2.0
3	18.2	2.0
4	−6.9	4.8
5	2.5	4.8

Assuming 0 for each measure in Year 0, **calculate** the TSECCF and TSL amounts for Years 1–5.

Answer:

TSECCF = cumulative TSECF amounts

TSL = TSECCF + TSCLGC

Year 1: TSECCF: 3.9 TSL = 3.9 + 0 = 3.9

Year 2: TSECCF: 9.7 TSL = 9.7 + 2.0 = 11.7

Year 3: TSECCF: 27.9 TSL = 27.9 + 2.0 = 29.9

Year 4: TSECCF: 21.0 TSL = 21.0 + 4.8 = 25.8

Year 5: TSECCF: 23.5 TSL = 23.5 + 4.8 = 28.3

Because most cash flows are stochastic, modeling should take into account both expected values and volatility associated with those values. It is important to ensure that extreme values for both positive and negative cash flows are measured.

Positive **cash flow at risk** is defined using the following formula, with x reflecting risk factors such as credit, behavioral, and market variables.

$$cfaR_{\alpha}^{+}(t_0, t_i) = cf_{\alpha}^{+}(t_0, t_i; x) - E[cf(t_0, t_i; x)] = cf_{\alpha}^{+}(t_0, t_i; x) - cf_e(t_0, t_i; x)$$

Negative cash flow at risk is similar, with the equation shown here:

$$cfaR_{1-\alpha}^{-}(t_0, t_i) = cf_{1-\alpha}^{-}(t_0, t_i; x) - E[cf(t_0, t_i; x)] = cf_{1-\alpha}^{-}(t_0, t_i; x) - cf_e(t_0, t_i; x)$$

The term structure of unexpected cash flows, given a confidence level of α , is shown next (for positive and negative amounts):

$$TSCF_{\alpha}^{+}(t_0, t_b) = \{cfaR_{\alpha}^{+}(t_0, t_0), cfaR_{\alpha}^{+}(t_0, t_1), \dots, cfaR_{\alpha}^{+}(t_0, t_b)\}$$

$$TSCF_{1-\alpha}^{-}(t_0, t_b) = \{cfaR_{1-\alpha}^{-}(t_0, t_0), cfaR_{1-\alpha}^{-}(t_0, t_1), \dots, cfaR_{1-\alpha}^{-}(t_0, t_b)\}$$

The formulas represent upper and lower bounds for the term structure of cash flows, with an expected value equal to the TSECF.

Redefining the term structure of liquidity (TSL) with maximum and minimum cash flows at confidence levels α and $1 - \alpha$ respectively, the appropriate formulas are shown here:

$$TSL_{\alpha}(t_0, t_b) = \{cf_{\alpha}(t_0, t_1), \dots, cf_{\alpha}(t_0, t_b)\}$$

$$TSL_{1-\alpha}(t_0, t_b) = \{cf_{1-\alpha}(t_0, t_1), \dots, cf_{1-\alpha}(t_0, t_b)\}$$

The **term structure of liquidity at risk (TSLaR)** is the collection of unexpected cash flows at each date for a given period, representing the difference between the average and minimum levels of cash flows. With a confidence level of $1 - \alpha$, the TSLaR is calculated using the following formula:

$$TSLaR_{1-\alpha}(t_0, t_b) = \left\{ cf_{1-\alpha}(t_0, t_1) - TSECCF(t_0, t_1) - TSCLGC(t_0, t_1), \dots, \right. \\ \left. cf_{1-\alpha}(t_0, t_b) - TSECCF(t_0, t_b) - TSCLGC(t_0, t_b) \right\}$$



MODULE QUIZ 65.2

1. If a bank manager is concerned about a high cost of liquidity risk, she is most likely concerned about:
 - A. selling assets quickly at fair market prices.
 - B. receiving lower than expected cash inflows in the future.
 - C. generating positive cash flows from its sources of liquidity.
 - D. a high interest rate for borrowing relative to the risk-free rate.
2. Which of the following statements is least accurate regarding TSECF and TSECCF calculations and the models used to estimate them?
 - A. Rollovers of maturing liabilities should be included.
 - B. Behavioral components are often adjusted for liquidity options.
 - C. Default risk and correlations between bank counterparties need to be captured.
 - D. Only deterministic cash flows are counted, with stochastic cash flows captured in other models.

MODULE 65.3: MANAGING ASSETS FOR LIQUIDITY

LO 65.e: Discuss the impact of available asset transactions on cash flows and liquidity generation capacity.

The **term structure of available assets (TSAA)** is a tool used to monitor a bank's LGC and to provide an indication of the extent to which an asset can be used to create liquidity. When a bank purchases a bond, the cash position reflects an outflow for the purchase and subsequent inflows for interest and the principal paid back at maturity. Because these cash flows relate to a contract, they are included in both the TSECF and TSECCF calculations after accounting for default probabilities. Also impacting the TSAA are other types of purchases (which increase the TSAA) and asset expirations (which decrease the TSAA). Repo transactions and sales impact asset availability and the TSAA calculation. A key takeaway is that possession, rather than ownership, drives availability for liquidity purposes.

Transactions that impact the TSAA include the following:

- Increases in the TSAA:
 - Reverse repo transactions: The bank pays cash equal to the asset price less the haircut in exchange for receiving the asset. The counterparty owns the asset (implying that asset payments are not included in TSECF and TSECCF calculations), but the bank has possession and can therefore use it as collateral for other transactions. The TSAA increases by the repo's notional amount, while TSLGC is not impacted (unless the asset is repoed).
 - Buy/sellback transactions: Cash and assets are exchanged, but unlike with reverse repos ownership and possession of the asset both pass to the bank at the start of the contract. Asset payments before the sellback go to the bank, which means that they, along with purchase and sale cash flows, are included in TSECF and TSECCF calculations. The TSAA increases by the notional amount of the agreement, while the TSLGC amount is not impacted (unless the asset is repoed).
 - Security borrowing: While similar to the buy/sellback, possession passes to the bank and no cash is paid by the bank to the counterparty. The counterparty

receives payments for the asset. The only impact to TSECF and TSECCF is the interest payment made by the bank at the expiration of the contract. The TSAA increases by the notional amount of the borrowing, as the bank can use the borrowed security as collateral. The TSLGC is not impacted, although the asset can produce liquidity.

- Decreases in the TSAA:
 - Repo transactions: The bank receives cash equal to the asset price less the haircut in exchange for delivering the asset to the counterparty. While the bank owns the assets, the counterparty has possession, which means they are not available for the bank's liquidity purposes. Asset payments during the life of the repo belong to the bank, which means TSECF and TSECCF are not impacted by those payments. The TSAA declines by the notional amount of the repo, while the TSLGC is impacted by both the cash received at the start and the negative cash flow at the end.
 - Sell/buyback transactions: Cash and assets are exchanged, but unlike with repo transactions, ownership and possession passes to the counterparty at the start of the contract. Asset payments prior to the buyback belong to the counterparty, which results in the removal of cash flows from the TSECF and TSECCF calculations. The TSAA decreases by the notional amount of the agreement, while the TSLGC is impacted in a similar fashion to repo transactions.
 - Security lending: While similar to the sell/buyback, only possession passes to the counterparty; no cash is paid by the counterparty to the bank. The bank receives fee payments for the asset along with interest from the counterparty at contract expiration, which positively impacts TSECF and TSECCF. The TSAA decreases by the notional amount of the lending arrangement, while the TSLGC is not impacted as the asset cannot generate liquidity until the end of the contract.

For assets such as stocks that don't have expiration dates, the only contract cash flows that impact TSECF and TSECCF are the initial outflow for the purchase and the inflows for dividends received.

For a single asset A_1 , where $A(t_i)$ is the asset quantity in the bank's possession, the TSAA is expressed as follows:

$$TSAA^{A_1}(t_0, t_b) = \{A_1^P(t_0), A_1^P(t_1), \dots, A_1^P(t_b)\}$$

For a set of M securities held by the bank, the total TSAA for all assets is equal to:

$$TSAA(t_0, t_b) = \left\{ \sum_{m=1}^M A_m^P(t_0), \sum_{m=1}^M A_m^P(t_1), \dots, \sum_{m=1}^M A_m^P(t_b) \right\}$$

Figure 65.2 summarizes the impacts that the transaction types discussed previously have on the various liquidity measures described throughout this reading.

Figure 65.2: Impact of Various Transactions on TSAA, TSLGC, and TSECCF

Transaction Types			Impacts		
Transaction Type	Possession	Ownership	TSAA	TSLGC	TSECF/TSECCF
Asset purchase	Bank	Bank	Yes	No (although possible)	Yes
Asset sale	Counterparty	Counterparty	Yes	Yes	Yes
Repo	Counterparty	Bank	Yes	Yes	No
Reverse repo	Bank	Counterparty	Yes	No (although possible)	Yes
Sell/buyback	Counterparty	Counterparty	Yes	Yes	Yes
Buy/sellback	Bank	Bank	Yes	No (although possible)	Yes
Security lending	Counterparty	Bank	Yes	No	Yes
Security borrowing	Bank	Counterparty	Yes	No (although possible)	Yes

As an example, a bond that is purchased will create an outflow for the TSECF/TSECCF calculations equal to the purchase price and an increase in the TSAA for the maturity value. Each subsequent coupon payment will increase TSECF by the amount of the payment and TSECCF will cumulatively increase by the coupon payments. At maturity, TSAA drops to 0 and TSECF/TSECCF reflect the inflow of the last coupon payment and the principal payment. If the bank chooses to sell a portion of the bond, it will reduce the TSAA by the amount of the sale, reduce the impact to TSECF/TSECCF due to small coupon payments and a lower principal payment at contract's end, and increase TSCLGC at the time of the sale.

Repo transactions will reduce TSAA by the notional amount of the repo but will increase TSCLGC by the repo price less the applicable haircut. When the repo ends, TSAA will return to previous levels, and TSCLGC will go back to zero. Reverse repos increase the TSAA by the notional amount of the repo, with a cash outflow reflecting the current price of the bond and the haircut reducing TSECF/TSECCF. When the reverse repo ends, a cash inflow reflecting interest earned positively impacts TSECF/TSECCF.

For a buy/sellback, the bank agrees to buy a specific amount of bonds and sell them back after a period of time. The cash outflow at the time of purchase is based on the current price of the bond and will increase TSAA while decreasing TSECF/TSECCF. The sellback will reduce TSAA but increase TSECF/TSECCF. For the sell/buyback, TSAA declines while TSCLGC increases at the time of sale. The buyback will increase TSAA and decrease TSCLGC.

A lending arrangement will reduce TSAA when the asset is lent and increase it when it is returned. The only cash impact (which positively impacts TSECF/TSECCF) is the fee received by the borrower at the end of the contract. In a borrowing arrangement, the only impact is the cash impact (which negatively impacts TSECF/TSECCF) associated with the interest payment at contract's end.



MODULE QUIZ 65.3

1. Gerard Bank enters into a reverse repo transaction for six months. Which of the following statements is most accurate regarding the impact of the transaction?
 - A. TSLGC will not be impacted.
 - B. Both TSAA and TSECCF are impacted.
 - C. TSECF is impacted, but TSECCF will not be impacted.
 - D. Possession and ownership of the asset belong to the counterparty.

KEY CONCEPTS

LO 65.a

Cash flows at a point in time can be identified based on two dimensions: time and amount. In terms of time, cash flows can be deterministic, which means they occur at known times, or stochastic, which means they occur randomly. Similarly, cash flows whose amounts are known are deterministic while cash flows that have unknown amounts are stochastic. Stochastic amounts are broken out into four categories: credit related (uncertainty due to credit events), behavioral (decisions by bank counterparties and clients drive cash flows), indexed/contingent (market variables drive cash flow amounts), and new business (cash flows driven by new contracts).

LO 65.b

A liquidity option is the right held by the option holder to give cash to or receive cash from the bank at predetermined times and terms. The need for a surplus of liquidity drives the exercise of the option. The decision to exercise liquidity options is based on cash flows produced after exercise, which may be independent from financial profitability.

The exercise of liquidity options has two primary effects on a bank. The first impact is on the balance sheet based on the amount repaid or withdrawn. The second impact is either a positive or negative financial impact, driven by the spread between the initial contract's interest rates, spread, and market values relative to those same metrics at the time the option is exercised. The tools needed to hedge liquidity impacts will either involve cash reserves, liquid assets, and/or easy access to credit lines.

LO 65.c

Quantitative liquidity risk occurs when the bank receives cash flows that are lower than expected in the future. Market liquidity risk, which is included as a component of quantitative liquidity risk, occurs when assets cannot be sold quickly at a fair price, resulting in lower than expected cash inflows from the sale. Funding cost risk (cost of liquidity risk) occurs when a bank has to incur a higher than expected cost (spread between cost versus the risk-free rate) in order to receive funds from available liquidity sources. Liquidity risk, encompassing both quantitative and cost dimensions, is the amount of economic losses due to the combination of positive and negative cash flows and available cash on a specific date differing from expectations. The quantitative dimension relates to the inability to secure funds to meet obligations, thereby requiring asset sales at sub-fair-value levels. The cost dimension is the ability to raise funds, but only at higher than expected costs (e.g., high interest rates).

Liquidity generation capacity (LGC) reflects the ability of a bank to generate positive cash flows from its sources of liquidity beyond those that are contractual. The LGC is the primary tool that a bank uses to manage negative amounts in the term structure of cumulated expected cash flows. LGC comes from two primary sources: balance sheet expansion and balance sheet shrinkage.

Liquidity generation capacity can also be delineated between security-linked and security-unlinked liquidity. Security-linked liquidity (essentially BSL) includes secured debt issuances, secured withdrawals from credit lines available via other financial institutions, and asset and repo sales. Security-unlinked liquidity includes unsecured bond issuances, unsecured borrowing from new clients (via new deposits), and unsecured credit line withdrawals.

The three primary source types for liquidity are asset sales, secured funding from repo transactions and using assets as collateral, and unsecured funding from credit line withdrawals and interbank market deposit transactions.

The term structure of the LGC, known as TSLGC, is the collection of liquidity at a given time that can be generated by sources of liquidity up to a terminal time. The term structure of cumulated LGC is the cumulative liquidity that can be generated by sources of liquidity up to a terminal time.

A repo allows a bank to sell an asset and then buy it back at the expiration of the contract. For repos and collateralized loans, haircuts are reductions in the bond's market value. The size of the haircut is driven by the price volatility of the collateral and the default probability of the bond issuer.

The term structure of expected liquidity (TSL_0) is a measure indicating whether an institution can cover negative cumulated cash flows at a given point in the future.

Because most cash flows are stochastic, modeling should take into account both expected values and volatility associated with those values. It is important to ensure that extreme values for both positive and negative cash flows are measured reflecting cash flow at risk.

The term structure of liquidity-at-risk (TSLaR) is the collection of unexpected cash flows at each date for a given period, representing the difference between the average and minimum levels of cash flows.

LO 65.d

Net cash flows that a bank expects to receive and pay in the future must be monitored in order to manage quantitative liquidity risk. The causes of liquidity risk, which can involve both positive and negative cash flows, relate to existing and forecasted future contracts arising from ordinary business activity. The sources of liquidity are the factors that can generate positive cash flows to help manage and hedge liquidity risk.

The term structure of expected cash flows (TSECF), also known as the maturity ladder, is the collection by date of positive and negative expected cash flows up until the expiration of the contract with the longest maturity. The term structure of expected cumulated cash flows (TSECCF) is the collection of cumulative expected cash flows in date order.

Banks use the TSECCF to not only monitor the cash flow balance on a given date but also how changes in net cash flows affect cash position to date. The balance of cash inflows and outflows can be negative on a specific date, but a positive cash position from previous inflows can help to reduce a net negative position. The key measure for a bank will be the cumulative amount of cash it has available at a given time.

The Treasury Department goal is to monitor TSECF and TSECCF, with the latter ideally positive at all times implying that positive cash flows can cover negative cash flows. A negative balance in TSECCF could be a precursor to insolvency and bankruptcy, which implies a significant importance to maintaining a positive balance.

LO 65.e

The term structure of available assets (TSAA) is a tool used to monitor a bank's liquidity generation capacity and to provide an indication of the extent to which an asset can be used to create liquidity. Possession, rather than ownership, drives availability for liquidity purposes.

Increases in the TSAA come from reverse repo transactions, buy/sellback transactions, and security borrowing. Decreases to the TSAA come from repo transactions, sell/buyback transactions, and security lending. All of these transactions, as well as asset purchases and sales, impact the TSECF and TSECCF calculations except for repo transactions. TSLGC may or may not be impacted depending on the transaction type.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 65.1

1. **A** Cash flows at a point in time can be identified based on two dimensions: time and amount. Cash flows that occur randomly and have unknown amounts are stochastic across both dimensions. A new bond issuance is time deterministic and amount stochastic. Each of the other choices (recovery on client default, American option payouts, and mortgage prepayments) are all time and amount stochastic. (LO 65.a)
2. **D** The decision to exercise a liquidity option is based on a need for liquidity, as opposed to financial options that are exercised when they are profitable (in the money). This implies that liquidity options may or may not be profitable upon exercise. Financial options typically produce positive cash flows after exercise, although that is not the intent of exercise. For financial options, the cash flow decision is independent of the profitability situation. (LO 65.b)

Module Quiz 65.2

1. **D** Funding cost risk (the cost of liquidity risk) is the risk that when a bank needs to access sources of liquidity, there will be a wide spread between the interest rate paid and the risk-free rate. The ability to sell assets quickly at fair market prices is market liquidity risk. Receiving lower than expected cash inflows in the future is overall quantitative liquidity risk. Generating positive cash flows from liquidity sources is the liquidity generation capacity (LGC). (LO 65.c)

2. **D** Stochastic cash flows are regularly captured in TSECF and TSECCF models, as a significant percentage of expected cash flows are stochastic. Rollovers of maturing liabilities, behavioral components adjusted for liquidity options, and default risk and correlations are also regularly captured in these models. (LO 65.d)

Module Quiz 65.3

1. **B** For a reverse repo transaction, both TSAA and TSECCF (and TSECF) are impacted. TSLGC may or may not be impacted. Ownership belongs to the counterparty, but possession is with the bank. (LO 65.e)

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Duffie.

READING 66

THE FAILURE MECHANICS OF DEALER BANKS

Study Session 11

EXAM FOCUS

Understanding the key failure mechanics for dealer banks is crucial for mitigating liquidity and solvency risks. Liquidity risks are accelerated when counterparties or prime broker clients question the solvency of a large dealer bank and, in turn, limit their exposure. This results in increased liquidity risk and insolvency risk for the bank and increased systemic liquidity risk for the financial markets in which dealer banks play commingled roles. Dealer banks play key roles as prime brokers, securities underwriters, special purpose entities (SPE), and as counterparties in the over-the-counter (OTC) derivatives and repo markets. Diseconomies of scope in risk management and corporate governance were revealed by the 2007–2009 market crisis. Thus, new policies to alleviate dealer bank risks were implemented to address off-balance sheet risks, capital requirements, leverage, liquidity risks, clearing banks, and adverse selection effects in “toxic” asset markets.

MODULE 66.1: FUNCTIONS OF DEALER BANKS

LO 66.a: Compare and contrast the major lines of business in which dealer banks operate and the risk factors they face in each line of business.

Large dealer banks provide a variety of intermediary functions in the markets for over-the-counter (OTC) derivatives, repurchase agreements, and securities. In addition, large dealer banks act as a prime broker for hedge funds and provide asset management for wealthy individuals and institutions.

Large dealer banks play an important function in the **OTC derivatives market**. Dealer banks transfer the risk of the derivatives positions requested by counterparties by creating new derivatives contracts with other counterparties. Examples of types of OTC derivatives are interest rate swaps, collateralized debt obligations (CDOs), collateralized mortgage obligations (CMOs), and credit default swaps (CDSs).

Counterparty risk in the OTC market refers to the risk that one or more of the counterparties will default on their contractual obligations. The total amount of wealth

does not change as derivatives transfer wealth from one counterparty to another as contingencies are realized over time. However, if a counterparty incurs large losses, their derivatives contracts incur frictional bankruptcy costs that result in distress costs for their counterparties. Dealer banks are often counterparties to other dealer banks and large market players. Therefore, the solvency and liquidity problems of one large dealer bank can quickly result in increased systemic risk and a potential liquidity crisis.

If the dealer bank does not have the liquidity to function, they will become insolvent. The failure of a large dealer bank would result in increased systemic risk for the OTC market. When counterparties question the solvency of a dealer bank, they will take actions to reduce their exposure and exit their positions. For example, the default of Lehman Brothers in September of 2008 not only disrupted the OTC derivatives markets, but the repercussions were also felt by other financial markets and institutions.

Another important function of large dealer banks is in the short-term repurchase or **repo market**. Large dealer banks finance significant fractions of another dealer bank's assets through repos. Prior to the global financial crisis, dealer banks used overnight repos to finance holdings of agency securities, corporate bonds, Treasuries, mortgages, and collateralized debt obligations (CDOs) with little incremental capital. Some large dealer banks had very high leverage due to the lack of capital requirements for these repos. The high leverage caused significant solvency risk when the use of subprime mortgages as collateral was questioned.

The systemic and firm specific risk is significantly increased if a repo counterparty questions the solvency of a dealer bank. Counterparties are unlikely to renew repos, and the repo creditors may be legally required to sell collateral immediately. Without a government or central bank stepping in as a lender of last resort, dealer banks have no place to turn when repos are not renewed. As many dealer banks act as counterparties for other positions, the solvency of one dealer bank is likely to have a ripple effect and greatly increase the systemic risk of these markets.

Dealer banks provide investment banking functions through the management and underwriting of securities issuances. These investment banking functions also include advising corporations regarding mergers and acquisitions and merchant banking functions, such as the buying and selling of oil, metals, and other commodities. These functions provide an important source of revenue for dealer banks. An additional strain on liquidity is caused by the lack of cash inflows when issuers question the solvency of the dealer bank and take their business elsewhere. This can lead to systemic risk as new issues and the liquidity of existing issues are halted, as few institutions are able or willing to fill the void when a large dealer bank's solvency or liquidity are questioned.

Large dealer banks act as a **prime broker** to large investors such as hedge funds. In this context, the services provided by the dealer banks include custody of securities, clearing, securities lending, cash management, and reporting. When the solvency of a prime broker is questionable, a hedge fund could demand cash margin loans from the dealer that are backed by securities. The prime broker may not be able to use those same securities as collateral with other lenders who may also question their solvency. Thus, the dealer bank's liquidity position is weakened if large clients reduce their exposure by exiting their positions or entering new positions to offset their risk.

In addition, if prime broker clients leave, then their cash and securities are no longer in the pool of funds to meet the dealer bank's liquidity needs for other clients. A systemic shortage of collateral and a liquidity crisis can result from the reduction of collateral securities caused by the flight of prime brokerage clients. Systemic risk is even greater when hedge funds do not mitigate their exposure through diversification. Prior to the global financial crisis, hedge funds had significant positions with only a few dealer banks.

Dealer banks also provide an important function as a counterparty for derivatives for brokerage clients. Dealer banks sometimes operate "internal hedge funds" and private equity partnerships. Off-balance sheet entity functions such as internal hedge funds, structured investment vehicles, and money market funds can have substantial losses. The dealer banks have an incentive to voluntarily support these entities to protect their reputation and franchise value. When a dealer bank shows signs of distress, counterparties and others may begin to exit their relationships, which severely increases the dealer bank's liquidity risk.

In addition, large dealer banks provide traditional commercial banking functions, such as gathering deposits for corporate and consumer lending. The risks for a dealer bank are similar to a traditional bank with respect to these functions. However, prior to the financial crisis of 2007–2009, dealer banks did not have access to the discount window (borrowing money from the central bank), and their accounts were not federally insured. For these reasons, a run on the bank's deposits was more likely to lead to a liquidity crisis. With increased concerns of the solvency of large dealer banks, the availability of credit across the industry was threatened. This had the potential to lead to severe market slowdowns if borrowers were unable to obtain credit.

Dealer Bank Markets

Large dealer banks operate in markets that are outside the scope of traditional bank-failure resolution mechanisms, such as conservatorship or receivership. The dealer banks are organized under the umbrella of holding companies in order to provide the wide variety of commercial banking, merchant banking, investment banking, brokerage, and off-balance sheet partnership activities. In addition, dealer banks often have large asset-management divisions that provide custody of securities, cash management, brokerage, and alternative investments vehicles. Dealer banks are also typically the general partner with limited partner clients.

In the primary securities market, dealer banks are the security underwriter. They buy equity and bond securities from issuers and sell them to institutions and investors over a period of time. Dealer banks also play a major role in the secondary securities market in providing liquidity to the market. They are the primary intermediary in the OTC securities markets by assisting in the private negotiation between investors and corporations, municipalities, certain national governments, and securitized credit products. Dealer banks are also actively involved in publicly traded equity markets by acting as brokers, custodians, securities lenders, and facilitating large block trades.

A major market in which dealer banks operate is the repurchase agreements, or **repos**, market. Repos are short-term cash loans collateralized by securities. In the repo market, one counterparty borrows cash from another counterparty. The majority of

repos are for a very short period of time, such as overnight. The loans are collateralized by government bonds, corporate bonds, mortgages, agency securities, or other securities such as CDOs. In order to reduce counterparty risk, a clearing bank often acts as a third party and holds the collateral. The clearing bank facilitates the trade and somewhat reduces the risk of default for the lender. It is common for counterparties to renew these positions on a continuous basis as long as the solvency of the dealer bank is not questioned. It is not uncommon for these counterparties to be another dealer bank.

Dealer banks are usually counterparties in the OTC derivatives market. The most prominent OTC derivatives are interest rate swaps where variable rate commitments often linked to the London Interbank Offered Rate (LIBOR) are exchanged for a fixed rate for a specific time period. Dealer banks typically perform what is known as a “matched book” dealer operation. They transfer the risk of the derivatives positions requested by counterparties by creating new derivatives contracts with other counterparties, who are oftentimes other dealer banks. Thus, dealer banks have large OTC derivatives exposures with other dealer banks. In addition to dealing with interest rate swaps, dealers are often counterparties in CDSs. In these contracts, the dealer bank transfers the default risk rather than the interest rate risk for the counterparties involved in the contracts.

Some large dealer banks are very active in off-balance sheet financing. In these markets, a bank can sell residential mortgages or other loans to a special purpose entity (SPE). The SPE compensates the sponsoring bank for the assets with the proceeds of debt that it issues to third-party investors or hedge funds. The SPE pays for the principal and interest of the debt issued with the cash flows from the mortgages or other assets that were purchased from the sponsoring bank. Thus, the SPE holds the collateralized pool of assets and provides an innovative product for hedge funds and other investors to purchase. These SPEs also provide a means for financial institutions to diversify their exposure by transferring risk to other investors who are either in or outside the financial industry.

For example, prior to the global financial crisis, dealer banks were actively participating as sponsor banks for structured investment vehicles (SIVs), which are a form of a special purpose entity. The SIV finances residential mortgages or other debt obligations with short-term debt sold to other investors in the form of CDOs and CMOs.

Before the crisis, banks were not required to include the off-balance sheet assets and debt obligations in minimum capital requirement and accounting reports. Thus, some dealer banks became highly leveraged as they were allowed to operate much larger loan purchases and origination businesses with a limited amount of capital. The fall in residential housing values in the summer of 2007 led to the rise of mortgage defaults, which threatened the ability of the SIV to make payments. As short-term creditors became concerned with the solvency of the SIVs, they refused to renew loans, and this created a liquidity and solvency issue for SIVs. Dealer banks had to provide support to SIVs to protect its reputation and franchise value.

Diseconomies of Scope

As mentioned, dealer banks act as holding companies in order to provide a wide variety of commercial banking, prime brokerage, investment banking, asset management, and off-balance sheet activities. The 2007–2009 financial crisis caused many to question the ability of dealer banks to manage risks properly. It is sometimes argued that forming large bank holding companies results in economies of scope with respect to information technology, marketing, and financial innovation. However, the financial crisis clearly identified diseconomies of scope in risk management and corporate governance. The executive management and board of directors did not fully understand or control the risk taking activities within their organizations.

For example, prior to their insolvency, Bear Stearns and Lehman relied heavily on overnight repos with leverage ratios above 30. These dealer banks held these assets on their balance sheets with little incremental capital. Management did not properly manage the amount of off-balance sheet risk the bank was exposed to. Thus, the over-leveraged positions made it impossible to overcome the liquidity and solvency issues that quickly arose when the values of the bank's assets were questioned. Increased awareness or more appropriate risk models may have prevented the insolvency of these dealer banks.



MODULE QUIZ 66.1

1. A dealer bank's liquidity crisis is least likely to be accelerated by:
 - A. the refusal of repurchase agreement creditors to renew their positions.
 - B. the flight of prime brokerage clients.
 - C. a counterparty's request for a novation through another dealer bank.
 - D. depositors removing their savings from the dealer bank.
2. Banks are most likely to diversify their exposure to a specific asset class such as mortgages by grouping these assets together and selling them to:
 - A. hedge funds.
 - B. government agencies.
 - C. the U.S. Federal Reserve.
 - D. special purpose entities.
3. The formation of large bank holding companies results in diseconomies of scope with respect to:
 - A. risk management.
 - B. technology.
 - C. marketing.
 - D. financial innovation.

MODULE 66.2: LIQUIDITY CONCERNS FOR DEALER BANKS AND RISK POLICY MEASURES

Liquidity Concerns for Dealer Banks

LO 66.b: Identify situations that can cause a liquidity crisis at a dealer bank and explain responses that can mitigate these risks.

A liquidity crisis for a dealer bank is accelerated if counterparties try to reduce their exposure by restructuring existing OTC derivatives with the dealer or by requesting a

novation (as discussed in the following). The flight of repo creditors and prime brokerage clients can also accelerate a liquidity crisis. Lastly, the loss of cash settlement privileges is the final collapse of a dealer bank's liquidity.

As mentioned previously, when OTC derivatives counterparties question the solvency of a dealer bank, they will begin to reduce their exposures to the dealer. A counterparty could reduce their exposure by borrowing from the dealer or by entering into new offsetting derivatives contracts with the dealer. A counterparty may also request to have in-the-money options revised to at-the-money strike prices and, thus, reduce their exposure to the dealer by receiving cash from the option position.

Another means that a counterparty has of reducing their exposure to a dealer is through a **novation** to another dealer. For example, a hedge fund may use a credit default swap from a dealer to protect themselves from a loss on a borrower. If the hedge fund was concerned about the solvency of the dealer bank, they could request a novation from another dealer bank to protect themselves from default arising from the original dealer bank. Although these novations are often granted by dealer banks, in the case of Bear Stearns, the request was denied, which raised additional concerns regarding the solvency of Bear Stearns. In addition to decreasing the reputation capital and franchise value of this dealer bank, the liquidity position was also under increased stress. A novation could result in the removal of the cash collateral of the original dealer bank and transfer of this collateral to the second dealer bank.

Central clearing mitigates the liquidity risk caused by derivatives counterparties exiting their large dealer bank exposures. OTC derivatives are novated or "cleared" to a central clearing counterparty that stands between the original counterparties. The use of a central clearing counterparty also mitigates the systemic risk of financial markets and institutions when the solvency of a large dealer bank is questioned. However, the use of central clearing counterparties is only effective with derivatives that contain relatively standard terms. Thus, this was not an effective means of dealing with the infamous customized AIG credit derivatives.

Further liquidity pressure can arise if derivative counterparties desire to reduce their exposure by entering new contracts that require the dealer bank to pay out cash. For example, a dealer bank may try to signal their strength to the market by quoting competitive bid-ask spreads on an OTC option. If the bid price is then accepted, the dealer must settle with a cash payment to the counterparty which reduces their liquidity. If the dealer refuses to quote competitive bid prices, it may further signal their liquidity concerns to the market.

Money market funds, securities lenders, and other dealer banks finance significant fractions of a dealer bank's assets through short-term repurchase agreements. As mentioned previously, if the repo counterparty questions the solvency of a dealer bank, they are unlikely to renew repos. In this event, the repo creditors may have an incentive, or be legally required, to sell the collateral immediately. If the sale of the collateral is less than the cash position, then the dealer counterparty may face litigation for the improper disposal of assets. Without a government or central bank stepping in as a lender of last resort, dealer banks have no place to turn when repos are not renewed. They could reinvest their cash in new repos, but other counterparties are unlikely to take these positions if the dealer bank's solvency is questioned.

The dealer bank can mitigate the liquidity risk caused by a run of short-term creditors by establishing lines of bank credit, holding cash and liquid securities, and by laddering the maturities of its liabilities. When a dealer bank ladders its liabilities, the maturities are spread out over time so that only a small fraction of its debt needs to be refinanced overnight. In 2008, the New York Federal Reserve Bank created the Primary Dealer Credit Facility to finance securities of investment banks. Immediately following the failure of Lehman, the remaining two dealer banks, Morgan Stanley and Goldman Sachs, became regulated bank holding companies. As a bank holding company, the firms gained access to the discount window and could turn to the government for financial support, including FDIC deposit insurance and loan guarantees.

Prime brokerage accounts are a source of cash inflows for large dealer banks. In normal circumstances, the cash and securities of prime brokerage clients are a source of liquidity for the bank. In the United Kingdom, assets from client prime brokerage accounts are commingled with the bank's own assets. However, in the United States, dealer banks are allowed to pool the money together into a separate account from the bank's own funds. Thus, the prime broker is able to use the cash from one client to help meet the liquidity needs of another client.

As mentioned previously, when the solvency of a prime broker is questionable, a hedge fund could demand cash margin loans from the dealer that are backed by the securities held in their account with the prime broker. The prime broker may not be able to use those same securities as collateral with other lenders who may question their solvency. Lenders may not find any incentive to lend to the questionable dealer bank. Thus, even without a run by prime brokerage accounts, considerable strain could be placed on the dealer bank's liquidity position.

In addition, if prime broker clients do leave on short notice, then their cash and securities are no longer in the pool of funds to meet the needs of other clients. In this case, the dealer bank must use its own cash to meet liquidity needs. The reduction of collateral securities caused by the flight of prime brokerage clients can lead to a systemic shortage of collateral and a liquidity crisis. In the future, hedge funds are likely to mitigate their exposure to a few dealer banks by diversifying their sources of prime brokerage with custodian banks.

Under normal conditions, a clearing bank may extend daylight overdraft privileges to clearing customers who are creditworthy. However, when the solvency of a dealer bank is questioned, the clearing bank may refuse to process transactions that are insufficiently funded by the dealer bank's cash fund account. For example, in the case of Lehman's default, JPMorgan Chase was the clearing bank that invoked its "full right of offset." Under this legal right, JPMorgan Chase was able to offset their exposures using Lehman's cash, and at the same time, discontinued to make cash payments during the day on Lehman transactions that would bring Lehman's account below zero. The failure to meet its transactions obligations on that day forced Lehman into bankruptcy. To mitigate this risk in the future, "emergency banks" are proposed to act as either a clearing bank or a tri-party repo "utility."

The basic economic principles causing a liquidity crisis, and potentially the insolvency of a large dealer bank, are not that different from the traditional retail bank run. Banks may finance illiquid assets with short-term deposits. However, an unexpected liquidity

demand from depositors or the inability of borrowers to repay their loans may lead to concerns about the solvency of the bank. If the concern persists, a bank run could lead to liquidity problems, and the concern about the bank's failure could end up as a self-fulfilling prophecy.

While the basic economic principles of a bank run are similar for large dealer banks and retail banks, the institutional mechanisms and the systemic destructiveness are very different. For example, dealer banks play an essential role in providing liquidity in the OTC derivatives and securities markets. When the solvency of a dealer bank is questioned, counterparties of these markets and prime brokerage clients begin to reduce their exposure to the dealer. The OTC derivatives counterparty may reduce their exposure by borrowing from the dealer, entering new offsetting derivatives contracts with the dealer, or requesting a novation. A counterparty may also request to receive cash from options positions that are in-the-money by having them revised to at-the-money. Prime broker clients may remove collateral and cash, which results in further accelerating the liquidity crisis. The fact that dealer banks are often counterparties to other dealer banks increases the systemic risk in the financial markets where dealer banks play essential roles.

Another area that dealer banks are very active involving liquidity is the repo markets. Especially in cases where the dealer banks are highly leveraged, the liquidity position is severely threatened when the dealer bank's solvency is questioned and counterparties are unwilling to renew repo positions overnight. Thus, a dealer bank is involved in many functions that result in increased liquidity pressures that traditional banks are not exposed to.

Policies to Alleviate Dealer Bank Risks

LO 66.c: Assess policy measures that can alleviate firm-specific and systemic risks related to large dealer banks.

The 2009 Public Private Investment Partnership (PPIP) was instituted by the U.S. Treasury Department's 2008 **Troubled Asset Relief Program (TARP)** to help dealer banks and the financial industry recover from the crisis at hand. One of the policy objectives was to mitigate the effect of adverse selection in the market for "toxic" assets, such as the CDOs backed by subprime mortgages. Adverse selection is the principle that buyers are only willing to buy the assets at a deep discount due to the information asymmetries that exist regarding the asset's true value. A dealer bank may be forced to sell illiquid assets in order to meet liquidity needs. This results in additional losses due to the lack of demand for those assets. The PPIP subsidizes bidders of "toxic assets" by offering below-market financing rates and absorbing losses beyond a predetermined level.

The United States Federal Reserve System and the Bank of England provided new secured lending facilities to large dealer banks when they were no longer able to obtain credit from traditional counterparties or the repo market. When the dealer bank's solvency is questioned, tri-party clearing banks are likely to limit their exposure to the dealer bank. A tri-party repo utility is proposed as an alternative and would be

designed to have fewer conflicting incentives and less discretion in rolling over a dealer's repo positions. New standards could be adapted for transaction documentation, margin requirements, and daily substitution of collateral with respect to repos. These standards could be incorporated through either the new repo utility or traditional tri-party clearing approaches.

Another potential approach is the creation of an "emergency bank" that could manage the orderly unwinds of repo positions of dealer banks with liquidity difficulties. The central bank would grant access to the discount window for the emergency bank to insulate critical clearing banks from losses during this unwinding process.

Capital requirements will most likely be increased and include off-balance sheet positions in an effort to reduce the leverage positions of dealer banks. The separation of tri-party repo clearing from other clearing account functions would also reduce a dealer bank's leverage by tightening the dealer's cash-management flexibility.

Central clearing will reduce the threat of OTC derivatives counterparties fleeing a questionable dealer bank. Although this would not eliminate the liquidity effect resulting from a derivative counterparty reducing their exposure to a particular dealer bank, it would reduce the total exposure to the dealer that would need to be managed through clearing.

Some large dealer banks and financial institutions are viewed as being "too-big-to-fail" based on the systemic risk their insolvency would place on the financial markets. Therefore, another proposed resolution for large dealer banks with questionable solvency that are deemed too-big-to-fail is to provide bridge banks similar to the approach used for traditional banks.



MODULE QUIZ 66.2

1. One potential solution for mitigating the liquidity risk caused by derivatives counterparties exiting their large dealer bank exposures is most likely the:
 - A. use of central clearing.
 - B. use of a novation through another dealer bank.
 - C. requirement of dealer banks to pay out cash to reduce counterparty exposure.
 - D. creation of new contracts by counterparties.
2. Which of the following items is not a policy objective of the U.S. Treasury Department's 2008 Troubled Asset Relief Program to help dealer banks recover from the subprime market crisis?
 - A. Provide below-market financing rates for bidders of "toxic" assets.
 - B. Absorb losses beyond a pre-specified level.
 - C. Force the sale of illiquid assets in order to better determine the "true" value.
 - D. Mitigate the effect of adverse selection.

KEY CONCEPTS

LO 66.a

Large dealer banks are active participants in over-the-counter (OTC) derivatives, repo, and securities markets. Their functions in these markets, as well as asset managers and prime brokers, result in a variety of liquidity risks when their solvency is questioned and counterparties reduce their exposure with them.

LO 66.b

A liquidity crisis is accelerated when prime broker clients or counterparties in the OTC derivatives or repo markets question the solvency of a dealer bank and desire to exit their positions or reduce their exposures with the dealer bank.

LO 66.c

The creation of emergency banks in the form of tri-party repo utilities and clearing banks are policy proposals to mitigate firm specific and systemic liquidity risk in the OTC derivatives and repo markets. The U.S. Treasury Department's 2008 Troubled Asset Relief Program (TARP) was designed to mitigate adverse selection in "toxic" asset markets by providing below market financing and absorbing losses above a pre-specified amount.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 66.1

1. **D** A liquidity crisis for a dealer bank is accelerated if counterparties try to reduce their exposure by restructuring existing OTC derivatives with the dealer or by requesting a novation. The flight of repo creditors and prime brokerage clients can also accelerate a liquidity crisis. Lastly, the loss of cash settlement privileges is the final collapse of a dealer bank's liquidity. (LO 66.a)
2. **D** Banks can diversify their exposure to a specific asset class, such as mortgages, by grouping these assets together and selling them to special purpose entities. (LO 66.a)
3. **A** Some argue that information technology, marketing, and financial innovation result in economies of scope for large bank holding companies. Conversely, the 2007–2009 financial crisis raised the concern that the size of bank holding companies creates diseconomies of scope with respect to risk management. (LO 66.a)

Module Quiz 66.2

1. **A** One potential solution for mitigating the liquidity risk caused by derivatives counterparties exiting their large dealer bank exposures is the use of central clearing through a counterparty. However, central clearing is only effective when the underlying securities have standardized terms. The reduction of a counterparty's exposure through novation, entering new offsetting contracts, or requiring a dealer bank to cash out of a position will all reduce the liquidity of the dealer bank. (LO 66.b)
2. **C** The U.S. Treasury Department's 2008 Troubled Asset Relief Program was designed to create policies to help dealer banks recover from the subprime market crisis by mitigating the effect of adverse selection, by providing below-market financing rates for bidders of "toxic" assets, and by absorbing losses beyond a pre-specified level. Forcing the sale of illiquid assets would worsen the liquidity position of the troubled dealer bank. (LO 66.c)

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Venkat and Baird, Chapter 3.

READING 67

LIQUIDITY STRESS TESTING

Study Session 11

EXAM FOCUS

This reading defines various types of liquidity and follows by introducing the liquidity asset buffer as a means of estimating contingent liability. For the exam, be able to differentiate between the types of liquidity mentioned. Also, be able to discuss liquidity stress test design issues, including scope, scenario development, assumptions, outputs, governance, and integration with other models.

MODULE 67.1: TYPES OF LIQUIDITY AND CONTINGENT LIQUIDITY

LO 67.a: Differentiate between various types of liquidity, including funding, operational, strategic, contingent, and restricted liquidity.

In this section, we define different types of liquidity, including funding, operational, contingent, strategic, and restricted liquidity.

- **Funding liquidity.** From the perspective of liquidity stress testing, the goal is to determine the probability and severity of funding liquidity risk, that is, the risk that a financial institution has insufficient liquid resources to satisfy its liabilities unless it suffers excessive losses. Under the umbrella of funding liquidity, there are four categories of funding liquidity: operational, contingent, strategic, and restricted.
- **Operational liquidity.** This is the funds required to cover the firm's regular day-to-day operational needs (e.g., proper clearing of payment transactions). Operating cash flow may sometimes fluctuate dramatically, resulting in cash needs at a given moment possibly being much higher than normal. As a result, a buffer of additional cash would be required. Given the nature of operational liquidity to fund the firm's operations, such funds cannot be used to satisfy nonoperational liabilities.
- **Contingent liquidity.** This comprises the (very high quality) liquid assets and credit facilities that are meant to satisfy general liabilities in stressed situations. Contingent liquidity is estimated through the *liquid asset buffer*. The main point of

the liquidity stress test is to determine how much contingent liquidity is needed in stressed situations.

- **Strategic liquidity.** This is the funds that the firm maintains to satisfy potential investment opportunities such as fixed asset purchases or mergers/acquisitions. The funds are not specifically meant to assist in stressed situations, but the most liquid funds may be reallocated to satisfying contingent liability obligations if required.
- **Restricted liquidity.** This comprises the liquid assets that have stated and predetermined operational uses such as collateralization. They cannot be used to satisfy general operational needs.

Estimating Contingent Liquidity

LO 67.b: Estimate contingent liquidity via the liquid asset buffer.

The **stressed liquidity asset buffer** is a measure of the sufficiency of the liquidity asset buffer. It is estimated as follows:

(normal) liquidity asset buffer – stressed cash outflow + stressed cash inflows

The characteristics of these components are as follows:

- Normal liquidity asset buffer.
 - This is the amount of contingent liquidity currently held.
 - The assets that may be included must be able to withstand the most extreme stressed situations.
 - Assets typically have little or no credit and market risk, are easy to value, and are actively traded in a deep market with many market participants.
- Stressed outflows.
 - This may require early settlement of liabilities or the inability to rollover debt.
 - Common outflows include retail deposit withdrawals, reduction or loss of unsecured and secured funding sources, early settlement of derivatives transactions, and early repayments of debt.
- Stressed inflows.
 - This may be lowered depending on market conditions.
 - It serves as an offset to stressed outflows.
 - Common inflows include upcoming maturing investments, customer debt repayments, and draws on the firm's available liquidity sources.



MODULE QUIZ 67.1

1. Which type of liquidity is meant specifically to fund capital asset purchases?
 - A. Contingent.
 - B. Funding.
 - C. Restricted.
 - D. Strategic.

2. Firm A has \$1 billion in highly liquid assets. In a sudden stressed scenario, it estimates that retail customers will withdraw \$150 million in deposits, and retail customers will be able to make \$80 million of loan repayments. Firm A must deal with \$60 million of margin and collateral calls on its derivatives transactions due to falling collateral values and greater volatility of the underlying assets. In addition, the firm has utilized \$90 million of its available \$100 million liquidity facility. What is the estimate of Firm A's stressed liquidity asset buffer?
- A. \$0.80 billion.
 - B. \$0.88 billion.
 - C. \$0.90 billion.
 - D. \$0.96 billion.

MODULE 67.2: LIQUIDITY STRESS TEST DESIGN ISSUES

LO 67.c: Discuss liquidity stress test design issues such as scope, scenario development, assumptions, outputs, governance, and integration with other risk models.

In this section, we will discuss different types of liquidity stress test design issues including scope, scenario development, assumptions, outputs, governance, and integration with other risk models.

Scope

A consolidated liquidity stress test for the firm is the starting point. However, within the overall organization, individual liquidity stress testing can be done on the parent company alone, the subsidiary companies, the business lines, and individual business units, for example. The crucial parts of the organization would be subject to more rigorous testing and more detailed reporting, whereas less crucial or less risky parts would be subject to less rigorous and less detailed reporting.

Liquidity transfer restrictions mean that liquidity may remain only in specific entities and cannot be transferred freely throughout the organization. An example could be between the parent company and its foreign subsidiary. Therefore, looking at consolidated liquidity may be misleading. The restrictions should be considered in both regular and stressed scenarios. The specific restrictions must be examined carefully to determine whether a separate stress test is required because of the restriction.

With the existence of foreign subsidiaries, the foreign currency may not be as established or widely-traded. As a result, the settlement procedures to convert the foreign currency to domestic currency may take too long or may not even be possible, which could negatively impact liquidity in a stressed situation.

Operating in more than one regulatory environment could result in the need to perform separate stress tests for the foreign entities.

Scenario Development

The first step with scenario development is to establish the benchmark level of funding and liquidity for the organization. The details and structure of the benchmark should be similar to the stressed scenarios to facilitate their comparison.

There are few historical examples of full-on liquidity failure, which makes it difficult to construct a robust model to provide a precise amount of minimum liquidity required by a firm. Because of the lack of empirical evidence, liquidity stress tests are based on stylized and specific scenarios (historical and hypothetical). Despite the generic nature of the scenarios, firms must always temper the scenarios with the key idiosyncratic risks that they specifically face.

Historical Scenarios

Historical scenarios are advantageous in that they account for liquidity failures that occurred. However, the disadvantage is the existence of very few examples with limited data. Another disadvantage is that the past is not always indicative of the future, so as the economy evolves, unexpected liquidity crunches could occur.

Hypothetical Scenarios

Hypothetical scenarios take a future-oriented perspective using the best available information. It is important to differentiate between systemic risks, such as a market-wide recession, versus idiosyncratic risks, such as a firm-specific ratings downgrade. Scenarios should be developed for systemic only, idiosyncratic only, and combined systemic and idiosyncratic.

In addition, the degree of severity (perhaps measured in monetary units) could be differentiated. In that regard, a *bad* scenario could be developed alongside an *extremely bad* scenario.

Each scenario must be clearly and thoroughly described. Items would normally include:

- Overall stress level (e.g., low, medium, and high), taking into account the state of the economy and credit markets, for example.
- State of secured and unsecured funding markets.
- Haircut changes for each type of collateral.
- For a given sale, the impact of liquidity on the sale prices of investments in the liquidity buffer.
- Occurrence of credit downgrades.
- Assumptions regarding the acceleration of deposit withdrawals.
- Impact of rating changes on derivatives margin and collateral calls.
- Estimated drawdowns on unfunded credit and liquidity sources.
- Estimated debt calls and buybacks.

Creating liquidity scenarios can be more big-picture in nature so as to capture a wider range of potential economic and financial factors and how they interact with each other. That would be much different than the usual process for liquidity, which is very standardized and looks at isolated factors.

Reverse Liquidity Stress Tests

These tests are useful as a supplement to hypothetical scenarios. Reverse liquidity stress tests assume the end result of business failure and work backward to determine the most crucial factors that would lead to the failure. Those factors would be stressed to the worst-case scenario. Although the idea appears straight forward on paper, it is difficult because many different factors could work together to result in business failure. Also, it would be highly unlikely for a very liquid firm to fail unless some extraordinary assumptions were made.

Assumptions

The expression of *garbage in, garbage out* applies to liquidity stress testing when it comes to the validity of assumptions. Ideally, assumptions are backed by sufficient historical or market data to enhance their validity.

There are some basic guidelines in formulating assumptions in this context:

- For the different cash flow types, perform separate qualitative analyses of the expected liquidity behavior to uncover any major liquidity risks.
- For each risk, estimate the optimal segmentation level using behavioral differences, subject to constraints on the availability of data.
- Perform qualitative analyses and rank each segmentation factor in terms of liquidity risk.
- Create assumptions (e.g., using historical data) for use in quantitative analysis.
- Create matrices of model assumptions using scored risk levels.
- On an as needed basis, amend assumption matrices based on the stress scenario.

Investment Portfolio Haircuts

Haircuts (i.e., valuation discounts) are expected to widen when there is a systemic crisis. Models should account for the fact that the amount of widening will differ based on the type of security and its unique liquidity traits, and therefore, provide a few plausible assumptions. Eventually, a liquidity ranking system can be established using segmentation features such as secured versus unsecured or government versus nongovernment.

In determining how much of a liquidity haircut to apply, preliminary analysis should include a comparison between regular market conditions versus conditions experienced at the time of a financial crisis.

Deposit Outflows

It is crucial for banks to model sudden or early withdrawals of deposit funds and time deposits because they represent a huge negative impact on liquidity to the bank. The assumptions made must be thorough and use a behavioral segmentation approach to examine specifics in terms of behavior by depositors during stressed times. The key problem is the relative lack of available data to create the assumptions. Regardless, in developing the segmentation, it is best to consider it beneath the portfolio level and down to the account level. Behaviors to consider that are common to individuals, small businesses, and larger commercial clients include the amount of time the banking

relationship has been in existence and the rates paid on deposits. FDIC coverage should be considered for individuals and small businesses and credit usage should be considered for small businesses and larger commercial clients.

Unsecured Wholesale Funding

Significantly less unsecured wholesale funding is likely to be available in stressed times. Banks should look at all their funding sources (especially overnight and term funding) to determine how they are impacted by the various liquidity factors. The general trend is for banks to assume very little or no availability of unsecured wholesale funding during a major stress event.

Collateral Requirements

Much more collateral is likely needed during stressed events because of the reduced values of existing collateral and the additional collateral required because of losses in derivatives positions. In making assumptions on how much additional collateral is needed (e.g., collateral call level), historical information could be used. Additional detail in the form of analyzing each position separately could occur if there was enough data to support it.

Other Contingent Liabilities

Significant cash outflows arising from contingent liabilities such as use of credit lines by customers, letters of credit, and trade financing should be modeled based on historical information if possible. Otherwise, the default is to go with more conservative assumptions.

At the same time, noncontractual obligations should be considered from the perspective that honoring them will help to maintain business reputation, for example. Doing so will require cash outflows for purposes such as buying back securities to protect counterparties from incurring losses.

Business Reduction

Assumptions also need to consider the bank's ability to curtail liquidity-reducing transactions, including the issuance of additional loans to customers. Doing so requires input from business unit leaders who could determine the optimal reduction that avoids harm to the bank's reputation.

Outputs

Outputs that arise from liquidity stress testing are used to evaluate structural and tactical liquidity in the context of internal limits and regulatory requirements. The stress test comprises a key component of the firm's risk escalation process. Although it will vary between banks, liquidity stress tests should be done at least on a quarterly basis, which will provide information to the asset-liability management committee on a sufficiently regular basis for their analysis.

The following four items should form the deliverables from liquidity stress testing for each entity:

- Stress testing assumptions.

- General stress level.
- Systemic, idiosyncratic, or combined scenario.
- Contribution of economic, market, and firm-specific events.
- Cash flows resulting from the scenario.
- Current liquidity position metrics.
 - Main objective is to determine how much liquidity is available compared to the net cash outflows (percent or dollar amount).
 - Tactical liquidity (e.g., 30 days) versus structural liquidity (e.g., 12 months) under stress, where the latter refers to a survival horizon.
- Future liquidity position metrics.
 - *Future* refers to the assumed stress horizon.
 - Important metrics: available liquidity in the future, level of wholesale funding dependence, and level of concentration in certain funding channels (e.g., to detect possible overconcentration).
 - Crucial to note any times during the stress horizon where survival would require significant transactions (e.g., capital infusion, complicated debt financing).
- Capital and performance metrics.
 - Going beyond the short-term nature of liquidity (e.g., one year), the analysis of the bank's long-term viability needs to be performed by considering its capital.
 - Banks are required to maintain regulatory capital. Therefore, regarding the investment of that capital, there is a cost-benefit decision between lower yield but more liquid investments or higher yield but less liquid investments.
 - Analyzing capital measures helps determine the impact on capital when capital is needed to support liquidity in stressed times.

Governance

Oversight of overall liquidity risk management is delegated to the following roles:

- Asset-liability committee (ALCO).
 - The ALCO is in charge of the liquidity stress testing framework.
 - The ALCO should focus on a few key tasks:
 - Creating and finalizing a liquidity stress testing policy (e.g., scenarios, major assumptions, roles and responsibilities, reporting, limits).
 - Creating and finalizing liquidity risk scenarios, which includes any key changes to the scenarios and/or the underlying assumptions.
 - Determining liquidity risk policy limits based on the results of stress testing.
 - Escalating any exceptions noted.
- Treasury unit (first line of defense).
 - Manages the stress testing process.
 - Suggests scenarios to be used for stress testing.

- Analyzes the bank's assets and liabilities in terms of their liquidity features; provides suggestions to the ALCO on the assumptions to be used for stress testing.
- Reports results of stress testing.
- Proper segregation of duties (independence) suggested in the testing process so that testing data is provided by a group outside of the treasury unit.
- Multiple entities within a large firm may result in multiple treasury units involved in stress testing, therefore, consistency in terms of scenarios and assumptions is needed.
- Risk management (second line of defense).
 - An independent party in the management of liquidity stress testing and administers the stress testing policy.
 - Analyzes and highlights any noted weaknesses in the proposed scenarios and assumptions.
 - Confirms that the firm's liquidity stress testing process is consistent with regulations and industry practice.
 - Approves and oversees the stress test-based limits.
 - Communicates the firm's liquidity risk profile to key individuals (e.g., board, senior management, ALCO).
- Internal audit (third line of defense).
 - Regular checks on the stress testing process, procedures, and controls as a confirmation of adherence to regulations.
- Model risk management.
 - A separate group that validates the stress testing model to ensure it is consistent with the firm's model risk management policy.

Integration With Other Risk Models

Liquidity stress testing should not be done independently and should account for related risk models such as capital stress testing and asset-liability management. It should use a framework that considers accounts for the dependencies and correlations between risks that will arise in a stress scenario. Three examples of integration include:

- Liquidity stress testing and capital stress testing.
 - Liquidity stress tests should account for any necessary capital injections from the parent company to any subsidiaries.
 - Each scenario can range from very simple (e.g., general capital injection) to very complex (e.g., specific credit loss and revenue) projections; the assumptions should be derived based on the systemic and idiosyncratic conditions expected.
 - Within capital stress testing, both liquidity stress evaluation and liquidity impact analysis should be performed to determine the extent of the negative impact of the capital injections to fund liquidity on the firm's overall capital adequacy.
- Liquidity stress testing and asset-liability management.

- Traditionally, liquidity impact analysis is not performed at the same time as interest rate risk stress testing because the latter is most likely to impact longer-term capital and less likely to impact shorter-term liquidity.
- With the liquidity stress model, banks must look at the impact of falling interest rates and the extent to which they increase the values of bond-like liabilities. Or, banks must consider disintermediation risk when interest rates are rising (e.g., steepening of yield curve) where deposit customers attempt to earn higher rates of return on longer-term bond investments.
- Liquidity stress testing and funds transfer pricing (FTP).
 - The FTP framework should establish the price of liquidity accurately. For example, any necessary cash holding requirements arising from liquidity stress tests will have a cost attached to them.
 - The cost should be charged to the appropriate area through the FTP framework.



MODULE QUIZ 67.2

1. Which liquidity stress impact factor would generally be the largest threat to a bank's liquidity?
 - A. Deposit run-off.
 - B. Derivatives cash flows.
 - C. Loss of secured funding.
 - D. Loss of wholesale funding.
2. In the context of deposit outflows, which behavioral assessment factor is relevant for individual, small business, and commercial/institutional customers of the bank?
 - A. Credit usage.
 - B. FDIC coverage.
 - C. Industry segment.
 - D. Relationship tenure.
3. How often is it generally recommended that the liquidity stress test be done to allow review by the asset-liability management committee?
 - A. Monthly.
 - B. Quarterly.
 - C. Semiannually.
 - D. Annually.

KEY CONCEPTS

LO 67.a

Under the umbrella of funding liquidity, there are four categories: operational, contingent, strategic, and restricted. Operational liquidity is the funds required to cover the firm's regular day-to-day operational needs. Contingent liquidity comprises the (very high quality) liquid assets and credit facilities that are meant to satisfy general liabilities in stressed situations. Strategic liquidity is the funds that the firm maintains to satisfy potential investment opportunities. Restricted liquidity comprises the liquid assets that have stated and predetermined operational uses.

LO 67.b

The stressed liquidity asset buffer is a measure of the sufficiency of the liquidity asset buffer. It is estimated as follows:

(normal) liquidity asset buffer – stressed cash outflow + stressed cash inflows

LO 67.c

Liquidity stress test design issues include scope, scenario development, assumptions, outputs, governance, and integration with other risk models.

- *Scope.* A consolidated liquidity stress test for the firm is the starting point. However, within the overall organization, individual liquidity stress testing can be done on the parent company alone, the subsidiary companies, the business lines, and individual business units, for example.
- *Scenario development.* The first step with scenario development is to establish the benchmark level of funding and liquidity for the organization. The details and structure of the benchmark should be similar to the stressed scenarios to facilitate their comparison.

Historical scenarios are advantageous in that they account for liquidity failures that occurred. However, the disadvantage is the existence of very few examples with limited data. Hypothetical scenarios take a future-oriented perspective using the best available information. It is important to differentiate between systemic risks versus idiosyncratic risks. Scenarios should be developed for systemic only, idiosyncratic only, and combined systemic and idiosyncratic. In addition, the degree of severity (perhaps measured in monetary units) could be differentiated. Each scenario must be clearly and thoroughly described.

Reverse liquidity stress tests are useful as a supplement to hypothetical scenarios. Reverse liquidity stress tests assume the end result of business failure and work backward to determine the most crucial factors that would lead to the failure.

- *Assumptions.* The expression garbage in, garbage out applies to liquidity stress testing when it comes to the validity of assumptions. Ideally, assumptions are backed up by sufficient historical or market data to enhance their validity. Key assumptions include:
 - Investment portfolio haircuts (a.k.a. valuation discounts).
 - Deposit outflows.
 - Unsecured wholesale funding.
 - Collateral requirements.
 - Other contingent liabilities.
 - Business reduction.
- *Outputs.* Outputs that arise from liquidity stress testing are used to evaluate structural and tactical liquidity in the context of internal limits and regulatory requirements. The following four items should form the deliverables from liquidity stress testing for each entity:
 - Stress testing assumptions.
 - Current liquidity position metrics.
 - Future liquidity position metrics.
 - Capital and performance metrics.

- *Governance.* Oversight of the overall liquidity risk management is delegated to the following roles:
 - Asset-liability committee (ALCO).
 - Treasury unit (first line of defense).
 - Risk management (second line of defense).
 - Internal audit (third line of defense).
 - Model risk management.
- *Integration with other risk models.* Liquidity stress testing should not be done independently and should account for related risk models such as capital stress testing and asset-liability management. Three examples of integration include:
 - Liquidity stress testing and capital stress testing.
 - Liquidity stress testing and asset-liability management.
 - Liquidity stress testing and funds transfer pricing (FTP).

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 67.1

1. **D** Strategic liquidity comprises the funds that the firm maintains to satisfy potential investment opportunities such as fixed asset purchases or mergers/acquisitions. (LO 67.a)
2. **D** The margin and collateral calls on the derivatives transactions are considered stressed outflows. The stressed liquidity asset buffer of \$0.96 billion is calculated as \$1 billion (highly liquid asset) – \$150 million (retail deposit outflow) + \$80 million (stressed inflow) – \$60 million (stressed outflow) + \$90 million (stressed inflow). (LO 67.b)

Module Quiz 67.2

1. **A** Deposit run-off in the form of depositors withdrawing their demand deposits immediately or suddenly and term depositors withdrawing their investments early (assuming such rights exist) are generally the largest threat to liquidity to banks. Therefore, they are the most important customer behavior to attempt to model. (LO 67.c)
2. **D** Relationship tenure is a behavioral assessment factor to consider for all three groups of bank customers. Credit usage applies more to small business and commercial/institutional customers and not individuals. FDIC coverage applies only to individuals and small businesses but not commercial/institutional customers. Industry segment does not apply to individuals and generally only applies to commercial/institutional customers. (LO 67.c)
3. **B** At a minimum, the liquidity stress test should be done at least quarterly to allow for proper analysis by the asset-liability management committee. Some banks are able to do the test more frequently (e.g., monthly or daily) by investing in the necessary technology and other tools. (LO 67.c)

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Choudhry, Chapter 14.

READING 68

LIQUIDITY RISK REPORTING AND STRESS TESTING

Study Session 11

EXAM FOCUS

This reading emphasizes best practices in reporting bank liquidity and performing stress tests. For the exam, be prepared to interpret specific liquidity reports such as deposit tracker, deposit type and tenor, daily liquidity, mismatch, funding concentration, undrawn commitment, and wholesale pricing and volume. The most important daily reports of daily liquidity and mismatch reports are related to the survival horizon stress test. For that reason, expect questions related to interpreting and explaining the significance of the survival horizon stress test.

MODULE 68.1: LIQUIDITY RISK REPORTS

The management information (MI) liquidity reporting process is mandated by regulatory authorities who set the frequency and information content of reports. The asset-liability committee (ALCO) is the bank leadership team responsible for overseeing the liquidity risk of the bank. Regulators stipulate requirements for individual liquidity adequacy standards (ILAS) firms. Smaller and foreign subsidiary banks are not required to follow the ILAS firm standards but may have some reporting due on a firm-specific case.

Best Practices in Liquidity Reporting

LO 68.a: Identify best practices for the reporting of a bank's liquidity position.

Figure 68.1 provides the liquidity frequency requirements set by the Financial Services Authority (FSA) for banks in the United Kingdom (UK). This table represents a list of reports and frequency as a representation of best practices in reporting a bank's liquidity position in the UK. Although this list is specifically for banks in the UK, other countries and regions have similar requirements. The following reports and frequency are required by the FSA.

- Daily reports are the daily cash flows and mismatch for market-wide stress tests.
- Weekly reports are the daily cash flows and enhanced mismatch (a.k.a. maturity gap) for firm-specific tests and the wholesale liability.
- Monthly reports are the liquidity buffer, funding concentration, and off balance sheet.
- Quarterly reports are the funding and currency analysis.

The two daily reports, daily cash flows and enhanced mismatch, are two of the most important reports for understanding the liquidity of a bank. In determining the cash inflows and outflows, it is important to understand how nonmaturing and off-balance-sheet items are interpreted so liquidity is viewed from the most conservative standpoint. The treatment of specific cash flows is a concern in reporting and the FSA in the UK recommends the following best practices for guidance in the treatment of nonmaturity items in liquidity analysis and off-balance-sheet items in maturity gap (mismatch) analysis.

- Best practices for treatment of nonmaturity items.
- Callable and demand deposits are treated as having one-day tenor by regulators. Some behavioral adjustments are allowable for stable retail deposits. For example, regulators may allow up to 50% of retail deposits to qualify for a longer maturity, but generally they are viewed as due in one day. Treatment of off-balance-sheet items required by FSA.
 - Derivatives are not included in liquidity ratio calculations (except that coupons receivable or payable are included on their pay dates).
 - Undrawn commitment exposure is included as an outflow of cash and is included in liquidity ratio calculations.

In order to be considered best practices, a conservative approach to treatment of cash inflows and outflows is recommended. In practice, bank models do not always follow exactly the suggestions of the FSA. Bank models commonly apply the following guidelines with respect to off-balance-sheet items.

- Derivatives are included to the amount that collateral is payable or receivable under an ISDA master agreement or credit support annex (CSA), in addition to including coupons on the pay date as recommended by FSA.
- Undrawn commitments are included in liquidity ratio calculations as a cash outflow.

Figure 68.1: Best Practice Liquidity Reporting in the UK

Report	Description	Frequency	Report Deadline
Daily cash flows	Analyzes the survival period out to three months	Firm specific is weekly; market-wide stress test is daily	Weekly firm report is due Monday; stress test is due end of following business day
Enhanced mismatch	ILAS risk drivers and cash flows for all maturities	Firm specific is weekly; market-wide stress test is daily	Weekly firm report is due Monday; stress test is due end of following business day
Liquidity buffer qualifying securities	Marketable asset holding analysis	Monthly	15 business days after month end
Funding concentration	Firm's borrowings of unsecured wholesale funds by counterparty class (excluding primary issues)	Monthly	15 business days after month end
Wholesale liabilities	Daily transaction prices and volume for unsecured liabilities	Weekly	Tuesday, end of day
Retail, SME, and large enterprises corporate funding	Profile of firm's retail and corporate funding and retail deposit stickiness	Quarterly	15 business days after month end
Currency analysis	Foreign exchange (FX) analysis for firm's balance sheet exposures	Quarterly	15 business days after month end
Off-balance-sheet report	Aggregate undrawn committed facilities	Monthly	15 business days after month end

Interpreting Liquidity Risk Reports

LO 68.b: Compare and interpret different types of liquidity risk reports.

The sample reports in this reading are examples of benchmark liquidity reports for regulated banks in the UK. While these are specifically for UK banks, requirements for regulatory reporting are similar in other countries. Bank liquidity reports are generated on a daily, weekly, monthly, and quarterly basis and include both quantitative and quality measures.

The following list of reports represent benchmark reporting in the UK.

- Deposit tracker report.
- Daily liquidity report.
- Funding maturity gap (mismatch) report.
- Funding concentration report.

- Undrawn commitment report.
- Liability profile.
- Wholesale pricing and volume.

Deposit Tracker Report

The deposit tracker report summarizes the current and forecasted size of deposits. The report is generated weekly and monthly and provides required information for computing the immediate term loans-to-deposit (LTD) ratio. The LTD ratio is a key liquidity ratio that bank management is required to report. Figure 68.2 provides an example of the first portion of a deposit tracker report for a medium sized commercial bank. The report breaks down the month end actual and forecasted customer deposits by type. The total customer loans or assets are also reported for historical and forecasted months. The LTD ratio is computed based on total customer deposits and total customer loans.

Figure 68.2: Deposit Tracker Report

(000s omitted)	Actual Month End			Forecasted Month End			
	5/31	6/30	7/31	8/31	9/30	10/31	11/30
Eligible correspondent banks	1,014	1,074	988	1,042	1,056	1,060	1,070
Corporate deposits	524	488	562	568	550	560	560
Private banking deposits	204	206	196	198	198	198	198
Local authority deposits	454	536	652	716	704	720	728
Retail bank deposits	2,528	2,628	2,494	2,706	2,496	2,622	2,622
Eligible private bank	74	76	72	96	74	76	84
Treasury sales	8	2	2	2	2	2	2
Total customer deposits	4,806	5,010	4,966	5,328	5,080	5,238	5,264
M/M change		204	(44)	362	(248)	158	26
Drawdown month ahead				141	18	10	3
Repayment loan schedules				72	22	5	51
Forecast monthly loan				76	(6)	6	(24)
Total customer loans	4,270	4,252	4,230	4,290	4,270	4,290	4,285
Loan to deposit (LTD) %	88.8%	84.9%	85.2%	80.5%	84.1%	81.9%	81.4%

EXAMPLE: Deposit tracker report (1)

Based on the deposit tracker report in Figure 68.2, how well is management doing in managing liquidity if the LTD limit is 85%?

Answer:

The last row of the deposit tracker report in Figure 68.2 suggests management has exceeded the 85% LTD limit in two of the last three months. However, forecasted

months are projected to be within the LTD ratio.

A second typical section included in the deposit tracker report is illustrated in Figure 68.3. The first column provides target LTD ratios set by the board. The top half of Figure 68.3 reflects how much liabilities would need to increase with all other assets held equal, to meet the target LTD ratio. The bottom half of Figure 68.3 illustrates the decrease in assets necessary to meet the target LTD ratio, holding liabilities constant.

Figure 68.3: Deposit Tracker Report: Target LTD

(000s omitted)		Actual Month End			Forecasted Month End			
		5/31	6/30	7/31	8/31	9/30	10/31	11/30
Liabilities increase	85%	217.5	−7.6	10.5	−280.9	−56.5	−190.9	−222.8
	84%	277.3	51.9	69.7	−220.9	3.3	−130.9	−162.8
	83%	338.6	112.9	130.4	−159.3	64.6	−69.3	−101.3
	82%	401.3	175.4	192.5	−96.3	127.3	−6.3	−38.4
	81%	465.6	239.4	256.2	−31.7	191.6	58.3	26.1
	80%	531.5	305.0	321.5	34.5	257.5	124.5	92.3
Assets decrease	85%	−184.9	6.5	−8.9	238.8	48.0	162.3	189.4
	84%	−233.0	−43.6	−58.6	185.5	−2.8	109.9	136.8
	83%	−281.0	−93.7	−108.2	132.2	−53.6	57.5	84.1
	82%	−329.1	−143.8	−157.9	79.0	−104.4	5.2	31.5
	81%	−377.1	−193.9	−207.5	25.7	−155.2	−47.2	−21.2
	80%	−425.2	−244.0	−257.2	−27.6	−206.0	−99.6	−73.8

EXAMPLE: Deposit tracker report (2)

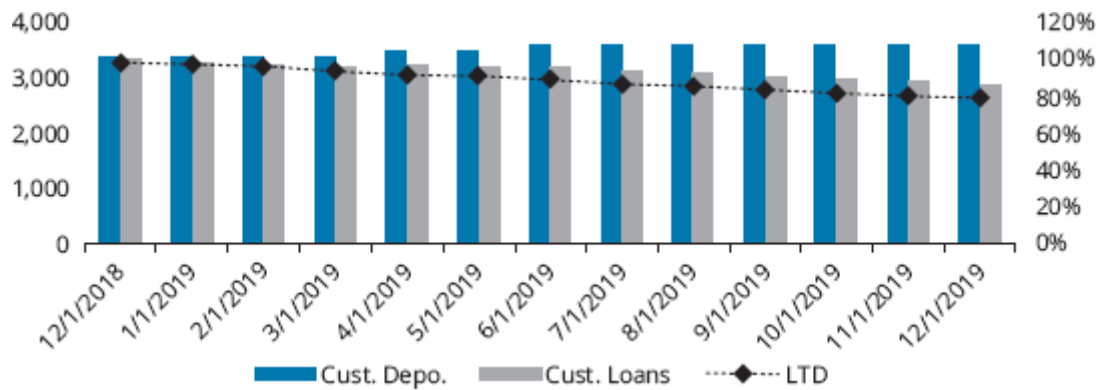
Based on the historical and forecasted information provided in Figure 68.3, how much would assets need to increase or decrease in November (the final column), all other things held equal, for the bank to meet the LTD ratio of 85%? (Note 000s are omitted in the figure.)

Answer:

All other things held equal, assets (i.e., loans) would need to increase of 189,400 to meet an 85% LTD ratio in November.

Figure 68.4 illustrates a deposit tracker report in a bar and line graph for another bank. The bars represent the cash inflows and outflows of customer deposits and loans, respectively quantified by the y-axis on the left-hand side. The line graph is the LTD ratio based with the scale shown on the right-hand side for the y-axis. Actual results are displayed up to July 2019 with the remaining months reflecting forecasted values. Assuming the bank board has a target LTD ratio of 85%, the bank's liquidity position exceeds the LTD ratio for the first half of 2019, but the forecasted trend is positive as the LTD is projected to reach 80% by December 2019.

Figure 68.4: Deposit Tracker Graph



EXAMPLE: Deposit tracker report (3)

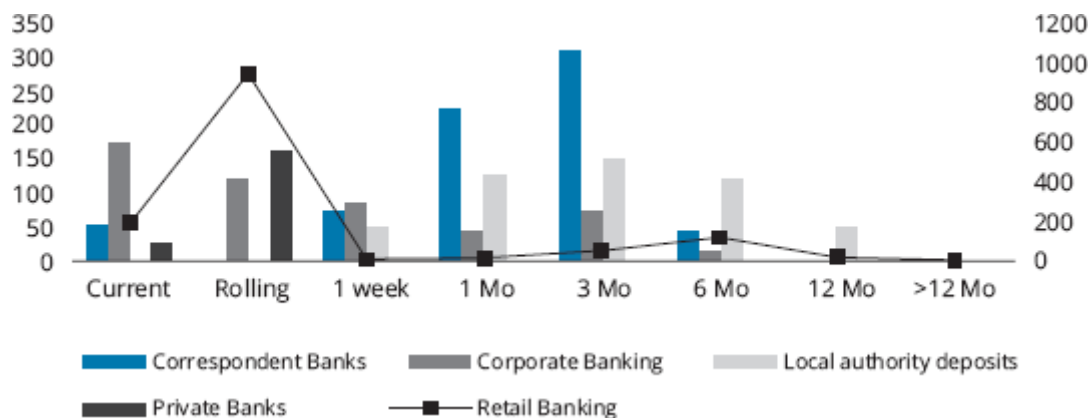
Based on the information provided in Figure 68.4, is the liquidity gap between customer deposits and customer loans improving or getting worse over the year 2019?

Answer:

The bank is improving its gap between customer deposits and customer loans as customer deposits are increasing while customer loans are decreasing. This is improving the liquidity position of the bank as it is projected to have an LTD ratio of approximately 80% by the end of 2019.

Figure 68.5 illustrates a graph of the daily liquidity report which breaks down the customer deposits by type and maturity (tenor). The graph in this example shows the retail banking division deposits as a line graph with the scale represented on the right-hand side of the graph. The other four divisions are shown as bar graphs with the scale on the left-hand y-axis of the graph.

Figure 68.5: Deposit Type and Tenor



EXAMPLE: Deposit tracker report (4)

Based on the information provided in Figure 68.5 for a commercial bank, where do the largest percentage of deposits lie for private banking, corresponding bank

deposits and local authority deposits? What actions should management take to improve the liquidity position of the bank?

Answer:

Based on the information provided in this graph, the retail banking division for this bank has a large percentage of the deposits in current and rolling accounts. Whereas, the corresponding bank deposits and local authority have a greater percentage of their deposits in fixed-term deposits. Regulators will not allow the short-term private banking liabilities to be treated as liquid funds. Bank managers should explore ways to have private banking customers move their deposits into longer-term fixed accounts to improve the bank's liquidity metrics.

Daily Liquidity Report

The bank's balance sheet is used to create the daily liquidity report, which summarizes the bank's liquid assets, liabilities by maturity, and cumulative liquidity position. Figure 68.6 is an example of a bank's list of liquid securities included in a typical daily liquidity report. The daily liquidity report details the bank's nonmarketable CDs by tenor and liquid assets (marketable securities) and amounts for eligible central bank (ECB), noneligible banks, and government securities by tenor.

Figure 68.6: Liquid Securities by Tenor

Classification and Average Tenor	Marketable Securities	CDs
Nonmarketable, non-ECB eligible CDs		
1 day		
2 days		
1 week		
2 weeks		3,250
1 month		7,500
2 months		40,000
3 months		50,000
6 months		105,000
Total non-ECB eligible CDs		205,750
ECB securities liquid in 1 week	339,845	
Non-ECB eligible securities liquid over 4 weeks	352,782	
Government securities	11,780	
Total marketable securities	704,407	

In addition to summarizing the assets and liabilities by tenor, the daily liquidity report summarizes the cumulative cash gap, counterbalancing capacity, and liquidity gap. The bank's balance sheet information is used to compute the liquidity gap and the liquidity risk factor summarized in the daily liquidity report. Figure 68.7 illustrates a typical liquidity gap and liquidity risk factor summary that is included in the daily liquidity report. The counterbalancing capacity in the second row of Figure 68.7 is the sum of all

available securities that can be liquidated to cover sudden cash outflows. The liquidity gap is computed as the cumulative cash gap (cash inflows less cash outflows) less the counterbalancing capacity.

Figure 68.7: Liquidity Gap and Liquidity Risk Factor

	1 day	2 day	1 week	2 week	1 month	3 months	6 months	1 year
Cumulative cash gap	(85,624)	(95,741)	(98,008)	(338,752)	(526,871)	(929,810)	(1,179,447)	(1,552,137)
Counterbalancing capacity	<u>7,895</u>	<u>7,895</u>	<u>225,780</u>	<u>459,722</u>	<u>678,213</u>	<u>854,879</u>	<u>927,005</u>	<u>927,005</u>
Liquidity gap	(77,729)	(87,846)	127,772	120,970	151,342	(74,931)	(252,442)	(625,132)
Liquidity Metrics								
1-week ratio			12.5%					
1-month ratio			2.8%					
Liquidity risk factor			4.15					
Liquidity Risk Factor								
Average remaining term—assets					43.78	without marketable securities		
Adjusted for marketable securities					37.56			
Average remaining term—liabilities					7.83	with no call stickiness		
Excluding call deposits					8.04			
Average tenor of call deposits					29.75			
Combined average term—liabilities					8.97			

Funding Maturity Gap (Mismatch) Report

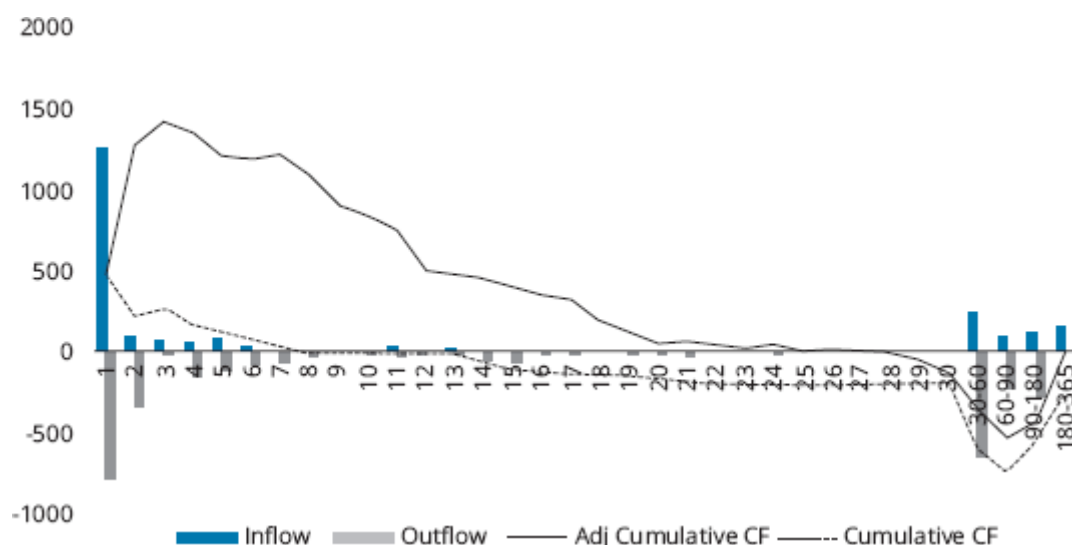
The funding maturity gap report shows the mismatch of all assets and liabilities for different time buckets. The mismatch report summarizes the cumulative liquidity cash flow like the previous liquidity gap report in Figure 68.7. Figure 68.8 illustrates a different bank's example of a mismatch report. This report is often referred to as the mismatch report because the timing of asset and liability cash flows do not offset each other for each time bucket. The net inflows and outflows are adjusted by liquid securities to compute the cumulative mismatch over the different time buckets.

Figure 68.8: Partial Funding Maturity Gap (Mismatch) Report

	Current	2-8 Days	9-31 Days	1-3 Mo	3-6 Mo	6-12 Mo	1-3 Years
Inflows (assets)	(302,734)	(62,669)	(235,133)	(125,377)	(28,776)	(32,404)	(160,491)
Outflows (liabilities)	<u>297,980</u>	<u>132,428</u>	<u>459,874</u>	<u>417,108</u>	<u>109,343</u>	<u>35,250</u>	<u>1,073</u>
Net bucket mismatch	(4,754)	69,759	224,741	291,731	80,566	2,846	(159,418)
Adjustments	<u>(418,959)</u>	<u>(423,713)</u>	<u>(353,954)</u>	<u>(129,213)</u>	<u>162,518</u>	<u>243,085</u>	<u>245,930</u>
Cumulative mismatch	(423,713)	(353,954)	(129,213)	162,518	243,084	245,931	86,513
Liquidity ratio	9.7%	8.1%	3.0%	-3.7%	-5.6%	-5.6%	-2.0%

The information in the maturity mismatch report is used to create the cash flow survival report illustrated in Figure 68.9. The cash flow survival report is used to track the bank's ability to meet the Basel III requirement of a thirty-day survival horizon. The dashed line represents the cash flow survival under normal circumstances. The solid line represents the cash flow survival after marketable securities and other adjustments are made.

Figure 68.9: Cash Flow Survival Report



EXAMPLE: Cash flow survival report

Based on the cash flow survival report illustrated in Figure 68.9, does this bank meet the requirements for Basel III?

Answer:

Basel III requires that banks can withstand a 30-day stress period. Based on the cash survival report in Figure 68.9, the bank does not meet the requirements and has only 8 days of cumulative cash flows under normal conditions and only 27 days after adjustments are made to the cumulative cash flows.

Funding Concentration Report

Senior Treasury and relationship managers rely on the funding source concentration report for large depositors as a key metric for tracking the diversity of deposits. Banks should mitigate liquidity risk by diversifying the source of funds by type and geographically regions. Banks should not be overly dependent on intragroup funds. Figure 68.10 illustrates a concentration report of large depositors for a banking group. In this example, *large* is defined as a depositor of \$50 million U.S. dollars. Large depositors can also be defined as a percentage of total liabilities rather than a specific absolute amount. The ALCO provides oversight for liquidity risk management for a bank. UK regulators suggest ALCO should treat deposits of 5% of total liabilities as large depositors.

Figure 68.10: Concentration Report of Large Depositors

Group Treasury Large Depositors by Country			
Country	Deposits (000,000s)	% External Country Funding	% External Group Funding
A	1,562,487	41.2%	4.7%
B	1,105,682	34.2%	3.3%
C	998,438	37.0%	3.0%
D	921,085	15.0%	2.8%
E	354,564	5.7%	1.1%
F	125,042	3.2%	0.4%
Total	5,067,298		

Large Depositors as a Percentage of Country and Total Funding							
Customer	Amount (000s)	% of Country's External Funding					
		A	B	C	D	E	F
ABC	945,102	11.1%		1.8%		0.9%	
XYZ	672,712		6.7%				
QRT	543,241	8.1%		3.0%			
BF3	352,887		4.7%				

EXAMPLE: Concentration report of large depositors

The ALCO for a bank must set a maximum single-source concentration limit. The ALCO set a limit of 10% for the bank with the concentration report of large depositors illustrated in Figure 68.10. What concerns should the ALCO address at this time?

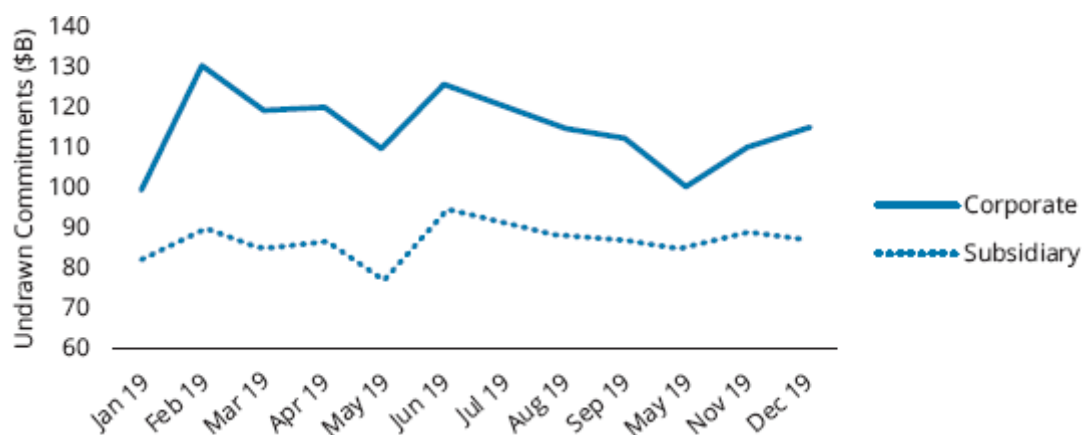
Answer:

The ALCO should limit the exposure to ABC customer as the percentage amount from this single-source just exceeded the limit by 1.1%. The bank should try to increase total liabilities to bring this account within limits. If the bank is unable to increase total liabilities, it will need to require that the customer ABC move some funds out of the bank so that the exposure is reduced to under 10%.

Undrawn Commitment Report

In a stress event, customers may experience liquidity issues and draw on unused funding lines. The existence of off-balance-sheet products in the form of liquidity lines, letters of credit, revolving credit facilities, and guarantees can dramatically increase the liquidity stress for a bank in a crisis event. The undrawn commitment report is used to monitor the liquidity position considering the total exposure for the head corporate office and subsidiaries as illustrated in Figure 68.11. These reports are useful for measuring the trend over time. In addition to reporting totals for the corporate and subsidiaries, undrawn commitment reports often break these aggregate total amounts down to provide detailed customer commitments.

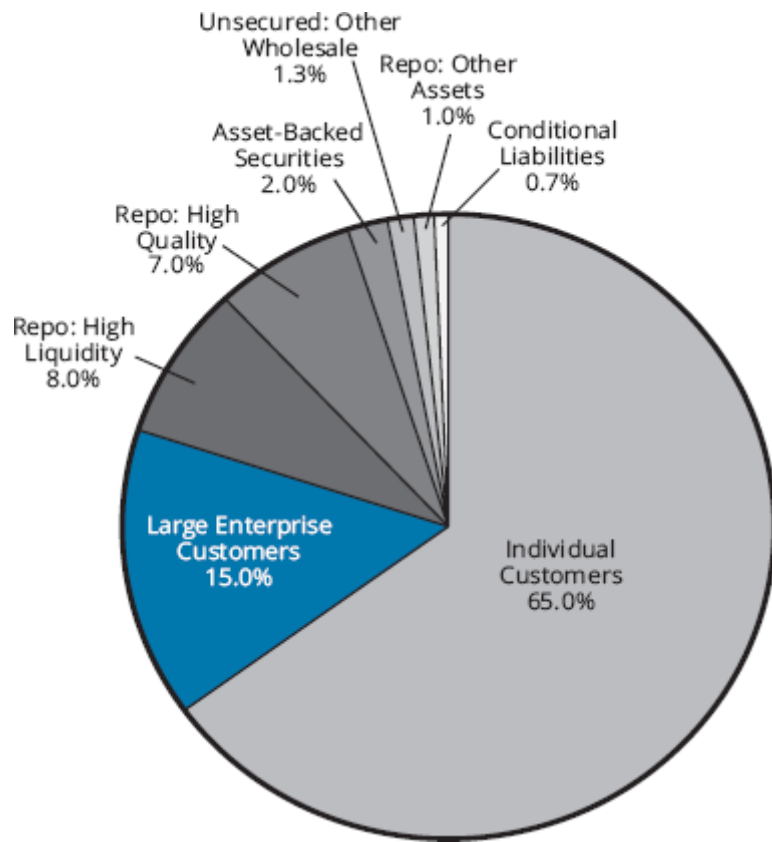
Figure 68.11: Undrawn Commitments



Liability Profile

The liability profile is a graph or table of each type of liability as a percentage of total liabilities. The example of a liability profile in Figure 68.12 illustrates that individual customers make up the largest percentage of liabilities at 65%, followed by large enterprise customers at 15%.

Figure 68.12: Liability Profile



Wholesale Pricing and Volume

In addition to cash flow measures previously discussed, a bank's funding cost and the breakdown of funding by product are key metrics that can impact a bank's liquidity position. By comparing firm-specific yield curves with peers, regulatory authorities can identify specific banks that may be areas of concerns if their yield curves raise significantly above other banks. Bank managers may be able to obtain benchmark information from the regulator to help senior managers monitor their own position. Figure 68.13 illustrates an example of a bank's firm-specific yield curves by type. Figure 68.14 provides a graph based on funding volume and product type. These reports are typically run on a quarterly basis, unless requested more frequently by regulatory authorities.

Figure 68.13: Firm-Specific Wholesale Funding Yield Curves

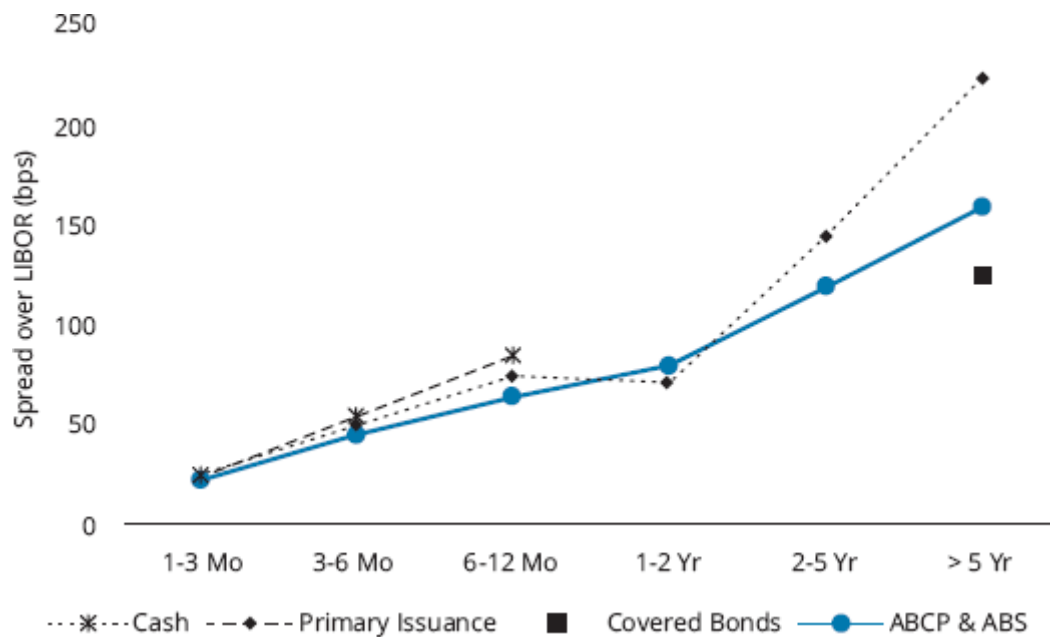
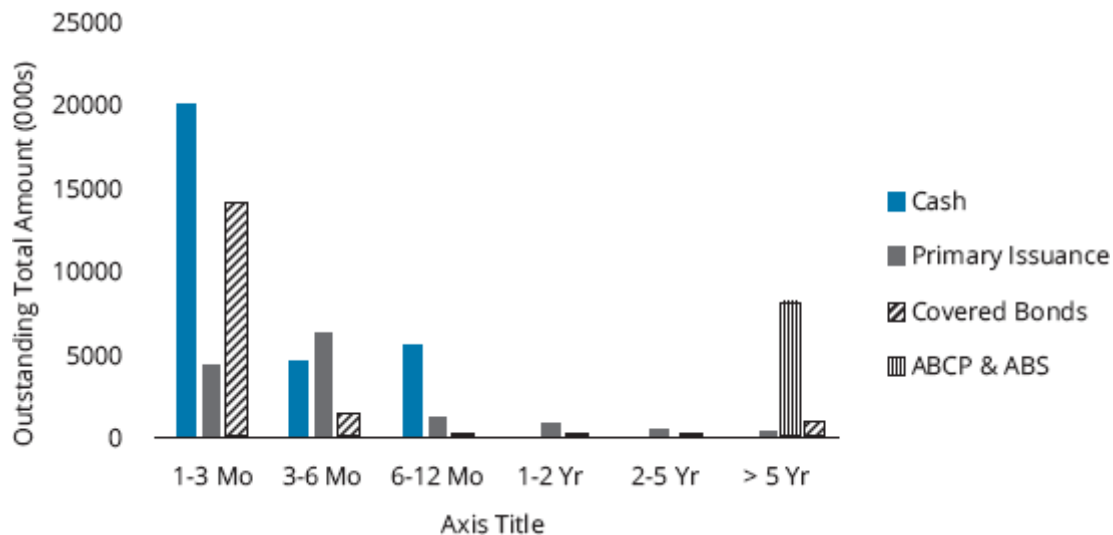


Figure 68.14: Funding by Product and Tenor Bucket

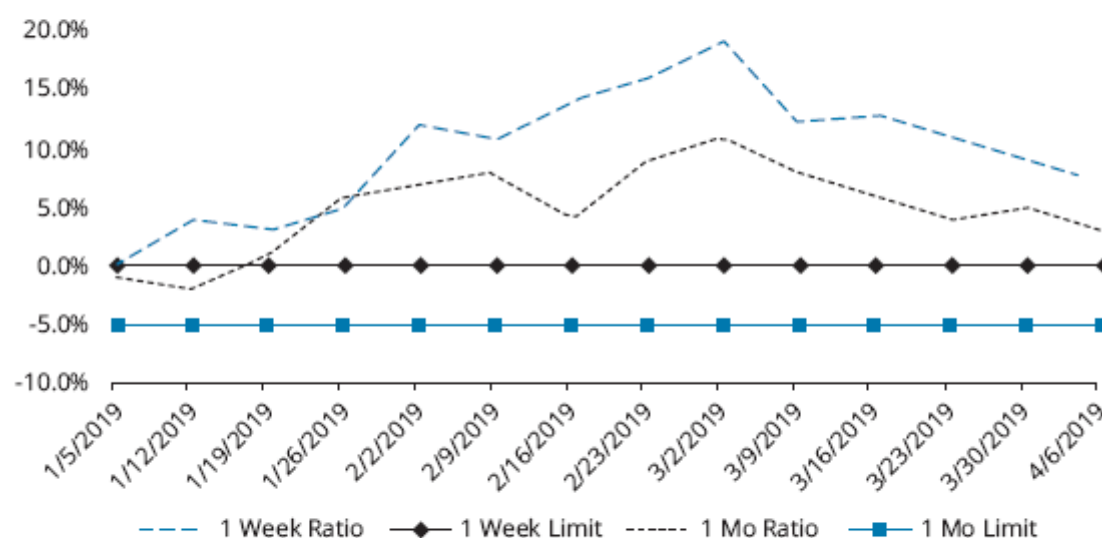


Summary Liquidity Report MI

A one-page summary liquidity report MI is prepared for senior management on a monthly basis unless the ALCO requests it more frequently during a stress period. A one-page summary of key metrics increases the visibility to senior managers of key liquidity metrics as the example in Figure 68.15 illustrates.

Figure 68.15: Summary Senior Management Liquidity Report MI

	1 Day	2 Day	1 Wk	2 Wk	1 Mo	3 Mo	6 Mo	1 Yr
Cumulative cash gap	80	95	(905)	(950)	(1,172)	(1,207)	(450)	(250)
Counterbalancing capacity	180	200	585	635	725	850	1,000	1,000
Liquidity gap	260	295	(320)	(315)	(447)	(357)	550	750

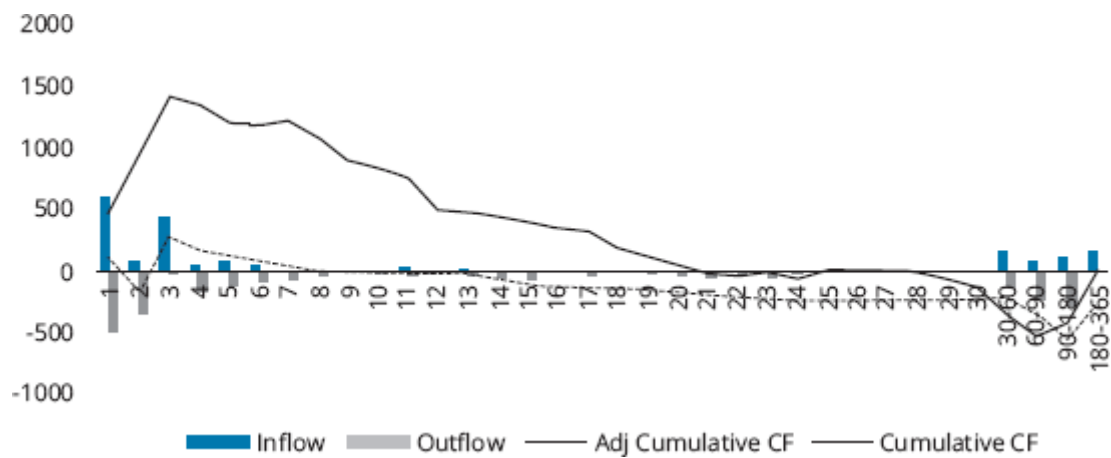


	Current	Last Month
Liquidity risk factor	22.7	24.8
Loan-to-deposit ratio	0.96	0.94
Net intergroup lending	(1,135)	(1,424)



MODULE QUIZ 68.1

- The treatment of tenor for certain types of cash flows for liquidity reporting is a concern for senior managers preparing reports for the Financial Services Authority (FSA) in the United Kingdom (UK). Based on recommendations of the FSA, what should be the treatment in liquidity reports for callable or demand deposits that have no maturity date?
 - 1 day.
 - 1 week.
 - 1 month.
 - 1 year.
- The management of a large national bank creates several reports to track progress in meeting Basel III requirements. The following graph is a cash flow survival horizon that was generated from the maturity gap report. Based on this report which, of the following statements best describes the banks progress in meeting Basel III?



- A. The bank satisfies Basel III requirements because, after adjustments, cash flow does not fall below $-1,000$, indicating that the survival horizon is met.
- B. The bank does not satisfy Basel III requirements because, after adjustments, cash flow falls below -500 , indicating that the survival horizon is not met.
- C. The bank satisfies Basel III because cumulative cash flows before adjustments are near zero for a horizon of 60 days.
- D. The bank does not satisfy Basel III requirements because cumulative cash flows before and after adjustments have a horizon of less than 30 days.

MODULE 68.2: LIQUIDITY STRESS TESTS

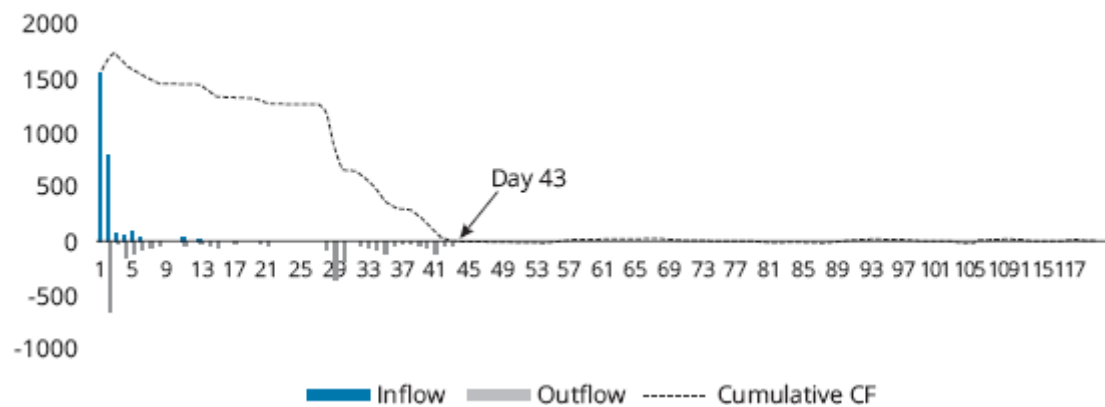
LO 68.c: Explain the process of reporting a liquidity stress test and interpret a liquidity stress test report.

Senior management of the bank must be able to understand what the bank's liquidity position will be in the event of idiosyncratic (firm-specific) or market-wide stress. The **liquidity stress tests** examine the funding difficulties that could arise in the event of extreme scenarios. Stress test reports help senior bank managers understand the liquidity position of the bank in the event of a market or bank-specific crisis. Understanding the bank's liquidity enables management to take actions to mitigate the liquidity risk. The daily cash flow survival report is due weekly for firm-specific stress events and daily for market-wide stress events.

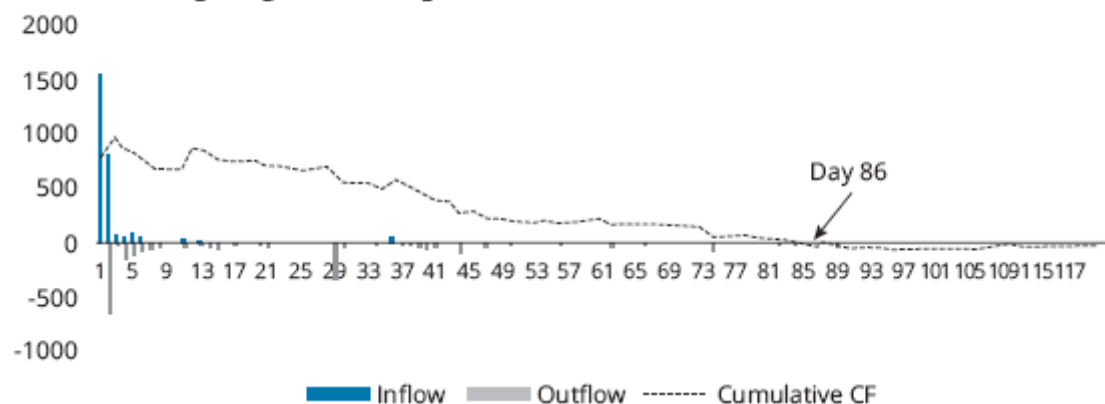
The **cash flow survival report** is the most important stress test for liquidity. The report examines the bank's liquidity under business as usual (BAU) conditions and after mitigating actions are used. Examples of mitigating actions of senior management include liquidating securities and acquiring contingent funding sources. Panel A of Figure 68.16 illustrates an example of a cash flow survival report for a bank under BAU conditions. Panel B of Figure 68.16 illustrates the same bank's cash flow survival report for a bank after senior management implements actions to mitigate liquidity risk. The cash flow survival report shows the daily cash inflows and outflows along with the cumulative cash flow position for BAU and after mitigating liquidity risk actions are in place. In this example, the cash flow survival horizon is almost doubled from 43 days under BAU to 86 days after implementing mitigating actions.

Figure 68.16: Cash Flow Survival Report

Panel A: BAU condition



Panel B: Mitigating actions in place



The FSA in the UK requires large banks to report the cash flow survival horizon report along with other key metrics in the stress report. The following list includes examples of liquidity measures included in a typical stress report.

- Wholesale funding.
- Retail.
- Intraday, three-day, and five-day.
- Cross-currency.
- Intragroup.
- Off balance sheet.
- Marketable assets.
- Nonmarketable assets.
- Funding concentration.

Another area included in the stress report is the observed behavioral forecasting (OBF), which examines the stickiness of liabilities. Figure 68.17 illustrates a liability stickiness report that would be included in stress tests for senior managers. In addition to these liabilities, OBF is sometimes examined for corporate deposits, government time deposits, interbank time deposits, and intragroup time deposits.

Figure 68.17: Liability Stickiness Stress Test Report

Liabilities	Stickiness %	Time Period
Noninterest bearing	100%	3 days
Current accounts	−4.36%	29 days
Retail time deposits	−0.81%	324 days
Cash and equivalents	100%	3 days
Fiscal liabilities	100%	3 days
Repo liabilities	100%	3 days
Time deposits	−0.38%	42 days
Foreign exchange (FX)	100%	30 days



PROFESSOR'S NOTE

In estimating the cash flows arising from its liabilities, banks assess the stickiness of its funding sources. In this context, stickiness refers to the tendency not to run off quickly under stress.

The FSA in the UK requires a quarterly line-by-line stress test report containing information like that in the example shown in Figure 68.18. (Regulators in other countries may require these tests more regularly.) The quarterly stress test report shows the impact to the liquidity ratio and the probability of the shock occurring for various levels of shocks. Shocks are defined as light, moderate, or severe for categories that include reduction in liquid assets, decrease in liabilities, FX mismatch, and combined scenarios of multiple shocks occurring at the same time as illustrated in the last two rows of Figure 68.18.

Figure 68.18: Quarterly Stress Test Report

Reduction in Liquid Assets	Degree of Change	Description of Shock	8 Day	1 Month	Prob.	Impact
Change in repo criteria	Light	1 rating downgrade	7.32%	2.12%	40.00%	25
	Moderate	2 rating downgrades	3.51%	0.19%	25.00%	75
	Severe	3 rating downgrades	-14.00%	-16.20%	1.00%	85
Market-to-market value decrease	Light		7.32%	2.12%	50.00%	25
	Moderate		3.51%	0.19%	30.00%	30
	Severe		-14.00%	-16.20%	5.00%	60
Increased asset haircut	Light		7.32%	2.12%	60.00%	25
	Moderate		3.51%	0.19%	40.00%	50
	Severe		-14.00%	-16.20%	10.00%	90
Unavailability of repo facilities	Severe	All marketable securities are treated as illiquid	-14.00%	-16.20%	10.00%	100
Decrease in liabilities due to withdrawal of customer deposits	Light	5% reduction in deposits replaced with overnight funding	7.32%	2.12%	75.00%	25
	Moderate	10% reduction in deposits replaced with overnight funding	3.51%	0.19%	20.00%	25
	Severe	15% reduction in deposits replaced with overnight funding	-14.00%	-16.20%	5.00%	25

Reduction in Liquid Assets	Degree of Change	Description of Shock	8 Day	1 Month	Prob.	Impact
Withdrawal of corporate deposits	Light	25% reduction in local deposits, other corp. deposits by 10%	7.32%	2.12%	5.00%	30
	Moderate	50% reduction in local deposits, other corp. deposits by 40%	3.51%	0.19%	2.00%	75
	Severe	100% reduction in local deposits, other corp. deposits by 80%	-14.00%	-16.20%	1.00%	100
Withdrawal of intragroup deposits	Light	Reduce net group liability to EUR500 mm	7.32%	2.12%	5.00%	10
	Moderate	Reduce net group liability to EUR250 mm	3.51%	0.19%	2.00%	25
Combined shocks	Light	Slow liquidity crunch	-32.10%	-29.30%	1.50%	90
	Severe	Reputational change	-48.70%	-51.20%	0.40%	100



MODULE QUIZ 68.2

- One of the most important stress tests for senior bank managers is the cash flow survival report. It is common for banks to forecast two types of cumulative cash inflows and outflows to measure the liquidity risk of the bank. Which of the following best describes the two types of cumulative cash flows and how often is the report typically run for firm-specific and market-wide stress tests?
 - The two types of cash flows are business as usual and cash flows with adjustments for derivatives and nonmaturing deposits. All stress tests are required weekly.
 - The two types of cash flows are business as usual and cash flows with adjustments for off-balance-sheet items and contingent funding. All stress tests are required daily.
 - The two types of cash flows are business as usual and cash flows with adjustments for retail banking deposits and contingent funding. Firm-specific stress tests are required daily and market-wide stress tests are required weekly.

- D. The two types of cash flows are business as usual and cash flows with adjustments for liquidated marketable securities and contingent funding. Firm-specific stress tests are required weekly and market-wide stress tests are required daily.

KEY CONCEPTS

LO 68.a

Best practices for banks in general is a conservative approach to treatment of cash inflows and outflows. Best practices for reporting suggest the following: daily reports are the daily cash flows and maturity gap (mismatch) for market-wide stress tests; weekly reports are the daily cash flows and maturity gap (mismatch) for firm-specific tests and the wholesale liability; monthly reports are the liquidity buffer, funding concentration, and off balance sheet; and quarterly reports are the funding and currency analysis. The FSA also recommends the following best practices:

- Callable and demand deposits are treated as having one-day tenor by regulators.
- Derivatives are not included in liquidity ratio calculation (except coupons receivable or payable are included on their pay dates).
- Undrawn commitment exposure is included as an outflow of cash and is included in liquidity ratio calculations.

LO 68.b

The deposit tracker report summarizes the current and forecasted size of deposits. The bank's balance sheet is used to create the daily liquidity report, which summarizes the bank's liquid assets, liabilities by maturity, and a cumulative liquidity report. The funding maturity gap (mismatch) report shows the mismatch of all assets and liabilities for different time buckets. Senior Treasury managers rely on the funding source concentration report as a key metric for tracking the diversity of deposits. The undrawn commitment report is used to monitor liquidity position considering a stress event in which customers may experience liquidity issues and draw on unused funding lines. The cash flow survival report is used to track the bank's ability to meet the Basel III requirement of a thirty-day survival horizon. The wholesale pricing and volume report examines a bank's funding cost by comparing firm-specific yield curves with peers. This report is used by regulatory authorities to identify banks that may be areas of concerns.

LO 68.c

The cash flow survival report is the most important stress test for liquidity. The report examines the bank's liquidity under business as usual (BAU) conditions and after mitigating actions are used.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 68.1

1. **A** The FSA in the UK recommends that callable and demand deposits are treated as 1-day tenor by regulators. (LO 68.a)

2. **D** Basel III requires that banks can meet a 30-day stress test in meeting cash flows. The cash flow survival horizon is approximately only 8 days for this bank before adjustments and only 21 days after adjustments. (LO 68.b)

Module Quiz 68.2

1. **D** The two types of cash flows are business as usual and cash flows with adjustments for liquidated marketable securities and contingent funding. The Financial Services Authority (FSA) in the UK requires firm-specific stress tests weekly and market-wide stress tests daily. (LO 68.c)

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Venkat and Baird, Chapter 7.

READING 69

CONTINGENCY FUNDING PLANNING

Study Session 11

EXAM FOCUS

Contingency funding plans (CFPs) are interlinked with liquidity stress testing. This reading is an extension of earlier readings on liquidity risk management, liquidity stress testing, and early warning indicators. For the exam, understand the relationship between a CFP and liquidity stress testing. Also, be familiar with the important considerations for a CFP, including governance and oversight, scenarios and liquidity gap analysis, contingent actions, monitoring and escalation, and data and reporting.

MODULE 69.1: CONTINGENCY FUNDING PLANNING

LO 69.a: Discuss the relationship between contingency funding planning and liquidity stress testing.

Contingency funding plans (CFPs) use the results of liquidity stress testing and other relevant data as inputs within the context of governance, available contingent liquidity actions, and making decisions. Contingent liquidity events can range from low-severity, high-frequency to high-severity, low-frequency; and CFPs are used for the high-severity, low-frequency events. Thus, CFPs provide a way to control for contingent liquidity events in times of extreme stress.

The relationship between contingency funding plans and liquidity stress testing is further established in terms of limits and escalation levels. In that regard, liquidity risk measures used during normal circumstances are a baseline for developing early warning indicators (EWIs).

LO 69.b: Evaluate the key design considerations of a sound contingency funding plan.

Five key design considerations of CFPs include the following:

- Alignment to business and risk profiles.
 - Consider the range of business activities, products, asset classes, geographic coverage, and foreign exchange.
 - Align the risk appetite statement to the CFP by using EWIs, limits, and escalation levels that are quantitative in nature.
 - Update CFP due to internal changes (e.g., strategy, products, services) and external changes (e.g., general economy) over time.
 - Add the CFP to the firm's strategic planning process so that the CFP is more future-oriented and adaptable.
- Integration with broader risk management frameworks.
 - The CFP is included in the firm's liquidity risk management, enterprise risk management (ERM), capital management, and business continuity and crisis management programs; such integration makes the CFP more effective because the CFP is able to work within the firm's internal control system.
 - Inclusion in business continuity and crisis management strengthens important operating and communicating procedures needed in a crisis.
- Operational, actionable, and flexible playbook.
 - The CFP should be ready to be placed into action quickly should a crisis occur suddenly. In that regard, numerous stress scenarios should be presented, each with potential contingency actions that will vary depending on severity levels.
 - The severity levels should be tied to EWIs, triggers, and contingency actions.
 - Because of the impossibility of predicting every scenario that could result in a liquidity crisis, the CFP needs to be flexible enough to prescribe stated contingency actions while allowing room to make sudden but logical decisions throughout the crisis.
- Inclusive of appropriate stakeholder groups.
 - Groups such as management committees, business units, corporate treasury, risk management, and technology, should be involved to ensure that the CFP is operationally ready.
 - Having a range of stakeholder groups involved gives a good opportunity for an open discussion of potential problems with the CFP that can be discussed and remedied.
- Supported by a communication plan.
 - A communication plan provides a structured and efficient dissemination of information to stakeholders during a crisis.
 - Doing so, especially to external stakeholders, helps to maintain the firm's reputation and functions as a form of damage control to contain any negative financial impact to the firm.



MODULE QUIZ 69.1

1. Which of the following statements regarding contingent funding plans (CFPs) is correct?
 - A. CFPs are linked to liquidity stress tests through their limit structures.
 - B. CFPs are used for high-severity, high-frequency contingent liquidity events.

- C. CFPs allow for a means to control contingent liquidity events in normal times.
 - D. Liquidity risk measures used during stressed times are a baseline for developing early warning indicators (EWIs) for CFPs.
2. What is a key design consideration in developing a contingency funding plan (CFP)?
- A. Aligned to business profile.
 - B. Supported by a backup plan.
 - C. Inclusive of all shareholder groups.
 - D. Can be used in both normal and stressed states.

MODULE 69.2: COMPONENTS OF A CONTINGENCY FUNDING PLAN

LO 69.c: Assess the key components of a contingency funding plan (governance and oversight, scenarios and liquidity gap analysis, contingent actions, monitoring and escalation, and data and reporting).

In this section, we will discuss important components of a CFP, including governance and oversight, scenarios and liquidity gap analysis, contingent actions, monitoring and escalation, and data and reporting.

Governance and Oversight

Stakeholder Involvement, Roles, and Responsibilities

A strong CFP must have involvement from stakeholders within the firm. For example, the different business units could discuss their performance in varying economic circumstances and stressed scenarios. Treasury and risk management could discuss the management of funding and liquidity risk in both normal and stressed scenarios.

Four key roles exist in a firm with regard to the development and use of CFPs: corporate treasury, liquidity crisis team, management committee, and board of directors.

- Corporate treasury.
 - In normal circumstances, corporate treasury has an oversight role for the firm's risk, funding, and liquidity. Based on an analysis of micro- and macroeconomic conditions and results from liquidity stress testing, the corporate treasurer may need to activate the CFP and involve the liquidity crisis team.
- Liquidity crisis team (LCT).
 - The LCT engineers the CFP and presents it to the management committee for approval.
 - The LCT has a general coordination and communication role (with internal and external stakeholders) in addition to the ongoing responsibility to monitor the firm's liquidity.
 - In conjunction with corporate treasury and the management committee, the LCT makes suggestions regarding the implementation of the CFP.

- Members of the LCT should include executives, business unit leaders, and other senior management.
- Management committee.
 - It consists of senior management and manages the LCT in periods of crisis.
 - Other roles include liaising with the board of directors, analyzing the firm's liquidity, and approval of any recommendations pertaining to the CFP implementation.
- Board of directors.
 - It provides leadership to the LCT and management committee during a crisis.
 - Board members who are well-versed with the CFP are in the best position to advise the management committee in terms of implementing the CFP.

Communication and Coordination

The various business units should be coordinated and be interdependent so as to produce data in a timely manner for decision-making purposes. A robust communication plan builds confidence within the firm; confidence and control are important to maintain in a crisis. All stakeholders want to know that management has clear plans to deal with the crisis and related post-crisis issues.

Ideally, a proper communication plan is managed centrally to ensure absolute consistency. However, some groups (e.g., investor relations, legal, and compliance) should be allowed to maintain the communication aspect with those stakeholders with whom they already have established relationships.

Policies and Procedures

Documentation of a CFP could include the following general elements:

- Introduction (e.g., overview and purpose, related policies).
- Governance (e.g., roles/responsibilities, approval).
- Stress testing and scenarios overview.
- Monitoring and escalation (e.g., liquidity gap analysis, contingent action).
- Reporting (e.g., frequency).

Testing and Readiness Assessment

Testing of key parts of the CFPs should be done at regular intervals. That will provide comfort regarding the usefulness of the CFPs during stressed times. Activities that create liquidity, such as issuing debt and the sale of securities from the investment portfolio, could be tested.

Assessing the CFP's operational effectiveness (e.g., governance, escalation, reporting) is important. Simulations and tests of plausible liquidity situations can enhance operational effectiveness and accelerate response times in a crisis. Additionally, the testing could be a means of uncovering weaknesses in the CFP and ways to improve the CFP.

Scenarios and Liquidity Gap Analysis

There should be consistency between the CFP stress scenarios and the liquidity stress testing ones. Furthermore, the CFP stress scenarios should link to the recovery provisions. Liquidity stress testing encompasses systemic and idiosyncratic risks, together with market liquidity and funding liquidity for stress periods in both the short-term and long-term. The CFP's role is to have a means of making management aware of an upcoming crisis situation along with feasible methods of remedying the situation.

The CFP considers the results of liquidity stress testing but might also examine other relevant liquidity stress scenarios beyond the firm's normal scope of analysis. The additional scenarios help to strengthen the contingency plans to consider possible (but perhaps less likely) events that could negatively affect liquidity.

Contingent Actions

Once a liquidity gap analysis has been performed, a firm can determine the appropriate contingent and capital actions to pursue. Such actions should be consistent with the amount of the capital shortfall, when the capital shortfall will occur, and the capital inflow associated with the contingent action.

Examples of contingent actions include:

- Keeping credit lines that do not have significant borrowing restrictions and offer attractive rates.
- Reducing the amount of lending activity (e.g., imposing stricter underwriting standards).
- Offering higher rates on deposits to increase the level of deposit activity by customers.
- Choosing not to reinvest securities when they mature.
- Moving from having less shorter-term funding and more longer-term funding sources.
- Increasing securitization activities.
- Disposing of liquid assets.
- Issuing subordinated debt.
- Issuing callable loans.
- Selling receivables (e.g., loans, credit cards).
- Disposing of business units.
- Lowering capital distributions.
- Implementing cost-cutting measures.

The nature (e.g., systemic and/or idiosyncratic) of the stressed events and the magnitude will determine which contingent actions can be taken and their level of effectiveness.

Factors that may reduce a firm's ability to take contingent actions include:

- Closure of securitization markets.
- Reduced access to repo funding.

- Credit downgrades combined with higher collateral deposits.
- Counterparties engaging in harmful margin and collateral behavior.
- Custodian banks mandating higher cash deposits.
- Higher funding costs.
- Funding no longer being rolled over by counterparties.
- Deposit run-off.

To the best of its ability, the firm needs to determine the likelihood of these factors and develop ways to overcome the negative effects of them.

When a firm faces a liquidity crunch, it must take action to mitigate the problem by improving its liquidity. That may necessitate reducing the amount of lending or reducing transactions with riskier counterparties. Unfortunately, doing so may send the incorrect message that the firm has been weakened financially, which could reduce the ability of the firm to effectively implement contingent actions later on. Therefore, the firm should always think about the message that it is sending based on its actions in terms of impacts on customers, lenders, and counterparties. Sometimes, a given contingent action taken early in the crisis may benefit short-term liquidity but may exacerbate the liquidity crunch in the long-term. Ideally, some contingent actions might be deferred until the latter stages of the crisis to avoid such a problem.

Monitoring and Escalation

The CFP should work off the firm's process of tracking and measuring liquidity risk. The measures form a group of EWIs that provide advance notice of possible liquidity problems in the future. EWIs can be subdivided into (1) market and business measures, and (2) liquidity health measures.

Market and Business Measures

Market and business measures can be both macroeconomic (e.g., market volatility, bond/stock prices) and microeconomic (e.g., firm revenues in a specific industry) and are broad in nature. They should include measures that are relevant in financial system risks and overall liquidity. Furthermore, examining industry factors and performing competitor analysis can provide further insight.

Market and business factors include:

- Large and sudden decline in stock market indices.
- Credit downgrades of U.S. Treasuries and/or other sovereign debt.
- Large surge in market volatility.
- Sudden catastrophic events.
- Accelerated increase in assets financed by unstable liabilities.
- Negative publicity.
- Asset quality deterioration.
- Falling earnings and earnings projections.
- Credit rating downgrades.
- Loans being withdrawn or not renewed.

- Increased spreads on the firm's debt and credit default swaps.
- Greater collateral to be provided by the firm.
- Counterparties avoiding unsecured or long-term transactions with the firm.
- Deposit run-off.

Liquidity Health Measures

Liquidity health measures (e.g., credit rating, ratio of short-term funding to long-term funding) are more focused and directly reflect the strength of a firm's current and future liquidity.

Liquidity health measures include:

- Projected net funding requirements to current unused funding capacity—financing needed to cover the firm's expansion of its lending business.
- Non-core funding to long-term assets—less reliable financing sources that may not exist in stressed situations or could be prohibitively expensive.
- Overnight borrowings to total assets—measure of a less reliable source of funding.
- Short-term liabilities to total assets—financing sources that need to be renewed in the near future and are required to support assets.
- Funding sources concentration—checking to determine if there are too few providers of liquidity who constitute the bulk of a firm's financing; significant liquidity risk if one or more of those providers suddenly withdraws funding during stressed times.
- Funding maturity profile—checking to determine when the financing sources mature and potentially need to be repaid; significant concentrations at a given maturity present liquidity risk, especially if the firm is reliant on short-term financing.
- Used capacity to total borrowing capacity—a measure of available borrowings as a source of liquidity in the future.
- Liquid assets to volatile liabilities—a measure of the buffer of liquid assets that exceeds the financing needs.
- Unpledged eligible collateral to total assets—a measure of how the firm could sell assets or pledge collateral for future financing needs.
- Loans to commitments—a measure of how much funding may be needed in the future based on how much has been used to date.

Escalation Levels

Level 1 is the starting point, caused perhaps by stress test results suggesting a greater than desirable reduction in liquidity, for example. It involves greater management oversight of market conditions and how they affect the firm's operating results. Oversight should be primarily on future-oriented measures of the firm's liquidity and the market view of the firm. At Level 1, the involvement of the LCT requires strong internal coordination and communication, partly to keep external stakeholders apprised of the situation.

Level 2 is a more elevated level in which systemic and/or idiosyncratic events are clearly having a negative effect on the firm's business and liquidity. There should be detailed analysis of current liquidity and reasons for deterioration, together with emphasis on how the firm's competitors and counterparties are responding to the market changes. With the evolving crisis, the focus is on the very near future, which includes activities relating to recovery and maintenance of the business. Methods to increase liquidity may be pursued, such as reducing loan-granting activities, selling less liquid and/or long-term assets.

Level 3 focuses on surviving and remaining a going concern. By this point, the firm would have undertaken significant activities to increase its liquidity during the stress situation.

Moving up and down between escalation levels should be contemplated and subject to approval by the LCT. Suitable communication and reporting requirements are required at Level 1. For example, at Level 1, the requirements may be much less onerous and consist of occasional updates to the management team. However, at Levels 2 and 3, more drastic contingent actions may require approval from the management team and/or the board.

Data and Reporting

In some firms, it would be desirable to have more frequent reporting (e.g., daily) of liquidity throughout the firm. In addition to the numbers, there should be relevant qualitative information provided to aid in comprehending the firm's liquidity profile.

Reporting should describe the ways of determining liquidity coverage for future liabilities and cash outflows as well as how much coverage is required. Reporting should account for intraday liquidity positions, contingent liabilities, and usage of funding sources.



MODULE QUIZ 69.2

1. In the context of governance and oversight of a contingency funding plan (CFP), which role has direct oversight of the liquidity crisis team (LCT)?
 - A. Board of directors.
 - B. Risk management.
 - C. Corporate treasury.
 - D. Management committee.
2. Which of the following items is an example of increasing a firm's ability to take a contingent action during a stress situation?
 - A. Securitizing assets.
 - B. Decreasing lending rates.
 - C. Increasing capital distributions.
 - D. Shifting from longer-term to shorter-term funding sources.
3. Which level of escalation within a contingency funding plan (CFP) has more emphasis on analyzing the causes of liquidity deterioration closely?
 - A. Level 1.
 - B. Level 2.
 - C. Level 3.
 - D. Level 4.

KEY CONCEPTS

LO 69.a

Contingency funding plans (CFPs) use the results of liquidity stress testing and other relevant data as inputs within the context of governance, available contingent liquidity actions, and making decisions.

LO 69.b

Five key design considerations of CFPs include:

- Alignment to business and risk profiles.
- Integration with broader risk management frameworks.
- Operational, actionable, and flexible playbook.
- Inclusive of appropriate stakeholder groups.
- Supported by a communication plan.

LO 69.c

Key components of a contingency funding plan (CFP) include governance and oversight, scenarios and liquidity gap analysis, contingent actions, monitoring and escalation, and data and reporting.

- *Governance and oversight.* Four key roles exist in a firm with regard to the development and use of CFPs: corporate treasury, liquidity crisis team, management committee, and board of directors. The various business units should be coordinated and be interdependent so as to produce data in a timely manner for decision-making purposes. Documentation of a CFP could include introduction, governance, stress testing and scenarios overview, monitoring and escalation, and reporting. For testing and readiness assessments, testing of key parts of the CFPs should be done at regular intervals. That will provide comfort regarding the usefulness of the CFPs during stressed times.
- *Scenarios and liquidity gap analysis.* There should be consistency between the CFP stress scenarios and the liquidity stress testing ones. Furthermore, the CFP stress scenarios should link to the recovery provisions.
- *Contingent actions.* Once a liquidity gap analysis has been performed, a firm can determine the appropriate contingent and capital actions to pursue. Such actions should be consistent with the amount of the capital shortfall, when the capital shortfall will occur, and the capital inflow associated with the contingent action. The nature (e.g., systemic and/or idiosyncratic) of the stressed events and the magnitude will determine which contingent actions can be taken and their level of effectiveness.
- *Monitoring and escalation.* The CFP should work off the firm's process of tracking and measuring liquidity risk. The measures form a group of EWIs that provide advance notice of possible liquidity problems in the future. EWIs can be subdivided into (1) market and business measures, and (2) liquidity health measures. In terms of escalation levels, Level 1 is the starting point. It involves greater management oversight of market conditions and how they affect the firm's operating results. Level 2 is a more elevated level in which systemic and/or

idiosyncratic events are clearly having a negative effect on the firm's business and liquidity. Level 3 focuses on surviving and remaining a going concern.

- *Data and reporting.* In some firms, it would be desirable to have more frequent reporting (e.g., daily) of liquidity throughout the firm. Reporting should describe the ways of determining liquidity coverage for future liabilities and cash outflows as well as how much coverage is required.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 69.1

1. **A** CFPs should be clearly linked to the liquidity stress tests through its limit structure and escalation levels. CFPs are used for high-severity, low-frequency events (not high-frequency events). CFPs allow for a means to control for contingent liquidity events in times of extreme stress (not normal times). Liquidity risk measures used during normal times (not stressed circumstances) are a baseline for developing EWIs. (LO 69.a)
2. **A** CFPs should be aligned to the firm's business and risk profiles. Examples include business activities, products, and asset classes. CFPs should be inclusive of appropriate stakeholder groups, which include shareholders but also include many other groups such as management committees, business units, and operations. CFPs, by nature, are meant to be used only in stressed states. (LO 69.b)

Module Quiz 69.2

1. **D** The management committee (comprising senior management) is responsible for direct supervision of the LCT. The board of directors does advise and provide assistance to the LCT as needed, but does not directly supervise the LCT. (LO 69.c)
2. **A** Securitizing assets is a source of cash (increases liquidity) for a bank. Decreasing lending rates encourages the growth of loans issued by the bank, which is an outflow of cash (reduces liquidity) for a bank. The same is true for increasing capital distributions (reduces liquidity). Shifting from shorter-term to longer-term sources of funding is a contingent action, not the other way around. (LO 69.c)
3. **B** Level 2 is a more elevated level where systemic and/or idiosyncratic events are clearly having a negative effect on the firm's business and liquidity. There should be detailed analysis of current liquidity and reasons for deterioration. (LO 69.c)

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Rose and Hudgins, Chapter 12.

READING 70

MANAGING AND PRICING DEPOSIT SERVICES

Study Session 11

EXAM FOCUS

This reading focuses on deposits as a funding source for financial institutions. It is a largely qualitative discussion of the types of deposits available and the relative benefits and costs of each kind of deposit from the financial institution's perspective. For the exam, understand the difference between deposit accounts that are used for transactions versus deposit accounts that are primarily savings vehicles. There are several approaches to pricing deposit services, including the cost-plus method, the marginal cost approach, and the conditional pricing method. Know the differences, and be able to calculate the marginal cost of raising additional funds. Unlike funding for other businesses, deposits are insured by the Federal Deposit Insurance Corporation (FDIC). Understand that deposit insurance lowers the bank's cost of funds, although the bank must pay deposit insurance fees. There are some related social/ethical issues that banks are challenged with, including whether all adults have a right to basic financial services, called basic banking or lifeline banking. An issue facing society is: who should pay for these services?

MODULE 70.1: TRANSACTION AND NONTRANSACTION DEPOSIT TYPES

LO 70.a: Differentiate between the various transaction and non-transaction deposit types.

The largest source of funds at most depository institutions (i.e., commercial banks, savings and loans [S&Ls] and credit unions) is **deposits**. In the broadest sense, a commercial bank is defined as an institution that accepts deposits and makes loans. As such, deposits are a source of profitability and growth potential for the institution. The difference between the yield banks earn on assets such as loans and securities, versus the cost of funds on deposits and other sources of funding, is a key driver of commercial bank profitability.

Bank managers and staff are concerned with two broad issues surrounding deposits:

- What are the lowest cost funding sources available?
- How can the bank raise sufficient deposits to fund loans and other activities?



PROFESSOR'S NOTE

There are several types of institutions that use deposits for funding, including commercial banks, credit unions, and S&Ls (also called thrift institutions). Throughout this reading, the word *bank* is often used as shorthand to mean *depository institution*. The characteristics of a savings account, for example, are generally the same if discussing a commercial bank, an S&L, or a credit union. There are differences in features such as the tax treatment of credit unions or the regulatory environment of an S&L, but in this chapter the focus is on deposit accounts, and from that perspective, the discussion is generally the same regardless of the specific type of financial institution. Also, the term *check* is used to mean a debit on an account. Historically, transaction accounts were called *checking accounts* and people wrote checks to make payments. However, in today's world of electronic banking, there are fewer and fewer paper checks being written each year.

Transaction (Demand) Deposits

Transaction (demand) deposits are used by depositors to make payments and are one of the oldest funding sources of banks. Banks must honor withdrawals immediately, without prior notice, either in person (i.e., the customer withdraws cash) or to a third party designated by the customer to receive funds. Withdrawals were historically done using checks, and more recently through debit cards and electronic fund transfers via internet (electronic) banking. Transactional accounts represent the least predictable deposits because they can be withdrawn without notice. This means their maturities are, at least potentially, the shortest of all bank sources of funds.

Transaction deposits include noninterest-bearing (i.e., deposits do not earn explicit interest payments) and interest-bearing demand deposits. Both noninterest-bearing and interest-bearing accounts provide account holders with:

- Payment services.
- A secure place to hold funds.
- Records of transactions.

Types of transaction deposits include:

- **Noninterest-bearing demand deposits.** Since the passage of the Glass-Steagall Act of 1933, banks were not allowed to pay interest on deposits. Historically, business deposit accounts made up the greatest proportion of noninterest-bearing deposits. Congress passed the Wall Street Reform and Consumer Protection Act in 2009, allowing banks to pay interest on corporate deposit accounts.
- **Interest-bearing transaction deposits. Negotiable order of withdrawal (NOW) accounts** came into existence in the 1970s in New England as a hybrid checking/savings account that paid interest. The bank was given the right to prior notice of withdrawal but rarely exercised the right; thus, the accounts were in

essence interest-bearing checking accounts. **Regulation Q** prevented banks from paying interest on demand deposits and limited the amount banks could pay on savings deposits. Supervisors were afraid that banks might fail if they competed for deposits based on interest rates. Regulation Q was in force from the 1930s until deregulation in the early 1980s. Following interest rate deregulation in 1980, the accounts were permitted nationwide beginning in 1981. Congress also allowed automatic transfers. This permitted depositors to preauthorize the movement of funds from savings to checking to cover overdrafts, in essence creating a checking account that earned savings account interest rates. Individuals and nonprofits could hold NOW accounts, but businesses could not.

- **Money market deposit accounts (MMDAs).** The Garn-St. German Depository Institutions Act of 1982 allowed banks to offer MMDAs (to compete with money market mutual funds offered by brokerage firms) that had unregulated, money market interest rates. **Super NOWs** are similar accounts, providing the transactional benefits (through limited check writing privileges) of demand deposits, with market interest rates. MMDAs are classified by regulators as savings deposits and may be held by businesses as well as individuals and nonprofits. NOW accounts may only be held by individuals and nonprofits.
- **Mobile check deposits.** Customers can take photos of the front and back of endorsed checks and receive an instant confirmation of the posted deposit. These new technologies lead to questions such as:
 - Will people continue to write checks, given the availability of mobile banking services?
 - Will we still need bricks and mortar branches or ATMs?
 - Will customers continue to visit banks? Will there be bank tellers in the future?
 - Does mobile banking offer new opportunities for attracting deposits? Can mobile banking lead to new sources of revenue?
 - Does mobile banking increase the number of potential bank customers (i.e., are there more phone users than depositors worldwide)?

Nontransaction (Savings or Thrift) Deposits

Savings (thrift) deposits are intended for customers who are saving for a future expenditure or for a financial emergency (i.e., rainy day savings). Savings accounts pay interest, and the interest rates on savings accounts are generally higher than the rates on demand deposits. The accounts have higher interest costs but generally lower management and administrative and processing costs. There are several types of savings accounts, including:

- **Passbook savings deposits.** A traditional savings account offered by depository institutions, passbook savings accounts could originally be opened for as little as \$5. There were no limits on withdrawals (though technically the institution could require prior notice to withdraw funds). Individuals, nonprofits, governments, and businesses could open passbook savings accounts.
- **Time deposits.** Often called **certificates of deposit (CDs)**, time deposits carry fixed maturities from a minimum of seven days up to five years or more. Some time deposits have interest rates that adjust periodically. This adjustment period

is called the *roll period* or *leg period*. **Negotiable** or **jumbo CDs** are available in denominations of \$100,000 or more and are sold to wealthy individuals and companies. They may be bought and sold before maturity. Retail CDs cannot be traded before maturity. For example, if your grandmother purchases a 365-day CD with her \$50,000, she cannot withdraw the funds before maturity without paying a penalty. However, if a corporation purchases a \$10 million negotiable CD, it can be sold before maturity. Innovations in CD accounts include:

- **Bump-up CDs.** The depositor can switch to a higher rate if interest rates rise.
- **Step-up CDs.** The interest rate periodically adjusts upward.
- **Liquid CDs.** The depositor is permitted to withdraw some funds without penalty.
- **Index CDs.** CD returns are linked to a stock market index such as the S&P 500.
- **Retirement savings deposits.** In 1962, Congress authorized financial institutions to sell Keogh plans, which are retirement accounts for self-employed individuals. In 1981, the Economic Tax Act allowed individuals who were not self-employed to open tax-deferred **retirement savings accounts**. Depositors can make before-tax contributions to an *individual retirement account (IRA)*. These accounts are offered by banks and other depository institutions, brokerage firms, mutual funds, insurance companies and sometimes by employers who have qualified pension plans or profit-sharing plans. The Tax Relief Act of 1997 created *Roth IRAs*. These accounts allow depositors to save after tax, and the savings grow tax free (i.e., the investor does not pay taxes at retirement when the funds are withdrawn). The Pension Protection Act of 2006 allowed employers to automatically enroll employees into retirement plans through payroll deductions. Fund managers must act as a “prudent person” and not be reckless with employee funds. Approximately one quarter of IRAs and Keogh plans are held by depository institutions, although retirement funds are less than 5% of total deposits in FDIC-insured banks. Retirement funds are a stable source of funding for banks, as they cannot typically be withdrawn without a sizeable penalty.



MODULE QUIZ 70.1

1. Which of the following deposit accounts will most likely have the highest interest rate?
 - A. Demand deposit account.
 - B. Time account (certificate of deposit) with one-year maturity.
 - C. Money market deposit account (MMDA).
 - D. Negotiable order of withdrawal (NOW) account.
2. Which of the following describes a certificate of deposit (CD) that carries an interest rate that periodically adjusts upward?
 - A. Liquidity CD.
 - B. Bump-up CD.
 - C. Step-up CD.
 - D. Index CD.

MODULE 70.2: METHODS OF PRICING DEPOSITS

LO 70.b: Compare the different methods used to determine the pricing of deposits and calculate the price of a deposit account using cost-plus, marginal cost, and conditional pricing formulas.

Interest rates on deposit accounts are generally higher for longer maturities. For example, a CD with a one-year or longer maturity will have a higher rate than an MMDA, and the MMDA will have a higher rate than the rate on an interest-bearing checking account. Large, money center banks usually pay a lower rates than smaller banks. Approximately 80% of deposits in the United States are interest-bearing, nontransaction deposits (i.e., time and savings deposits). Noninterest-bearing transaction deposits have declined to less than 10% of all deposits as of 2010. **Core deposits**, the least expensive source of bank deposits, include checking, savings and time accounts, are not highly sensitive to interest rate changes and are thus a stable source of funding. While many core deposits may be withdrawn without notice, the effective maturity is years, increasing the duration of the institution's liabilities.

Deposit Account Costs

Demand (checkable) deposit accounts are generally the lowest cost funding for banks. Interest expense per dollar of time deposits is about three times that of transaction deposits. Although management costs are higher for these accounts, low-to-zero interest costs keep the overall cost of funding low. Electronic imaging has further reduced the costs of these accounts as paper checks become a less common method of payment. Also, automatic bill paying services, including online bill payments and electronic debits, have further reduced costs.

Banks have traditionally earned fee income on deposit accounts, offsetting some of the overhead costs. Fees have especially increased for items such as returned checks for insufficient funds, stop payments, overdraft fees, and ATM usage fees. It is primarily public preference that determines the mix of deposit accounts, despite the wishes of bank managers, who would prefer to fund the bank with noninterest-bearing demand deposit accounts. As a result of deregulation, other types of financial services firms are also vying for deposits.

Deposit Services Pricing

When depository institutions were first allowed to pay interest on transaction accounts, many institutions aggressively sought market share through *below-cost pricing*. Because operating and overhead costs associated with providing services was higher than the fees customers paid, depositors earned **implicit interest**. Leading up to interest rate deregulation in 1980 and 1982, banks were not allowed to pay interest on transaction accounts (i.e., Regulation Q). As such, the only way to pay interest was through implicit interest. Banks gave depositors anything from teddy bears to toasters to airline tickets (when market rates were extremely high in the later 1970s to early 1980s) to compete for deposits and to provide compensation for the use of depositor funds.

Cost-Plus Pricing of Deposit Services

Unbundled service pricing has resulted from deregulation and the overall cost of deposits (at least before short-term interest rates were pushed to near zero percent for nearly a decade) has increased. Depository institutions price deposit services separately. Banks may use a **cost-plus pricing method** of pricing deposits to cover costs. This formula is:

$$\begin{aligned} & \text{unit price charged to the customer for each deposit service} \\ &= \text{operating expense per unit of deposit service} \\ &+ \text{estimated overhead expense allocated to the deposit service function} \\ &+ \text{planned profit margin for each service unit sold} \end{aligned}$$

In other words, each deposit service should be priced to cover both the explicit operating costs, the allocated overhead costs, and the planned profit.

EXAMPLE: Cost-plus pricing of deposit services

Bank of the Bluegrass offers a demand deposit account that has a \$500 minimum deposit. The cost to service the account, including labor and computer time, is \$2.50 per month. The allocated overhead expense is \$1.25 per month, and the bank would like to build in a \$0.25 profit margin per account. **Calculate** the monthly fee the bank should charge the customer using the cost-plus pricing method.

Answer:

$$\text{Monthly fee per account} = \$2.50 + \$1.25 + \$0.25 = \$4.00 \text{ per month}$$

Marginal Cost Method to Set Deposit Rates

Depository institutions should be forward-looking, and therefore should consider the marginal cost to bring in one additional dollar of deposits, rather than assuming that the historical average cost applies to new deposit funds. Current rates may be higher or lower than historical rates. The marginal cost is calculated as:

$$\text{marginal cost} = \text{change in total cost} = (\text{new interest rate} \times \text{total funds raised at new rate}) - (\text{old interest rate} \times \text{total funds raised at old rate})$$

$$\text{marginal cost rate} = \text{change in total cost} / \text{additional funds raised}$$

Consider a bank that has a base amount of savings deposits of \$100 million and currently pays 5% rate on these funds. To raise additional funds, the bank will have to increase the interest rate. Figure 70.1 illustrates the marginal cost (dollar and rate) of raising the additional deposits.

Figure 70.1: Marginal Cost of Raising Additional Deposits

Expected deposits	Average rate to attract new deposits	Total interest cost of funds raised	Marginal cost of new funds raised	Marginal cost as a percent of new funds raised
\$100 million	5.0%	\$5 million	\$5 million	5%
\$125 million	5.5%	\$6.875 million	\$1.875 million	7.5%
\$150 million	6.0%	\$9 million	\$2.125 million	8.5%
\$200 million	7.0%	\$14 million	\$5 million	10.0%

Assuming the funds can be invested in loans that will yield an average rate of 8%, the difference between the marginal cost and the marginal benefit is positive if the bank raises \$100 million or \$125 million ($8.0\% - 5.0\% = 3.0\%$ and $8.0\% - 7.5\% = 0.5\%$, respectively), and negative if the bank raises \$150 million or \$200 million ($8.0\% - 8.5\% = -0.5\%$ and $8.0\% - 10.0\% = -2.0\%$, respectively).

One can also calculate the total profit in *dollars* for each alternative. For example, if the bank raises \$150 million at 6%, the cost is \$9 million. If the bank invests those funds at 8%, the dollar return will be \$12 million, for a \$3 million total profit earned after interest costs. This means that although the marginal cost of funding is increasing, the additional funds are adding more to marginal revenue than to marginal cost. Thus, the bank should raise the additional funds.

This type of analysis is valuable to managers because they can see that at some point, expanding the deposit base becomes unprofitable. If that happens, the bank must either find a lower cost of funding (on the margin), or higher yielding assets.

Because the rates on deposits apply to all accounts of the same type, there may be an advantage to choosing a different, higher rate source of funds for the marginal amount, versus paying the new rate (to attract additional deposits) to everyone.

EXAMPLE: Marginal cost method

Green Back Bank has \$400 million of MMDAs. To attract an additional \$10 million, the bank believes it will have to raise the MMDA rate by 0.5%—from 2.0% to 2.5%. Alternatively, the bank could pay the negotiable CD rate of 4% to raise the same funds. **Calculate** the marginal cost in dollars for each source of funds as well as the marginal cost rate for the alternative ways the bank may raise the funds.

Answer:

The cost of raising the additional funds in the MMDA is:

$$(0.025 \times \$410 \text{ million}) - (0.02 \times \$400 \text{ million}) = \$2.25 \text{ million}$$

Versus the cost of raising the funds in the negotiable CD market:

$$0.04 \times \$10 \text{ million} = \$400,000$$

The marginal cost rate of raising MMDA funding is: $\$2.25 / \$10 = 22.5\%$

The marginal cost rate of raising the funds in the negotiable CD market is thus $\$400,000 / \$10,000,000 = 4\%$.

In this case, although the rate is higher on negotiable CDs, the institution need only pay that rate for the additional \$10 million needed. Because the rate must be paid on both old and new MMDA funds, the money market funding is more expensive overall.



PROFESSOR'S NOTE

In the past, when Regulation Q was enforced, depository institutions were more likely to move rates for all account holders. In recent years, institutions have been more targeted in the way they set deposit rates. This means the earlier marginal cost example may be a bit exaggerated today because banks target specific customers with higher rates, and pay other, perhaps “sticky” depositors in less competitive markets, lower rates.

Conditional Pricing

When a depository institution sets prices (e.g., fees) based on a condition, it is known as **conditional pricing**. Minimum balances on checking and savings accounts required to earn a rate (e.g., on a demand deposit account) or a premium rate (e.g., on a savings account) are examples of conditional pricing. The fee is conditioned upon the amount of deposits in the account over a designated period, such as a month. Examples of conditional pricing include:

- The number of transactions during a period, such as the number of checks written, wire transfers made, stop payment orders authorized, or notices of insufficient funds issued.
- The maturity of deposits in days, weeks, or months.

Economist Constance Dunham classifies conditional pricing on checking accounts into three categories:

1. **Flat-rate pricing.** Flat pricing involves a fixed charge per time period (e.g., a flat fee of \$3 per month to have the account). It may also be a fixed charge per transaction, such as \$1 per use of ATM. A particular institution may put both types of fees in place.
2. **Free pricing (free checking).** There is no charge either for the account or for transactions in a free pricing model. It is not really free to the customer, though, because the interest paid on this type of account is likely lower than market rates (and can be 0%). The customer has forgone income, which is an **opportunity cost**. Free pricing is generally unprofitable for the institution in that it attracts smaller, active accounts.
3. **Conditionally free pricing.** In this case, the customer chooses an account in which small deposit accounts may have fees associated with them while large deposit accounts are free. Conditionally free pricing favors large deposits. Because the customer chooses, there is *market signaling*, providing valuable information about customers to the institution.

EXAMPLE: Conditional deposit pricing

Consider two banks. Bank A is located in an affluent neighborhood. Bank B is located near the local college and actively markets to students.

On checking accounts, Bank A charges:

- Minimum daily balance of \$1000;—no monthly fee
- Balance of \$500–\$1,000—\$3 monthly fee
- Balance less than \$500—\$5 monthly fee
- No item charges (i.e., checks or ATM transactions) apply

On savings accounts, Bank A charges:

- Minimum daily balance \$5,000—no monthly fee
- Less than minimum daily balance of \$5,000—\$3 monthly fee

On checking accounts, Bank B charges:

- Minimum daily balance of \$300—no monthly fee
- Balance less than \$300—\$2 monthly fee
- \$0.10 per item charge for all checking account and ATM debit transactions if the account holder has less than a \$300 minimum daily balance

On savings accounts, Bank B charges:

- No monthly fee, regardless of balance

From the previous information it appears that Bank A is soliciting customers with higher balances in both savings and checking accounts, and more transactions in checking accounts. Bank B is soliciting customers with fewer funds available and likely fewer transactions (i.e., college students). Both banks are pricing deposit services to suit their customer bases. Deposit pricing is sensitive to both the types of customers a bank serves as well as to the cost to serving the different types of depositors. Banks price deposits to cover all (or at least most of) the costs of providing the service.

Banks can also engage in **relationship pricing**. This means the bank prices deposit services in conjunction with all the other services the customer uses and/or pays for. For example, a corporate customer with a large loan might get preferential pricing on deposit or treasury services. A wealthy family that keeps very large demand deposit and savings balances may receive lower pricing on trust department services.



MODULE QUIZ 70.2

1. A bank is located near a college campus and would like to attract students to the bank. Which of the following conditional pricing demand deposit accounts would most likely appeal to a college student?
 - A. A high minimum balance, no item charge/activity fees account.
 - B. A high minimum balance, high item charge/activity fees account.
 - C. A low or zero minimum balance account with low- to moderate-item charge/activity fees account.
 - D. A low or zero minimum balance account with high item charge/activity fees account.
2. A bank currently has \$100 million of deposits earning an average rate of 2%. It would like to raise an additional \$50 million, but to do so, will have to raise the deposit rate to 3% on both the old and new accounts. What is the marginal cost rate of the additional

\$50 million in funds?

- A. 3%.
- B. 5%.
- C. 7%.
- D. 9%.

MODULE 70.3: CHALLENGES TO OFFERING DEPOSIT ACCOUNTS

LO 70.c: Explain challenges faced by banks that offer deposit accounts, including deposit insurance, disclosures, overdraft protection, and basic (lifeline) banking.

Deposit Insurance

The FDIC, established in 1934, insures deposits. Banks can borrow funds at relatively low rates because deposits are insured (i.e., deposit insurance lowers the overall cost of funds). Current coverage is \$250,000 per account holder. Deposits are added together in a single institution. Depositors who have funds in several institutions are covered in each institution, even if the total exceeds \$250,000. If two institutions merge, and the customer had \$250,000 in each bank, the new coverage will cap at \$250,000 (not \$500,000 as it was premerger). Depositors can increase coverage at a single institution by placing funds in legally different accounts. For example, a married couple may have a joint account with \$250,000. One spouse may have an account with an additional \$250,000 and the other spouse may have a third account in the institution, also with \$250,000. In this case, because ownership is legally different on the three accounts, the coverage would total \$750,000.

Insurance coverage was initially \$2,500 in 1934 and has slowly increased over time. Coverage was raised from \$100,000 to \$250,000 temporarily in 2008 in response to the financial crisis and was made permanent in 2010 with the passage of the Dodd-Frank Act. The insurance covers:

- Demand deposits.
- Savings deposits.
- NOW accounts.
- Christmas club accounts.
- Time deposits (CDs).
- Cashiers' checks.
- Money orders.
- Officers' checks.
- IRA and Keogh deposits.
- Outstanding drafts normally protected by deposit insurance.
- Items that the depository institution is primarily liable for, including certified checks, letters of credit, and traveler's checks.

FDIC insurance does not cover (although banks may privately insure):

- Government securities such as Treasury bills, notes, or bonds.
- Mutual fund shares.
- Safe deposit box contents.
- Funds stolen from an insured depository institution.

Business accounts are not insured. If the business is a sole proprietorship, the funds are considered personal funds and are added to the single-owner accounts to determine insurance coverage.

FDIC Insurance Premiums

Insurance premiums are determined using a risk-based system. Riskier depository institutions pay higher FDIC insurance premiums than do less risky institutions. Risk is determined by both the risk class of the institution and the capital adequacy of the insured institution. Insurance fees change based on the FDIC insurance fund. If the fund falls below \$1.25 per \$100 in covered deposits (called the designated reserve ratio [DRR]), fees increase to shore up the fund. If reserves exceed \$1.25 per \$100 in covered deposits, fees may be reduced or removed for a period. The 1.25% of insured deposits rate is called a *hard* target. The FDIC now has authority to let the DRR range from 1.15% to 1.5%. The insurance limit may increase to protect against inflation if the FDIC and the National Credit Union Administration believe it is warranted.

Bank Disclosures

The **Truth in Savings Act of 1991** requires banks to make greater disclosures of the terms on deposit accounts. Regulation DD specifies the rules for compliance with these laws. Depositors must be informed of terms before they open new accounts. Required disclosures include:

- Minimum balance required to open the account.
- Minimum balance that must be in the account to avoid fees.
- Amount that must be in an account to earn the promised yield.
- How the balance is calculated.
- When interest begins to accrue.
- Penalties for early withdrawal.
- Options available at maturity.
- Reinvestment and distribution options.
- For fixed maturity deposits, advance notice of the approaching end of term, and bonuses that are available.
- Institutions must warn customers of rate changes.
- For fixed rate accounts, the time over which the rate is in effect.
- For variable rate products, the bank must warn the customer that rates can change, how frequently they will change, if there is a limit to how much the rate may change, and how the new rate will be determined.
- The frequency with which interest is compounded and credited.
- Automatic renewals must be disclosed.

- The customer must be informed about what will happen to the funds if an account is not automatically renewed, (e.g., will they go into an interest-bearing or noninterest-bearing account?).
- 30-day notice of a change that will lower the customer's yield.
- The **annual percentage yield (APY)** must be disclosed. It is calculated as:

APY earned =

$$100 \times [(1 + \text{interest earned} / \text{average account balance})^{365/\text{days in period}} - 1]$$

For example, suppose a customer has an average balance of \$500, which earned \$3 of interest in a 30-day period. The APY = $100 \times [(1 + 3 / 500)^{365/30} - 1] = 7.55\%$.

Interest must be calculated on the full balance in the account for each day, not the minimum balance that was in the account on a single day during the statement period. Renewals of deposits, such as time accounts, are considered new accounts and are subject to disclosure requirements.

Overdraft Protection

Overdraft protection (bounce protection) is a service that protects a depositor in the event he accidentally overdraws on his deposit account, allowing him to avoid not sufficient funds fees. The service can either be a line of credit set up to cover overdrafts, or a second account such as an MMDA, from which funds are transferred to cover overdrafts. Overdraft protection provides additional revenue sources for depository institutions (e.g., a fee to set up the service, and interest on the line of credit) and customers like overdraft protection. However, the service is controversial: both regulators and the public have expressed several concerns:

- The customer pays a fee to set up the account. Also, the credit line interest rate is high (e.g., 18%) and the loan must be paid off quickly, often within 30 days. These combined costs may result in an annual percentage rate of 200% or more to cover bad checks. Some consider this predatory lending.
- Low income individuals who are more financially vulnerable may rely more heavily on the service. This again, to critics, looks like predatory lending to low income individuals.
- Customers may be more likely to write bad checks if they know they will be covered. The result is that they will pay high interest costs to cover overdrafts, rather than building up savings.
- People may not bother to balance their account statements because they know they are protected from overdrafts.

Basic (Lifeline) Banking

A controversial social issue facing financial institutions today is whether access to financial services is a human right. It is difficult to live in our current society, to obtain shelter, education, healthcare, and employment without access to bank accounts. For example, many employers will no longer write checks for payment of wages to employees; the employee must have a bank account and wages are directly deposited

into that account. If a person does not have a bank account, then all of the jobs/employers that require direct deposit are inaccessible. As such, some government officials and human rights activists have asked the question of whether every adult should be guaranteed access to basic financial services. This is called **basic or lifeline banking**.

The question of whether there is a right to services such as telephone, gas, and electric should also be considered. Many believe that these services, critical to human health and comfort, should be provided at a reduced price to citizens who cannot afford them. Lifeline banking became an issue in the 1980s and 1990s with consumer groups such as the American Association of Retired Persons campaigning for the right to basic banking services. In the 1990s, approximately 15% of Americans did not have transaction deposits, and 12% did not have checking or savings accounts. These citizens are called *unbanked*, meaning no loans or deposits (representing about 8–9 million households in 2010) or *underbanked* (about 18–21 million households). Underbanked households use payday loans, pawn shops, check cashing companies, and money order services to meet expenses and pay bills. Minority citizens were more likely to be underbanked, and both unbanked and underbanked citizens were more likely to be low income, undereducated, and often single-parent households. These citizens often do not have Social Security numbers and/or identification required to open accounts.

Many unbanked documented and undocumented workers wire money to family and friends in other countries. These wire transfers and remittances are potentially profitable lines of business for banks. For example, billions of dollars are wired each year from the United States to Latin America.

In the mid to late 1990s, the government began requiring that paychecks and Social Security checks be delivered electronically, requiring a deposit account. Banking is a regulated industry, and agencies must consider public convenience and needs when granting new bank charters. Furthermore, the 1977 Community Reinvestment Act requires regulators to consider whether a bank has made an “affirmative effort” to serve all communities in which it operates. However, the issues of whether banks should be required to provide basic services and who should bear the costs of lifeline banking have not been resolved and are likely to become more pressing as the world becomes more digital.



PROFESSOR'S NOTE

This last learning outcome deals largely with ethical issues. What should be disclosed to customers? Does the fact that taxpayers back deposit insurance mean that banks should be required to provide some services, such as lifeline banking, for free or at a reduced cost to consumers? And if so, what about shareholders; should they bear this cost? Should banks provide overdraft protection, and, if so, to whom and at what price? In terms of disclosures (and regulatory compliance in general), the Dodd-Frank Wall Street Reform and Consumer Protection Act (which was passed after the publication of this book) has increased the burden on banks and other financial institutions to protect consumers, increasing compliance costs. Think of these issues as they relate to each other and what they mean for the broader society.

MODULE QUIZ 70.3



1. Which of the following is not a criticism of financial institutions providing credit lines to cover overdrafts?
- A. It creates moral hazard. To prevent moral hazard, people who write bad checks should have to suffer the cost and embarrassment of dealing with the consequences so that they will not do it in the future.
 - B. It encourages people to write bad checks because they know they will be covered if there are insufficient funds in their accounts.
 - C. It leads to predatory lending. It preys on lower income individuals because they may be more likely to write bad checks and the interest rate on overdraft lines of credit tend to be high.
 - D. People who have overdraft protection may neglect to balance their monthly bank statements.

KEY CONCEPTS

LO 70.a

Transaction deposits are deposits that customers use to make payments. These accounts include:

- Noninterest-bearing checking (demand) deposits.
- Interest-bearing checking deposits.
- Money market deposit accounts (MMDAs).
- Mobile check deposits.

Nontransaction deposits (savings or thrift deposits) are used primarily for savings. These accounts include:

- Passbook savings accounts.
- Time accounts (certificates of deposit or CDs).
- Retirement savings deposits (individual retirement accounts [IRA] and Keogh plans).

LO 70.b

Methods used to price deposits include:

- Cost-plus method. This method prices the deposit service such that the amount covers the direct and overhead costs associated with providing the service, as well as a profit margin.
- Marginal pricing method. This method compares the cost of raising additional funds (which is often higher than the cost of existing funds), with the yield the financial institution earns on the assets in which it invests the additional funds. The formula is:

$$\text{marginal cost} = \text{change in total cost} = (\text{new interest rate} \times \text{total funds raised at new rate}) - (\text{old interest rate} \times \text{total funds raised at old rate})$$
$$\text{marginal cost rate} = \text{change in total cost} / \text{additional funds raised}$$

- Conditional pricing method. Depository institutions often set deposit fees based on a condition, such as a minimum balance to be maintained in an account. If the customer meets the condition, she pays a lower (or no) fee. For example, if the customer's account balance stays above \$1,000, the monthly fee is \$0. If the

account balance falls below \$1,000, the monthly fee on the account is \$5. Banks can pursue desirable customers based on a conditional fee structure.

LO 70.c

Depository institutions face a range of difficult questions. One of the more important social challenges is that of lifeline banking. Many believe that it is nearly impossible to survive in the modern world without basic financial services. Low income, undereducated, and undocumented individuals are more likely to suffer the consequences of not having access to banking services. However, assuming that all people do have a right to financial services, who should bear the cost? Some argue that because banks have the benefit of deposit insurance, backed by tax payers, they have some responsibility to society to provide basic services. This responsibility may mean providing lifeline banking to those who cannot afford it. The issue is unresolved.

Other issues depository institutions must manage are deposit insurance, overdraft protection, and the social issues overdraft protection gives rise to, and truth in savings (i.e., the required disclosures banks must make to customers).

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 70.1

1. **B** Generally, the longer the maturity of a deposit, the higher the interest rate. This suggests that the time account should have the highest rate of interest. The phrase *demand deposit account* implies that it is a transaction account, which may be interest bearing or not. NOW accounts are interest-bearing checking accounts, but as they are transaction accounts, they will have a lower interest rate than a time account (certificate of deposit). The MMDA will earn interest, but again, because it allows for some liquidity in terms of check writing, it will likely earn less than the one-year time account. (LO 70.a)
2. **C** The step-up CD has an interest rate that periodically adjusts upward. The bump-up CD has a rate that may increase if interest rates increase. (LO 70.a)

Module Quiz 70.2

1. **C** College students generally have less deposits than, for example, the average depositor in an affluent neighborhood. The conditional pricing that would most appeal to students would be a low minimum balance demand deposit account with low- to moderate-item charge and activity fees. However, this fee structure may be unprofitable for the bank. (LO 70.b)
2. **B** The marginal cost of the new funds is equal to 5%. The formulas for calculating marginal cost are:

marginal cost = change in total cost = (new interest rate × total funds raised at new rate) – (old interest rate × total funds raised at the old rate)

marginal cost rate = change in total cost / additional funds raised

marginal cost = $(0.03 \times \$150,000,000) - (0.02 \times \$100,000,000) = \$4,500,000 - \$2,000,000 = \$2,500,000$ additional interest

marginal cost rate = $\$2,500,000 / \$50,000,000 = 5.0\%$
(LO 70.b)

Module Quiz 70.3

1. A Criticisms include:

- The customer pays a fee to set up the account and rates are high, making it (to some) predatory lending.
- Low income individuals who are more financially vulnerable may rely more heavily on the service.
- Customers may be more likely to write bad checks if they know they will be covered.
- People may avoid balancing their bank statements because they know they are protected from overdrafts.

Moral hazard means that one does not suffer a consequence for “bad behavior.” In this case, the customer does pay for overdraft protection. There is no spoken criticism that the person with insufficient funds to cover the debit should be embarrassed into behaving in the future, although some people might believe this to be true. (LO 70.c)

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Rose and Hudgins, Chapter 13.

READING 71

MANAGING NONDEPOSIT LIABILITIES

Study Session 11

EXAM FOCUS

Financial institutions borrow in money and capital markets to cover funding gaps when deposits do not fully cover loan demand and security purchases. This reading focuses on nondeposit funding such as federal (fed) funds, negotiable certificates of deposit (CDs), repurchase agreements, discount window borrowing, commercial paper, Federal Home Loan Bank (FHLB) borrowing, and Eurodollar funding. For the exam, know the characteristics of each type of funding and the factors that affect the institution's choice of nondeposit funding. Also, be able to calculate the available funds gap and estimate the cost of total funding using the historical average cost approach and the pooled funds approach.

MODULE 71.1: NONDEPOSIT LIABILITIES AND AVAILABLE FUNDS GAP

Sources of Nondeposit Liabilities

LO 71.a: Distinguish between the various sources of non-deposit liabilities at a bank.

The largest source of funds at most depository institutions (i.e., commercial banks, savings and loans [S&Ls], and credit unions) is **deposits**. However, depository institutions may not choose to, or be able to, fully fund assets (e.g., loans and securities) with deposits and owners' equity.

The **customer relationship doctrine** states that lending institutions should make a loan as long as that loan and the relationship it involves are expected to generate net positive earnings. Thus, saying to customers, "We do not have enough deposits to make your loan," is inadequate and will be poorly received.

To fill a funding gap, banks use **nondeposit liabilities**, which are money and capital market sources of debt funding. These have maturities that can range from overnight to

several years.

As with deposits, bank managers and staff are concerned with two broad issues surrounding nondeposit funds:

- How much nondeposit funding is needed?
- Which nondeposit source of funds is optimal given the bank's needs?



PROFESSOR'S NOTE

As in previous readings, we use the word *bank* broadly to mean *depository institutions*, including commercial banks, credit unions, and thrift institutions.

The process of buying funds, primarily from other banks, to meet loan demand and regulatory requirements (e.g., reserve requirements on deposits) is called **liability management**. Because some sources of funds mature daily, liability management is a daily process and an interest sensitive approach to raising funds. This means that the cost of funds is sensitive to interest rates (i.e., reprices), and using these sources increases a bank's interest rate risk relative to sources of funds such as demand and savings deposits.

A key advantage of nondeposit funding is flexibility. Assuming a bank is creditworthy and markets are functioning properly (i.e., there is no liquidity crunch as experienced in the 2007–2009 financial crisis), it can raise the amount of funding needed, when it is needed. Large banks use approximately four times as much nondeposit funding as small banks (16% of assets compared to about 4% of assets).

Alternative sources of nondeposit funds include:

- Federal funds (fed funds).
- Repurchase agreements (repos).
- Discount window borrowing.
- FHLB.
- Negotiable CDs.
- Eurocurrency deposit market.
- Commercial paper market.
- Long-term nondeposit funds.

Fed funds are short-term borrowings between depository institutions. The funds, on deposit at the Federal Reserve (the Fed), are used to meet reserve requirements, clear checks, and pay for purchases of Treasury securities. The funds are often borrowed and loaned overnight and are primarily used to meet reserve requirements and loan demand that cannot be met with deposits. Fed funds are also used by the Fed as a tool of monetary policy.

Funds are either wired, if the borrowing and lending institutions are in different federal regions, or transferred, if the institutions are in the same federal region. A correspondent bank (a bank, often larger, that performs services on behalf of another bank) or funds broker may also be used to facilitate the transaction.

Fed funds loans are typically one of three types:

- **Overnight loans.** Funds are returned the next day.
- **Term loans.** Loans may have maturities lasting days, weeks, or months, often accompanied by a written contract.
- **Continuing contracts.** Loans are automatically renewed each day until either the borrower or the lender ends the agreement. These are often used between a smaller institution and its correspondent bank.

Repurchase agreements (repos) are less popular and more complex than fed funds. Repos are collateralized short-term borrowings. The borrower sells high-quality liquid securities and purchases funds, then reverses the process at maturity, repurchasing the securities from the lender. The *starting leg* of a repo agreement is selling securities in exchange for funds. The *closing leg* of the agreement is the repurchase of securities at a predetermined price. Collateral may take the form of marketable securities such as Treasury bills, notes, or bonds. The collateral reduces credit risk for the lender.

In 1998, the Bank of New York, JPMorgan Chase, and the Fixed Income Clearing Corporation (FICC) created General Collateral Finance (GCF) repos, in which the borrower and lender can agree to eligible collateral. At maturity, any of the satisfactory collateral may be delivered, not necessarily the securities pledged at the start of the loan. GCF repos also allow netting of obligations between borrowers and lenders (i.e., repos may be settled on the FICC books), reducing transaction costs.

Both fed funds and most domestic repos are transacted across the Federal Reserve Wire (Fedwire) system. The repo market suffered during the 2007–2009 financial crisis due to concerns over the quality and values of pledged collateral.

Repo interest is calculated as:

$$\text{interest cost} = \text{borrowed amount} \times \text{current repo interest rate} \times (\text{number of days borrowing} / 360)$$

While the Fed is not really in the lending business, a bank can get a short-term loan at the **discount window**. The Fed makes the loan and credits the funds to the bank's reserve account. Loans must be backed by acceptable collateral (e.g., Treasury securities, agency securities). Discount window borrowing may be classified into three categories:

- **Primary credit.** Short-term loans, usually overnight at a rate slightly higher than the target fed funds rate.
- **Secondary credit.** Loans made at a higher rate to institutions that do not qualify for primary credit. The rate may be as much as 150 basis points above the fed funds rate.
- **Seasonal credit.** Longer maturities for institutions experiencing seasonal needs, such as loans for planting crops. The rate is the average of the fed funds rate and the 90-day CD rate.

Seasonal credit carries the lowest interest rate, primary credit the second lowest, and secondary credit the highest.

The **Federal Home Loan Bank (FHLB)** system historically has made loans to mortgage lenders. It was created in 1932 at a time when banks were experiencing runs on deposits. Home mortgages are used as collateral for the debt. The FHLB lends to

community banks and thrifts as well as to mortgage lenders. The funding is typically longer term (but it can be as short as overnight), stable, and at below-market fixed or variable interest rates. If an institution fails, the FHLB is first in line to recover funds, ahead of even the FDIC.

While **negotiable (jumbo) CDs** are legally classified as deposits, they are really more akin to fed funds and repos, meant to tap a short-term source of money market funding. Negotiable CD denominations are \$100,000 or more, although typically sold in multiples of \$1 million. They were developed to compete with other money market instruments such as commercial paper. There are fixed and variable rate CDs. The majority of negotiable CDs are fixed rate. For fixed rate CDs, interest is calculated, like repos, based on a 360-day year.

$$\text{interest cost} = \text{principal amount} \times \text{CD interest rate} \times (\text{days to maturity} / 360)$$

There are four major types of negotiable CDs:

- **Domestic CDs.** U.S. institutions issuing CDs inside the United States.
- **Dollar-denominated CDs (Euro CDs).** Dollar-denominated CDs issued by banks outside the United States.
- **Yankee CDs.** Foreign bank issued CDs to sell through U.S. branches.
- **Thrift CDs.** Issued by nonbanks such as thrift institutions.

Floating rate notes (FRNs) and floating rate CDs (FRCs) were introduced in the 1970s, generally tied to the London Interbank Offered Rate (LIBOR). Banks and large companies may exploit an arbitrage opportunity between European and U.S. CD markets if rates get out line with each other (i.e., the negotiable CD rate in the United States drops significantly below the European interest rate or vice versa).

Developed in Western Europe in the 1950s, **eurocurrency deposits** provided a market for funds that could be loaned to large customers or traded among large multinational banks. **Eurodollar deposits** are dollar-denominated deposits in banks outside the United States. When a non-U.S. bank branch lends to the home office in the United States, it is recorded in an account labeled *liabilities to foreign branches*. Like negotiable CDs, most Eurodollar deposits are fixed rate.

Commercial paper is short-term borrowings (usually a few days to a maximum of 270 days) used by large companies. They are issued at a discount to face value either through private placement or through security dealers. *Industrial paper* is used to finance working capital needs (e.g., inventory). *Finance paper* is issued by finance companies such as GE Capital.

Banks may borrow in the **long-term debt market**, although this is usually viewed as a source of secondary capital rather than a source of funding, as discussed previously. Mortgages, which are secured, may be issued to finance construction. Capital notes and unsecured debentures may also be issued in maturities of typically 5 to 12 years.



PROFESSOR'S NOTE

When comparing deposit sources of funds to nondeposit sources, a distinguishing feature is interest rate (i.e., liability) sensitivity. Deposits, especially demand deposits, are relatively insensitive to interest rate changes,

primarily because they are used for transactions and thus have lower interest rates to begin with. Money market funding (e.g., fed funds, repos, and commercial paper) have rates that are market driven, and due to short maturities, may change day-to-day as interest rates change. During the 2007–2009 financial crisis, lenders were concerned about the quality of collateral and demanded additional collateral. Eventually, money market lenders began to fear that they would not be paid back at all and markets froze. Nondeposit sources of funds are important for flexibility but they do have more interest rate risk than their deposit counterparts.

Available Funds Gap

LO 71.b: Describe and calculate the available funds gap.

The **available funds gap (AFG)** is the difference between the current and projected inflows and outflows of bank funds. If deposits are insufficient to cover loan demand, security purchases, and customer withdrawals, the institution will borrow the difference using the sources described previously. Banks will often add a small amount to their AFG to cover unexpected loan demand, a shortfall in deposits, or above-average withdrawals. The bank can estimate its AFG as:

AFG = current and projected loans and other investments – current and expected deposit inflows and other available funds

EXAMPLE: Available funds gap

Ravens Bank expects to make \$100 million of new loans in the coming quarter. Ravens Bank also expects to invest \$15 million in mortgage-backed securities. It expects current loan customers to draw down an additional \$30 million on revolving credit lines. The bank expects new deposits to be \$75 million in the coming quarter. The bank plans to add a 10% safety margin to the AFG to cover unexpected loan demand and a potential shortfall in new deposits. **Calculate** the AFG for the coming quarter in millions.

Answer:

$$\text{AFG} = (\$100 + \$15 + \$30) - \$75 = \$70 \text{ million}$$

If the bank adds a 10% safety margin, the amount the bank would plan to borrow in nondeposit markets would be $1.10 \times \$70 \text{ million} = \77 million .



MODULE QUIZ 71.1

1. Which of the following nondeposit funding sources requires collateral?
 - A. Fed funds and commercial paper.
 - B. Commercial paper and discount window borrowing.
 - C. Fed funds and repurchase agreements.
 - D. Discount window borrowing and repurchase agreements.

2. Which of the following types of nondeposit funding was created to provide liquidity to mortgage lenders?
 - A. Fed funds.
 - B. Repurchase agreements.
 - C. Federal Home Loan Bank (FHLB) borrowing.
 - D. Discount window borrowing.
3. Barbara Friedman, a bank manager on the asset-liability committee, must estimate the amount of money market funding she expects the bank to need in the coming week. Friedman estimates that the bank will make \$60 million of new loans in the coming week. The bank does not plan to make any security investments but does expect additional drawdowns on credit lines to equal \$10 million. The bank is in a highly competitive deposit market and only expects \$15 million in new deposits in the coming week. However, based on previous years' experience, she expects that two of the bank's largest customers will withdraw \$1 million each in the coming week. Friedman should estimate the available funds gap for the coming week to be:
 - A. \$43 million.
 - B. \$45 million.
 - C. \$53 million.
 - D. \$57 million.

MODULE 71.2: CHOICE AND COST OF NONDEPOSIT SOURCES OF FUNDS

Choice of Funds

LO 71.c: Discuss factors affecting the choice of non-deposit funding sources.

Historically, nondeposit sources of funds fill the gap between an institution's total security purchases and credit demands and the deposits available to fund those needs. Banks must forecast current and future loan demands. Several factors influence the decision between various types of nondeposit funds. They include costs, risks, maturity, size, and regulatory requirements.

Relative costs of each funding source. The institution must constantly monitor interest rates on various sources, usually choosing the least expensive source, though other factors may affect the decision. In general, fed funds are one of the most inexpensive sources of short-term funding, while domestic CDs and Eurocurrency deposits are slightly more expensive. Depending on maturity, commercial paper rates are generally slightly higher than CDs and Eurocurrency deposits.

Fed funds are readily available at maturities ranging from hours to months. However, fed funds interest rates can be volatile, especially on the settlement day when banks must meet reserve requirements.

CDs and commercial paper offer greater stability, although interest rates are higher than on Fed funds. Fed funds are generally more popular for short-term funding needs but CDs and commercial paper are often better for longer-term needs (i.e., several days to several weeks).

Noninterest costs must be considered, such as deductions for reserve requirements, insurance fees, costs associated with investing the funds into nonearning assets such as reserves or fixed assets, and administrative costs (e.g., staff time, computing costs, facilities, and transaction costs). Net investable funds are the funds the institution invests in earning assets.

The effective cost of deposit and nondeposit funding is equal to:

(current interest cost on funds borrowed + noninterest costs incurred to access funds) / net investable funds raised

Risks of each funding source. Risks relate to the funding sources' availability, dependability, and volatility. Except for discount window borrowing, most interest rates are determined by supply and demand.

Interest rate risk increases when interest rates are volatile. Rates are more volatile for shorter-term loans; thus fed funds tend to have the most volatile rates of the nondeposit funding sources.

Institutions must also consider **credit availability risk**, whether funding will be reliable and available on an ongoing basis. Fed funds are generally more reliable, while CD, Eurodollar, and commercial paper markets are more subject to credit availability risk. Switching to an alternative source, potentially at a higher rate, may be necessary if funds become unavailable.

Maturity. The bank must consider the required maturity of borrowed funds to meet the funding need (e.g., longer-term funding to finance fixed-rate mortgages compared to overnight funding to meet reserve requirements). Long-term debt and, in some cases, commercial paper are not immediately available. Fed funds are immediately available. Managers must consider the timing and maturity of funding needs before choosing among alternative sources.

Size of the financial institution. Smaller institutions may not have access to negotiable CDs and Eurodollar markets due to the large trading units (i.e., multiples of \$1 million) of these funding sources. Also, the availability of a secondary market may matter to investors. For example, investors prefer negotiable CDs from money-center banks because there is an active secondary market for prime-rated CDs. Smaller institutions may have to rely on discount window borrowing or fed funds, which are available in smaller amounts.

Regulatory requirements. Regulations may place limits on a particular funding source. For example, CDs must have a minimum maturity of seven days. Regulators may limit the amount an institution may borrow, the frequency with which it borrows, or the use of the funds raised. Also, the Fed may impose restrictions at times of financial stress. For example, in the late 1960s to early 1970s, the Fed required banks to maintain reserve requirements (generally limited to deposits) on fed funds, repurchase agreements, and commercial paper, as part of tight monetary policy employed to fight inflation. As regulators make changes, both the costs and the risks of a particular funding source may be affected.

Cost of Funds

LO 71.d: Calculate overall cost of funds using both the historical average cost approach and the pooled-funds approach.

Historical Average Cost Approach

The **historical average cost approach** to estimating funding costs uses the experience of all the funding sources the institution has raised to date, including interest and noninterest costs. It also considers the shareholders' required rate of return. The institution must first calculate the weighted average interest expense before considering noninterest costs. Next it must include noninterest costs to calculate a breakeven cost rate. Finally, it must calculate the weighted average cost of capital, including the expected return of shareholders.

EXAMPLE: Historical cost of funds approach

Orange Tree Bank uses the historical average cost approach to estimate its cost of funds. The bank estimates noninterest expenses, including salaries and overhead, to be \$11 million. The bank has total assets of \$1 billion, earning assets of \$800 million, and equity capital of \$100 million. The after-tax required rate of return of shareholders is 12%. Its tax rate is 20%. Using the following table of the bank's historical costs, **calculate** the average cost of funds.

Funding sources (millions)

Sources of Funds	Average Amount Raised (millions)	Average Interest Rate	Total Interest Paid
Non-interest-bearing demand deposits (checking)	\$200	0.0%	\$0.0
Interest-bearing transaction (checking) deposits	\$100	1.0%	\$1.0
Passbook savings accounts	\$200	3%	\$6.0
Money market deposit accounts	\$200	4%	\$8.0
Time accounts	\$100	4.5%	\$4.5
Negotiable CDs	\$50	5.5%	\$2.75
Fed funds	<u>\$50</u>	5.0%	<u>\$2.5</u>
Total borrowed funds raised	\$900	Total interest paid	\$24.75

Answer:

weighted average interest expense = total interest paid / total funds raised =
\$24.75 / \$900 = 2.75%

breakeven cost rate on borrowed funds invested in earning assets = (total interest paid + other operating expenses) / earning assets = (\$24.75 + \$11) / \$800 = 4.47%

This is called the *breakeven cost rate* because it is the rate the bank must earn on earning assets in order to cover the costs of borrowing money, before considering the required rate of return of equity holders.

weighted average overall cost of capital = breakeven cost on borrowed funds + before-tax cost of stockholders' investment in the bank

$$= \text{breakeven cost} + \frac{\text{after-tax cost of stockholders' investment}}{(1 - \text{tax rate})}$$

$$\times \frac{\text{stockholders' investment}}{\text{earning assets}} = 4.47\% + \frac{12\%}{1 - 0.2} \times \frac{\$100}{\$800} = 6.35\%$$

This means Orange Tree Bank's weighted average cost of funds is 6.35%. The bank must earn a minimum of 6.35% on earning assets to cover the cost of capital, assume a \$100 million investment from shareholders.

Pooled Funds Approach

The **pooled funds approach** takes a forward look at the cost of funds. In this case, the goal is to determine the minimum rate of return the bank must earn on future loans and securities to cover the costs of all new funds raised. The bank must calculate the pooled costs of funds and the rate that earning assets must earn to cover the cost of new funds, called the hurdle rate.

EXAMPLE: Pooled funds approach

Orange Tree Bank estimates the following in terms of raising additional funds and investing those funds. Given the forecast data, **calculate** the pooled deposit and nondeposit funds expense and the hurdle rate required on all newly raised funds.

Forecast of New Deposit and Nondeposit Funding

New Deposits and Nondeposit Borrowings	Dollar Amount of New Deposits and Nondeposit Funds	Proportion of Funding to Be Placed in New Earning Assets	Amount Invested in Earning Assets in Dollars (Millions)	Interest and Other Expenses on New Borrowings As a % of Amount Raised	Interest and Other Expenses Incurred in Dollars (Millions)
Interest bearing transaction deposits	\$120	80%	\$96	8%	\$9.60
Time deposits	\$100	80%	\$80	7%	\$7.00
New shareholders' equity	\$50	90%	\$45	12%	\$6.00
Total	\$270		\$221		\$22.60

Answer:

pooled deposit and nondeposit funds expenses = all expected operating expenses / all new funds expected = $\$22.60 / \$270 = 8.37\%$

However, only \$221 million of the \$270 million raised will be invested in earning assets. As such, the hurdle rate of return over all earning assets = hurdle rate over all earning assets = expected operation expenses / dollars invested in earning assets = $\$22.60 / \$221 = 10.23\%$

This means Orange Tree Bank must earn at least 10.23% before tax on all new deposit and nondeposit funds, to meet the expected costs of raising new funds.



MODULE QUIZ 71.2

1. Kris Gaines, Treasurer at Palm Air Bank and Trust, is considering ways to meet a funding gap created by greater than expected loan demand. Palm Air is a medium sized bank located in Florida. The funding gap is approximately \$850,000. Gaines is choosing between several nondepository funding types. The funds are needed immediately. Which type of funding is most appropriate in this situation?
 - A. Commercial paper.
 - B. Negotiable certificates of deposit (CDs).
 - C. Federal funds borrowing.
 - D. Eurodollar deposits.
2. Blue Star Bank expects to raise \$300 million, \$250 million of which will be invested in earning assets. The total expected interest and overhead costs on the newly raised funds is forecasted to be \$22.00. The pooled deposit and nondeposit funds expense and hurdle rate over all earning assets are, respectively:
 - A. 7.33%; 7.33%.
 - B. 7.33%; 8.80%.
 - C. 8.80%; 7.33%.
 - D. 8.80%; 8.80%.

KEY CONCEPTS

LO 71.a

Alternative sources of nondeposit funds include:

- *Federal funds (fed funds)*. Fed funds are short-term borrowings between depository institutions. The funds are often borrowed and loaned overnight and are generally immediately available.
- *Repurchase agreements (repos)*. Repos are collateralized short-term borrowings. The borrower sells high-quality liquid securities and purchases funds, reversing the process at maturity and repurchasing the securities from the lender.
- *Discount window borrowing*. A bank may get a short-term loan at the discount window. The Federal Reserve (the Fed) makes the loan and credits the funds to the bank's reserve account. Loans must be backed by acceptable collateral (e.g., Treasury securities, agency securities).
- *Federal Home Loan Bank (FHLB)*. The FHLB system historically has made loans to mortgage lenders, which are used as collateral for the debt.

- *Negotiable CDs.* Negotiable (jumbo) CDs are legally classified as deposits. However, they are more like fed funds and repos, meant to tap a short-term source of money market funding. There are four major types of negotiable CDs including domestic, dollar-denominated, Yankee, and thrift.
- *Eurocurrency deposit market.* Eurodollar deposits are dollar-denominated deposits in banks outside the United States.
- *Commercial paper market.* Commercial paper is a short-term borrowing (usually a few days to a maximum of 270 days) used by large companies. They are issued at a discount to face value either through private placement or through security dealers.
- *Long-term nondeposit funds.* Banks may borrow in the long-term debt market, although this is usually viewed as a source of secondary capital rather than a source of funding, as discussed previously.

LO 71.b

The available funds gap is the difference between the current and projected inflows and outflows of bank funds. It is calculated as:

available funds gap = current and projected loans and other investments – current and expected deposit inflows and other available funds

LO 71.c

Several factors influence the decision between various types of nondeposit funds including the relative costs of each funding source; the risks associated with funding, including interest rate risk and available funding risk; the needed maturities; and any regulatory requirements.

LO 71.d

There are two primary ways to estimate the overall funding costs at a financial institution: the historical average cost approach and the pooled funds approach.

The historical average cost approach is backward looking, estimating the cost of all the funding sources the institution has raised to date. This approach considers the costs of all sources of debt financing including interest costs and the noninterest costs of borrowing. It also includes the required rate of return of the institution's shareholders.

The pooled funds approach is forward looking. It is an estimate of the minimum rate of return the bank must earn on future loans and securities to cover the costs of all new funds raised including deposits, nondeposit funds, and equity.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 71.1

1. **D** Repurchase agreements involve selling securities to a lender and buying them back at a later date for a previously agreed upon price, thus they are collateralized. The Federal Reserve also demands collateral in order to borrow at the discount window. (LO 71.a)

2. **C** The FHLB system was created in 1932 to make loans to mortgage lenders, at a time when banks were experiencing runs on deposits. The FHLB stabilized the system, allowing banks to continue to make mortgage loans. (LO 71.a)

3. **D** available funds gap = current and projected loans and other investments – current and expected deposit inflows and other available funds

$$\text{AFG} = (\$60 + \$10) - (\$15 - \$2) = \$57 \text{ million}$$

In this case, the bank's expected outflows are twofold, the new loans and the expected drawdowns on credit lines. While the bank expects \$15 million of new deposits, Friedman cannot ignore the forecast \$2 million being withdrawn by two deposit customers, leaving a net \$13 million of deposits. Thus, she expects the bank to need \$57 million in nondeposit sources of funding in the coming week. (LO 71.b)

Module Quiz 71.2

1. **C** Federal (fed) funds are likely the best funding choice for three reasons. First, because Palm Air Bank and Trust is a medium-sized bank, it may not have access to commercial paper, negotiable CDs, and Eurodollar deposits. Second, these funding sources come in units of \$1 million or more. Because the bank needs less than \$1 million, commercial paper, negotiable CDs, and Eurodollar deposits are not necessarily appropriate. Third, the funds are needed immediately. Fed funds are available in smaller denominations and are usually immediately available. (LO 71.c)

2. **B** pooled deposit and nondeposit funds expenses = all expected operating expenses / all new funds expected = \$22.00 / \$300 = 7.33%

$$\begin{aligned} \text{hurdle rate over all earning assets} &= \text{expected operation expenses} / \text{dollars} \\ \text{invested in earning assets} &= \$22.00 / \$250 = 8.80\%. \end{aligned} \quad (\text{LO 71.d})$$

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Tuckman and Serrat, Chapter 12.

READING 72

REPURCHASE AGREEMENTS AND FINANCING

Study Session 12

EXAM FOCUS

Repurchase agreements, or repos, are short-term financing vehicles to borrow/lend funds on a secured basis. The most common repos are for overnight lending. This reading discusses the mechanics of repos, including settlement calculations, the motivations of market participants for entering into repos, as well as the risks (credit risk and liquidity risk) that arise from their use. It also discusses collateral types used in repos, including general collateral and special collateral. For the exam, focus on the characteristics of repo transactions and the primary motivations for using repos. Understanding these motivations should give you a good indication of how and why repos are used in the market, what risks repos hedge, what risks arise from repo trading, and how changes in the market environment affect repos.

MODULE 72.1: MECHANICS OF REPOS, REPO MOTIVATIONS, AND COUNTERPARTY AND LIQUIDITY RISK

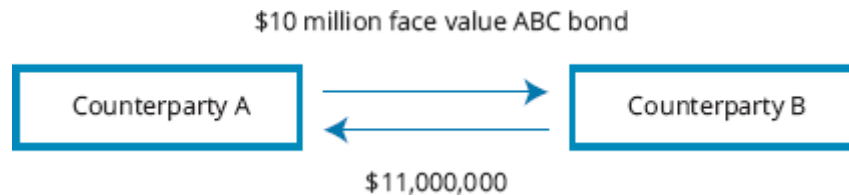
Mechanics of Repurchase Agreements

LO 72.a: Describe the mechanics of repurchase agreements (repos) and calculate the settlement for a repo transaction.

Economically, a **repurchase agreement** (i.e., **repo**) is a short-term loan secured by collateral. Mechanically, it is a contract between two parties where one party sells a security at a specified price with a commitment to buy back the security at a future date at another specified (higher) price. The difference between the sell and buy prices of the security is the implied interest (i.e., return) on the transaction. Repos are used by both borrowers needing short-term funds and by lenders needing short-term investments or access to hard-to-find collateral.

The term repo refers to the transaction from the *borrower's* side; that is, from the side that sold the security with a promise to buy it back. When we examine the same transaction from the *lender's* side, the transaction is referred to as a **reverse repurchase agreement** (i.e., **reverse repo**). Figure 72.1 and Figure 72.2 illustrate an example of a repo trade.

Figure 72.1: Repo Initiation



Suppose that on May 1, counterparty A wishes to borrow \$11 million for 31 days. It therefore sells ABC bonds with a face value of \$10 million and a market value of \$11 million to counterparty B, with a contract price of \$11 million to reflect the bond's market value. Concurrently, counterparty A agrees to buy back the bond in 31 days at the contract price plus 0.3% interest (30 basis points).



PROFESSOR'S NOTE

Interest rates for repos are always quoted at an annualized rate, and the convention for most money market securities is to use an actual/360 day count.

The repurchase price in this example is computed as follows:

$$\$11,000,000 \times \left(1 + \frac{0.3\% \times 31}{360} \right) = \$11,002,841.67$$

As illustrated in Figure 72.2, on the June 1 termination of the repo trade, counterparty A will purchase back the \$10 million face value ABC bond for \$11,002,842.

Figure 72.2: Repo Termination (Settlement)



LO 72.b: Discuss common motivations for entering into repos, including their use in cash management and liquidity management.

Borrowers in Repos

From the perspective of the *borrower*, repos offer relatively cheap sources of obtaining short-term funds. Relative to unsecured borrowing, repos allow the borrower to obtain funds at favorable rates because lenders are willing to accept lower returns (relative to unsecured transactions) in favor of the security of collateral.

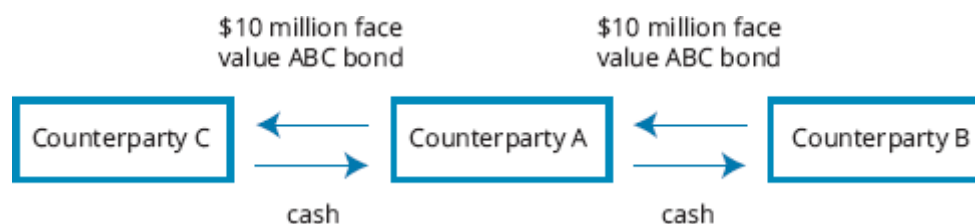
Bond Financing

Repos can also be used to obtain cash to finance a long security position. Consider a financial institution in the previous example (as counterparty A) that just purchased the same \$10 million face value ABC bond from a client in hopes of selling it to another investor for a profit. Until the new buyer is found, however, the financial institution needs to finance the purchase of the bond. It can do so by borrowing cash through an overnight repo trade (from counterparty B) and pledging the ABC bond as collateral, subject to any applicable haircuts. If the financial institution cannot immediately find a buyer, it needs to roll/renew its position. If the initial repo trade and the subsequent rolls are transacted with the same counterparty, the trade flow is similar to Figure 72.1.

If the repo is renewed/rolled with a different counterparty, the financial institution first needs to unwind the initial trade (with counterparty B) and then enter into a new repo trade with another counterparty (counterparty C). This is illustrated in Figure 72.3.

Similar to financing a bond purchase, the financial institution may also use repos to finance proprietary positions or to finance its inventory in order to make markets.

Figure 72.3: Back-to-Back Repo Trades



Liquidity Management

Firms can borrow funds in different ways. They can issue equity capital or issue long-term or short-term debt, either on a secured or unsecured basis. Repos offer secured short-term financing; however, they are considered less stable given that repos need to be repaid within a short time period, and they are subject to swings in market conditions and sentiment. By contrast, equity financing is considered the most stable financing form given that the issuing firm has no obligation to pay dividends and equity financing does not need to be paid back. However, given its stability, equity financing is the most expensive and requires the highest expected return. By contrast, repo financing is cheaper but less stable.

Firms need to balance this tradeoff between the costs of funding among the various alternatives and potentially being left without financing. This is referred to as **liquidity management**.

Lenders in Repos

From the perspective of the *lender*, repos can be used for either investing or for financing purposes as part of an entity's cash management or financing strategies.

Cash Management (Repos as Investment Vehicles)

Lenders use repos (taking the reverse repo side) for investing when they hold cash either for liquidity or safekeeping reasons and need short-term investing opportunities

to generate return on their surplus cash position. For example, money market mutual funds hold cash for safekeeping on behalf of investors and therefore need low risk, short maturity investments to generate return rather than holding idle cash. Municipalities, on the other hand, have significant surplus cash generated from tax revenues. Municipalities are prohibited from investing in high-risk investments, and repos offer a low risk, collateral-secured investment opportunity.

Investors look for liquidity and tend to favor very short-term positions in **overnight repos**, which provide significant flexibility to the investor. Following each overnight repo transaction, the investor could re-evaluate its decision whether to continue lending cash. Investors may also transact in **open repos** by lending for a day under a contract that renews each day until it is canceled. Repos could have longer maturities out to several months, although typically the longer the maturity, the lower the overall demand.

In addition to liquidity, investors also prefer higher quality collateral. Repo collateral is generally limited to high-quality securities, including securities issued or guaranteed by governments and government-sponsored entities. Because the lender is faced with the risk of a decline in collateral value during the term of the repo transaction, repo agreements often require collateral haircuts. A **haircut** refers to discounting the value of the collateral posted in relation to its risk. In our earlier repo trade example, counterparty B may only lend \$10.5 million against the \$11 million market value of the ABC bond collateral received. Finally, repo transactions are also subject to margining and (daily) margin calls. A margin call requires a borrower to post additional collateral in a declining market, but it also allows the borrower to withdraw excess collateral in up markets.

Short Position Financing (Repos as Financing Vehicles)

Lenders may also use repos (as the reverse repo side) to finance short positions in bonds. Consider an investment management firm that has a view that interest rates will rise and bond prices will fall. It can take advantage of this view by obtaining the desired bond collateral through lending cash in a reverse repo trade. It would then short sell the bond received through the reverse repo and buy it back at the market price at a later date, hoping to benefit from the trade from a fall in prices. The transaction flows would be similar to what we previously illustrated in Figure 72.1 and Figure 72.2, with the investment management firm as counterparty B.

Counterparty Risk and Liquidity Risk

LO 72.c: Discuss how counterparty risk and liquidity risk can arise through the use of repo transactions.

Repo transactions involve the exchange of cash as well as the exchange of collateral. As a result, both counterparty risk (credit risk) and liquidity risk are present.

Counterparty risk is the risk of borrower default or non-payment of its obligations, and it arises because the lender is exposed to the risk of a failure by the borrower to repay the repo loan and interest. Given, however, that repo loans are secured by

collateral, this makes the lender much less vulnerable to a decline in the creditworthiness of the borrower. The lender can recover any amounts owed by simply selling the collateral. As a result, because repos are generally very short-term transactions secured by collateral, counterparty (credit) risk is less of a concern.

Liquidity risk is the risk of an adverse change in the value of the collateral and can be of particular concern to the lender. Even if the lender is less concerned with the credit risk of a counterparty given the security of collateral, the lender is still exposed to the risk of collateral illiquidity and to the value of the collateral declining during the repo term. Especially during times of market turbulence (as we will see in next LO), the value of collateral can decline significantly and its liquidity can dry up. This risk can be mitigated with the use of haircuts, margin calls, reducing the term of the repo, and accepting only higher quality collateral.



MODULE QUIZ 72.1

1. Pasquini Investments (Pasquini) is a private brokerage looking for 30-day financing of \$25 million of its accounts payable but is unsure whether the appropriate investment is a term repurchase agreement (repo) or a term reverse repo agreement. Pasquini is willing to post AAA-rated government bonds as collateral. The bonds have a face value of \$27 million and a market value of \$25 million. The firm is quoted a rate of 0.5% for the transaction. Which of the following choices most accurately reflects the contract type and the contract price needed by Pasquini?

<u>Contract type</u>	<u>Contract price</u>
A. Repo	\$27,011,250
B. Reverse repo	\$25,010,417
C. Repo	\$25,010,417
D. Reverse repo	\$27,011,250

2. Posting collateral and requiring collateral haircuts are important risk mitigants in repo transactions with respect to which of the following risks?

<u>Posting collateral</u>	<u>Collateral haircuts</u>
A. Market risk	Interest rate risk
B. Credit risk	Interest rate risk
C. Market risk	Liquidity risk
D. Credit risk	Liquidity risk

3. Kotra Bank Holdings, Inc., (Kotra) is currently weighing the cost of its funding against the risk of being left without financing. The term that best describes Kotra's activities is:
- A. counterparty (credit) risk.
 - B. specials trading.
 - C. liquidity management.
 - D. overnight funding.

MODULE 72.2: THE CREDIT CRISIS, COLLATERAL, AND SPECIAL SPREADS

Repos During the Credit Crisis

LO 72.d: Assess the role of repo transactions in the collapses of Lehman Brothers and Bear Stearns during the 2007–2009 financial crisis.

Prior to the 2007–2009 credit crisis, the repo market was considered relatively liquid with stable demand by both borrowers and lenders. Borrowers often posted weaker quality collateral, including corporate bonds or mortgage-backed securities. This benefited both borrowers, who were able to post less desirable collateral, and lenders, who were able to obtain higher repo rates in exchange for accepting lower quality collateral. However, as the crisis escalated, lenders were reluctant to continue to accept these securities, and were increasingly demanding higher quality collateral and larger haircuts. At the extreme, they simply withdrew liquidity and stopped transacting in the markets. Borrowers that were the worst hit experienced collateral liquidations, capital declines, and ultimately bankruptcies. The case studies of Lehman Brothers and Bear Stearns provide important insights into the role of repo transactions in the demise of these once important institutions.

Repos and Lehman Brothers

JPMorgan Chase & Co. (JPM) was the tri-party repo clearing agent of Lehman Brothers Holdings, Inc. (Lehman). (In a tri-party repo agency arrangement, the repo trades are still executed between two counterparties; however, the collateral selection, payment, settlement, and repo management is outsourced to a third-party agent. Agents are essentially custodians and do not take on the risks of the transactions.) These tri-party repos were traded in the overnight market, and were transacted predominantly between institutional repo lenders and financial institution borrowers (including Lehman). Given that the trades were overnight transactions, they matured each morning, leaving the borrowers without funding during the rest of the day. To bridge this funding gap, JPM, as tri-party agent, was lending directly to Lehman on a secured basis during the day, typically without requiring haircuts on intraday advances. By August 2008, however, due to the increased risk in the repo markets, JPM began to phase in haircuts on intraday loans, with the loan amounts exceeding \$100 billion in the final week of Lehman's bankruptcy.



PROFESSOR'S NOTE

Lehman was one of the largest U.S. investment banks. The failure of Lehman in September 2008 was the largest in U.S. history (\$600 billion in assets).

Both Lehman and JPM provide different viewpoints of the events leading up to Lehman's bankruptcy in September 2008. Despite the differing accounts, it is clear that the liquidity and value of collateral pledged in repo transactions declined during the crisis, and additional collateral and additional haircuts were necessary to mitigate the risks in repos.

According to Lehman, JPM, despite a conflict of interest due to its agent and lender role, breached its duty to Lehman and took advantage of its insider status (being insider to Lehman's internal financial condition and proposed business plans). Lehman accused JPM of using its influence to drain close to \$14 billion in collateral from Lehman during the last few days before the bankruptcy, despite already being in an overcollateralized

position. Although Lehman agreed at the time to provide additional collateral, it did so unwillingly and simply because there were no viable alternatives.

According to JPM, however, JPM acted in good faith by providing continued funding to Lehman up until the last day, despite Lehman's deteriorating financial condition. When it became clear that the collateral posted to JPM by Lehman was illiquid with apparently overstated values, JPM's exposure to Lehman was growing at a time when Lehman's creditworthiness and financial condition was deteriorating. Nevertheless, JPM continued to lend money despite inadequate haircuts and collateral values. The close to \$14 billion in additional collateral requested by JPM was significantly less than what was needed to cover JPM's true exposure.

Repos and Bear Stearns

Prior to 2007, Bear Stearns Companies, Inc., (Bear Stearns) relied on funding its borrowings primarily in the form of short-term unsecured commercial paper. By 2007, however, Bear Stearns switched from unsecured borrowing to a more stable form of borrowing through longer term, secured repo financing, which better positioned the firm to withstand market liquidity events. Given the high-quality collateral posted, the firm was able to obtain financing at favorable rates on a term basis.

Given the events of 2007–2009, lenders during this period became increasingly less willing to provide loans in the form of repo trades, and were especially averse to providing term (rather than overnight) repos. This led to a general shortening of repo terms, requiring larger haircuts, and requesting borrowers to post higher quality collateral. In early March 2008, Bear Stearns experienced a run on the bank that resulted from a general loss of confidence in the firm. This bank run led to a massive withdrawal of cash and unencumbered assets (i.e., assets that have not been committed or posted as collateral), and lenders refused to roll over their repo trades. The rapid decline in market confidence and withdrawal of capital ultimately led to Bear Stearns' collapse.



PROFESSOR'S NOTE

Bear Stearns was a U.S. investment bank and brokerage firm that was bailed out by the Federal Reserve Bank of New York and subsequently sold to JPM in March 2008.

Collateral in Repo Transactions

LO 72.e: Compare the use of general and special collateral in repo transactions.

Repo trades can be secured either with general collateral or with specific (i.e., special) collateral.

General Collateral

While lenders care about the quality of collateral delivered, under **general collateral** (GC), repo lenders are not concerned with receiving a particular security or class of securities as collateral. Instead, only the broad categories of acceptable securities are

specified. The logic here is that when lenders are looking to receive a specific rather than generic security as collateral, this creates a demand for that security and lenders have to accept a lower return on the repo trade. GC trades suit investors in repos because they can obtain the highest repo rate for the collateral received.

The repo rate for trades secured with general collateral is called the **GC rate**. GC rates can be used for repos with U.S. Treasury collateral, and the overnight rate for U.S. Treasury collateral is referred to as “the” GC rate. In the United States, the GC repo rate is typically slightly below the federal funds rate, although repos with U.S. Treasury collateral are considered safer and in fact can trade below the federal funds rate. The difference between the federal funds rate and the GC rate is measured through the **fed funds-GC spread**. This spread widens when Treasuries become scarcer (the GC rate falls) or during times of financial stress, as was the case during the 2007–2009 financial crisis.



PROFESSOR'S NOTE

The federal funds rate is an interest rate that depository institutions in the United States charge each other for lending funds maintained at the Federal Reserve.

Special Collateral

When lenders are concerned with receiving a particular security as collateral, the collateral is referred to as **special collateral**, and the repo trade is called a **specials trade**. If you recall our discussion on financing as a motivation for repo lending, it should be clear that specials trades are particularly important in financing transactions used to obtain specific bonds. The repo rate for trades secured with special collateral is called the **special rate**.

In specials trading, the lender of cash is concerned with receiving a particular security in order to finance the purchase of a bond (for shorting), or to finance its inventory or proprietary positions. Lenders accepting special collateral face a trade-off between receiving the desired security and lending at below GC rates to receive the desired security. Special rates differ by security because there is a rate for each security for each term. Special rates are determined by market supply and demand; however, it is important to note that the supply and demand of the underlying security is not the same as the supply and demand of the specials trade itself. In fact, a bond that is in high demand in the market may not be in great demand as collateral for a specials trade. The reverse could equally be true.

Special Spreads and the Auction Cycle

LO 72.f: Identify the characteristics of special spreads and explain the typical behavior of US Treasury special spreads over an auction cycle.

The difference between the GC rate and the special rate for a particular security and term is called a **special spread**. Special spreads are important because in the United

States, they are tied closely to the U.S. government Treasury bond auctions, and the level and volatility of the spread can be an important gauge of market sentiment.

In the United States, federal government bonds are sold at auction based on a predetermined, fixed schedule. The most recent issue is called the **on-the-run (OTR)** or *current* issue, while all other issues are called **off-the-run (OFR)**. Current OTR issues tend to be the most liquid, with low bid-ask spreads, that can be liquidated quickly even in large sizes. This liquidity makes them desirable for both long positions and short positions. For example, a repo lender would favor these securities for short positions because the shorts could be covered quickly and at a relatively low cost. The popularity of OTR issues as special collateral in repo trades historically resulted in lower repo rates and wider special spreads.

Several observations can be made by looking at the special spreads of OTR Treasury securities (OTR special spreads) and the auction-driven pattern of special spreads. First, OTR special spreads can be volatile each day depending on the special collateral. Second, spreads can fluctuate over time. Third, and most important, OTR special spreads are generally narrower (smaller) immediately after an auction but wider before auctions. They are narrower after auctions due to the extra supply of a new OTR security, which depresses special spreads. Spreads widen before auctions due to the substitutability of the special collateral as shorts change to the new OTR security.

The influence of auctions can also be observed from the term structure of individual OTR issues based on term special spreads (the difference between term GC rates and term special rates). Term special spreads are expected to decline immediately following the issue of the new OTR security but increase closer to the dates of the new auctions.

Special Spreads and Rate Levels

Special spreads generally move within a band that is capped at the GC rate (implying a floor of 0% for the special rate). When a trader short sells the OTR Treasury security but fails to deliver on settlement, the trader would not receive cash from the sale and would also miss out on a day's interest on the cash. To satisfy the settlement obligation to deliver the bond, the trader could borrow the bond in the overnight repo market and pay a special rate of 0% (essentially the trader provides free financing in exchange for receiving the desired bond). At any rate below 0%, no trader would borrow the bond. This puts both an effective lower bound and an effective cap of the special spread at the GC rate.

The special spread can also be tied to the penalty for failed trades. Until 2009, there was no penalty for failed trades. However, in light of the financial crisis and trillions of dollars in failed OTR deliveries, regulators adopted a penalty rate for failed trades, equal to the greater of 3% minus the federal funds rate, or zero. This means that as the federal funds rate increases, the penalty falls, and when the federal funds rate declines to zero, the penalty rate reaches its maximum at 3%. As a result, the new upper limit for the special spread is the penalty rate.

LO 72.g: Calculate the financing advantage of a bond trading special when used in a repo transaction.

The premium trading value of OTR bonds is due both to their liquidity and financing advantage as we previously discussed. The liquidity advantage stems from the ability to sell these bonds quickly for cash. The financing value stems from the ability to lend the bonds at a cheap special rate and use the cash to lend out at higher GC rates. This financing value is dependent on the trader's expectation of how long the bond will continue trading at its special rate before the rate moves higher toward the GC rate.

Let's assume that an OTR bond is issued on January 1 and trades at a special spread of 0.18%. A trader expects the bond to trade at GC rates past March 31. The financing value of the OTR bond is therefore the value over 90 days. The value of \$100 of cash at the spread of 0.18% is:

$$\$100 \times \frac{90 \times 0.18\%}{360} = \$0.045$$

Thus, the financing value is 4.5 cents per \$100 market value of the bond.



MODULE QUIZ 72.2

1. In a presentation to management, a bond trader makes the following statements about repo collateral:

Statement 1: "The difference between the federal funds rate and the general collateral rate is the special spread."

Statement 2: "During times of financial crises, the spread between the federal funds rate and the general collateral rate widens."

Which of the trader's statements are accurate?

- A. Both statements are incorrect.
 - B. Only Statement 1 is correct.
 - C. Only Statement 2 is correct.
 - D. Both statements are correct.
2. The latest on-the-run (OTR) Treasury bond issued on March 1 is trading at a special spread of 0.25%. Traders expect the bond to trade at general collateral (GC) rates past June 30. The financing value of the OTR bond is therefore the value over 122 days. Given this information, the value of lending \$100 of cash is closest to:
 - A. \$0.085.
 - B. \$0.250.
 - C. \$0.305.
 - D. \$0.847.

KEY CONCEPTS

LO 72.a

Repurchase agreements, or repos, are bilateral contracts where one party sells a security at a specified price with a commitment to buy back the security at a future date at a higher price. From the perspective of the borrower we refer to repos, while from the perspective of the lender we refer to reverse repos. Repos are valued based on a simple time value of money calculation.

LO 72.b

From the perspective of the borrower, repos offer relatively cheap sources of obtaining short-term funds. Balancing the cost of funding (e.g., through repos) and other sources

of funds (including potentially no funding) is called liquidity management.

From the perspective of the lender, repos can be used for either investing (cash management) or for financing purposes (e.g., to finance short bond positions).

LO 72.c

Repos give rise to both counterparty risk and liquidity risk. Counterparty (credit) risk is the risk of borrower default or non-payment of its obligations. Liquidity risk is the risk of an adverse change in the value of the collateral. Counterparty risk is mitigated with collateral, while liquidity risk is mitigated with haircuts, margin calls, shorter repo terms, and higher quality collateral.

LO 72.d

During the 2007–2009 financial crisis, lenders were increasingly demanding higher quality collateral and larger haircuts and even withdrew liquidity altogether. Borrowers experienced collateral liquidations and capital declines, leading to several high profile company failures and bankruptcies. The failures of Bear Stearns and Lehman Brothers illustrate these events.

LO 72.e

Repo trades can be secured either with general collateral or with specific collateral. Lenders (as investors) in general collateral (GC) repo trades are not concerned with receiving a specific security, and only the broad categories of acceptable securities are specified. GC trades suit investors in repos because they can obtain the highest repo rate for the collateral received. Lenders (as financing participants) in special collateral repo trades (specials trades) are concerned with receiving a particular security as collateral. The particular security received can then be used to finance the purchase of a bond (for shorting) or to finance its inventory or proprietary positions.

LO 72.f

The difference between the GC rate and the special rate for a particular security and term is called a special spread. Special spreads are tied closely to Treasury bond auctions, and the level and volatility of the spread can be an important gauge of market sentiment. Special spreads are generally narrower immediately after an auction, but widen before auctions. Spreads generally move within a band that is capped at the GC rate (implying a floor of 0% for the special rate).

Following the global financial crisis, regulators adopted a penalty rate for failed trades at the greater of 3% minus the federal funds rate, or zero. As a result, the penalty rate becomes the new upper limit for the special spread.

LO 72.g

The financing value of the bond is the ability to lend the bonds at a relatively cheap special rate and use the cash to lend out at higher GC rates. This financing value is dependent on the trader's expectation of how long the bond will continue trading at its special rate.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 72.1

1. **C** Given that Pasquini is a borrower in the repo market, the transaction is a repo from the perspective of the firm (but a reverse repo from the perspective of the lender). The contract price is calculated as follows:

$$\$25,000,000 \times \left(1 + \frac{0.5\% \times 30}{360} \right) = \$25,010,417$$

(LO 72.a)

2. **D** Collateral is an important counterparty credit risk mitigant. Repo loans are secured by collateral, which makes the lender much less vulnerable to a decline in the creditworthiness of the borrower. Collateral haircuts are important in mitigating liquidity risk in repo transactions. The lender is exposed to the risk of the value of the collateral declining during the repo term, which can be mitigated by requiring (higher) haircut values, that is, discounts to the value of the posted collateral. (LO 72.b)
3. **C** The process of weighing the cost of its funding against the risk of being left without financing is called *liquidity management*. Counterparty (credit) risk is the risk of borrower default or non-payment of its obligations. In specials trading, a lender of cash initiates a repo trade in order to receive a particular security (special collateral). Overnight funding refers to borrowing and lending in the overnight market. (LO 72.b)

Module Quiz 72.2

1. **C** The trader's first statement is incorrect. The difference between the federal funds rate and the general collateral (GC) rate is known as the *fed funds-GC spread*. The *special spread* is the difference between the GC rate and the special rate for a particular security.

The trader's second comment is correct. During times of financial crises, the spread between the federal funds rate and the general collateral rate widens as the willingness to lend Treasury securities declines, lowering the GC rate (thereby increasing the spread). (LO 72.e)

2. **A** The financing value of \$100 of cash at a spread of 0.25% is calculated as:

$$\$100 \times \frac{122 \times 0.25\%}{360} = \$0.0847 \text{ or } 8.47 \text{ cents}$$

(LO 72.g)

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Grant.

READING 73

LIQUIDITY TRANSFER PRICING: A GUIDE TO BETTER PRACTICE

Study Session 12

EXAM FOCUS

The focus for this reading is best practices in liquidity transfer pricing (LTP) that are recommended by regulatory authorities following the global financial crisis. For the exam, be able to clearly describe how a proper LTP process is structured with a centralized treasury overseeing all wholesale funding. Also, be able to explain why the matched-maturity marginal cost approach is the recommended way to allocate costs, benefits, and risks of liquidity at a granular level to all business units. In addition, understand how stress tests using scenario analysis of idiosyncratic and systemic shocks are applied for providing an adequate liquidity cushion that includes potential off-balance-sheet cash outflows such as derivatives and collateral calls. Finally, be prepared to explain how better LTP practices are necessary to ensure that banks do not accumulate illiquid long-term assets that are funded with overnight or short-term funding that may not be available in a prolonged market crisis.

MODULE 73.1: BEST PRACTICES AND CHALLENGES FOR LIQUIDITY TRANSFER PRICING

A group of prudential regulators surveyed 38 banks from 9 different countries in 2009 following the global financial crisis. The survey was designed to gather information related to **liquidity transfer pricing (LTP)** and the processes used at the different banks. The results of the survey are discussed in this reading along with suggestions for improving the LTP process. Prior to the global financial crisis, many banks treated liquidity as a free good and did not properly manage LTP. Poor LTP practices contributed to the liquidity problems experienced during the global financial crisis.

LTP Process

LO 73.a: Discuss the process of liquidity transfer pricing (LTP) and identify best practices for the governance and implementation of an LTP process.

LTP is the process of attributing the costs, benefits, and risks associated with liquidity to appropriate business units of the bank. LTP should be centrally managed by a group treasury within the bank. Banks should attribute liquidity funding rates based on their marginal cost of funds and matched to the maturity of the product. The most common base reference for attributing funding costs of liquidity is the LIBOR/swap curve.

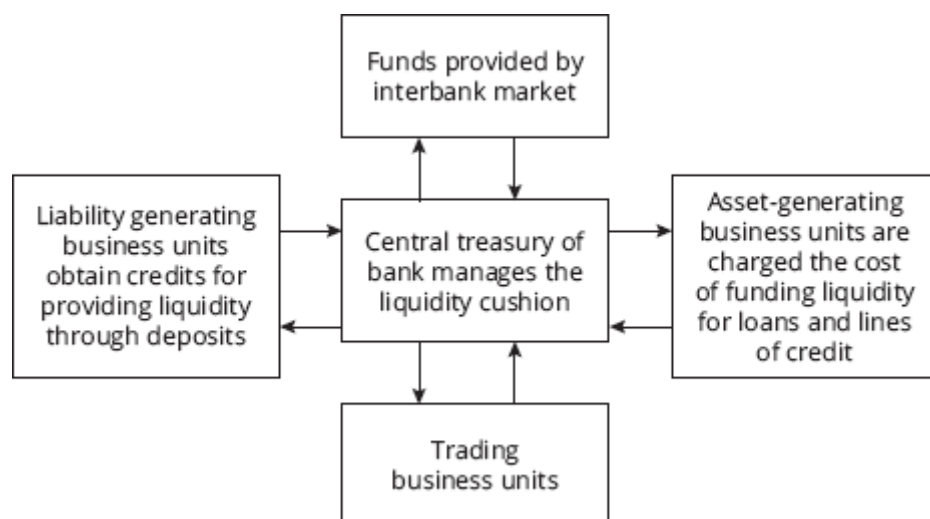
Loans of a bank are classified as assets and the bank's business units should be charged a liquidity premium for the cost of funding liquidity. This includes charging lines of credit based on the expected use of liquidity when funds are fully drawn. Deposits of a bank are classified as liabilities and its business units should be credited for the benefits of providing liquidity based on the maturity of the deposits.

The 2009 international survey of 38 banks across 9 countries revealed numerous deficiencies in LTP. The following list summarizes major shortcomings prior to the global financial crisis.

- Decentralized funding structures with weak internal risk controls required manual adjustments to LTP. These factors resulted in poor oversight by management and risk control personnel.
- Liquidity management information systems (LMIS) did not compute the costs, benefits, and risk of liquidity at a granular level for all business units.
- Employees and business unit managers were rewarded based on exaggerated profits of business units that did not properly account for liquidity funding costs and risks.
- Zero cost and average cost funding approaches for determining LTP significantly underpriced the cost of liquidity for illiquid long-term assets and did not provide credit for providers of liquidity.
- Stress tests were not used to determine the size of a liquidity cushion necessary to meet off-balance-sheet contingent liquidity risks and prolonged idiosyncratic and market shocks.
- Illiquid long-term assets were funded with overnight funding that was not available in a prolonged systemic crisis. Banks relying on these cheap funding sources underestimated the cost of liquidity.
- Average charges and small liquidity premiums were charged to all assets to fund liquidity cushion costs. This LTP process ignored contingent liquidity risks of specific business units.

Figure 73.1 illustrates a centralized approach for managing the LTP process. All wholesale funding is transferred through the central treasury. The central treasury charges business units that produce loans for the cost of funding liquidity, and credits business units for providing liquidity through deposits. Trading business units are charged for the use of funds for contingent commitments such as derivatives and collateral calls. Conversely, trading business units are credited for providing funds through the sale of marketable securities.

Figure 73.1: Central Treasury Management of LTP Process



Best Practices for Governing the LTP Process

Applying best practices of LTP helps to ensure banks will not overweight their balance sheets with illiquid assets. In addition, the LTP process should match the maturities of assets with the maturities of liabilities to help provide an adequate liquidity cushion. Banks with poor processes for LTP either underprice or fail to price the cost or benefit of liquidity. Poor LTP processes result in underpricing liquidity and provide an incentive for business units to accumulate illiquid assets.

The following list summarizes best practices for governing the LTP process.

- Banks should have a well-defined LTP process with guiding principles and rules in place that apply to all business units that use funding liquidity or provide funding liquidity.
- A group treasury should centrally manage all wholesale funding.
- Trading book funding policies and principles should be clearly set and understood, and the treasury should have knowledge of all funding liquidity risks.
- Senior management and independent risk and financial control personnel should oversee the LTP process and hold monthly meetings to monitor all funding costs.
- LMIS should attribute funding costs at a granular level, reflecting all costs, benefits, and risks associated with funding liquidity for each business activity.
- Employee bonuses and remuneration practices should factor in the cost of liquidity on the profitability of all business units.

LTP processes and practices are governed externally through regulatory authorities and competition. External control factors affect all banks. Therefore, it is more important for each bank to focus on internal control factors such as board oversight and risk management. Firms are more likely to achieve goals with strong internal controls for the oversight of the LTP process. Survey results indicated that weak internal controls led to poor LTP processes where liquidity was not priced or severely underpriced. The mispricing of liquidity led to adverse selection in terms of maturities for producing loans and deposits. In addition, moral hazard was evident for trading business units that did not account for potential costs and risks of liquidity for derivative products and contingent collateral calls. Establishing adequate LTP policies and procedures is necessary to create an appropriate LTP process.

A centralized funding center is necessary for proper internal governance of the LTP process. Wholesale funding should be restricted to a group or subsidiary treasury. Most problems identified by the banking survey stemmed from a decentralized funding structure. Decentralized LTP processes often relied on manual off-line procedures that were not updated frequently enough and led to internal arbitrage profits for business units that took advantage of the underpricing of liquidity. Another problem evident from the survey was banks with large trading businesses failed to properly charge these units for contingent liquidity exposures caused by derivative trading and collateral calls.

In addition to a funding center, proper board oversight and risk controls are necessary to mitigate the risks of internal arbitrage and mispriced liquidity. Lack of oversight of business unit activities led to mismatched maturities on the balance sheet and the accrual of too many long-term illiquid assets. The global financial crisis revealed that some banks accumulated large amounts of highly rated but highly illiquid collateralized debt obligations (CDOs) in their trading accounts. These assets were funded with short-term liabilities such as overnight to 90-day funds. During the crisis, these liquid funding sources were not available, causing a liquidity crisis for the bank. Furthermore, severe drops in market prices led to margin calls that made many banks unable to meet funding requirements. The liquidity cost of potential margin calls was never priced prior to the global financial crisis.

Challenges of Implementing the LTP Process

LO 73.b: Discuss challenges that may arise for banks during the implementation of LTP.

A major challenge in implementing the LTP process is maintaining proper oversight to manage and monitor the process. Oversight is necessary to prevent the accrual of illiquid long-term assets due to mispricing of liquidity premiums. The biggest problems that arose from the global financial crisis were the result of short-term funding reliance for long-term illiquid assets.

Therefore, a major challenge is properly accounting for the cost of liquidity in funding illiquid assets and crediting business units that provide liquidity through deposits. A centralized treasury center is recommended to overcome challenges that arise from decentralized funding centers. Arbitrage opportunities are less likely in a centralized LTP process.

Another challenge is developing trading book policies and implementing best practices to account for potential liquidity costs of derivatives and contingent collateral calls and margin calls. Management at all levels, a central treasury function, and independent risk personnel must all be engaged in the LTP process to improve oversight. This includes increasing the frequency of meetings related to funding costs to monthly rather than quarterly or semi-annual, as had been common before the global financial crisis.

A further challenge in implementing the LTP process is ensuring the LMIS infrastructure is sufficient to produce useful high-quality reports of liquidity in a timely manner. The LMIS should implement internal pricing policies and mechanisms to track costs, benefits, and risks of liquidity. The LMIS should ensure that business units receive charges for the cost of liquidity or credits for the benefit of liquidity.

Better LTP processes will help ensure that performance measures reflect the costs and risk associated with liquidity. A challenge in implementing the LMIS infrastructure is ensuring that the remuneration policy for executives of business units properly account for liquidity. Performance of business units is not appropriately quantified when liquidity costs, benefits, and risks are not properly accounted for. For example, lending business units targeted long-term loans that were undercharged for the cost of funding liquidity. This led to higher profits and higher rewards for performance. Similarly, business units were not properly incentivized to provide more liquidity with long-term deposits because credits were undervalued for longer-term deposits.



MODULE QUIZ 73.1

1. Which of the following is considered a best practice of liquidity transfer pricing (LTP)?
 - A. A centralized treasury funding center should be implemented to manage the liquidity cushion across business units.
 - B. Banks should rely on external factors to improve LTP by meeting regulatory authority requirements.
 - C. Remuneration policies should not be linked to LTP to help incentivize business unit managers to produce longer-term assets.
 - D. Contingent collateral calls and derivatives should not be included in the LTP process but managed separately to properly account for risks.
2. Which of the following best describes one of the major challenges for banks in implementing an effective LTP process?
 - A. A decentralized LTP process is recommended to mitigate arbitrage opportunities for different business units.
 - B. Illiquid long-term assets should be penalized for increasing liquidity risk.
 - C. Performance evaluations of business unit managers should be separate from the LTP process.
 - D. A liquidity management information system (LMIS) should produce and monitor high-quality reports on a quarterly basis.

MODULE 73.2: APPROACHES FOR LIQUIDITY TRANSFER PRICING AND CONTINGENT LIQUIDITY RISK PRICING

LO 73.c: Compare the various approaches to liquidity transfer pricing (zero cost, average cost, and matched maturity marginal cost).

The 2009 survey revealed four different approaches that were used in LTP at 38 different banks across 9 countries: zero cost, pooled average cost, separate average cost, and matched-maturity marginal cost. All the approaches used the swap curve as a reference for pricing interest rate risk. However, the different approaches varied greatly in how liquidity premiums were added to the swap rate.

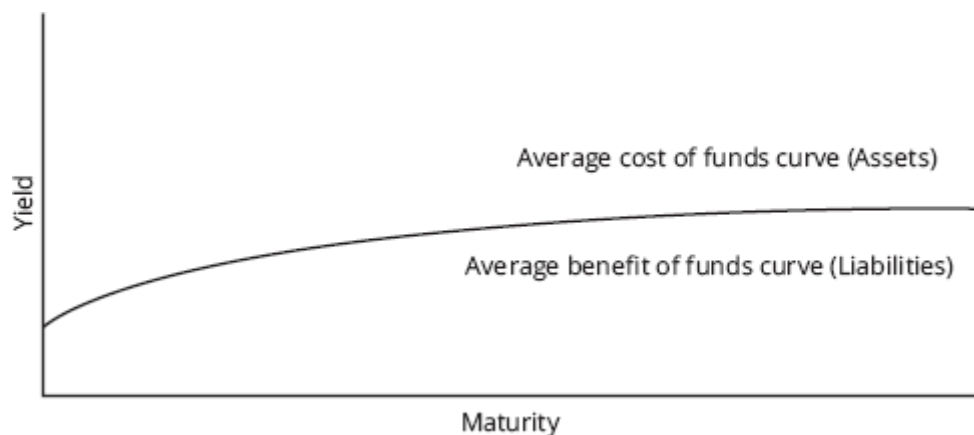
Zero-Cost Approach

Some banks failed to account for the costs, benefits, and risk of liquidity in pricing for the different business units. Under this zero-cost approach, liquidity was essentially viewed as free with no costs, benefits, or risk assigned to it. No charges were assigned to assets for the cost of using up funding liquidity. Furthermore, no credits were attributed to liabilities that provided funding liquidity benefits. In practice, the rate charged to users of funds was simply derived from the swap curve with no additional spread added. Under this, banks ended up with balance sheets that were heavily overweighted in illiquid assets with very few long-term liabilities to offset these funding demands as they came due.

This raises the question of why some banks viewed liquidity as a free good prior to the global financial crisis. From 2005 through the first quarter of 2007, the one-year LIBOR/swap spread was only 0.5 bps. Thus, during the time preceding the crisis, banks were easily able to fund credit, and liquidity risk was not priced or considered. A few banks using the zero-cost approach were naïve in believing funding was always available at this low of a rate. Therefore, assets were not charged for the funding cost of liquidity and liabilities were not credited for the benefit of providing liquidity. During the global financial crisis in 2008, the one-year LIBOR/swap spread exceeded 120 bps as the banking industry realized liquidity is not free and overnight funding is not always available.

For the zero-cost approach, the swap curve would represent the cost of funding for assets and credit for providing funding for liabilities with zero premium or spread added for liquidity, as illustrated in Figure 73.2.

Figure 73.2: Zero-Cost Approach for LTP Based on Swap Curve

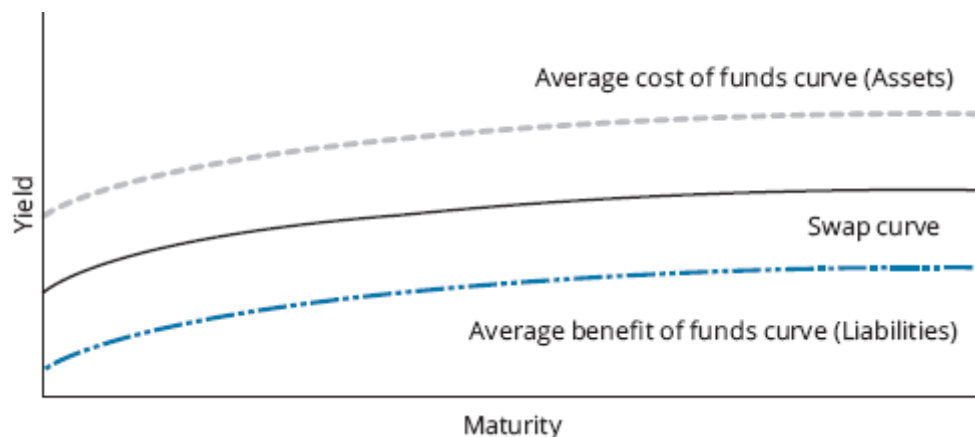


Pooled Average Cost of Funds Approach

A second approach used by some banks was a pooled average cost of funds approach. The interest expense cost of funds across all maturities was simply averaged to charge users of liquidity funding and credit providers of liquidity. For example, if a bank's funding source was strictly from deposits, the bank would simply sum the interest expense (cost of funds) across all funding sources for different maturities and divide by the total amount of deposits after adjusting for floats and reserve requirements.

Figure 73.3 illustrates how the pooled average approach to LTP is used in practice. The swap rate is used as a base across different maturities. Assets are then assigned a spread (or an average cost of funding) as a fixed amount above the swap rate across all maturities, as illustrated by the dashed line above the swap curve. Similarly, banks would use the same average spread across all maturities for liabilities. The line below the swap curve in Figure 73.3 represents the spread for the average benefit of funds curve for all maturities using the swap curve as a base.

Figure 73.3: Pooled Average Cost Approach for LTP



The pooled average cost approach for LTP is much better than zero-cost approach, which totally ignores liquidity costs, benefits, and risks. However, there are two major disadvantages of using the pooled average cost approach for LTP:

- All assets are charged the same for liquidity risk regardless of their maturities. As a result, longer-term assets, which have greater liquidity risk, are undercharged.
- Providers of liquidity are given the same credit regardless of the maturity of the deposit.

The disadvantages of this approach are illustrated further in the following example.

EXAMPLE: Pooled average approach

Suppose a bank uses the pooled average approach for LTP. What is likely to happen to the balance sheet if the bank decreases the liquidity spread from 9 bps to 6 bps?

Answer:

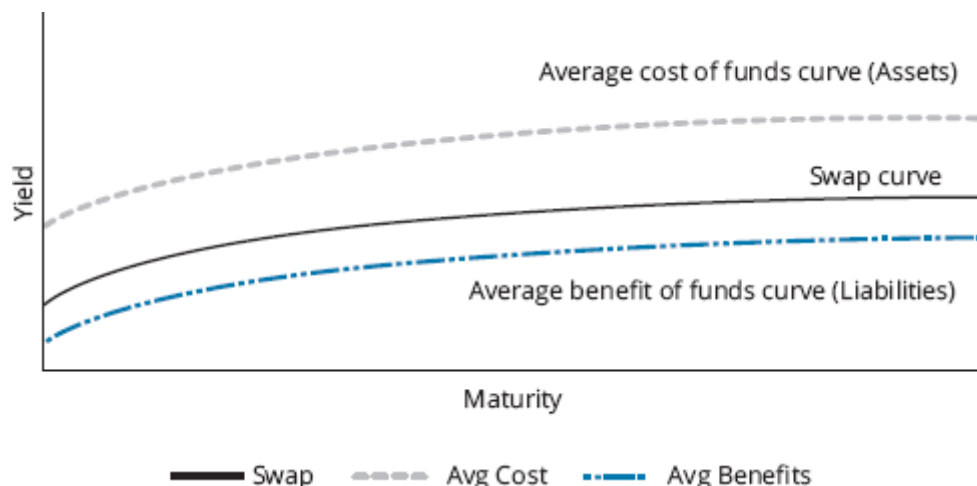
Decreasing the spread would have different impacts on liabilities and assets. Decreasing the spread from 9 bps to 6 bps would increase the amount of loans generated as the cost of funding liquidity is significantly reduced. It would have the opposite effect on deposits because a smaller liquidity spread reduces the incentive to provide funds. Thus, assets would most likely increase while liabilities would most likely decrease, creating an adverse effect on the loan-to-deposit ratio.

Separate Average Costs of Funds Approach

To avoid the problem described in the preceding example, some banks used a separate average cost of funds approach for assets and liabilities. Figure 73.4 illustrates the

average cost of funds curve for assets and the average benefit of funds curve for liabilities, assuming different liquidity spreads for assets and liabilities. Banks would use an average spread across all maturities for liabilities. The line below the swap curve in Figure 73.4 represents the spread for the average benefit of funds curve for all maturities using the swap curve as a base.

Figure 73.4: Separate Average Cost and Average Benefit Approach to LTP



EXAMPLE: Separate average costs of funds approach

Suppose a bank applies a separate average cost of funds approach for assets and liabilities at all maturities using a spread of 9 bps for all loans and a spread of 3 bps for all deposits. Under this approach:

- What is the use of funds charge for five \$100,000 loans maturing in one, two, three, four, and five years?
- What is the credit for deposits for providing liquidity for five separate deposits of \$100,000 with maturity dates in one, two, three, four, and five years?
- What is the advantage of this approach over the pooled average cost of funds approach for LTP?

Answer:

Figure 73.5 shows that for these five loans of \$100,000 each, the use of funds charge is \$90 (\$100,000 times 0.0009) regardless of the loan maturity. The providers of funding through deposits will each receive the same \$30 credit regardless of maturity (\$100,000 times 0.0003).

Figure 73.5: Charge for use of funds and credit for use of funds

Panel A

Term	1 year	2 year	3 year	4 year	5 year
Loan	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000
Average cost of funds (bps)	9	9	9	9	9
Charge for use of funds	\$90	\$90	\$90	\$90	\$90

Panel B

Term	1 year	2 year	3 year	4 year	5 year
Deposit	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000
Average benefit of funds (bps)	3	3	3	3	3
Credit for use of funds	\$30	\$30	\$30	\$30	\$30

The advantage of this approach is bank management can lower the funds charge on assets from 9 bps to 6 bps as an incentive to generate more loan activity without affecting the liability side of the balance sheet. The spread of 3 bps in this example is unchanged for deposits.

Whether the pooled or separate average cost of funds approach is used for LTP, major disadvantages persist. Because an average spread is applied to all assets and liabilities regardless of maturity, the average cost of funds does not reflect the current market perception of liquidity risk. Both average cost of funds approaches provide incentives for business units to underwrite more long-term loans, while business units are not encouraged to gain long-term deposits to offset those loans. This results in a wider mismatch of maturities between assets and liabilities on the balance sheet, which increases liquidity risk for the bank. If remuneration policies are based on employee performance incentives this puts increased pressure on the maturity mismatch as employees will target more long-term funds to generate more interest income.

Information asymmetries will also lead to more long-term loans being written. If business units know that the average cost of funds is used, they will seek more long-term loans because long-term loans are charged the same rate for liquidity risk as short-term loans. Information asymmetries will also encourage more short-term deposits to be acquired with greater incentives for credit under the average cost approach. Long-term deposits do not have enough incentive to justify the longer deposit maturity.

Average cost of funds approaches to LTP distort profit assessment for business units. When market prices become more volatile, the mispricing of assets and liabilities becomes more evident on risk-adjusted terms. This problem is magnified by the fact that an average cost of fund LTP approach is based on historical rates and not current market rates.

There are several reasons that banks historically have used an average cost of funds LTP approach:

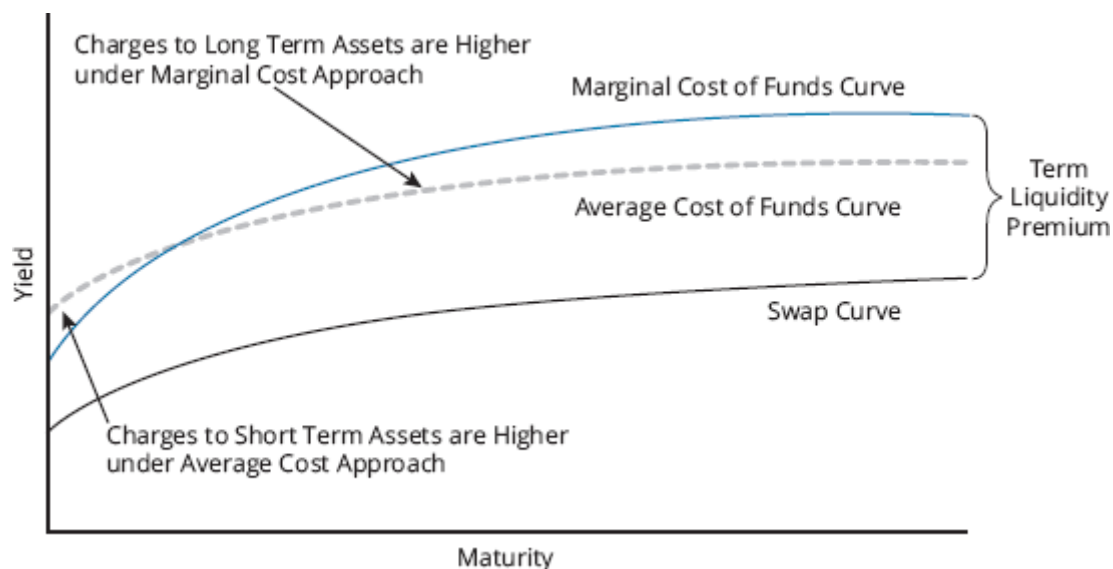
- It is a simple process to implement, which is easier to administer because all products are charged the same spread.
- This approach is easier for bank employees at different business units to understand and comply with.
- A basic LMIS can be used.
- Interest income volatility across business units is reduced using this approach because the spreads do not react as much to intermediate changes in the actual market cost of funds for the bank. This allows central management decision-makers to have more control in maintaining group-wide objectives.

Marginal Cost of Funds Approach

The best practice for LTP is the matched-maturity marginal cost of funds approach. This approach uses the bank's actual market cost of funding to calculate the correct liquidity spread. Fixed-rate borrowing costs are converted to floating-rate borrowing costs through internal swap transactions between business units using the swap curve as a reference. The spread is called a term liquidity premium for charging assets for the cost of funds and crediting liabilities for the benefits of providing liquidity.

As Figure 73.6 demonstrates, the marginal cost of funds curve is greater than the average cost of funds curve for long-term assets. This reflects the additional liquidity premium that is determined by current market rates. For shorter-term assets the marginal cost of funding curve is lower than the average cost of funding curve, reflecting a smaller term liquidity premium for shorter-term assets. Thus, the marginal cost of funding approach for LTP is based on market rates across different maturities using the swap curve as a reference base.

Figure 73.6: Marginal Cost of Funds vs. Average Cost of Funds Approach to LTP



EXAMPLE: Marginal cost of funds approach

Suppose a bank has fixed-rate costs associated with issuing unsecured wholesale term debt. How can the bank assign the portion associated with liquidity?

Answer:

Swapping fixed-rate costs to floating rates allows the bank to strip out the portion attributable to liquidity. The process involves stripping structured debt into embedded derivatives and floating-rate cash instruments. The term liquidity premium is determined by the spread above the reference rate for the internal swap transaction at par. This liquidity premium is a better measure of the cost of liquidity than using average costs because it reflects market access premiums as well as idiosyncratic credit risks attributed to the bank.

Similar to the average cost of funding approach, the marginal cost of funds approach is typically referenced to the swap curve constructed from LIBOR or Euribor rates for funding up to one year. Swap rates are considered to be a good base reference for the term structure that is used to determine liquidity premiums. Swap curves more directly reflect market and idiosyncratic risk for borrowing and lending in the interbank market. In addition, using current market rates captures the market's perception of current market conditions, as opposed to lagging historical rates used in the average cost of funding approach.

Applying the Matched-Maturity Marginal Cost Approach in Practice

Most loans are repaid over time following an amortization schedule. However, a nonamortizing bullet loan is made for a fixed time period with the principal and interest being repaid in total at the end of the loan period. The following example illustrates how the matched-maturity marginal cost approach is used for calculating the cost of funds for a nonamortizing bullet loan.

EXAMPLE: Matched-maturity marginal cost approach for a bullet loan

Suppose Bank MMM uses the matched-maturity marginal cost of funds approach for LTP, and Bank AVG used the average cost approach for LTP prior to the global crisis and still uses it currently. Figure 73.7 presents the spreads used at different maturities for these two banks during these two different time periods. Suppose both banks make two nonamortizing bullet loans of \$100,000 each with maturities of one and five years during both the precrisis and current time periods. **Calculate** the cost of funds for the loans of both banks during the two time periods.

Figure 73.7: Comparison of Matched-Maturity Marginal Cost of Funds Approach and Average Cost of Funds Approach Using Precrisis and Current Spreads

Panel A: Bank MMM Term Liquidity Premium (bps)

Term	1 year	2 year	3 year	4 year	5 year
Precrisis	1	2	3	5	8
Current	4	8	15	24	35

Panel B: Bank AVG Using Average Cost of Funds Approach to LTP (bps)

Term	1 year	2 year	3 year	4 year	5 year
Precrisis	2	2	2	2	2
Current	7	7	7	7	7

Answer:

Using Panel A of Figure 73.7, during the precrisis period, Bank MMM's funding costs for the \$100,000 one-year loan are $0.0001 \times \$100,000 = \10 and for the five-year loan are $0.0008 \times \$100,000 = \80 . Using current costs, these same two loans from Bank MMM have a cost of $0.0004 \times \$100,000 = \40 and $0.350 \times \$100,000 = \350 , respectively.

Using Panel B, the \$100,000 one-year and five-year loans from Bank AVG using the average cost of funds approach have a funding cost of $0.0002 \times \$100,000 = \20 each during the precrisis period. These same two loans from Bank AVG have a cost of $0.0007 \times \$100,000 = \70 each using current costs.

This example illustrates that the cost of funding is underestimated using the average cost of funds approach for longer-term loans. In this example, a five-year \$100,000 nonamortizing bullet loan had a cost of only \$20 during the precrisis period and \$70 during the current period. This is considerably lower than the matched-maturity marginal cost approach, with a five-year \$100,000 loan having a funding cost of \$80 and \$350 for the precrisis and current periods, respectively. Not only does this illustrate the impact of mispricing the liquidity premium based on the maturities, but it also illustrates how the mispricing of liquidity premiums becomes a bigger mismatch during more volatile times, such as when the price of liquidity rose after the crisis.

Amortizing loans provide principal repayments throughout their life. Because principal is gradually repaid over the life of the loan, the cost of funding the principal is not computed for its entire life.

EXAMPLE: Matched-maturity marginal cost approach for an amortizing loan

Suppose a bank makes a \$500,000 five-year loan that repays principal (and interest) with five principal repayments of \$100,000 at the end of each year. Using the same spreads provided in Figure 73.7, **calculate** the charge for this loan using the matched-maturity marginal cost of funds approach.

Answer:

We can assume this is similar to five separate loans of \$100,000 each maturing at 1, 2, 3, 4, and 5 years. This is computed using a tranching approach that is similar to

calculating duration. For the precrisis time period, the charge is computed using the matched-maturity marginal cost approach as follows:

$$\frac{1(1) + 2(2) + 3(3) + 4(5) + 5(8)}{1 + 2 + 3 + 4 + 5} = \frac{74}{15} = 4.9 \text{ bps}$$

For the current time period, the charge is computed using the matched-maturity marginal cost approach as follows:

$$\frac{1(4) + 2(8) + 3(15) + 4(24) + 5(35)}{1 + 2 + 3 + 4 + 5} = \frac{336}{15} = 22.4 \text{ bps}$$

Thus, in both cases, the charge is approximately the same as the charge of a bullet loan just under four years, and not the entire five-year life of the loan. Note from Figure 73.7 that a bullet loan for four years would have a charge of 5 bps and 24 bps for the two time periods, respectively.

Not all amortizing loans have repayments in which the cash flows are known with certainty. For example, variable rate mortgages are often originated for 25 or 30 years. Repayments vary based on repayment frequency and repayment amount as some homeowners end up moving or selling their homes early and paying off the entire balance at the time of the sale. In this case, it is better to bundle all similar types of loans based on origination tenor, if mortgages tend to be repaid on average in the same way. This approach is referred to as the **weighted-average life (WAL) method** for computing the funding charge based on the behavior and maturity of a portfolio of similar loans. The WAL calculation is the weighted-average time it takes to recover \$1 of principal.

The charge for the entire portfolio is computed as:

$$\text{WAL} = \sum_{i=1}^n \frac{p_i}{P} t_i$$

where:

p_i = principal amount in distribution

P = amount of loan

t_i = years of payment i

EXAMPLE: WAL method

Suppose in an average month a bank writes \$1 billion of 15-year amortizing loans. Based on the behavior of past customers who often repay the entire balance early, the bank assumes the repayment of the principal for the portfolio will be closer to 8 years. Assume that the current rate for the matched-maturity approach of funding cost is 58 bps. **Calculate** the dollar cost of this charge for the entire portfolio.

Answer:

The charge to this business unit for the entire \$1 billion portfolio is 58 bps. The dollar cost of this charge would be $0.0058 \times \$1 \text{ billion} = \5.8 million

Deposits are categorized as sticky or *hot/volatile* based on the likelihood of customers withdrawing the funds. Examples of sticky deposits are term deposits for a prespecified

maturity. Examples of hot or volatile deposits are demand deposits, savings, and transaction accounts that can be fully withdrawn at any point in time.

EXAMPLE: Calculating the credit for the liquidity benefit of deposits

Suppose the two banks described in the previous example, Bank MMM and Bank AVG, each have two \$100,000 deposits with one-year and five-year terms. Using the same information provided in Figure 73.7, what should be the credit given to business units that acquire deposits with one-year and five-year terms, both prior to the crisis and currently, using the two approaches for cost of funding?

Answer:

The business unit for Bank MMM using the matched-maturity marginal cost of funds approach for LTP would give a credit prior to the crisis of \$10 for the one-year and \$80 for the five-year term deposits. Using current bps spreads, the business unit for Bank MMM would give a credit of \$40 and \$350 for the one-year and five-year term deposits, respectively.

The business unit for Bank AVG, using the average cost of funds approach for LTP, would give a credit prior to the crisis of \$20 each for the one-year and five-year term deposits. Using current bps spreads, the business unit for Bank AVG would give a credit of \$70 each for both deposits regardless of the term.

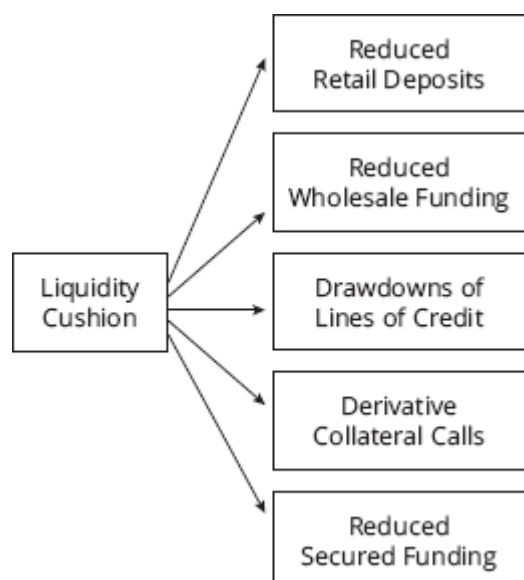
Contingent Liquidity Risk Pricing Process

LO 73.d: Describe the contingent liquidity risk pricing process and calculate the cost of contingent liquidity risk.

Basel Committee on Banking Supervision (BCBS) recommended two global standards for mitigating liquidity risk. A **liquidity coverage ratio (LCR)** is required for net cumulative cash flow needs to withstand idiosyncratic shocks for a period of 30 days. A **net stable funding ratio (NSFR)** mitigates a bank's structural liquidity risk by encouraging longer-term liability funding to cover illiquid long-term assets.

These two metrics are designed to change banks' behavior, make them more self-sustainable for longer time periods, and reduce the need for central banks to step in as a lender of last resort during crisis periods. These measures are designed to increase the *liquidity cushion* using highly liquid assets that banks are required to maintain to help their survival during periods of unexpected funding outflows. Examples of unexpected funding outflows are illustrated in Figure 73.8.

Figure 73.8: Liquidity Cushion for Unexpected Funding Outflows



Stress tests and scenario analyses should be used to determine the appropriate size of the liquidity cushion because the complexity and size of banks varies greatly. A scenario analysis should consider idiosyncratic shocks as well as systemic shocks for prolonged market disruptions. BCBS recommends that banks meet LCR ratios with highly liquid assets such as cash and government securities. The liquidity cushion should not be composed of short-term funding such as overnight funding. Rather, longer-term deposits should be used to protect against longer periods of market disruptions.

The cost of carrying a liquidity cushion is a significant factor in reducing business unit profits. This should be considered a cost of doing business and directly attributed to the business units that require the bank to carry the cushion for contingent liquidity needs. Business activities that have a higher probability of needing unexpected funding outflows should be charged accordingly with higher contingent liquidity charges.

Prior to the global financial crisis many banks just charged assets an average cost of funding for the bank carrying additional liquidity at the overnight funding rate. There are several problems with this approach:

- It assumes that all assets have the same contingent liquidity risk.
- Only charging assets ignores the fact that liabilities have run-off risk related to reduced deposits and off-balance-sheet risks such as additional drawdowns on lines of credit.
- It does not match the liquidity risk with the probability of liquidity usage by different business activities.
- The liquidity charge is not measured granular enough to discourage the use of products that have more contingent liquidity risk.

Therefore, banks should run stress tests of different types of idiosyncratic and market shocks to derive the size of the liquidity cushion needed. In addition, a larger portion of the liquidity cushion should contain cash and government securities that are more costly than holding overnight funding to meet liquidity needs. Scenarios should assume market disruptions will last for 30 days and the bank should be able to meet off-balance-sheet contingent liquidity needs. Higher contingent liquidity charges should be

applied based to those business activities that have a higher probability of funding unexpected cash outflows that were described in Figure 73.8. The following example illustrates how contingent liquidity needs should be computed for a specific business activity.

EXAMPLE: Cost of contingent liquidity risk

Suppose a bank supplies a line of credit of \$20 million that currently has a balance of \$5 million outstanding. Based on the customer's transaction history, projected needs, and credit score, the bank determines that there is a 70% probability the customer will use the \$15 million remaining line of credit. The bank's cost of funding for the liquidity cushion is 15 bps. If the bank charges contingent commitments based on the probability of a drawdown, **calculate** the charge for liquidity for this line of credit.

Answer:

The rate charged for the contingent commitment is determined using the following formula:

$$\begin{aligned}\text{contingent liquidity charge} &= (\text{remaining balance} / \text{credit limit}) \\ &\times \text{probability of drawdown} \times \text{liquidity cushion cost of funding} \\ \text{contingent liquidity charge} &= (\$15 \text{ million} / \$20 \text{ million})(70\%)(0.0015) \\ &= 0.000788 \text{ or } 7.88 \text{ bps}\end{aligned}$$

Multiplying this cost by the \$20 million credit line amount yields a dollar cost of \$15,750.



MODULE QUIZ 73.2

- Which of the following statements describes the best approach for liquidity transfer pricing?
 - Zero cost of funds approach is preferred in cases in which swap rates are unknown and undeterminable.
 - The pooled average cost of funds approach is more appropriate for banks with numerous business units.
 - The separate average cost of funds approach is preferred to accurately account for business units with large trading activities.
 - The matched-maturity marginal approach is preferred because it quantifies liquidity risk premiums across all maturities.
- A bank supplies a line of credit of \$10 million that currently has \$6 million already drawn. The bank determines that there is a 65% probability the customer will use the remaining line of credit. The bank's cost of funding for the liquidity cushion is 16 bps. If the bank charges contingent commitments based on the probability of a drawdown, what should the charge for liquidity be for this line of credit?
 - \$1,664.
 - \$2,496.
 - \$4,160.
 - \$5,850.

KEY CONCEPTS

The liquidity transfer pricing (LTP) process should be centrally managed by a group treasury within the bank and attribute liquidity funding rates based on their marginal cost of funds and matched to the maturity of the product.

LO 73.b

Challenges in implementing the LTP process include maintaining proper oversight to manage and monitor the process, reducing internal arbitrage opportunities, ensuring the information system infrastructure is sufficient to produce high-quality useful reports in a timely manner, and ensuring that the remuneration policy for executives of business units and personnel properly account for liquidity costs and risks.

LO 73.c

Banks using the zero-cost approach for LTP viewed liquidity as a free good with no costs, benefits, or risk assigned to it. Disadvantages of the average cost of funds approach to LTP are the mispricing of liquidity across maturities and use of historical costs, which lag current market rates. The best practice for LTP is the matched-maturity marginal cost of funds approach.

LO 73.d

Stress tests and scenario analyses should be used to determine the appropriate size of the liquidity cushion. The scenario analysis should consider idiosyncratic shocks as well as systemic shocks for prolonged market disruptions.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 73.1

1. **A** A centralized funding center is necessary for proper internal governance of the LTP process. Wholesale funding should be restricted to a group or subsidiary treasury. Internal factors play an important role in effectively managing the LTP process. Proper LTP processes ensure remuneration policies are effective. LTP process must include contingent collateral calls and derivatives. (LO 73.a)
2. **B** A major challenge in implementing an effective LTP process is properly accounting for the cost of liquidity in funding illiquid long-term assets and crediting business units that create benefits of liquidity through deposits. Liquidity costs, benefits, and risks should be considered in rewarding manager performance. The LMIS should create monthly reports not quarterly reports. Centralized treasury funding oversight is recommended to reduce business unit arbitrage opportunities. (LO 73.b)

Module Quiz 73.2

1. **D** The best practice for LTP is the matched-maturity marginal cost of funds approach. This approach uses the bank's actual market cost of funding to calculate the correct portion to liquidity. (LO 73.c)
2. **C** The rate charged for the contingent commitment is determined as follows:
$$\text{contingent liquidity charge} = (\text{remaining balance} / \text{credit limit})(\text{probability of drawdown})(\text{liquidity cushion cost of funding})$$

$$= (\$4 \text{ million} / \$10 \text{ million})(65\%)(0.0016)$$

$$= 0.000416 \text{ or } 4.16 \text{ bps}$$

Multiplying this cost times the \$10 million credit line amount yields a dollar cost of \$4,160. (LO 73.d)

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—McGuire and von Peter.

READING 74

THE US DOLLAR SHORTAGE IN GLOBAL BANKING AND THE INTERNATIONAL POLICY RESPONSE

Study Session 12

EXAM FOCUS

This reading provides important insight into some of the vulnerabilities that contributed to the global financial crisis starting in 2007, and the institutional responses that helped reduce these pressures. It is structured in three parts: an overview of the banks' balance sheet structures and an explanation and causes of funding risk; the nature of the U.S. dollar crisis caused by an escalation of these funding risks; and the international policy response. Vulnerabilities in the financial system can best be measured by looking at banks' global consolidated balance sheets, by observing the maturity mismatches between banks' U.S. dollar assets and their U.S. dollar liabilities. As banks found it increasingly difficult to roll over their short-term obligations and had difficulty obtaining U.S. dollars, the U.S. Federal Reserve (the Fed) extended U.S. dollar funding through an international swap network to central banks globally. The swap network ensured that banks had access to significant, or even unlimited, amounts of U.S. dollars through collateralized arrangements with the Fed.

MODULE 74.1: GLOBAL BANK BALANCE SHEETS AND VULNERABILITIES

LO 74.b: Evaluate the importance of assessing maturity/currency mismatch across the balance sheets of consolidated entities.

Global Balance Sheets and Funding Risk

Before we discuss the international policy responses to the global banking crisis that began in 2007, it is important that we understand the composition of banks' balance sheets and their significant expansion during the previous decade. Throughout this

section, we are discussing banks' *global* balance sheets, looking at their fully consolidated operations. This is an important point, because stresses and vulnerabilities build up across the global balance sheet.

During the decade leading up to 2007, banks had significantly expanded their investment portfolios globally through diversifying internationally, increasing their investment holdings of U.S. dollar loans and structured products. Banks could finance these positions in three ways:

- Borrow in their domestic currency, convert to U.S. dollars in the spot market, and buy the asset.
- Convert their domestic currency liabilities into U.S. dollars using foreign exchange (FX) swaps, and buy the asset.
- Borrow U.S. dollars directly in the interbank markets from other participants or from the central bank.

Under the first item, banks do not have foreign currency needs in the future, but are exposed to any unhedged U.S. dollar position on their balance sheets. It is assumed that banks do not leave significant unhedged positions, and would hedge this risk through FX swaps. Therefore, the first item and first leg of the swap in the second item are similar. Also, the requirement to deliver the foreign currency when the obligations are due are similar under the second leg of the swap in the second item and the foreign currency borrowing under the third item.

Regardless of the funding choices, banks are exposed to **funding risk**, or the risk that they will be unable to roll over their maturing liabilities. The level of this risk depends on the assets' maturity transformation on the balance sheets, creating a foreign currency mismatch—referred to as a **funding gap**—if the investment horizon of the foreign currency assets exceeds the time to maturity of the foreign currency liabilities (funding or FX swaps). If a bank were unable to roll over its maturing liabilities due to stressed market conditions or lack of liquidity, it would have to sell its foreign currency assets, possibly at a significant loss.

As a result, the maturity-mismatch and funding risk in foreign currencies is of critical importance. Banks are exposed to funding risk in their domestic currencies if the domestic currency asset investment horizon exceeds the liability maturity. However, banks can receive emergency liquidity funding from central banks, which can act as **lenders of last resort**, significantly minimizing domestic funding risk. On the other hand, central banks cannot create foreign currencies and, therefore, banks would need to meet any foreign currency requirements directly in the international markets.

The foreign currency funding risk has to be measured across banks' global consolidated balance sheets by looking at mismatches between the maturity, currency, and counterparty in order to identify any vulnerabilities and stresses. However, banks do not publicly disclose important details of their international positions including any identified mismatches. This lack of information makes regulatory and supervisory oversight more challenging. Nevertheless, comprehensive information obtained from Bank of International Settlements (BIS) statistics for the 1999–2009 period provides a relatively clear picture of consolidated bank balance sheets including their (1)

consolidated foreign assets and liabilities, (2) estimates of the gross and net positions by currency, and (3) information on financing sources.

Vulnerabilities in Balance Sheets

The Importance of Banks' Foreign Offices

Because large banks operate internationally across many jurisdictions and manage currency and maturity positions globally, there can be identified mismatches on their balance sheets at each of their offices or locations. Banks may leave these local mismatches unhedged if they are hedged off balance sheet or if there are offsetting positions on balance sheet across their foreign offices, resulting in an overall hedged position for the bank on a consolidated basis. Foreign offices book the majority (typically over 50%) of banks' foreign currency claims and, therefore, account for a significant share of banks' consolidated balance sheet positions. At the extreme, Switzerland's foreign claims account for 80% of their total consolidated balance sheet assets, and nearly 80% of foreign claims, are booked in offices outside of Switzerland.

On a country level, the magnitude of positions booked by offices of domestic versus foreign banks differs significantly. Banks' cross-border positions were a significant share of external assets in 2007 for each of the 11 countries measured by the BIS, generally accounting for between a quarter and half of a country's external assets. Importantly, this highlights that bank *nationality* and bank *residency* are different, and positions booked by an office in a country is only a small part of its external asset position. As a result, banks' national balance sheets may not be good indicators of vulnerabilities and stresses.

Because banks significantly expanded their cross-border lending activities and foreign acquisitions in the decade leading up to the banking crisis, the choice of offices for their balance sheet adjustments had significant implications. When banks use foreign offices for these adjustments, they can create large variabilities in foreign countries' external positions. For example, banks' foreign offices contributed to significant changes in the net external positions of the UK, Italy, and Spain. Therefore, it may be difficult to observe vulnerabilities in banks' balance sheets by simply looking at their home country's external positions even when domestic positions are factored in. Vulnerabilities would only be seen when looking at the global balance sheet of the consolidated entity.

Global Balance Sheet Expansion and Cross-Currency Funding

Between 2000 and 2007, banks' total foreign claims more than tripled from \$10 trillion in 2000 to \$34 trillion by the end of 2007. At the same time, the rate of growth in foreign claims also accelerated, with an annual growth in 2007 of nearly 30%. The U.S. dollar denominated position accounted for a significant share of the increase, contributing (along with other non-euro currencies) to just over half of the total increase in foreign assets between 2000 and mid-2007.

The way banks financed their expansions is important. In Europe, foreign claims were primarily financed in banks' domestic currency through intra-euro area cross-border positions. In other countries, including the UK, Japan, and Switzerland, foreign claims were predominantly financed in foreign currencies, primarily in U.S. dollars.

As banks expanded their global asset purchases, foreign currency assets often exceeded funding in these currencies. Long foreign currency positions were often financed through borrowing in their domestic currency at home. Further, the on-balance sheet open cross-currency net positions were small, indicating the extent of hedging through FX swaps. For example, by mid-2007, UK banks' long positions in U.S. dollars stood at \$200 billion, German and Swiss banks at a combined \$300 billion, and Dutch banks at \$150 billion. The combined long U.S. dollar positions of European banks grew to nearly \$700 billion by mid-2007. These positions were funded by short positions in British pounds, euros, and Swiss francs.

Maturity Mismatches Across Balance Sheets

Given the general difficulty in obtaining an accurate picture of the maturity profile of banks' foreign currency assets and liabilities, the counterparty sector information from the BIS data can be useful in assessing funding risk. More specifically, counterparty sector breakdown can help gauge banks' U.S. dollar funding gaps, where the gaps are the difference between banks' U.S. dollar long-term assets and U.S. dollar long-term liabilities. The gaps, therefore, measure the amount of U.S. dollars that need to be rolled over before asset maturity.

Interbank claims tend to have shorter maturities with greater liquidity than U.S. dollar claims on nonbanks. Nonbank investments range from short-term U.S. treasuries and agency securities to long-term lending to corporations and hedge funds. Banks need to finance these U.S. dollar investments through liabilities to counterparties, either through short-term U.S. dollar borrowing in the interbank market, or even shorter-term borrowing through FX swaps. Banks can also obtain U.S. dollar funding from nonbanks, including corporate and retail deposits, central bank deposits, or through money market financing. The maturities of these various funding types will differ. If the maturity of U.S. dollar liabilities to nonbanks is longer-term, a lower bound of the U.S. dollar funding gap can be established as the net U.S. dollar position to nonbanks. If the maturity of U.S. dollar liabilities to nonbanks is shorter-term, an upper bound of the U.S. dollar funding gap can be established as the gross U.S. dollar position to nonbanks. In mid-2007, the largest funding gaps in Europe were by German, Swiss, Dutch, and UK banks. Within countries, the reliance on funding type differed significantly, with German banks primarily relying on interbank funding, while UK banks had more balanced positions across interbank funding, central bank deposits and FX swaps.

By the beginning of the financial crisis, banks were exposed to significant funding risk, creating a material funding gap. The BIS estimates the U.S. dollar funding gap by European banks at \$1–1.2 trillion in mid-2007. Prior to the financial crisis, banks met these funding needs primarily from the interbank market and borrowing from central banks, while they used FX swaps to convert their domestic currency funding to U.S. dollars. If we also assume that funding through money markets is short-term funding, then the estimate of the funding gap increases to \$2–2.2 trillion.



MODULE QUIZ 74.1

1. If the maturity of a bank's U.S. dollar liabilities to nonbanks is longer-term:
 - A. a lower bound of the U.S. dollar funding gap can be established as the net U.S. dollar position to nonbanks.

- B. an upper bound of the U.S. dollar funding gap can be established as the net U.S. dollar position to nonbanks.
 - C. a lower bound of the U.S. dollar funding gap can be established as the gross U.S. dollar position to nonbanks.
 - D. an upper bound of the U.S. dollar funding gap can be established as the gross U.S. dollar position to nonbanks.
2. Prior to 2007, banks would least likely finance their increasing investment holdings of U.S. dollar assets by:
- A. drawing on U.S. dollar bank credit lines.
 - B. borrowing U.S. dollars from their central bank.
 - C. borrowing U.S. dollars directly in the interbank markets.
 - D. borrowing in their domestic currency and converting it to U.S. dollars in the spot market.
3. The funding gap can be best defined as:
- A. a mismatch between banks' domestic and foreign currency obligations.
 - B. the difference between banks' foreign currency and domestic currency reserves.
 - C. the difference between a bank's collateralized and noncollateralized foreign borrowings.
 - D. a foreign currency mismatch if the investment horizon of the foreign currency assets exceeds the time to maturity of the foreign currency liabilities.

MODULE 74.2: U.S. DOLLAR SHORTAGE AND INTERNATIONAL POLICY RESPONSE

LO 74.a: Identify the causes of the US dollar shortage during the Great Financial Crisis.

LO 74.c: Discuss how central bank swap agreements overcame challenges commonly associated with international lenders of last resort.

Causes of the 2007–2009 U.S. Dollar Shortage

The gradual maturity transformation and increase in the funding gap resulted in less stable short-term funding among institutions. This change, coupled with rising counterparty and liquidity risks, disrupted FX swap markets and led to rising costs by banks—who needed short-term funding sources—to obtain U.S. dollars through currency swaps. At the same time, money markets withdrew from bank-issued paper, while central banks withdrew a sizable portion of their U.S. dollar foreign exchange reserves.

In this market environment it was difficult for banks to sell their U.S. dollar assets, other than their liquid U.S. government securities, without incurring significant losses, including structured products. In addition, previously off-balance sheet vehicles were brought back onto banks' balance sheets, and prearranged credit commitments drawn. As U.S. dollar assets matured, banks needed to roll over these assets. During the precrisis period, rollovers were primarily financed through the nonbank funding market and through short-term FX swaps. However, because assets could not be rolled over, the holding period of assets *lengthened*, exactly at the same time as funding maturity *shortened*. This scenario created a U.S. dollar shortage.

As we noted, prior to the Lehman Brothers collapse in the second quarter of 2008, banks accessed dollar funds in the U.S. markets through their U.S. offices, including borrowing from the Fed, which could then be transferred back to other markets through interoffice transfers. During 2007 and 2008, banks' U.S. dollar liabilities grew significantly, including their borrowings from the Fed (given their status as primary dealers), while their U.S. dollar assets did not change significantly. This created a U.S. dollar funding gap.

Data indicates that the lower bound of the funding gap declined by nearly 50% during the financial crisis. However, this decline is misleading because much of it was caused by asset write-downs, which reduce U.S. dollar asset claims and net claims by nonbank institutions, and also reduces the estimated net FX swap positions.

The accuracy of the estimate of the funding gap largely depends on whether banks actually unwound their funding positions, or rolled them over. If banks simply unwound their net U.S. dollar positions by buying U.S. dollars in the spot market, then the observed funding gap would be correct (this was estimated at \$583 billion at the end of the first quarter of 2009). However, if banks did not close out their funding positions but rolled them over, the funding gap would be underestimated by the amount of the asset write-downs. This truer value of the funding gap was estimated at \$880 billion for the same period.

International Policy Response by Central Banks

While central banks in the banks' home jurisdictions attempted to alleviate the U.S. dollar shortage, they had insufficient U.S. dollar liquidity. In response, several central banks entered into **reciprocal swap arrangements** with the Fed to obtain the U.S. dollars they needed in their domestic jurisdictions through these swaps. The swap network was a mechanism for the Fed to extend loans to other central banks collateralized by foreign currencies. In turn, central banks made these funds available to other banks through local U.S. dollar auctions. This process allowed even those commercial banks with insufficient amounts of collateral or no significant U.S. subsidiaries to obtain U.S. dollar liquidity.

The earliest swap agreements with the Fed included the European Central Bank (ECB) and the Swiss National Bank, but these arrangements were extended following the Lehman Brothers collapse to include the central banks of Canada, England, and Japan as the swap lines doubled in size. As disruptions continued to spread globally, other central banks were also involved including in Australia, New Zealand, Latin America, and several Asian countries, creating a global central bank network of swap lines.

Beginning in late 2008, the Fed responded to the growing crisis by making the swap lines unlimited with the Bank of England, Swiss National Bank, and the ECB. An unlimited swap line effectively ensured that the Fed acted as an international lender of last resort. Following this change, the share of the swap lines to the ECB, Bank of England, and Swiss National Bank rose to around 80%.

The swap lines proved effective, leading to a significant reduction in their use immediately following the financial crisis, from the \$583 billion peak we noted, to around \$50 billion by late 2009. The swap network also ensured that banks could avoid further distressed sales of U.S. dollar assets, and led to lower interbank rate volatility

and reduced pressure for the U.S. dollar to appreciate. The use of swap lines also provided two institutional benefits:

- In contrast to other central banks, the Fed had the power to create unlimited amounts of U.S. dollars, which was distributed through swap lines internationally. This signals that the use of swap lines can also serve to mitigate pressures in other currencies.
- The swap network does not increase the risk of moral hazard, because the lines are collateralized and, therefore, the Fed did not face counterparty risk. Credit monitoring of banks was the responsibility of the other central banks.



MODULE QUIZ 74.2

1. Which of the following factors is least likely a contributor to the U.S. dollar shortage during the financial crisis?
 - A. Banks' prearranged credit commitments were drawn.
 - B. Structured finance products became more difficult to sell.
 - C. Central banks globally reduced their issuance of U.S. dollars.
 - D. Banks brought off-balance vehicles back to their balance sheets.
2. Which of the following statements about the U.S. dollar swap lines extended by the Fed to global central banks during the 2007–2009 financial crisis is least accurate?
 - A. Swap lines could be unlimited.
 - B. Swap lines were primarily uncollateralized.
 - C. The Fed can be seen as a lender of last resort.
 - D. Central banks typically made funds available locally through auctions.

KEY CONCEPTS

LO 74.a

The maturity mismatch between banks' U.S. dollar assets and liabilities and rise in the funding gap created short-term funding disruptions and made it difficult to obtain U.S. dollars through currency swaps. This was compounded by a withdrawal of money markets from bank-issued paper, and central banks withdrew a sizable portion of their U.S. dollar foreign exchange reserves.

As U.S. dollar assets matured, banks needed to roll over these assets. Until mid-2008 banks accessed U.S. dollars directly in U.S. markets through their U.S. offices, including borrowing from the Fed. However, banks encountered difficulty in selling their less liquid U.S. dollar assets, including structured products, without incurring significant losses. As a result, the holding period of assets lengthened while the funding maturity shortened, creating a U.S. dollar funding gap.

Estimating the true size of the funding gap is difficult and depends on whether banks actually unwound their funding positions or rolled them over. Under the assumption that banks rolled over their positions, the funding gap would be underestimated by the amount of the asset write-downs.

LO 74.b

Banks could finance their U.S. dollar assets by (1) borrowing domestically and converting to U.S. dollars in the spot market and buying the asset, (2) converting their domestic currency liabilities into U.S. dollars using FX swaps and buying the asset, and

(3) borrowing U.S. dollars directly in the interbank markets from other participants or from the central bank.

If the investment horizon of the U.S. dollar assets differs from the maturity of the foreign currency liabilities, a funding gap exists and banks are exposed to funding risk. Funding risk is the risk that banks are unable to roll over their maturing liabilities and may have to sell foreign currency assets, possibly at a loss.

Large banks operate internationally, which can create mismatches in currency and maturity positions on their balance sheets. Given that bank positions booked by their local offices are only a small part of their external asset position, national balance sheets may not be good indicators of vulnerabilities and stresses. Vulnerabilities are best seen when looking at the global balance sheet of a consolidated bank entity.

As banks' global asset purchases increased, foreign currency assets often exceeded funding in these currencies, leading to a U.S. dollar funding gap. By the beginning of the financial crisis, the funding gap was estimated at \$1–1.2 trillion by European banks. The gap measured the amount of U.S. dollars that need to be rolled over before asset maturity, given the difference between banks' U.S. dollar long-term assets and U.S. dollar long-term liabilities.

Banks need to finance their U.S. dollar investments through short-term U.S. dollar borrowing in the interbank market, borrowing through FX swaps, or obtaining U.S. dollar funding from nonbanks. If the maturity of U.S. dollar liabilities to nonbanks is longer term, a lower bound of the U.S. dollar funding gap can be established as the net U.S. dollar position to nonbanks. If the maturity of U.S. dollar liabilities to nonbanks is shorter-term, an upper bound of the U.S. dollar funding gap can be established as the gross U.S. dollar position to nonbanks.

LO 74.c

Central banks had insufficient U.S. dollar liquidity to alleviate their banks' funding shortages. Reciprocal swap arrangements with the Fed helped central banks obtain U.S. dollars. This created a swap network where the Fed lent money collateralized by foreign currencies.

The earliest swap agreements were between the Fed, the ECB, and the Swiss National Bank. Later, these arrangements were extended to other central banks, creating a global central bank network of swap lines.

As the crisis widened in late 2008, the swap lines with several of the major European banks were made unlimited, effectively making the Fed as an international lender of last resort.

The swap lines were effective and led to a significant reduction in interbank rate volatility while they also reduced pressure for the U.S. dollar to appreciate.

The use of swap lines also have two broader institutional benefits:

- The success of the U.S. dollar swap network signals that the use of swap lines can also serve to mitigate pressures in other currencies.
- A central bank that lends through the swap network is protected against credit risk (counterparty default) because the lines are collateralized.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 74.1

1. **A** If the maturity of U.S. dollar liabilities to nonbanks is longer-term, a lower bound of the U.S. dollar funding gap can be established as the net U.S. dollar position to nonbanks. If the maturity of U.S. dollar liabilities to nonbanks is shorter-term, an upper bound of the U.S. dollar funding gap can be established as the gross U.S. dollar position to nonbanks. (LO 74.b)
2. **A** Banks could finance their increasing investment holdings of U.S. dollar assets by borrowing in their domestic currency and converting it to U.S. dollars in the spot market, or by borrowing U.S. dollars directly in the interbank markets, from other market participants or from their central bank. Banks could also convert their domestic currency liabilities into U.S. dollars using FX swaps to buy the asset. (LO 74.b)
3. **D** A bank's funding gap is best defined as a foreign currency mismatch if the investment horizon of the foreign currency assets exceeds the time to maturity of the foreign currency liabilities. (LO 74.b)

Module Quiz 74.2

1. **C** Central banks outside of the U.S. can only issue their domestic currency. Only the Fed can issue U.S. dollars.
Some of the factors that contributed to the U.S. dollar shortage and increasing difficulty for banks to fund their U.S. dollar obligations included difficulty in selling less liquid structured products, bringing off-balance-sheet vehicles onto banks' balance sheets, and drawing prearranged credit commitments. (LO 74.a)
2. **B** Swap lines to central banks were collateralized by foreign currencies.
The swap lines to some of the largest central banks globally were made unlimited in 2008. As a result, the Fed can be seen as a lender of last resort. Borrowing central banks typically made the funding they obtained through the swap network available locally through U.S. dollar auctions. (LO 74.c)

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Borio, McCauley, McGuire, and Sushko.

READING 75

COVERED INTEREST PARITY LOST: UNDERSTANDING THE CROSS- CURRENCY BASIS

Study Session 12

EXAM FOCUS

This reading addresses a very straightforward question: why have deviations from covered interest parity (CIP) persisted since the financial crisis of 2007–2009? The typical finance textbook describes violations of CIP as arbitrage opportunities that can be easily exploited by arbitrageurs. Hence, CIP should hold all the time. However, real-world constraints have caused these *mispricings* to occur and to persist. For the exam, know what CIP is, what the cross-currency basis is, and how the pricing of foreign exchange (FX) swaps and cross-currency basis swaps reflects violations of CIP. Also, be able to explain the two main causes of persistent violations of CIP since the financial crisis: increased demand for currency hedges and limits to CIP arbitrage.

MODULE 75.1: COVERED INTEREST PARITY VIOLATIONS

Covered interest parity (CIP) is a theoretical no-arbitrage condition: it must hold or a risk-free arbitrage opportunity exists. In the absence of any market frictions, traders will execute the arbitrage trades to exploit the mispricing until the arbitrage opportunity evaporates.

CIP is represented as:

$$\frac{F}{S} = \frac{1 + r}{1 + r^*}$$

Or:

$$F - S = S \left(\frac{1 + r}{1 + r^*} - 1 \right)$$

where:

S = spot exchange rate in U.S. dollars per unit of foreign currency (USD/FC)

F = forward exchange rate in U.S. dollars per unit of foreign currency (USD/FC)

r = U.S. dollar interest rate

r^* = FC interest rate

The second form of CIP suggests that the forward premium ($F - S$) in points should be equal to the spot rate times the interest rate differential.

Perhaps a more convenient way to think about CIP is that there are two ways to invest in U.S. dollars:

- Directly, by investing at the USD interest rate, r .
- Indirectly, by exchanging USD for FC at the spot rate, S , investing the FC at the FC interest rate, r^* , and locking in the return by agreeing to convert those FC proceeds back into USD at maturity at the forward rate, F .

These two trades should have the same return or a risk-free arbitrage opportunity will be available.

LO 75.a: Differentiate between the mechanics of foreign exchange (FX) swaps and cross-currency swaps.

We will explore two ways of exploiting the arbitrage opportunity that violations of CIP present: via **foreign exchange (FX) swaps** and **cross-currency swaps**. We will use USD/foreign currency swaps to illustrate them, given that the CIP violations we will explore later typically involve the USD and a second foreign currency like the Euro or the Yen.

Foreign Exchange (FX) Swaps

In an FX swap, the two parties agree to swap USD for an FC today at the spot rate (USD/FC) and simultaneously agree to swap back at the forward rate at maturity. In effect, one party is lending USD and borrowing the FC, and the other party is lending the FC and borrowing USD. FX swap contracts are typically quoted in forward points ($F - S$). Since 2008, the USD has tended to command a premium relative to the FC in FX swaps: the party lending USD can sell the FC forward at a price F that is higher than indicated by the interest rate differential. We can use the second form of CIP we previously introduced to show this premium. Typically, $(F - S)$ has been “too wide” and CIP has not held, such that:

$$F - S > S \left(\frac{1 + r}{1 + r^*} - 1 \right)$$

Cross-Currency Basis Swaps

Cross-currency basis swaps are similar to FX swaps in that both parties swap currencies at the outset of the contract at the current spot rate. However, there are important differences:

- Cross-currency swaps are longer term, often more than one year.
- At maturity, the currencies are swapped back at the original spot rate (not the forward rate, as in an FX swap).
- During the life of the contract, the counterparties exchange interest payments; the reference rates are the interest rates of the two currencies plus the basis (b).

The cross-currency swap basis (b) is the amount by which the USD interest rate must be adjusted so that CIP holds (assuming $F - S$ is too wide), as previously discussed. This is shown in the following formula:

$$F - S = S \left(\frac{1 + r + b}{1 + r^*} \right) - S$$

The effect is that when CIP does not hold, the party borrowing the USD pays the basis in addition to the USD interest rate, while the party borrowing the FC pays less than the FC interest rate by the amount of the basis. Note that if CIP holds throughout the life of the contract, then the basis is equal to zero and the cross-currency basis swap is simply a straightforward floating-for-floating currency swap.

LO 75.b: Identify key factors that affect the cross-currency swap basis.

There are two key factors that can cause deviations from CIP and, consequently, cause the cross-currency swap basis to change and not be equal to zero in times of financial crisis: (1) decline in market liquidity and (2) increases in the risk of the underlying instruments that gives rise to risk premia.

The first factor is lack of market liquidity in the underlying forward and spot FX contracts resulting from an external financial crisis. The result of this lack of liquidity is wider bid-ask spreads that increase the transactions costs of executing the FX swap and eliminate the arbitrage opportunity.

The second factor is risk premia that result from increases in counterparty credit risk in the underlying FX markets (measured using LIBOR-OIS spreads) and increases in sovereign credit risk in the government bonds used in CIP arbitrage (measured using sovereign credit default swap [CDS] spreads). Even small increases in risk premia can have a significant impact on arbitrageurs' ability to execute the underlying trades if the hedging demand for one of the currencies is sufficiently large.

LO 75.c: Assess the causes of covered interest rate parity violations after the financial crisis of 2008.

The financial crisis of 2007–2009 and subsequent continued violations of CIP even after the crisis subsided forced market participants to look for other factors that can lead to a non-zero cross-currency basis. We will discuss first why the basis opens up post-crisis and second, why it does not close.

Why the Basis Opens Up: Demand for Currency Hedges

As mentioned previously, even small risk premia that are present during noncrisis times can make it difficult to arbitrage violations of CIP if the hedging demand for the currency is large enough. There are three sources of hedging demand that have grown since the crisis:

- The first source of currency hedging demand is from banks managing currency mismatches on their balance sheets using FX swaps.

- The second source of currency hedging demand is from institutional investors (like insurance companies and banks) using FX swaps to hedge the foreign currency risk in their investment portfolios.
- The third source of currency hedging demand is from U.S. nonfinancial firms issuing foreign-currency denominated debt when credit spreads narrow in foreign debt markets. These firms then swap the FC proceeds back to USD using FX swaps.

Why the Basis Does Not Close: Limits to Arbitrage

In the absence of additional market constraints, even if the basis does open up, it should close very quickly as arbitrageurs exploit the opportunity. However, this type of arbitrage is both costly and risky and it requires an expansion of the arbitrageur's balance sheet. With that expansion comes credit risk on both sides of the arbitrage trade (borrowing and lending) and capital and funding risk, as well as liquidity risk when faced with mark-to-market requirements.

These risks have always been there, but post-crisis market participants have been managing their balance sheets—and the accompanying risks and exposures—much more carefully. This has resulted from pressure from regulators, shareholders, and creditors. The bottom line is that limits to arbitrage resulting from careful balance sheet management has limited the impact of arbitrage activities on the cross-currency basis, and as a result, violations of CIP persist.



MODULE QUIZ 75.1

1. The cross-currency swap basis is:
 - A. the interest rate differential in a cross-currency swap.
 - B. the price to the long position in a cross-currency swap.
 - C. the difference between the forward and spot exchange rates in a cross-currency swap.
 - D. the amount by which the interest rate of one currency must be adjusted in a cross-currency swap so that covered interest parity (CIP) holds.
2. In an foreign exchange (FX) swap:
 - A. the price is quoted in forward points.
 - B. the term is typically more than one year.
 - C. the counterparties swap currencies back at the end of the contract at the original spot rate.
 - D. the counterparties exchange net interest payments based on the reference rate during the term of the swap.
3. Since the financial crisis of 2007–2009, the cross-currency basis for most major currencies relative to the U.S. dollar (USD) has consistently been:
 - A. equal to zero.
 - B. greater than the interest rate differential.
 - C. greater than zero for the USD interest rate.
 - D. greater than the forward premium on the USD.

KEY CONCEPTS

LO 75.a

In a foreign exchange (FX) swap, the two parties agree to swap U.S. dollars for the foreign currency today at the spot rate (USD/FC) and simultaneously agree to swap

back at the forward rate at maturity. Cross-currency basis swaps are similar to FX swaps in that both parties swap currencies at the outset of the contract at the current spot rate. However, there are important differences:

- Cross-currency swaps are longer term, often more than one year.
- At maturity, the currencies are swapped back at the original spot rate (not the forward rate, as in an FX swap.)
- During the life of the contract the counterparties exchange interest payments; the reference rates are the interest rates of the two currencies plus the basis (b).

LO 75.b

There are two key factors that can cause deviations from covered interest parity (CIP) and, consequently, cause the cross-currency swap basis to change and not be equal to zero in times of financial crisis. The first is a decline in market liquidity and the second is increases in the risk of the underlying instruments that gives rise to risk premia.

LO 75.c

Since the financial crisis of 2007–2009, increased FX hedging demand has caused the cross-currency basis to open up, and limits to arbitrage have kept arbitrageurs from closing it.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 75.1

1. **D** The cross-currency swap basis (b) is the amount by which the interest rate of one currency must be adjusted so that CIP holds. This is shown in the following formula:

$$F - S = S \left(\frac{1 + r + b}{1 + r^*} \right) - S$$

(LO 75.a)

2. **A** An FX swap is quoted in forward points ($F - S$). The other choices are features of cross-currency swaps. (LO 75.a)
3. **C** Since the 2007–2009 crisis, the USD has tended to command a premium relative to the foreign currency (FC) in FX swaps; the party lending USD can sell the FC forward at a price F that is higher than indicated by the interest rate differential. That means the cross-currency swap basis has been greater than zero. (LO 75.a)

The following is a review of the Liquidity and Treasury Risk Measurement and Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Rose and Hudgins, Chapter 7.

READING 76

RISK MANAGEMENT FOR CHANGING INTEREST RATES: ASSET-LIABILITY MANAGEMENT AND DURATION TECHNIQUES

Study Session 12

EXAM FOCUS

This reading focuses on the effect of interest rate changes on bank profitability and bank capital. Banks primarily use two measures, interest-sensitive gap and duration gap, in managing their interest rate risk. For the exam, know how to calculate net interest income, net interest margin, and interest-sensitive (IS) gap. Also, understand how a bank's IS gap is related to the effects of interest changes on its net interest income (NII) and net interest margin (NIM) and how a bank can manage its IS gap. In addition, be able to calculate the duration of an asset and a bank's duration gap, given the durations of portfolio assets and liabilities. Finally, it is important to understand the limitations the IS gap and duration gap as risk measures and as tools for managing a bank's net income, net equity, and risk.

MODULE 76.1: INTEREST-SENSITIVE GAP MANAGEMENT

Asset-Liability Management Strategies

LO 76.a: Discuss how asset-liability management strategies can help a bank hedge against interest rate risk.

Bank management is focused on its NII, its equity (assets minus liabilities), and its risk. Here we do not address the credit risk of a bank's assets (loans and securities), but focus on the effects of interest rate changes on its net income and equity. First, we address the income side. A bank's net income, simply put, is the difference between the interest income earned on its assets and the interest costs of its liabilities.

Institutions take an integrated approach to balance sheet management, called **asset-liability management (ALM)**. The two sides of the balance sheet are, with respect to both profitability and risk, seen as an integrated whole. The **asset-liability committee (ALCO)** manages the process and is made up of senior management from different departments of the institution.

Funds management, as part of the ALM process, refers to:

- Decisions regarding the volume, mix, and interest rates of both assets and liabilities.
- Policies regarding assets and liabilities, which must be consistent with each other.
- Managing the revenues and costs generated from both assets and liabilities to both increase interest income and control costs.

Managing Interest Rate Risk

A fundamental risk that banks must manage is **interest rate risk**. As market interest rates change, the institution's yield on earning assets (i.e., returns on loans and securities) and cost of funds (i.e., the cost of borrowing from depositors and other lenders) will also change. This causes changes to interest income and interest expense on the bank's income statement. Additional interest rate risk, **reinvestment risk**, results from the uncertainty about the interest rate that the bank can earn from reinvesting its interest income in interest bearing assets over time.

The uncertainty about changes in the value of bank assets (securities and loans) that results from changes in market interest rates is referred to as **price risk** or **market risk**. As interest rates rise, the values of fixed income securities and fixed payment loans fall.

Banks use asset-liability strategies to manage both price risk and reinvestment risk. The mix, maturities, and amounts of assets and liabilities may be managed to reduce the effect of changes in interest rates on net income. This requires adjustment of the maturities of assets and liabilities, as well as changing the amount or mix of assets and liabilities. Financial institutions may also use off-balance-sheet solutions, such as futures and swap contracts, to hedge the risk to net income from changes in market interest rates.

Net Interest Margin and Gap Management

LO 76.b: Describe interest-sensitive gap management and apply this strategy to maximize a bank's net interest margin.

A key measure of bank performance is its **net interest margin (NIM)**:

$$\text{NIM} = \text{NII} / \text{earning assets}$$

$$\text{NII} = \text{interest income} - \text{interest expense}$$

Earning assets are the bank assets that earn income (e.g., loans and securities).

EXAMPLE: NIM

Gray Sky Bank has total assets of \$50 billion and earning assets of \$45 billion. The bank earned \$4 billion interest income and paid \$2.2 billion in interest expense.

Calculate the bank's NIM.

Answer:

$$\text{NIM} = (\$4 - \$2.2) / \$45 = 4.00\%$$

Typically, a bank's assets have longer maturities than their liabilities. A bank that holds long-term, fixed-rate mortgages funded with a short-term borrowing (e.g., federal [Fed] funds) will profit from an upward sloping yield curve because the yield on mortgage loans (long-term) will be higher than the cost of fed funds (short-term).

The **IS gap** is one measure of interest rate risk.

$$\text{IS gap} = \text{IS assets} - \text{IS liabilities}$$

If the value of a bank's IS assets is greater than the value of its IS liabilities, the bank has a positive IS gap and is said to be *asset sensitive*. If the value of its IS assets is less than the value of its IS liabilities, the bank has a negative IS gap and is said to be *liability sensitive*.

There are several steps involved in estimating the IS gap. They are:

1. Select a series of maturity buckets based on the time period until assets and liabilities will reprice (interest rates change to current market rates) (e.g., a day, a week, a month, a quarter, a year).
2. Add the assets that will reprice and the liabilities that will reprice into the specific repricing buckets. For example, determine the dollar amount of assets that will reprice in 90 days and the dollar amount of liabilities that will reprice in 90 days next quarter.
3. Calculate the IS gap for each bucket (time period).
4. Use the bucket IS gaps to estimate the change in NII and NIM for an assumed change in interest rates.

An asset or liability is rate sensitive over a given time horizon if:

- It matures.
- It is a variable-rate instrument.
- Prepayments or withdrawals are expected but uncertain.

Determination of the time period over which an asset or liability will reprice is more straightforward for securities with fixed maturities, when variable rates reset on a specified schedule, and when there are significant penalties for prepayments and withdrawals. It is more difficult to determine the repricing period when expected prepayments are uncertain and when assets or liabilities have no specified maturity dates.

Figure 76.1: Examples of IS Assets and Liabilities

IS Assets (Repriceable)	IS Liabilities (Repriceable)	Non-Rate-Sensitive Assets	Non-Rate-Sensitive Liabilities
Short-term securities	Money market funding sources such as fed funds, repurchase agreements, negotiable CDs	Cash	Non-interest-bearing demand deposits
Short-term loans	Short-term savings accounts	Long-term securities	Long-term savings and retirement accounts
Variable-rate securities or loans	Money market deposits accounts (MMDAs)	Fixed-rate loans	Long-term debt (capital notes)

The financial institution must estimate the interest sensitivity of accounts such as non-interest-bearing demand deposits. While not directly sensitive to interest rates, funds may increase or decrease in amount as rates change on alternatives to checking accounts, such as money market accounts.

The bank may also calculate a **cumulative gap** by summing the IS gaps across some or all repricing periods (buckets).

Relative gap is the IS gap relative to bank assets.

$$\text{relative gap} = \text{IS gap} / \text{total assets}$$

The **interest sensitivity ratio (ISR)** = IS assets / IS liabilities.

The relationship between the bank's IS gap and its NII is:

$$\text{change in NII} = (\text{change in rate}) \times \text{IS gap}$$

This equation is accurate when interest rates on all assets and liabilities change by the same amount, but this is an unlikely outcome. The relationships between the bank's IS gap and its NII and NIM are:

- IS gap = 0: NII and NIMM are not affected by interest rate changes.
- IS gap > 0: the bank's balance sheet is asset sensitive and an increase in rates will increase NII and NIM, while a decrease in interest rates will decrease NII and NIM.
- IS gap < 0: the bank's balance sheet is liability sensitive and an increase in rates will decrease NII and NIM, while a decrease in rates will increase NII and NIM.

Interest rate risk management is more complex than this analysis suggests. Once we relax the assumption that all interest rates at all horizons change in lock step, the weights in each bucket will affect the change in NII so that a simple average IS gap across all time periods will not suffice. Additionally, the signs of interest rate changes at the various horizons, the rates of change in interest rates at various horizons, and the rates of change for interest rates on assets and liabilities could all differ as well.

Because of these complexities, most banks use computer modeling to estimate interest rate sensitivity. However bank managers approach the task, they must choose a target

NIM (either to maintain the current NIM or increase it). The bank must then determine the volume and mix of assets and liabilities that will achieve the stated goals.

Figure 76.2 illustrates IS gap analysis and the effect of IS gap on NII and NIM in a simple case.

Figure 76.2: Example of IS Gap Analysis

Assets and Liabilities	One Month (0 to 30 Days)	Next 31 to 90 Days	91 to 365 Days	More Than One Year	Total
Assets					
Cash	150	0	0	0	150
Short-term securities	250	100	100	0	450
Business loans	200	1,100	200	200	1,700
Commercial real estate loans	500	100	50	50	700
Residential mortgages	100	100	50	1,000	1,250
Total repricing assets	1,200	1,400	400	1,250	4,250
Liabilities					
Demand deposits	1,000	0	0	0	1,000
Savings accounts	100	0	0	0	100
Money market deposit account	700	200	0	0	900
Time accounts	100	300	500	1,350	2,250
Total repricing liabilities	1,900	500	500	1,350	4,250
IS gap	-700	+900	-100	-100	
Cumulative gap	-700	+200	+100	0	
ISR	1,200 / 1,900 = 63%	1,400 / 500 = 280%	400 / 500 = 80%	1,250 / 1,350 = 93%	
Sensitivity	Liability sensitive	Asset sensitive	Liability sensitive	Liability sensitive	

Assumptions:

- Average yield on IS assets is 6%.
- Average cost of funds on IS liabilities is 3%.
- Average yield on fixed-rate assets is 7%.
- Average cost of fixed-rate liabilities is 4%.
- Average earning assets equal \$4250.
- Under these assumptions, NIM will be as follows.

Figure 76.3: Income and Expense Analysis

	One Month	31–90 Days	91–365 Days	More Than One Year
Total interest income (annualized)	$1,200 \times 0.06 + (4,250 - 1,200) \times 0.07 = 72 + 213.50 = 285.50$	$1,400 \times 0.06 + (4,250 - 1,400) \times 0.07 = 84 + 199.50 = 283.50$	$400 \times 0.06 + (4,250 - 400) \times 0.07 = 24 + 269.50 = 293.50$	$1,250 \times 0.06 + (4,250 - 1,250) \times 0.07 = 75 + 210 = 285.00$
Total interest expense (annualized)	$1,900 \times 0.03 + (4,250 - 1,900) \times 0.04 = 57 + 94 = 151$	$500 \times 0.03 + (4,250 - 500) \times 0.04 = 15 + 150 = 165$	$500 \times 0.03 + (4,250 - 500) \times 0.04 = 15 + 150 = 165$	$1,350 \times 0.03 + (4,250 - 1,350) \times 0.04 = 40.50 + 116.00 = 156.50$
NII (annualized)	$285.50 - 151 = 134.50$	$283.50 - 165 = 118.50$	$293.50 - 165 = 128.50$	$285.00 - 156.50 = 128.50$
NIM (annualized)	$134.50 / 4,250 = 3.17\%$	$118.50 / 4,250 = 2.79\%$	$128.50 / 4,250 = 3.02\%$	$128.50 / 4,250 = 3.02\%$

From Figure 76.2, we can see that the IS gaps for the four buckets are -700 for 0–30 days, 900 for 31–90 days, -100 for 91–365 days, and -100 for over 365 days. The 0–30 days bucket is liability sensitive, so equal increases in asset rates and liability rates will decrease NII. We can use the IS gap of -700 to calculate the change in NII for a 1% increase in rates as $(0.01 \times -700) = -\$7.00$ (NII for this bucket would decrease from $\$134.50$ to $\$127.50$).

From the IS gap for the 31–90 day bucket of 900 we can see that this bucket is asset sensitive. An increase in rates of 1% will increase NII for this bucket by $(0.01 \times 900) = \$9.00$ (NII for this bucket would increase from $\$118.50$ to $\$127.50$).

Note that in the example, the cumulative IS gap over all horizons is zero (as we omitted). If asset rates and liability rates all change by the same amount at all horizons, NII will be unaffected. Under a variety of other assumed changes in rates, NII would be affected. Given a set of expectations about interest rate changes, the bank may choose assets and liabilities in each bucket to change there. It could also use derivative contracts, such as futures or swaps, to hedge the risk. Also, banks that are confident in their interest rate forecasts may try to shift the IS gap one way or the other (i.e., toward asset sensitivity or liability sensitivity) to profit from expected rate changes.



MODULE QUIZ 76.1

- An integrated approach to managing balance sheet interest rate risk is called:
 - asset management.
 - liability management.
 - asset-liability management (ALM).
 - asset-liability and owners' equity management.
- A bank has a portfolio of short-term bonds. Holding the bank's earning assets and cost of funds constant, in a rising interest rate environment, the bank's:
 - NII and NIM will remain steady.
 - NII and NIM will decline.
 - NII and NIM will increase.
 - NII will decrease and NIM will increase.

3. A mortgage bank has the major part of its assets in 30-year, fixed-rate mortgages. The bank has a small amount of core deposits but is mostly funded with repurchase agreements and one-quarter negotiable certificates of deposit (CDs). The bank's 91-day interest-sensitive (IS) gap is most likely:
 - A. positive.
 - B. negative.
 - C. zero.
 - D. equal to its duration gap.
4. The net interest margin (NIM) of a bank with a positive interest-sensitive (IS) gap will:
 - A. increase as interest rates increase.
 - B. increase as interest rates decrease.
 - C. decrease as interest rates increase.
 - D. any of these might happen.
5. Paul Saunders, a risk manager and member of the asset-liability committee (ALCO) at National Bank and Trust, is considering strategies to hedge the bank's net interest margin (NIM) against expected increasing interest rates. The bank currently has negative cumulative interest-sensitive (IS) gap positions over the one-month, one-quarter, and one-year maturity buckets. Which would be the least effective strategy?
 - A. Selling long-term Treasury bonds and purchasing short-term Treasury bonds.
 - B. Shifting from a focus on making fixed-rate mortgages to a focus on making variable-rate mortgages.
 - C. Increasing the volume of overnight funding from the fed funds market and relying less on long-term funding from the Federal Home Loan Bank.
 - D. Shifting funding from overnight repurchase agreements to five-year retail certificates of deposits.

MODULE 76.2: DURATION GAP MANAGEMENT

LO 76.c: Describe duration gap management and apply this strategy to protect a bank's net worth.

Even when a bank uses IS gap to manage the interest rate risk of their net investment income, there is still interest rate risk with regard to the bank's net worth, the value of its assets minus the value of its liabilities. The effect of a change in interest rates on the values of a bank's assets and liabilities can be approximated with duration.

Recall that the duration of a bond is calculated as the time-weighted average of the present value of its expected cash flows as a percentage of its current (present) value. The expected percentage change in a bond's value based on its duration (D), in response to a change in the appropriate interest rate of Δi , can be calculated as:

$$\frac{\Delta P}{P} \approx -D \times \frac{\Delta i}{1 + i}$$

where:

P = the present value of the bond's cash flows

i = the bond's current yield to maturity

The duration of a portfolio of securities can be estimated as a weighted average of the durations of the securities in the portfolio. The following example provides a simple example of this calculation.

EXAMPLE: Portfolio duration and change in total assets

A bank has the following assets with the given current values and durations, based on a discount rate of 2.5%.

Type of Securities	Current Market Value	Duration
Residential mortgages	\$120 million	7.4 years
Commercial loans	\$40 million	0.8 years
Treasury securities	\$60 million	6.5 years
Consumer loans	\$30 million	1.4 years
Total assets	\$250 million	

1. **Calculate** the duration of the bank's asset portfolio.

The weighted average duration (with portfolio proportions as weights) is calculated as:

$$[(120 \times 7.4) + (40 \times 0.8) + (60 \times 6.5) + (30 \times 1.4)] / 250 = 5.41$$

2. **Estimate** the change in the market value of total assets for an increase in the appropriate discount rate from 2.5% to 3%.

The duration-based estimate of the percentage change in total assets is:

$$\frac{\Delta P}{P} = -D \left(\frac{\Delta i}{1+i} \right) = -5.41 \times \frac{0.005}{1.025} = -0.0264$$

The change in the value of total assets is:

$$-0.0264 \times \$250 \text{ million} = -\$6.6 \text{ million}$$

An increase in the interest rate of 0.5% is expected to decrease the value of assets by \$6.6 million.

If assets were equal to liabilities, we could match the duration of assets (D_A) to the duration of its liabilities (D_L) to minimize the effect of interest rate changes on the bank's net worth.

In practice, however, assets are typically greater than liabilities (i.e., the bank has positive net worth). In this case, equal percentage changes in asset and liability values will not leave net worth unchanged. If the durations of assets and liabilities are equal, net worth will be changed by a change in the interest rate applicable to both assets and liabilities. We must take into account the initial values of assets and liabilities, so that the changes in their dollar values in response to a change in interest rates are approximately equal.

The **leverage-adjusted duration gap** takes the values of total assets and total liabilities into account.

$$\text{leverage-adjusted duration gap} = D_A - D_L \times \frac{\text{total liabilities}}{\text{total assets}}$$

This means that in order to minimize the effects of interest rate changes on its net worth a bank must manage D_A and D_L so that the leverage-adjusted duration gap is equal to zero. The relationship between asset duration and liability duration must be:

$$D_A = D_L \times \frac{\text{total liabilities}}{\text{total assets}}$$

Recall that a duration-based estimate of the change in security value is only an approximation. In practice, our estimate would be improved by also including the effect of convexity on the change in security value.

To summarize, in order to hedge net worth against rate increases, banks should examine the duration of each of the bank's assets and liabilities. The ALCO should:

- Calculate the duration of loans, securities deposits, money market funding, et cetera.
- Weight each of the durations by the market values of each instrument.
- Sum the weighted durations to determine the duration of the asset and liability portfolios.
- Calculate the duration gap.

The effect of the (leverage-adjusted) duration gap on the market (price) risk of assets and liabilities is:

- **Zero duration gap.** The effect of changes in interest rates on net worth are minimized.
- **Positive duration gap (assets have more dollar market risk than liabilities).** Net worth has interest rate risk, increases in rates will decrease net worth, and asset value will decrease more than liability value.
- **Negative duration gap.** Net worth has interest rate risk and increases in rates will increase net worth (liability value will fall more than asset value).

Basically, the larger the magnitude of the leverage-adjusted duration gap, the greater the impact on net worth, for a given change in rates. A bank can attempt to structure the balance sheet such that the leverage-adjusted duration equals zero, insulating the bank's net worth from interest rate changes. The bank might also use derivatives to move the leverage-adjusted duration gap toward zero.

Gap Management Limitations

LO 76.d: Discuss the limitations of interest-sensitive gap management and duration gap management.

Limitations of Interest-Sensitive Gap Management

One limitation of using the IS gap as a measure of the uncertainty about NII due to interest rate changes is that rates on assets and liabilities may not move together. For example, banks may be slow to raise savings rates but quick to adjust loan rates in a rising rate environment. Banks have developed a weighted IS gap measure to account for the different speeds with which assets and liabilities adjust to rising or falling rates.

For example, the bank may apply a weight of 1.0 to the fed funds rate (market driven) but 0.5 to savings rates (changed at the bank's discretion). The bank may weight a highly volatile security 1.4. This weighted approach better reflects how rates on assets and liabilities reprice when market rates change and better reflect of the risk to NII, versus the simple IS gap analysis, which assumes all rates move in unison.

Second, the point at which assets and liabilities reprice is often not easy to identify. Banks may adjust rates on interest bearing demand deposits and savings accounts at any time, not just when the Fed increases or decreases the target fed funds rate. Also, rates may change at different speeds for different types of securities. A bank could have variable-rate loans that reprice annually, financed with short-term funds that reprice daily. While the cumulative IS gap is zero and the bank appears to be immunized against interest rate changes, the reality is that NII will vary over the year as the cost of funding adjusts with market rates.

Limitations of Duration Gap Management

It is often difficult to define the pattern of cash flows for instruments such as demand deposits and savings accounts, making it difficult to calculate their durations. Prepayments on loans, which affect duration, may be uncertain.

Duration, as a measure of price sensitivity to changes in interest rates, is more accurate for small changes in rates. For larger changes in rates, it is less accurate due to the convexity of the relation between securities values and their yields to maturity.

Duration is based on parallel changes to a parallel yield curve and is therefore an approximation of sensitivity of asset and liabilities values to interest rate change, at best. Our analysis was based on an assumption that yields change the same amount at all maturities by the same amounts for both assets and liabilities. In practice, short-term rates differ from longer-term rates. Interest rates can change in different amounts and at differing speeds for different assets and liabilities. Analysts should be aware of these limitations, however, duration gap analysis is a useful tool for estimating the effect of changes in interest rates on a bank's capital position.



MODULE QUIZ 76.2

1. A bank has the major part of its assets in 30-year fixed-rate mortgages. The bank has a small amount of core deposits but is mostly funded with repurchase agreements and negotiable certificates of deposit (CDs). Assuming the bank's assets are approximately 10% greater than its liabilities, the bank's leverage-adjusted duration gap is most likely:
 - A. positive.
 - B. negative.
 - C. zero.
 - D. equal to its duration gap.
2. Frank Bloomfield, a risk manager and asset-liability committee (ALCO) member at Bloomfield Bank, makes two statements to investors regarding the impact on the bank's capital and profitability. The bank has a positive leverage-adjusted duration gap and negative interest-sensitive (IS) gap. Bloomfield states the following:

Statement 1: Our bank has a positive leverage-adjusted duration gap, so the expected increasing interest rate environment will improve our bank's capital position.

Statement 2: Our bank has a negative IS gap, so the expected increasing interest rate environment will improve our bank's NIM.

Which of the following is most correct?

- A. Both statements made by Bloomfield are correct.
 - B. Both statements made by Bloomfield are incorrect.
 - C. Statement 1 is correct; statement 2 is incorrect.
 - D. Statement 1 is incorrect; statement 2 is correct.
3. Which of the following is a limitation associated with duration gap?
- A. Rates on assets and liabilities may not move together.
 - B. Rates may change at different speeds within a maturity bucket.
 - C. The point at which assets and liabilities reprice is not easy to identify.
 - D. It may be difficult to define the pattern of cash flows for instruments such as demand deposits.

KEY CONCEPTS

LO 76.a

Asset-liability management refers to selecting assets and liabilities to control interest rate risk. Changes in interest rates will affect net interest income (NII) as well as a bank's capital position, as the values of both assets and liabilities are affected by changes in interest rates.

LO 76.b

A key measure of bank performance is net interest margin (NIM), calculated as:

$$\text{NIM} = \text{net interest income} / \text{earning assets}$$

$$\text{NII} = \text{interest income} - \text{interest expense}$$

The interest-sensitive (IS) gap for assets and liabilities is calculated for securities based on the time period over which their interest rates adjust to changes in market rates.

For assets and liabilities that reprice over a specific period (a bucket):

$$\text{IS gap} = \text{IS assets} - \text{IS liabilities}$$

The steps involved in estimating the bank's IS gap are:

1. Select a series of maturity buckets for determining when assets and liabilities will reprice (e.g., one month, one quarter, one year).
2. Add the assets that will reprice and the liabilities that will reprice into the specific repricing buckets.
3. Calculate the IS gap for each bucket by taking the difference between the rate-sensitive assets and rate-sensitive liabilities.
4. Estimate the change in NII and NIM given an assumed change in interest rates.

Bank managers use the IS gap to manage the effect of interest rate changes on NII and NIM. The bank can hedge interest rate risk, moving IS gap toward zero. The bank can also use IS gap and interest rate forecasts to aggressively manage NII and NIM, based on their expectations about future interest rate changes.

LO 76.c

Duration is a time-weighted measure of maturity that considers the amount and timing of each of an asset's or liability's cash flow. It is also a measure of interest rate sensitivity. Duration gap is a measure of the market (price) risk on assets relative to the market (price) risk on liabilities. The leveraged duration gap measures the effect of interest rate changes on the balance sheet (i.e., on the bank's equity capital). The leverage-adjusted duration gap is calculated as:

$$D_A - D_L \times \frac{\text{total liabilities}}{\text{total assets}}$$

LO 76.d

There are limitations associated with IS gap. They are:

- Rates on assets and liabilities may not move together.
- Rates may change at different speeds within a maturity bucket.
- The point at which assets and liabilities reprice is not easy to identify. For example, banks may adjust rates on interest-bearing demand deposits and savings accounts at any time.
- An aggressive approach to NII and NIM management via IS gap may increase earnings volatility, which may in turn negatively affect the bank's stock price.

There are limitations associated with duration gap. They are:

- It may not be possible for the bank to match the durations of assets to the duration of liabilities, even if managers prefer a zero duration gap.
- The durations of shorter-term securities and loans are closer to their maturities than the durations of longer-term securities and loans.
- It is often difficult to define the pattern of cash flows for instruments such as demand deposits and savings accounts, making it difficult to calculate the instrument's duration.
- Duration gap is more effective for small changes in rates and rate changes that affect the entire yield curve, than for large changes and/or slope changes in the yield curve.
- Duration shifts as rates change.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 76.1

1. **C** Financial institutions take an integrated approach to balance sheet management, called ALM. The two sides of the balance sheet are seen as an integrated whole. Banks do engage in capital planning and management, but it is not called asset-liability and owners' equity management. (LO 76.a)

2. **C** The short-term bonds (assets) will reprice while the cost of funds holds steady, increasing NII and NIM. (LO 76.b)
3. **B** This bank likely has a negative IS gap because assets are not likely to reprice over the next 91 days (or at least only a very small portion will) but all of the negotiable CDs will reprice each quarter. (LO 76.b)
4. **A** The NIM of a bank with a positive IS gap will increase as interest rates increase. The bank is asset sensitive, meaning that assets will reprice faster than liabilities, increasing net interest income (NII) and NIM. (LO 76.b)
5. **C** The bank needs to shift toward a zero or positive IS gap position from a negative gap position. The bank will see NIM squeezed in a rising rate environment as the cost of funds increases faster than the yield on earning assets. Any strategy that makes assets more rate sensitive or liabilities less rate sensitive will accomplish Saunders' goal. Thus, the least effective would be shifting into shorter-term funding (which will get more expensive in a rising rate environment) and out of longer-term funding. The least effective strategy would be to increase overnight funding from the fed funds market and shrink longer-term funding from the Federal Home Loan Bank. (LO 76.b)

Module Quiz 76.2

1. **A** Given the large difference between the average maturity of its assets and its liabilities, the leverage-adjusted duration gap will be positive. This bank has long maturity (duration) assets funded with short maturity (duration) liabilities. This means the bank's duration gap will be positive, while its IS gap is likely negative (with a positively sloped yield curve). (LO 76.d)
2. **B** Both statements made by Bloomfield are incorrect. If the bank has a positive duration gap, capital will decline as interest rates increase. Asset values will fall more than liability values, reducing capital. If the bank has a negative IS gap, the cost of funds will increase faster than the yield on earning assets in an increasing rate environment, shrinking the bank's NIM. (LO 76.c)
3. **D** It is difficult to calculate the duration of an asset or liability if the cash flow pattern is difficult to define. Rates on assets and liabilities moving out of sync and changing at different speeds within a maturity bucket are limitations associated with an IS gap. Also, the difficulty identifying the point at which assets and liabilities reprice is also a problem associated with an IS gap. (LO 76.d)

READING 77

ILLIQUID ASSETS

Study Session 12

EXAM FOCUS

This reading examines illiquid asset market characteristics and the relationship between illiquidity and market imperfections. Reported return biases are discussed as well as the illiquidity risk premium within and across asset classes. For the exam, understand that all markets, even highly liquid markets such as commercial paper, can be illiquid at some points in time. Also, know the three biases that impact reported returns of illiquid asset classes (survivorship bias, sample selection bias, and infrequent sampling). Finally, understand the factors that influence the decision to include illiquid asset classes in a portfolio.

MODULE 77.1: ILLIQUID MARKETS, MARKET IMPERFECTIONS, BIASES, AND UNSMOOTHING

Illiquid Asset Markets

LO 77.a: Evaluate the characteristics of illiquid markets.

There are several characteristics that describe illiquid asset markets, including:

1. Most asset classes are illiquid, at least to some degree.
2. Markets for illiquid assets are large.
3. Illiquid assets comprise the bulk of most investors' portfolios.
4. Liquidity dries up even in liquid asset markets.

Most Asset Classes Are Illiquid

All markets, even large-cap equity markets, are somewhat illiquid. It is clear, however, that some assets (e.g., real estate) are less liquid than others (e.g., public equities). Illiquid assets trade infrequently, in small amounts, and generally exhibit low turnover. For example, there are mere seconds between transactions in public equity markets with an annualized turnover rate greater than 100%. In contrast, over-the-counter (OTC) equities typically trade within a day, but sometimes a week or more may pass

between trades, with annualized turnover of 25% to 35%. Corporate bonds trade daily, and municipal bonds typically trade semiannually. At the far end of the liquidity spectrum is institutional infrastructure with an average investment commitment of 50 to 60 years (up to 99 years), and art, with 40 to 70 years between transactions. There is negligible turnover in infrastructure. Turnover in residential real estate is about 5% per year, while turnover in institutional real estate is approximately 7%. Time between real estate transactions can range from months to decades.

Markets for Illiquid Assets Are Large

The size of the U.S. residential mortgage market was \$16 trillion in 2012. The institutional real estate market was measured at \$9 trillion. In contrast, the market capitalization of the NYSE and Nasdaq combined was approximately \$17 trillion. The total wealth held in illiquid assets exceeds the total wealth in traditional, liquid stock, and bond markets.

Investor Holdings of Illiquid Assets

The home is often an individual's most valuable asset. As a result, illiquid assets represent approximately 90% of total wealth, not counting human capital, the largest and least liquid asset for many individual investors. High net worth individuals in the United States even typically allocate 10% of portfolios to fine art and jewelry, known as treasure assets. High net worth individuals in foreign countries hold an average of 20% in treasure assets. Institutional investors have also increased allocations to illiquid assets over the last 20 years. University endowments have increased allocations of illiquid assets to approximately 25%, up from 5% in the early 1990s. Pension funds have increased allocations to approximately 20%, up from 5% in 1995. In general, investors hold sizeable amounts of illiquid assets.

Liquidity Can Dry Up

In stressed economic periods, such as during the 2007–2009 financial crisis, liquidity can dry up. For example, money markets froze (i.e., repurchase agreement and commercial paper markets) during the crisis as investors were unwilling to trade at any price. Residential and commercial mortgage-backed securities markets, structured credit markets, and the auction rate securities market, a market for floating rate municipal bonds, also became illiquid during the crisis. The auction rate securities market is still frozen, more than six years later. Major liquidity crises have occurred at least once every 10 years across the globe, in conjunction with downturns and financial distress.

Market Imperfections

LO 77.b: Examine the relationship between market imperfections and illiquidity.

Many economic theories assume that markets are perfect. This means that market participants are rational and pursue utility maximization, that there are no transaction costs, regulation or taxes, that assets are perfectly divisible, that there is perfect

competition in markets, and that all market participants receive information simultaneously. The reality, though, is that markets are imperfect.

Imperfections that encourage illiquidity include:

- **Market participation costs.** There are costs associated with entering markets, including the time, money, and energy required to understand a new market. In many illiquid markets, only certain types of investors have the expertise, capital, and experience to participate. This is called a **cliente effect**. There will be less liquidity in markets that are suited to a limited number of investors and/or where there are barriers to entry in terms of required experience, capital, or expertise.
- **Transaction costs.** Transaction costs include taxes and commissions. For many illiquid assets, like private equity, there are additional costs, including costs associated with performing due diligence. Investors must pay attorneys, accountants, and investment bankers. These costs can impede investment.

When acknowledging the existence of transaction costs (i.e., acknowledging that markets are imperfect), some academic studies assume that as long as an investor can pay the transaction costs (and sometimes these costs are large), then any investor can transact (i.e., any asset can be liquid if one can pay the transaction cost). However, this is not always true. For example, there are:

- **Difficulties finding a counterparty (i.e., search frictions).** For example, it may be difficult to find someone to understand/purchase a complicated structured credit product. It may also be difficult to find buyers with sufficient capital to purchase an office tower or a skyscraper in a city like New York. No matter how high the transaction cost, it may take weeks, months, or years to transact in some situations.
- **Asymmetric information.** Some investors have more information than others. If an investor fears that the counterparty knows more than he does, he will be less willing to trade, which increasing illiquidity. When asymmetric information is extreme, people assume all products are lemons. Because no one wants to buy a lemon, markets break down. Often liquidity freezes are the result of asymmetric information. Because investors are looking for non-predatory counterparties who are not seeking to take advantage of asymmetric information, information itself can be a form of search friction.
- **Price impacts.** Large trades can move markets, which, in turn, can result in liquidity issues for the asset or asset class.
- **Funding constraints.** Many illiquid assets are financed largely with debt. For example, even at the individual level, housing purchases are highly leveraged. As a result, if access to credit is compromised, investors cannot transact.

Illiquid Asset Return Biases

LO 77.c: Assess the impact of biases on reported returns for illiquid assets.

LO 77.d: Explain the unsmoothing of returns and its properties.

In general, investors should be skeptical of reported returns in illiquid asset markets. The reason is that reported returns are generally overstated. There are reporting biases that result in inflated returns. Three main biases that impact returns of illiquid assets are:

- Survivorship bias.
- Selection bias.
- Infrequent trading.

Survivorship Bias

There are no requirements for certain types of funds (e.g., private equity, hedge funds, buyout funds, and so on) to report returns to database providers. As such, poorly performing funds have a tendency to stop reporting. Additionally, funds may never begin reporting because returns are not high enough to appeal to investors. This results in **reporting biases**. In addition, many poorly performing funds ultimately fail. Performance studies generally include only those funds that were successful enough to survive over the entire period of analysis, leaving out the returns of funds that no longer exist. Both of these factors result in reported returns that are too high. This is called **survivorship bias**. Non-surviving funds have below average returns and surviving funds have above average returns, but it is the surviving fund returns that are reported. Studies show mutual fund returns are 1% to 2% lower than reported and returns may be as much as 4% lower for illiquid asset markets. While the solution to survivorship bias seems obvious (to observe the entire universe of funds), it is impossible to do in illiquid asset markets.

Sample Selection Bias

Asset values and returns tend to be reported when they are high. For example, houses and office buildings typically are sold when values are high. Often, a seller will wait until property values recover before selling. These higher selling prices are then used to calculate returns. This results in **sample selection bias**.

The problem with selection bias is especially prevalent in private equity markets. Buyout funds take companies public when stock prices are high. Venture capitalists sell companies when values are high. Distressed companies are often not liquidated and left as shell companies (these are sometimes called zombie companies). It is difficult to tell, based on old data without any recent transactions, if a company is alive or whether it is a “zombie” company.

Impacts of sample selection bias include:

- Higher reported alphas relative to true alphas because only high prices are recorded. For example, one study estimates an alpha of more than 90% for venture capital log returns. However, alpha falls to -7% after correcting for sample selection bias. Another study estimates returns are decreased 2% to 5% per month if you correct for the bias.
- Lower reported betas than true betas because there are fewer (only high) prices recorded, flattening the security market line (SML). The effect is smaller for real estate returns because volatility is lower than in private equity and studies often

include downturns such as what happened in real estate in the early 1990s and the early 2000s.

- Lower reported variance of returns than the true variance of returns because only high returns are counted (i.e., underestimated risk).

In sum, sample selection bias results in overestimated expected returns and underestimated risk as measured by beta and the standard deviation of returns (i.e., volatility).

Infrequent Trading

Illiquid assets, by definition, trade infrequently. **Infrequent trading** results in underestimated risk. Betas, return volatilities, and correlations are too low when they are computed using the reported returns of infrequently traded assets. Returns for these infrequently traded assets are smoothed. For example, if one compares quarterly returns to the daily returns of the same asset, quarterly returns will appear (and actually be) less volatile. Prices will often be higher or lower in a given investment horizon, than it appears when examining quarterly returns. The computed standard deviation of returns often will be lower when examining quarterly returns compared to daily returns. Also, correlations with other asset classes (e.g., liquid assets such as large-cap stocks) will be artificially low because return volatility is muted by infrequent trades.

It is possible to unsmooth or de-smooth returns using **filtering algorithms**. Filtering algorithms generally remove noise from signals. However, unsmoothing adds noise back to reported returns to uncover the true, noisier returns. Unsmoothing returns affects risk and return estimates, and could have a dramatic effect on returns. For example, reported real estate returns during the 1990s downturn were -5.3%. The corresponding unsmoothed returns were -22.6%. The National Council of Real Estate Investment Fiduciaries (NCREIF) returns reached -8.3% in December 2008. Unsmoothed returns during the same quarter were -36.3%. The standard deviation of the raw returns was 2.25% during the same quarter compared to 6.26% for unsmoothed returns. For comparison, stock return volatility was approximately 7.5% per quarter. Correlations between the S&P 500 Index and NCREIF returns increased from 9.2% to 15.8% when returns were unsmoothed.



MODULE QUIZ 77.1

1. Global liquidity crises generally occur because:
 - A. governments choose not to engage in monetary policy actions to stimulate economies.
 - B. financial distress causes markets to freeze.
 - C. markets for illiquid assets shrink, causing liquidity issues to infect traditional asset classes.
 - D. transaction costs increase as developing economies get stronger.
2. When an investor has difficulty finding a counterparty for a complicated credit product like a structured debt instrument, this is known as:
 - A. market participation costs.
 - B. agency costs.
 - C. search frictions.
 - D. selection bias.

3. Blue Sky Funds, a private equity fund, has suffered low returns for the last five years. As a result, the fund has decided to quit reporting returns. The fund did report returns each year for the last 10 years when performance was strong. This problem of reporting leads to:
- A. survivorship bias.
 - B. sample selection bias.
 - C. infrequent trading bias.
 - D. attrition bias.

MODULE 77.2: ILLIQUIDITY RISK PREMIUMS AND PORTFOLIO ALLOCATION TO ILLIQUID ASSETS

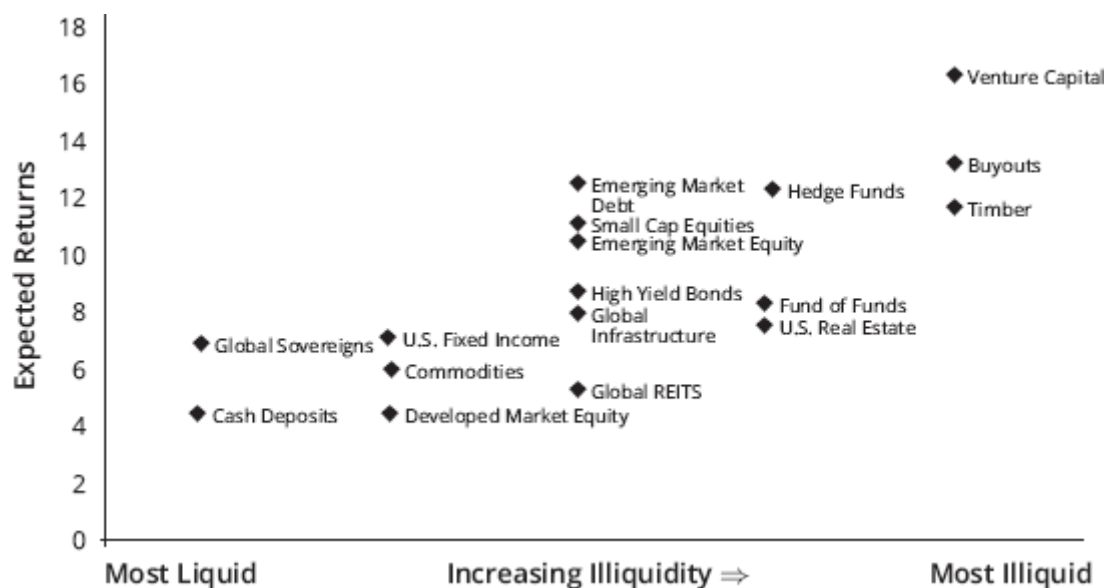
Illiquidity Risk Premiums

LO 77.e: Compare illiquidity risk premiums across and within asset categories.

Illiquidity Risk Premiums Across Asset Classes

As part of the analysis in Antti Ilmanen's 2011 book *Expected Returns*¹, we can relate liquidity to expected returns as shown in Figure 77.1. Note, however, that we cannot completely pigeonhole asset classes based on illiquidity (e.g., some private equity funds are more liquid than some hedge funds or infrastructure investments). Also note that, in this analysis, returns are computed over the period 1990 to 2009 and the illiquidity estimates are just estimates (i.e., they represent Ilmanen's opinions). Ilmanen's work does imply a positive relationship between the illiquidity of an asset class and its expected return. Venture capital is considered the least liquid and has the highest expected return, between 16% and 17%. Buyout funds and timber are also illiquid but command lower expected returns, approximately 13% and close to 12%, respectively. Hedge funds are more liquid and are expected to earn a little more than 12%. Real estate is on par with hedge funds in terms of liquidity but commands a lower return of nearly 8%. Equities are much more liquid and earned a bit more than 4% over the period. Cash is the most liquid and it too earned a little over 4% during the period.

Figure 77.1: Liquidity vs. Expected Returns



It is the conventional view that there is a premium for illiquidity. However, this may not be true. First, there are illiquidity biases. As discussed previously, reported returns of illiquid assets are too high (i.e., overstated if using raw, unsmoothed data) and risk and correlation estimates are too low.

Second, illiquid asset classes such as private equity, buyout funds, and physical assets like timber contain significant risks beyond liquidity risk. After adjusting for these risks, illiquid asset classes are much less attractive. According to one study, after adjusting for risk, most investors are better off investing in the S&P 500 than in a portfolio of private equity.

Third, there is no “market index” for illiquid assets. Private equity, hedge fund, and real estate indices are not investable, so no investor is actually earning the index return. For example, the NCREIF includes thousands of properties. Because individuals do not typically own thousands of properties, they are much more subject to idiosyncratic risks and are less diversified within the asset class.

Fourth, you must rely on manager skill in illiquid asset classes. There is no way, as there is with tradeable, cheap bond and equity index funds, to separate factor risk (i.e., systematic risk) from the talents of fund managers. As noted, there is no way to earn index returns. If an investor cannot earn index returns in illiquid asset class markets, he has no way of separating passive returns from alpha generated by active managers.

These factors imply that it may not be possible to generate substantial illiquidity risk premiums across illiquid asset classes. However, there is evidence of large illiquidity risk premiums within asset classes.

Illiquidity Risk Premiums Within Asset Classes

Less liquid assets generally have higher returns than more liquid assets, within asset classes. Currently, there is no formal theory about why illiquidity risk premiums exist within asset classes but not between. It might be that investors simply overpay for illiquid asset classes, chasing the illusion of higher returns. It may also be that firms do not manage portfolios as a cohesive whole, but instead put asset classes in different silos. Mispricing (i.e., the lack of a premium across classes) may be due to slow-moving

capital across classes, limits to arbitrage, and institutional constraints (e.g., the fixed-income desk doesn't talk to the equity traders, and so on).

Illiquidity Effects in U.S. Treasury Markets

On-the-run (i.e., newly issued) Treasury bills (T-bills) are more liquid and have lower yields than off-the-run (seasoned) T-bills. The difference is called the on-the-run/off-the-run bond spread. During the 2007–2009 financial crisis, same maturity T-bonds and T-notes traded with different yields. While prices should have been the same, T-bond prices were more than 5% lower than T-note prices. Given that the U.S. Treasury market is one of the largest and most liquid in the world, it is surprising to observe large illiquidity effects.

Illiquidity Effects in Corporate Bond Markets

Larger bid-ask spreads and infrequent trading led to higher yields in corporate bond markets. Studies indicate that illiquidity risk explains 7% of the variation in investment grade bond yields and 22% of the variation in junk bond yields. Also, as bid-ask spreads increase, yield spreads increase by more than double the amount (e.g., a one-basis point increase in the bid-ask spread results in a more than two-basis point increase in the yield spread).

Illiquidity Effects in Equity Markets

There are several variables related to illiquidity that are shown to impact equity returns. Studies indicate that less liquid stocks earn higher returns than more liquid stocks. Illiquidity factors that impact equity returns are:

- Bid-ask spreads.
- Volume.
- Turnover.
- Volume measured by whether the trade was initiated by buyers or sellers.
- Ratio of absolute returns to dollar volume, called the “Amihud measure.”
- Price impact of large trades.
- Informed trading measures (i.e., adverse selection).
- Quote size.
- Quote depth.
- Frequency of trades.
- Number of “zero” returns (in liquid markets returns are usually not zero).
- Return autocorrelations (which are a measure of stale prices).

All of these factors are characteristics of illiquidity that are unique to each stock. There are also illiquidity risk betas that are covariances of stock returns with illiquidity factors. Researchers estimate illiquidity risk premiums at 1% to 8% depending on the illiquidity measure used. Research also indicates that risk premiums have declined, although studies find a 1% risk premium for listed equities compared to a 20% risk premium for OTC stocks.

Secondary Markets for Private Equity and Hedge Funds

Private equity funds trade companies with each other, providing needed liquidity. In 2005, these secondary buyouts represented about 15% of all private-equity buyout deals. This does allow funds to get out of specific deals, may give limited partners (LPs) some cash in the process, and may allow LPs to better understand the values of portfolio companies. However, secondary buyouts do not allow limited partners to get out of the private equity fund itself.

LPs can exit private equity funds in secondary markets. However, these markets are immature, small, and more opaque. Firms participating in these markets on the buy side were called vultures in the 1990s. Buyers took advantage of distressed sellers, getting discounts of 30% to 50%. Discounts fell below 20% in the early 2000s, but shot up again during the 2007–2009 financial crisis.

Harvard University saw its endowment fall by more than \$8 billion, or 22%, between July 1, 2008, and October 31, 2008. Harvard relies on the endowment for some of its operating funds. Endowment fund managers attempted to sell stakes in private equity to free up cash for operations and faced discounts of 50%.

Because hedge fund investors can typically redeem their investments at predetermined dates, discounts on secondary market transactions are much smaller than in private equity investments. During the 2007–2009 financial crisis, hedge fund discounts were 6% to 8% on average. Some funds traded at a premium, even during the crisis, due to strong demand (i.e., the funds were closed to new investors). Large asset owners like sovereign funds and pension funds can supply liquidity in hedge fund and private equity markets, buying stakes at reduced prices and harvesting illiquidity risk premiums.

In sum, there are four ways that investors can harvest illiquidity premiums:

1. Allocating a portion of the portfolio to illiquid asset classes like real estate. This is **passive allocation to illiquid asset classes**.
2. Choosing more illiquid assets within an asset class. This means engaging in **liquidity security selection**.
3. Acting as a **market maker** for individual securities. For example, Dimensional Funds Advisors (DFA) is a liquidity provider that buys stock at a discount from those wanting to sell quickly and sells small-cap stocks at a premium to investors demanding shares. The firm avoids adverse selection problems by choosing counterparties who fully disclose information about stocks. The firm is trustworthy in its dealings and does not manipulate prices or engage in front running. Sovereign wealth funds, large pension funds, and other large asset owners can also act as market makers, providing liquidity while buying at discounts and selling at premiums.
4. Engaging in **dynamic factor strategies** at the aggregate portfolio level. This means taking long positions in illiquid assets and short positions in liquid assets to harvest the illiquidity risk premium. Investors rebalance to take advantage of the liquidity differences as less liquid assets become more liquid. Rebalancing the portfolio is the simplest way to provide liquidity. As long as buyers buy when others want to sell and sell when others want to buy, rebalancing is countercyclical. Of the four ways investors can harvest the illiquidity premium, this is the easiest to implement and can have the greatest effect on portfolio returns.

Portfolio Allocation to Illiquid Assets

LO 77.f: Evaluate portfolio choice decisions on the inclusion of illiquid assets.

In determining the portfolio allocation to illiquid asset classes, or any asset class for that matter, investors must consider their personal circumstances. The illiquid asset allocation decision is influenced by different investment horizons, the lack of tradeable indices, the need to hire talented active portfolio managers, and the need to monitor those managers. Portfolio choice models that include illiquid assets must consider two important aspects of illiquidity that impact investors:

1. Long time horizons between trades (i.e., infrequent trading).
2. Large transaction costs.

Asset Allocation to Illiquid Asset Classes with Transaction Costs

The primary issue with asset allocation models that include transaction costs is that they assume an asset will always trade if the counterparty pays the transaction cost. However, this is not true in private equity, infrastructure, real estate, and timber markets. It is not (or may not) be possible to find a buyer in a short period of time. Counterparties, if identified, must perform due diligence, which takes time. In some cases, the counterparty, upon completion of due diligence, chooses not to buy the asset. In periods of stress, even liquid asset classes face liquidity freezes and it becomes impossible to find buyers at any price.

Asset Allocation to Illiquid Asset Classes with Infrequent Trading

As anyone trying to sell in a period of illiquidity knows, one cannot “eat” illiquid assets. Consider the example of Harvard University, briefly described earlier. The only way the university could generate cash for operations in a period of significant losses and illiquidity across what some would consider some of the most liquid assets (i.e., commercial paper and repurchase agreements), Harvard would have had to sell at huge discounts. Only liquid assets can be consumed. As a result, illiquidity has a major effect on investors’ portfolio choices. Illiquidity causes the following with respect to portfolio choice:

- **Reduces optimal holdings.** The less frequently a liquidity event is expected to occur, the lower the allocation to the illiquid asset class.
- Rebalancing illiquid assets (i.e., when there is infrequent trading in the asset class) causes allocations to **vary significantly**. The investor must wait until the liquidity event arrives. As such, the allocation prior to a liquidity event (or during nonrebalancing periods) can vary from too high to too low relative to the optimal allocation.
- Investors cannot hedge against declining values when an asset cannot be traded. As a result, **illiquid asset investors must consume less** than liquid asset investors to offset the risk.
- **There are no illiquidity “arbitrages.”** To construct an arbitrage, an asset must be continuously traded. Illiquid assets are not continuously traded.

- Due to infrequent trading, illiquid asset investors must **demand an illiquidity risk premium**. The more frequently the asset is traded, the lower the premium. For example, one study indicates that private equity investments generate returns 6% higher than public markets to compensate investors for illiquidity.

The inclusion of illiquid assets in a portfolio is not as simple or desirable as it might seem. The following points should be considered:

1. Studies show that illiquid assets do not deliver higher risk-adjusted returns.
2. Investors are subject to agency problems because one must rely on the talents and skills of the manager. It is difficult to monitor external managers (e.g., private equity managers).
3. In many firms, illiquid assets are managed separately from the rest of the portfolio.
4. Illiquid asset investors face high idiosyncratic risks. There is no “market” portfolio of illiquid assets. Recall the example of the NCREIF versus the individual investor. It is not possible for most investors to hold thousands of properties, and small numbers of properties can lead to undiversified, property specific risks (but also returns, making illiquid assets compelling to investors). Illiquid assets are compelling because:
 - Illiquid asset markets are less efficient than stock and bond markets.
 - There are large information asymmetries in illiquid asset markets.
 - High transaction costs keep many investors out of the market.
 - Management skill is crucial and alpha opportunities are widely dispersed.

All of these factors suggest there are great opportunities for the skilled investor to profit from investments in illiquid assets. Investors must have the skills and resources to find, evaluate, and monitor illiquid asset opportunities. Endowments like Harvard, Yale, and Stanford have the skills and resources. Unskilled investors, even those endowments at less sophisticated, skilled, and connected schools, can lose big in illiquid asset markets.



MODULE QUIZ 77.2

1. Which of the following variables is not an illiquidity factor that affects equity returns?
 - A. Measures of adverse selection.
 - B. The number of recorded positive returns.
 - C. Turnover.
 - D. Volume.
2. Rick Faircloth, a general partner and portfolio manager with Faircloth Funds, is considering ways in which his company can profit from illiquidity risk premiums. He has studied several alternative methods for harvesting illiquidity risk premiums. Which of the following strategies might Faircloth implement that will likely have the greatest effect on portfolio returns?
 - A. Acting as a market maker for individual securities.
 - B. Choosing the most illiquid assets within an asset class, even if the asset class is generally considered to be liquid.
 - C. Allocating a portion of a portfolio to illiquid asset classes.
 - D. Using dynamic factor strategies at the aggregate portfolio level.

KEY CONCEPTS

LO 77.a

There are four main characteristics that describe illiquid asset markets, including:

1. Most asset classes are illiquid, at least to some degree.
2. Markets for illiquid assets are large.
3. Illiquid assets comprise the bulk of most investors' portfolios.
4. Liquidity dries up even in liquid asset markets.

LO 77.b

Market imperfections encourage illiquidity in asset markets. Specifically, market participation costs (i.e., clientele effects) and transaction costs give rise to illiquidity. Some academic models assume that all assets can be traded if one will pay the required (sometimes very high) transaction cost. However, this is not necessarily true in illiquid asset markets. There are search frictions (i.e., difficulties finding a counterparty and information asymmetries), price impacts, and funding constraints that may prevent trades from occurring, no matter how high the transaction cost.

LO 77.c

In general, investors should be skeptical of reported returns in illiquid asset markets as they are generally overstated. There are reporting biases that result in artificially inflated returns. The three main biases that impact reported illiquid asset returns are:

1. Survivorship bias: Poor performing funds often quit reporting results. Also, many poor performing funds ultimately fail. Finally, some poor performing funds never begin reporting returns because performance is weak. All of these factors lead to survivorship bias. Survivorship bias leads to an overstatement of stated returns relative to true returns.
2. Selection bias: Asset values and returns tend to be reported when they are high. For example, houses and office buildings typically are sold when values are high. These higher selling prices are used to calculate returns. This results in sample selection bias, which again leads to overstated returns.
3. Infrequent trading: Illiquid assets, by definition, trade infrequently. Infrequent trading results in underestimated risk. Betas, return volatilities, and correlations are too low when they are computed using the reported returns of infrequently traded assets.

LO 77.d

Unsmoothing adds noise back to reported returns to uncover the true, noisier returns. This process affects risk and return estimates and could have a dramatic effect on returns.

LO 77.e

There is little evidence that there are large illiquidity risk premiums across asset classes. However, there are large illiquidity risk premiums within asset classes.

There are four primary ways that investors can harvest illiquidity premiums:

1. Allocating a portion of the portfolio to illiquid asset classes like real estate. This is passive allocation to illiquid asset classes.
2. Choosing more illiquid assets within an asset class. This means engaging in liquidity security selection.
3. Acting as a market maker for individual securities.
4. Engaging in dynamic factor strategies at the aggregate portfolio level. This means taking long positions in illiquid assets and short positions in liquid assets to harvest the illiquidity risk premium. Of the four ways investors can harvest illiquidity premiums, this is the easiest to implement and can have the greatest effect on portfolio returns.

LO 77.f

There are several points to consider when deciding to allocate portfolio resources to illiquid assets:

1. Studies show that illiquid assets do not deliver higher risk-adjusted returns.
2. Investors are subject to agency problems because one must rely on the talents and skills of portfolio managers. It is difficult to monitor external managers.
3. In many firms, illiquid assets are managed separately from the rest of the portfolio.
4. Illiquid asset investors face high idiosyncratic risks. There is no “market” portfolio of illiquid assets. Illiquid assets are compelling because illiquid asset markets are less efficient than stock and bond markets, there are large information asymmetries in illiquid asset markets, high transaction costs keep many investors out of the market, management skill is crucial, and alpha opportunities are widely dispersed.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 77.1

1. **B** In stressed economic periods, such as during the 2007–2009 financial crisis, liquidity can dry up. Major liquidity crises have occurred at least once every ten years across the globe, in conjunction with downturns and financial distress. (LO 77.a)
2. **C** Difficulties finding a counterparty are called search frictions. For example, it may be difficult to find someone to understand/purchase a complicated structured credit product. It may also be difficult to find buyers with sufficient capital to purchase multimillion dollar office towers in major metropolitan areas. No matter how high the transaction costs, it may take weeks, months, or years to transact in some situations. Asymmetric information can also be a type of search friction as investors search for non-predatory counterparties with which to transact. (LO 77.b)
3. **A** There are no requirements for certain types of funds, like private equity funds, to report returns. As such, poorly performing funds have a tendency to stop reporting. Additionally, many poorly performing funds ultimately fail. Performance studies generally include only those funds that were successful enough to survive over the entire period of analysis, leaving out the returns of funds that no longer exist. Both of

these factors result in reported returns that are too high. This is called survivorship bias. (LO 77.c)

Module Quiz 77.2

1. **B** There are several variables related to illiquidity that are shown to impact equity returns. They are bid-ask spreads, volume, turnover, volume measured by whether the trade was initiated by buyers or sellers, the ratio of absolute returns to dollar volume, the price impact of large trades, informed trading measures (i.e., adverse selection), quote size and depth, the frequency of trades, the number of zero returns, and return autocorrelations. It is not the number of recorded positive returns, but the number of recorded zero returns, that are relevant. (LO 77.e)
2. **D** There are four primary ways that investors can harvest illiquidity premiums:
 1. Allocating a portion of the portfolio to illiquid asset classes like real estate (i.e., passive allocation to illiquid asset classes).
 2. Choosing more illiquid assets within an asset class (i.e., liquidity security selection).
 3. Acting as a market maker for individual securities.
 4. Engaging in dynamic factor strategies at the aggregate portfolio level. This means taking long positions in illiquid assets and short positions in liquid assets to harvest the illiquidity risk premium. Of the four ways investors can harvest illiquidity risk premiums, this is the easiest to implement and can have the greatest effect on portfolio returns.

(LO 77.e)

¹ Ilmanen, A. (2011). *Expected Returns: An Investor's Guide to Harvesting Market Rewards*. Chichester, West Sussex, U.K.: Wiley.

FORMULAS

Reading 59

$$\text{bid-offer spread: } s = \frac{\text{offer price} - \text{bid price}}{\text{mid-market price}}$$

$$\text{cost of liquidation (normal market)} = \sum_{i=1}^n \frac{s_i \alpha_i}{2}$$

$$\text{cost of liquidation (stressed market)} = \sum_{i=1}^n \frac{(\mu_i + \gamma \sigma_i) \alpha_i}{2}$$

$$\text{liquidity-adjusted VaR (normal market)} = \text{VaR} + \sum_{i=1}^n \frac{s_i \alpha_i}{2}$$

$$\text{liquidity-adjusted VaR (stressed market)} = \text{VaR} + \sum_{i=1}^n \frac{(\mu_i + \gamma \sigma_i) \alpha_i}{2}$$

liquidity coverage ratio (LCR):

$$\frac{\text{high-quality liquid assets}}{\text{net cash outflows in a stressed 30-day period}} \geq 100\%$$

net stable funding ratio (NSFR):

$$\frac{\text{amount of stable funding}}{\text{required amount of stable funding}} \geq 100\%$$

Reading 60

$$\text{leverage ratio: } L = \frac{A}{E} = \frac{(E + D)}{E} = 1 + \frac{D}{E}$$

$$\text{leverage effect: } \text{ROE} = (\text{leverage ratio} \times \text{ROA}) - [(\text{leverage ratio} - 1) \times \text{cost of debt}]$$

transactions cost confidence interval:

$$+/- P \times \frac{1}{2}(s + 2.33\sigma_s)$$

where:

P = an estimate of the next day asset midprice, usually set to P , the most recent price observation

s = expected or typical bid-ask spread calculated as: $(\text{ask price} - \text{bid price}) / \text{midprice}$

σ_s = sample standard deviation of the spread

$$\text{spread risk factor} = \frac{1}{2}(s + 2.33\sigma_s)$$

Reading 62

net after-tax return = nominal after-tax municipal bond return – interest expense
incurred to buy the bond + tax advantage

tax advantage = marginal bank tax rate \times ratio of interest expense that qualifies
for a tax deduction \times interest expense incurred to fund the bond
purchase

percentage change in investment price =

$$-\text{duration} \times \frac{\text{change in interest rate}}{1 + \text{initial interest rate} \times (1/m)}$$

where:

m = number of times investment pays interest (coupon) in a year

Reading 63

net liquidity position (L) = supplies of liquidity – demands for liquidity

where:

supplies of liquidity = incoming deposits (inflows) + customer loan repayments + asset sales + revenue from nondeposit services + money market borrowings

demands for liquidity = deposit withdrawals (outflows) + borrowing repayments + dividend payments + loan requests + other operating expenses

liability liquidity reserve =

[0.90 × (hot money deposits and nondeposit funds – legal reserves held)]
+ [0.25 (vulnerable deposits and nondeposit funds – legal reserves held)]
+ [0.10 (stable deposits and nondeposit funds – legal reserves held)]

total liquidity requirement =

[0.90 × (hot money deposits and nondeposit funds – legal reserves held)]
+ [0.25 (vulnerable deposits and nondeposit funds – legal reserves held)]
+ [0.10 (stable deposits and nondeposit funds – legal reserves held)]
+ [1.00 × (potential loans outstanding – actual loans outstanding)]

expected liquidity requirement = \sum (probability of each unique outcome
× estimated liquidity surplus / deficit for each outcome)

cash position indicator: (cash + deposits due from depository institutions) / total assets

liquid securities indicator: U.S. government securities / total assets

core deposit ratio: core deposits / total assets

hot money ratio: money market (short-term) assets / volatile liabilities

net federal funds and repurchase agreements position: (federal funds sold and reverse repo agreements – federal funds purchased and repo agreements) / total assets

capacity ratio: net loans and leases / total assets

loan commitments ratio: unused loan commitments / total assets

pledged securities ratio: pledged securities / total securities holdings

deposit composition ratio: demand deposits / time deposits

deposit brokerage index: brokered deposits / total deposits

total required legal reserves =

(transaction deposit reserve requirement × daily average amount of net transaction deposits for the computation period) + (nontransaction reservable liabilities' reserve requirement × daily average amount of nontransaction deposits for the computation period)

Reading 65

term structure of expected cash flows (TSECF):

$$\text{TSECF}(t_0, t_b) = \{cf_e^+(t_0, t_0), cf_e^-(t_0, t_0), cf_e^+(t_0, t_1), cf_e^-(t_0, t_1), \dots, cf_e^+(t_0, t_b), cf_e^-(t_0, t_b)\}$$

term structure of expected cumulated cash flows (TSECCF):

$$\text{TSECCF}(t_0, t_b) = \{CF(t_0, t_0, t_1), CF(t_0, t_0, t_2), \dots, CF(t_0, t_0, t_b)\}$$

Reading 67

stressed liquidity asset buffer:

$$(\text{normal}) \text{ liquidity asset buffer} - \text{stressed cash outflow} + \text{stressed cash inflows}$$

Reading 70

$$\text{marginal cost} = \text{change in total cost} = (\text{new interest rate} \times \text{total funds raised at new rate}) - (\text{old interest rate} \times \text{total funds raised at old rate})$$

$$\text{marginal cost rate} = \text{change in total cost} / \text{additional funds raised}$$

Reading 71

available funds gap:

$$\text{AFG} = \text{current and projected loans and other investments} - \text{current and expected deposit inflows and other available funds}$$

Reading 73

weighted-average life:

$$\text{WAL} = \sum_{i=1}^n \frac{p_i}{P} t_i$$

where:

p_i = principal amount in distribution

P = amount of loan

t_i = years of payment i

$$\text{contingent liquidity charge} = (\text{remaining balance} / \text{credit limit}) \times \text{probability of drawdown} \times \text{liquidity cushion cost of funding}$$

Reading 75

covered interest parity:

$$\frac{F}{S} = \frac{1 + r}{1 + r^*}$$

Reading 76

net interest margin:

$$\text{NIM} = \text{net interest income (NII)} / \text{earning assets}$$

$$\text{NII} = \text{interest income} - \text{interest expense}$$

$$\text{leverage-adjusted duration gap} = D_A - D_L \times \frac{\text{total liabilities}}{\text{total assets}}$$

INDEX

A

ABCP conduits, 18
adverse price impact, 29
adverse selection, 29
annual percentage yield (APY), 176
Ashanti Goldfields, 6
asset conversion, 65
asset-liability committee (ALCO), 250
asset-liability management (ALM), 17, 250
asset sensitive, 251
asymmetric information, 267
available funds gap (AFG), 187

B

back-end load maturity approach, 56
balanced liquidity management, 65
balance sheet expansion, 94
balance sheet risk, 16
balance sheet shrinkage, 94
bankers' acceptances, 47
bank-qualified bonds, 51
bank run, 112
barbell strategy, 56
basic banking, 177
Bear Stearns, 203
bid and offer price, 2
bump-up CDs, 168
business risk, 53

C

call risk, 53
capacity ratio, 70

- capital market instruments, 46
- carry return, 57
- carry trade, 57
- cash, 31
- cash flow at risk, 96
- cash flow survival report, 145
- cash management, 200
- cash position indicator, 70
- certificates of deposit (CDs), 46, 168
- clearing balance, 73
- cliente effect, 267
- collateralized mortgage obligations (CMOs), 49
- collateral markets, 20
- commercial paper, 47, 186
- conditionally free pricing, 172
- conditional pricing, 172
- contingency funding plans (CFPs), 153
- contingent liquidity, 118
- contingent liquidity risk pricing, 225
- continuing contracts, 185
- convertible arbitrage hedge funds, 19
- core deposit ratio, 70
- core deposits, 169
- corporate bonds, 48
- corporate notes, 48
- cost-plus pricing, 170
- counterparty risk, 201
- covered interest parity (CIP), 241
- credit availability risk, 189
- credit risk, 52
- cross-currency basis swaps, 243
- cross-margin agreements, 21
- crossroads account, 45
- cumulative gap, 252
- customer relationship doctrine, 183

D

- daily liquidity report, 137
- deleveraging, 10
- deposit brokerage index, 71

- deposit composition ratio, 71
- deposits, 165, 183
- deposit tracker report, 134
- depth, 31
- deterministic, 89
- discount window, 185
- diseconomies of scope, 109
- dollar denominated CDs, 186
- domestic CDs, 186
- duration, 58

E

- early warning indicators (EWIs), 37, 153
- economies of scope, 109
- embedded leverage, 24
- escalation levels, 160
- euro CDs, 186
- eurocurrency deposits, 186
- eurodollar deposits, 186
- expected rate of return, 50

F

- federal agency securities, 46
- federal funds market, 73
- Federal Home Loan Bank (FHLB), 186
- fed funds, 184
- fed funds-GC spread, 204
- filtering algorithms, 269
- finance paper, 186
- flat-rate pricing, 172
- foreign exchange (FX) swaps, 242
- fractional-reserve bank, 17
- free pricing (free checking), 172
- front-end load maturity approach, 56
- funding concentration report, 140
- funding constraints, 267
- funding cost risk, 94
- funding gap, 232

funding liquidity, 16, 117
funding maturity gap (mismatch) report, 139
funding risk, 232
funds management, 250

G

general collateral, 204
general obligation (GO) bonds, 48
gross leverage, 26

H

haircut, 21, 95, 200
historical average cost approach, 190
holding period yield (HPY), 50
hot money ratio, 70

I

illiquidity risk premiums, 270
implicit interest, 169
index CDs, 168
industrial paper, 186
inflation risk, 54
infrequent trading, 269
interest-bearing transaction deposits, 167
interest-only (IO) securities, 49
interest rate risk, 52, 189, 250
interest-sensitive (IS) gap, 251
interest sensitivity ratio (ISR), 252
international eurocurrency deposits, 47
intraday liquidity, 79
intrinsic value, 26
inventory management, 29

J

jumbo CD, 168

L

ladder (spaced-maturity) policy, 55
Lagged Reserve Accounting (LRA), 72
legal reserves, 72
Lehman Brothers, 202
lenders of last resort, 232
leverage-adjusted duration gap, 257
leveraged buyouts (LBOs), 18
leverage effect, 22
leverage ratio, 22
leveraging, 10
liability management, 65, 184
liability profile, 142
liability sensitive, 251
lifeline banking, 177
liquid asset, 65
liquid CDs, 168
liquidity, 1, 15, 63
liquidity asset buffer, 118
liquidity black holes, 9
liquidity coverage ratio (LCR), 7
liquidity crisis team (LCT), 156
liquidity cushion, 225
liquidity funding risk, 5
liquidity gap, 67
liquidity gap analysis, 157
liquidity generation capacity (LGC), 94
liquidity indicators, 70
liquidity management, 200
liquidity option, 91
liquidity risk, 15, 53, 94, 201
liquidity risk management (LRM), 37
liquidity risk reports, 131
liquidity stress test, 119, 145
liquidity transfer pricing, 211
liquid securities indicator, 70
loan commitments ratio, 71
long-term debt market, 186

M

- marginal cost of funds approach, 220
- margin loans, 21
- market imperfections, 267
- market liquidity risk, 94
- market maker, 273
- market participation costs, 267
- market risk, 250
- maturity ladder, 92
- maturity mismatch, 16
- merger arbitrage hedge funds, 18
- Metallgesellschaft (MG), 6
- mid-market price, 2
- mobile check deposits, 167
- money market deposit accounts (MMDAs), 167
- money market instruments, 46
- money market mutual fund, 19
- money position manager, 72
- mortgage-backed bonds (MBBs), 49
- municipal bonds, 48
- municipal notes, 48

N

- negative duration gap, 257
- negative feedback traders, 9
- negotiable CD, 168
- negotiable (jumbo) CDs, 186
- negotiable order of withdrawal (NOW) accounts, 167
- net interest margin (NIM), 250
- net investable funds, 189
- net leverage, 26
- net liquidity position, 64
- net stable funding ratio (NSFR), 7
- nondeposit liabilities, 184
- noninterest-bearing demand deposits, 166
- Northern Rock, 6
- nostro accounts, 80
- novation, 110

O

- off-the-run, 205
- on-the-run, 205
- open repos, 200
- operational liquidity, 117
- opportunity cost, 172
- OTC derivatives market, 105
- overdraft protection, 176
- overnight loans, 185
- overnight repos, 200

P

- passbook savings deposits, 167
- pass-through securities, 48
- pledged securities ratio, 71
- pledging requirements, 54
- pooled average cost of funds approach, 217
- pooled funds approach, 191
- portfolio immunization, 58
- portfolio shifting, 52
- positive duration gap, 257
- positive feedback traders, 9
- predatory trading, 2
- prepayment risk, 54
- price impact, 267
- price risk, 250
- primary credit, 185
- prime broker, 106
- principal-only (PO) securities, 49
- Public Securities Association (PSA), 54

Q

- quantitative liquidity risk, 94

R

- rate expectations approach, 56
- real estate mortgage conduits (REMICs), 49
- rebate, 22
- reciprocal swap arrangements, 236
- Regulation Q, 167
- rehypothecation, 21
- reinvestment risk, 250
- relationship pricing, 173
- relative gap, 252
- remargining, 21
- repledging, 21
- repo market, 106
- reporting biases, 268
- repurchase agreement, 21, 108, 185, 197
- reserve computation period, 72
- reserve maintenance period, 72
- resiliency, 31
- restricted liquidity, 118
- retirement savings accounts, 168
- retirement savings deposits, 168
- revenue bonds, 48
- reverse repo, 198
- riding the yield curve, 57
- rollover risk, 16

S

- sample selection bias, 268
- savings (thrift) deposits, 167
- search frictions, 267
- seasonal credit, 185
- secondary credit, 185
- securities lending, 22
- securitized assets, 48
- separate average costs of funds approach, 218
- short-term municipal obligations, 47
- slippage, 29
- solvency, 1
- sources and uses method, 67
- special collateral, 205
- special purpose entity, 108

- special rate, 205
- special spread, 205
- specials trade, 205
- spread risk factor, 30
- step-up CDs, 168
- stochastic, 89
- strategic liquidity, 118
- stripped securities, 49
- structured credit products, 18
- structured investment vehicles (SIVs), 18, 108
- structured notes, 48
- structure of funds method, 68
- Super NOWs, 167
- survivorship bias, 268
- sweep accounts, 73
- systematic funding risks, 18
- systemic risk, 16

T

- tax-equivalent yield (TEY), 51
- tax swapping, 52
- term structure of available assets (TSAA), 97
- term structure of cumulated LGC (TSCLGC), 95
- term structure of expected cumulated cash flows (TSECCF), 92
- term structure of expected cash flows (TSECF), 92
- term structure of expected liquidity, 95
- term structure of liquidity-at-risk (TSLaR), 97
- term structure of LGC (TSLGC), 95
- thrift CDs, 186
- tightness, 31
- time deposits, 168
- time value, 26
- total return swaps, 22
- toxic assets, 113
- trade processing costs, 28
- transaction costs, 267
- transaction (demand) deposits, 166
- transactions liquidity, 16
- Treasury bills, 46
- Treasury bonds, 46, 47

Treasury Inflation-Protected Securities (TIPS), 54
Treasury notes, 46, 47
Troubled Asset Relief Program, 112
Truth in Savings Act of 1991, 175

U

undrawn commitment report, 141
unpledged assets, 32

W

weighted-average life (WAL) method, 223

Y

Yankee CDs, 186
yield curve, 56
yield to maturity (YTM), 50

Z

zero-cost approach, 216
zero duration gap, 257

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